Third International Student Conference Proceeding

"Empirical Models in Social Sciences"

M. Efe Postalcı
Editor

ISBN: 978-975-8789-23-8

İzmir University of Economics Publication no: IEU-025

İzmir University of Economics
Sakarya Cad. No. 156, 35330 Balçova, İzmir, Turkey

İZMİR UNIVERSITY OF ECONOMICS

Third International Student Conference

"EMPIRICAL MODELS IN SOCIAL SCIENCES"

İzmir, TURKEY

April 13-14, 2007

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Government Capacity, Social Welfare, and Non-State Political Violence

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Abstract

Despite major improvements in the field of terrorist studies, scholars are still baffled by the duration of terrorism, particularly in modern industrial democracies. Why do groups continue to resort to violent tactics to express their political preferences? And what are the most productive policy responses to obstruct terrorist operations while reducing the root causes of the phenomenon?

This paper addresses the latter question—namely, the best ways to reduce the root causes of terrorism. Using original data of domestic terrorist group emergence in 196 countries, I argue that governments with high capacity are most likely to produce domestic terrorist groups. However, the emergence and duration of these groups can be mitigated by increased social welfare spending, which tends to (1) ameliorate the major grievances of terrorists; (2) increase the legitimacy of the government in the eyes of the public; and (3) reduce residual public sympathies for violent political expression.

Governability and Grievance: The Roots of Terrorism

There are several different expectations regarding the capacity of a country and its propensity to produce domestic terrorist groups.[2] One expectation is that the public will become more satisfied as its government becomes more capable, leading to reduced nonviolent and violent protest within the polity. On the whole, once a government achieves a certain level of prosperity and uses its riches to benefit the public, members of the society will view the government as more legitimate, thus undermining grievances.

Recent literature (Burgoon 2006) has supported this claim, indicating that government spending on public goods—especially welfare spending—has reduced the occurrence of major terrorist incidents around the world. However, such literature has argued that welfare spending will reduce the propensity for an individual to conduct a terrorist attacks abroad, or the propensity for a country to suffer a terrorist attack from abroad. Burgoon considers the effects of welfare spending on domestic terrorist incidents only in limited fashion and during a limited time period (1998-2001).

On the other hand, according to the relative deprivation hypothesis (Gurr 1970), the public revolts when rising expectations are frustrated by a lack of government output. In the context of modern democracies, one might expect that governments with a great deal of capacity would experience more terrorism because of increased frustration on the part of groups who expect their governments to produce even more public goods. During the 1970s, scholars such as Huntington (1974) and Birch (1984) explained waves of public protest throughout the Western world by referring to the problem of "ungovernability," in which governments were unable to meet the excessive demands of its citizens. Such scholars suggested that citizens must make more moderate demands in order for democracy to function. Out of this frustration, or relative deprivation, violent groups may emerge in light of competing demands and interests within society.

Democracy and Terrorism

Are more responsive democracies solutions to these dilemmas? Often, pundits and policy makers assume that weak and failed states are the most likely hosts of terrorism (either intentionally or inadvertently), and that democracy is the antidote to terrorism. However, recent scholarship suggests that terrorism is just as common, if not more common, in democracies as in weak, failed, or authoritarian states (Li 2005, Chenoweth 2006). Thus democratic governments with high capacity are likely to experience terrorism just as much as nondemocratic governments with weak capacity. The only regime types that seem to be immune from terrorism are autocratic regimes, which purge their governments regularly and maintain strict control of the polity.

While "badly performing" democracies are especially at risk due to perceived political opportunities for influence, even strong consolidated democracies are vulnerable to major terrorist campaigns, as evidenced by the United Kingdom in the late 20th century. Such democracies are especially prone to "saturation" by informal and formal organized interests, which compete for power and influence. This inter-group competition

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[2] For the purposes of this study, terrorism is defined as the use or threat of force intended to evoke fear in a wider population to achieve a political objective. See Hoffman 2006 for a discussion and debate on alternative definitions of terrorism.

sometimes produces escalation of group tactics, eventually leading to the decision by some groups to adopt violent tactics to affect policy (Tarrow 1989, Chenoweth 2006).

Capacity, Welfare Spending, and Terrorist Groups

In light of this literature, there are two competing expectations with regard to the effect of social welfare spending on terrorist group emergence. The first is that social welfare spending will increase terrorism, since it is often a reflection of competing pressures within the polity who are making demands of the government. As described above, such competition often produces extreme factions who view violence as a way to achieve notoriety among the surge of interest groups. The second expectation is that once the government has acceded to interest group demands within the polity, mass demobilization should follow. Since terrorism usually occurs as an escalatory tactic, demobilization of conventional interest groups may also lead to the demise of violent terrorist groups.

Drawing together the current literature, I argue that both theoretical perspectives can contribute to our understanding of the effects of capacity on terrorism. While more prosperous states with higher capacity may experience more terrorism due to resentment and relative deprivation, this effect can be mitigated by more popular government spending on public goods, such as social welfare (Burgoon 2006). Increased government spending on the public at large may undermine the major grievances of terrorist groups in the first place, many of whom argue for more leftist policies. Finally, when the government becomes more "generous" with its social spending, the public views it as more legitimate, withdrawing sympathy from terrorist groups entirely. Once this has occurred, terrorists no longer gain the public sympathy required for their recruitment and operations, and violence is viewed as a completely illegitimate form of political expression.

These two arguments are characterized by the following two hypotheses, tested below:

H_1: An increase in government capacity will produce an increase in new terrorist groups.

H_2: An increase in social welfare spending will have a negative effect on the number of new terrorist groups.

Research Design and Results

In order to test these hypotheses concerning the relationship between social welfare spending, government capacity, and new terrorist group emergence, I conduct several tests involving salient variables.[3] My dependent variable is the total number of new domestic terrorist groups emerging within each state between 1996 and 2001, thus extending the analysis to a five-year study of new terrorist group emergence as opposed to Burgoon's 3-year study of domestic terrorist incidents. The data are from the RAND-MIPT database and were collected by the author in 2006. To avoid conflating domestic and transnational terrorism as is so common in the literature, I limit the analysis to the emergence of domestic terrorist groups whose principal grievances are against their own governments. Because the dependent variable is an event count, I use a negative binomial regression model as the estimator.

For the independent variables, I use data from Burgoon (2006) on social welfare spending, government capacity, left-wing governments, trade, and population size. The first independent variable is *Capacity*, which is the logged annual composite index of the state's share of the world's total population, gross domestic product per capita (GDP), GDP per unit energy, military manpower, and military expenditures, averaged from 1990-1995.[4] As discussed previously, this variable should have a positive effect on terrorist group emergence.

Next, *Welfare Spending* is the logged average total of welfare spending (transfers and education) as a percentage of GDP from 1990-1996. Due to the mitigating effects of social welfare provisions on the root causes of terrorism, I expect it to have a negative effect on terrorist group emergence.

Several control variables are in order. The first is the existence of left-wing governments (*Left*), which is coded as the percentage of years in which a left-wing party controlled the government from 1985-1995. The existence of a left-wing government may have independent effects on both the spending preferences of the government and the emergence of terrorist groups within the polity (Berrebi and Klor 2006). Therefore, I expect the existence of left-wing governments to have a positive effect on terrorist group emergence.

Whether a country is engaged in an interstate conflict or in extensive trade activities can also affect the domestic polity by producing public protest. I control for conflict using a conflict variable from Burgoon (2006) identifying the percentage of years in which a state was engaged in an interstate conflict from 1985-

[3] The data and research design are largely drawn from Burgoon 2006. This article provides an alternative test and robustness check to Burgoon's findings.
[4] To avoid endogeneity, the independent variables are temporally lagged behind the dependent variable.

1995. I control for trade using a measure of the average degree of trade openness ((M/X)/GDP) from 1960-1995, logged. I also control for population size and region, using the average logged population from 1975-1995 and region dummies from Burgoon (2006). The results appear in Table 1.

The results demonstrate the positive effect of capacity on new group emergence. States with greater capacity tend to contain more new terrorist groups than states with less capacity. As expected, states engaged in interstate conflict have a higher likelihood of experiencing domestic terrorism. Moreover, states engaging in more trade experience less terrorism, although the effects of both conflict and trade are insignificant. As expected, the size of the population is positive but insignificant, and the effect of democracy is negative but insignificant. Moreover, there is no significant difference between the effects of capacity of group emergence in different regions of the world relative to the Middle East.

Table 1: The Effect of Capacity on Terrorist Group Emergence

Variable	Coefficient
Capacity	1.87**
	(.818)
Conflict	.905
	(.883)
Trade	-.470
	(.771)
Size	.341
	(.292)
Democracy	-.084
	(.158)
Africa	.137
	(.909)
Americas	.457
	(.855)
Europe	1.51
	(.994)
Asia	.841
	(.836)
Constant	-3.10**
	(.794)
N=114	
Wald chi2 = 59.35	
Prob > chi2 = .0000	
** p < .05	

In addition to these findings, the next model (a zero-inflated negative binomial to account for an overdispersion of zeroes in the dependent variable) tests the effects of social welfare spending on the same sample. As one can see in Table 2, increased social welfare spending reduces the number of terrorist groups within the polity. This effect is especially salient in Europe, where most social welfare states appear. Despite the positive effect of government capacity on the likelihood of terrorist group emergence, this effect is mitigated by social welfare spending within the polity. Therefore, both hypotheses achieve preliminary support.

Table 2: The Effect of Welfare Spending on Terrorist Group Emergence

Variable	NBR	Logit
Welfare	-1.47**	114.88
	(.475)	(1406.3)
Left	.180	152.70
	(.540)	(3095.6)
Capacity	3.09**	150.39
	(.857)	(3819.6)
Conflict	1.42	-364.5
	(1.31)	(10938.6)
Trade	-1.04	-241.7
	(.543)	(2971.2)
Size	-.047	-169.1
	(.221)	(1894.9)
Democracy	.077	-67.92
	(.172)	(713.7)
Africa	.036	-123.7
	(.932)	(4089.4)
Americas	1.04	228.6
	(.738)	(2953.9)
Europe	2.43**	54.39
	(.743)	(3754.8)
Asia	.399	276.5
	(.766)	(1.93e+7)
Constant	-1.33	-28.7
	(1.12)	(4973.4)
N=95		
LR chi2 = 51.49		
Prob > chi2 = .0000		
** p < .05		

Summary and Conclusion

The findings in this paper support the notion suggested by Burgoon (2006) that social welfare spending can help to reduce the root causes of terrorism in states with high capacity. In order to reduce terrorism in their own polities, states should adopt more wide-reaching social welfare programs that can reduce grievances against the government, increase government legitimacy, and diminish public sympathy for groups using violent methods to express their grievances. These outcomes can obstruct both recruitment efforts and operational goals of potential and existing terrorist groups. In order to extend the study, scholars should apply pooled time-series data to these findings in order to discern temporal effects and apply more standard robustness checks to the

results. Moreover, scholars should use an alternative dependent variables—domestic terrorist incidents—to determine whether terrorist attack patterns are discernable when compared to social welfare policies over time.[5]

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[5] Burgoon (2006) uses domestic terrorist incidents in the aggregate, but does not disaggregate them to apply time series analysis.

A Game Theoretic Approach to Sustaining Social Dialogue

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Abstract

This paper contextualizes the ILO-recognized enabling conditions for successful social dialogue in non-cooperative game theory, potentially allowing holistic statistical analysis to complement the field's traditional use of case studies. It relates the theoretical dilemma of sustaining macroeconomic coordination to the solution presented by the Folk Theorem, whose conditions for sustained cooperation in iterated games are indeed similar to those identified empirically. Most importantly, the Theorem allows dialogue's enabling conditions to be treated holistically, quantitatively, and with clear assumptions open to scrutiny. As a result, it may formalize and guide conceptual analysis of troubleshooting defective dialogue regimes by rationalizing the role of stabilizing partners, institutionalizing dialogue fora, embedding retaliation for defection, and accelerating communication, monitoring, compliance. The model is presented alongside the case of tripartism in the Republic of Korea.

Introduction

Since 1919, the International Labour Organisation, the labor arm of the United Nations, has promoted democratic participation through organized interest representatives as the vehicle for setting the goals, measures, and methods of social progress. Today, "social dialogue" figures prominently in the lives of workers and employers around the world, as the failure of labor, business, and state organizations to effectively coordinate economic policy can engender major inefficiencies and industrial conflict, and stymie development and investment prospects. The aim of this paper is to present and compare a potentially sustained cooperative result from game theory using the "enabling conditions" of social dialogue as historically presented by the ILO; an ultimate goal of this field is to catalyze efficient economic coordination by predicting and preventing its obstacles while promoting its enabling conditions.

Identifying these basic enabling conditions is as difficult as it is important. Economic, political, cultural, and institutional differences make every case of social dialogue unique, leading ILO officials to assert that "of course, there is no fixed formula that can guarantee successful outcomes in an industrial relations process."[1] None the less, expansive applied literature has contextualized the panoply of national-level negotiations around the world in terms of the ILO-recognized universal enabling conditions, which include (i) commitment to the dialogue process , (ii) recognition of the principles of freedom of association and collective bargaining, (iii) strong and representative social partners, and (iv) institutional support. The ILO contends that these conditions will allow labor, commercial, and civic interests to unite under the banner of social partnership, promoting stability and democracy in the wake of structural adjustment. The distribution of these benefits would be fair, set by bargaining power that is justly proxied by the regard for democratic principles, making a wasteful demonstration of this power by instigating industrial conflict unnecessary.

This logic is appealing because its outcomes are flexible and its principles timeless. However, it is of limited use when seeking themes in the failure of dialogue fora. Because traditional standards judge social dialogue's success upon whether settlement is reached and enforced through democratic means, the "enabling conditions" are almost tautological: if no settlement was reached, there is a failure to bargain in good faith; if a settlement could not be enforced, social partners are not sufficiently strong; and if settlement and enforcement is guaranteed through repression, then the forum doesn't truly represent an instance of democratic social dialogue. To put it another way, these conditions are not the *causes* of success, they *are* success. The prescription of a vision for how dialogue should evolve is partly to blame for the micro-evolution of fundamental theory where empirical literature has burgeoned.

* Alan Michael Benson gratefully acknowledges funding from the ILR School's Undergraduate Academic Research and Summer Research Fellowships, and Hunter R. Rawlings III Cornell Presidential Research Scholars. He also thanks Maria Lorena Cook, Department of International and Comparative Labor, Cornell, and Linda Yueh, Department of Economics, Oxford University, for their helpful comments and advice.

[1] Patricia O'Donovan, then director of the ILO InFocus Programme on Social Dialogue, Labour Law, and Labour Administration, quoted in Byun, Duk-kun. "Korea Needs to Develop its Own Model in Labor Dispute Settlement," in The Korea Times, 10-28-2003.

This paper takes a step back from the vein of empirical literature. It shows why social dialogue can be treated as an *iterated prisoners' dilemma*, or a game where a player could reap immediate rewards for unilaterally abrogating agreements, though such a move would ever-after prompt a socially *inefficient* state of distrust. From the iterated prisoners' dilemma, we can derive the Folk Theorem, a new set of conditions for sustained dialogue. As comparisons to the case of South Korea and observations taken from other literature will suggest, approaching social dialogue from this class of games may offer a glimpse into its inner workings. Although the parameters that compose this unified framework are potentially quantifiable, this paper emphasizes linking concepts from game theory and social dialogue literature, and will assume minimal familiarity with the theory of games. Naturally, this approach seeks to shed a theoretical light on social dialogue where experience drawn from case studies is deficient, so that future industrial conflict in which all sides lose can be avoided.

I.Dialogue as an Iterated Prisoners' Dilemma

Scholars have pointed to a variety of reasons why macroeconomic coordination and social dialogue can be more efficient than market mechanisms. These include preventing the public loss engendered by market adjustment, mutual legitimization, encouraging democratic social stability, and allowing workers to voice preferences and promote the efficient distribution of resources . This section discusses these benefits, and explores how the ILO has encouraged social dialogue.

I. A. The Adjustment Dilemma

How and whether macroeconomic coordination produces socially desirable results has been a topic debate. Ezio Tarantelli (1986) theorized that coordinating wages at a national level allows for inflation, employment, and public debt to be controlled while avoiding adjustment costs engendered by the market mechanism—an important hypothesis that has since been evidenced by a series of econometric analyses (see Calmfor and Driffill 1988; Carlin and Soskice 1990; and Layard, Nickell, and Jackmann 1991). Social dialogue also promotes social stability and legitimizes its representatives. However, such coordination also requires trust; players can forfeit a sustained cooperative solution for short-term gains. In a simple example, a country may curb inflation by running a contractionary monetary policy, though this generates temporary unemployment as a side-effect. Instead, the state and labor could agree to top-down controls on wage inflation in return for assurances against such contractions. If organized labor defected from its targets, it could attain large real wage gains at the expensive of inflation; alternatively, a contractionary monetary policy in a time of suppressed wages should be particularly effective at curbing inflation, but generate unemployment at great cost to workers.

In addition to achieving a superior trade between unemployment, inflation, and public debt, there are other reasons to suspect other sources of mutual gains to dialogue. Crouch (2000a) notes that social pactmaking may be necessary to reach economic goals where monetary manipulation is impossible, such as among members of the European Monetary Union. He adds (2000b) that welfare state reform demands coordinating the implementation of benefits, such as those for pensions, unemployment, and sickness. Dialogue also assuages social turbulence caused by structural adjustment, and provides a more general sense of stability.

Alluding to Hirschman's (1970) characterization of “Exit, Voice, and Loyalty,” Crouch also notes that the collective provision of Voice allows for socially beneficial accord with bargaining being a mechanism for identifying preferences and effectively distributing resources. This characteristic is particularly salient where Exit is limited (here, emigration into a different labor relations system is very costly or impossible), and where market mechanisms for allocating benefits are weak (typical of developing countries). Observers have noted that social dialogue serves to mutually legitimize institutions representing social constituencies. Where freedom of association is respected, this may serve to advance democratization; where it is not, there may be legal or institutional barriers to non-agreement, making defection prohibitively costly or impossible. Unlike the hypothesized wage bargaining scenario, not all of these promise potential immediate rewards for defection.

I. B. The ILO's Solution: Social Dialogue

Recognizing the potential for organized labor to be a vehicle for mutually beneficial cooperation, the ILO has long vocalized a language of “social partnership,” and strengthening social dialogue has been a guiding principle and strategic objective of the ILO. Historically, however, the definition of “social dialogue” has not remained static, and has generally broadened to remove assumptions about the level and formality of communication. The ILO mandate to include representatives from society in the “planning, implementation, and evaluation of technical programmes and projects” relevant to the ILO's mission was first engendered in the Consultation Recommendation No. 113, 1960 and the Social Policy Convention No 117, 1962 (ILO 1995). In 1976, the Tripartite Consultation Convention No. 144 and Recommendation No. 152 mandated tripartite

consultation as the vehicle for the planning, implementing, and evaluating programs relevant to ILO activities. Since then, literature produced by and for the ILO reaffirms that adherence to the principles of freedom of association and collective bargaining—as outlined in Conventions No. 87 and No. 98—is necessary for effective dialogue.

Indeed, social dialogue's broad construction underlies the ILO's philosophy of democratic self-determination. From this philosophy, a language of "social partnership" has been born, in which corporatist agents representing labor and employers bargain over social and economic policy under the guidance of a "competent authority," a metonymy for the government, and typically the labor ministry. Provided certain enabling conditions, dialogue presents a democratic and participatory avenue for making social policy. Although the ILO recognizes that dialogue can extend beyond topics relevant to its mission , the structure of the ILO naturally promotes tripartite dialogue over labor issues (Kuruvilla 2003). Broader dialogue may expand partnership beyond the government, labor, and business, which denotes a "tripartite-plus" regime.

Systematic differences have prompted scholars to distinguish the "societal corporatism" of Western Europe from the "state corporatism" of much of the developing world. The latter brand is believed to be the result of late capitalization, where the states have taken "a dominant, autonomous role in shaping both the distribution of power within society and the direction of economic development" (Staniland 1985: 75). As a result, labor is typically represented by weak organizations dependent on the state for resources and access to dialogue, engendering structural barriers to disagreement with the state, and in some instances, some degree of legal protection and monopoly recognition.

Indeed, state corporatist regimes have historically been prone to state-incited structural obstacles such as the protection of monopoly representatives, surveillance, or harassment, abrogating the principles of freedom of association and the right to organize and collectively bargain. In theory, this includes preventing the formation of a competitive organization ("Exit"), and the suppression of grassroots representation that may redirect the attention of the organization (Voice). In practice, this could mean that the state only granted legitimacy to a single labor federation, in which membership is compulsory and there are significant structural barriers to democratic representation. Citing West Germany's response to economic crisis, Offe (1981) and Streek (1982) maintain that a degree of setting strategy from the top-down is deemed necessary to establish continuity beyond the relatively myopic rank and file.

Heise (2002) notes that the most elegant solution to the prisoners' dilemma is a binding contract, which is difficult to enforce where dialogue occurs at the peak level. Still, international organizations, such as the ILO, the OECD's Trade Advisory Committee, several NGOs, and transnational unions have some ability to pressure partners to meet contractual and civil obligations. Trade sanctions can also serve in this regard; the threat of losing US GSP benefits has been credited for engendering social dialogue that brought Dominican workers a new labor code that protects the most basic of labor rights (Jessup and Gordon 2000; Douglas et al 2004).

Although the diversity of historical, political, cultural, and institutional contexts has prompted the ILO recognize that there is no universal model of social dialogue, it broadly espouses a set of conditions that it sees as imperative for dialogue in any country to succeed. Notably, ILO literature has emphasized the need for (i) strong, independent, and representative social partners with the (ii) institutional support and (iii) political willingness to engage in good faith collective bargaining and concertation while (iv) respecting fundamental rights relating to labor's free association and representation. To restate for emphasis, these conditions underlie the ILO's philosophy and espousal of democratic self-determination.

II. A Game Theoretic Approach to Social Dialogue

At most tacit consideration has been given to the potential ability of game theory to unify social dialogue's enabling conditions. This section first reviews the assumptions of the model and how they allow for further refinement. Then, the sequence of play is presented, revealing the condition necessary for bilateral cooperation.

II. A. Assumptions

This model uses the Nash equilibrium solution, and so certain necessary conditions must be met, as outlined by Nash's (1950) axiomatic model. In particular, players must be able to identify and compare given strategies with complete and transitive preferences, calculate their payoffs, and rationally select the optimum strategy.

Naturally, the strictest adherence to these requirements is impossible to meet. Theories of rationality, decisions, and agency are at the core of many disciplines, and have been the subject of voluminous academic literature impossible to fully assess here. One potential violation of these assumptions is manifest in "bounded rationality," the human limits of reconstructing and solving complex problems (Simon 1957). Another classic dilemma of corporatist bargaining is the Principal-Agent problem, which arises where there is misalignment in

the incentives and motivations of the principals and the agents. Here, worker, employer, and social negotiators may mis-represent their constituents. Such a scenario leaves partners vulnerable to what Simon refers to as "satisficing," where agents seek to optimize their own utilities, treating the needs of the principals as a minimal constraint to be met rather than the maximization problem.

These costs are clearly salient when discussing any form of social dialogue. For example, in highly democratic or decentralized systems, we may observe enormous transaction costs and delays in informing the membership to help them understand their choices and convey their preferences. Another problem with such systems, as noted, was the possibility for deviation from an agreement; indeed, even within labor organizations, there exists a form of the prisoners' dilemma, but with potentially several players, cooperation without hierarchical controls would be particularly volatile, as expressed in non-game theoretic terms by Bacarro. On the other hand, satisficing may be exacerbated in "top down" organizations, as the options available to the leadership are less transparent, and constituents have less ability to identify and control errant representatives. One applicable venue for challenging the "unitary actor assumption" and exploring hierarchy in interest-representation systems may be Robert Putnam's (1988) model of multi-level bargaining within and among partners.

Several emerging democracies are characterized by strong ties between labor and political institutions, and here the perspective of "social partnership" may be most salient. To take one example, South Africa's Tripartite Alliance, forged from its apartheid-era struggle for democracies, catalyzed the formation of its social dialogue forum, the National Economic Development and Labor Council, or NEDLAC. Indeed, Gostner (2000) notes that community leaders "wore two hats" between their political and union roles. In the language of Putnam (1993), these ties built social capital and fostered "networks of civic engagement," a critical element of a healthy society that fosters cooperation by magnifying the cost of defection. Such ties may have been crucial for preserving COSATU's participation in NEDLAC through the ANC's promotion of the neoliberal Growth, Employment, and Redistribution Programme (McKinley 2003), and indeed such partnerships may be crucial for catalyzing social dialogue in new democracies.

With these characteristics in mind, one can imagine that the traditional social dialogue literature and the game theoretic perspective may coalesce in organizational theory. Indeed, imperfections that arise from rational choice theory may be mitigated by factors considered in organizational literature; in an ideal world, only intelligent and rational leaders expressing veritable affective commitment to the organization by internalizing the collective identity would come to be its representative. In practice, it becomes an empirical question, and organizational theory can contribute to game theoretic refinements.

II. B. The Model: The Folk Theorem with Probable Termination

As previously noted, this paper intends to make a first-step towards a universally testable game theoretic approach by considering the experiences of non-European and state corporatist traditions, where employers' organizations serve a relatively minor role. Also, because dialogue is performed at the initiative of the state, it must believe *ex ante* that it will gain more by engaging in dialogue rather than the usual menu of fiscal and monetary policies. To reiterate from Section *I. A.*, such dialogue may theoretically foster political and economic stability, allow efficient articulation of preferences and distribution of resources, or allow labor and employers organizations to concert economic policy to more efficiently control inflation, unemployment, and public debt. Because , cooperative social dialogue represents a mutually efficient and Pareto-optimal way to achieve the best balance of the three, but because defection is an immediately credible threat, the prisoner's dilemma is the appropriate class of game.

Recognizing the cyclical and iterative nature of social dialogue, the ILO has empirically modeled sustained dialogue into four steps: (i) *Discussion and Negotiation*, followed by (ii) *Agreement of Action Programme*, followed by (iii) *Implementation*, and then (iv) *Follow up, Monitoring, and Evaluation*. Finally, this provides *Feedback* to the next round of dialogue (Ishikawa 2003).

Grafting the prisoners' dilemma into a cyclical model where social partners are largely poised in a captive relationship suggests that an iterated prisoners' dilemma is appropriate. Hypothesizing a finitely repeated alternative, where the precise termination of a forum or partner is acknowledged, results in a backwards induction solution where players defect in every game—the so-called "caterpillar game." However, because the tenure of bargaining relationships are not known, a forwards-induction reputation-based model is appropriate. The theoretical groundwork for the analysis of the infinite-horizon game is laid by the Folk Theorem, proven by Friedman (1971), which describes the conditions necessary for sustained cooperation (in technical terms, where the bilateral cooperation is a subgame-perfect Nash equilibrium in an infinite-horizon game). It shows that if certain conditions are met, each player employs a "trigger strategy," where a player cooperates until the other does not. Put simply, the iterated prisoners' dilemma describes where players may be deterred from

exploiting the immediate gains of defection by waste over the "long shadow of the future" in which neither side cooperates. Here, a version of the iterated prisoners' dilemma is adopted that also includes an "end-game" discount rate in addition to a time-value discount rate. Payoffs relevant to the Folk Theorem remain the same.

Following Friedman, and including the provision that dialogue may not continue, we have our generalized enabling condition. and a "trigger strategy" is employed where

$$d_i \leq \frac{1-p}{1-r} c_i \qquad \textit{[Folk Theorem]}$$

Here, p represents the believed probability that the next round of dialogue will not occur (the "end game" discount"), r models impatience (the "time-value" discount), d_i and c_i represent the per-period defection and cooperation payoffs respectively.

The intuition behind the Folk Theorem's application to the iterated prisoners' dilemma is that both players will cooperate if their gains from defecting rather than cooperating is greater than their discount of the future; the present-value of one-period defection and subsequent non-cooperation is greater than the present-value of sustained cooperation. If the generalized enabling condition is not satisfied, the pure strategy Nash equilibrium will exist where the player defects in any given round, and non-cooperation will continue as long as the parameters and players remain the same.

III. The Folk Theorem and the Conditions for Sustained Cooperation

This section reconstructs the enabling conditions of social dialogue by breaking down each of the four parameters of the Folk Theorem, and then notes similarities within existing literature where appropriate. The first condition relates to the assumptions of the game; *partners must be rational and informed* of the nature of the game. The second through fifth conditions relate to the parameters, and construct the appropriateness of the trigger strategy, given the assumption that partners are rational and informed; that is, for cooperation in a first period, *partners must be sufficiently integrated, stable, reactive, and farsighted*. The sixth condition for cooperation, given by the trigger strategy, requires that other players cooperated in the previous period; sustained cooperation requires that *other players have a reputation for cooperation*. The theoretical discussion of each parameter is pre-empted by a case. In the interest of continuity and uniformity, cases will be drawn from the Republic of Korea. A brief context is provided:

Korea's democratization in 1987 released the floodgates of labor activity, as authoritarian controls gave way to rapid adjustment as the working class pressed employers to raise historically suppressed wages to market levels. Controlling wages to preserve cost- competitiveness became a central tenet of President Roh's administration, and in 1989, the Korean Labor Institute collaborated with Australian experts to culture the embryonic stages of social dialogue. However, the state-protected Federation of Korean Trade Unions (FKTU) was reticent to engage in dialogue over wage moderation within the National Economic and Social Council (NESC),[2] prompting the government to unilaterally impose a single-digit national wage increase guideline in 1990. Under government pressure, the FKTU agreed to a series of tripartite negotiations, and by 1994, a relatively modest guideline of 5-8% was set (Young-Ki 2000).

In practice, the wage guidelines did little to slow burgeoning wages. However, one result of the guidelines was that it alienated and excited the nascent independent union movement, which vigorously opposed the wage guidelines (Leggett and Kwon 1998). The guidelines, in addition to heightened awareness of Korea's clear abrogation of international standards on freedom of association since its induction to the ILO in 1991, bolstered the recently formed Korea Trade Union Congress (KTUC). Although the illegal KTUC confronted severe repression that included the imprisonment of most of its leadership, its radical and militant ideology quickly gained sway over the most historically exploited sectors of the workforce (Ho Keun 1999). In November of 1995, the Korean Confederation of Trade Unions (KCTU) was declared from the loose myriad of independent unions in the Korean Council of Trade Union Representatives. At the time of the KCTU's official inception, it represented 400,000 members from 861 unions.

Owing to the KCTU's origins as an illegal grassroots movement, and the new democracy's revolving leadership, it is easy to see why subsequent attempts at dialogue could be seen as a non-cooperative game, largely independent of institutional connections to the government. Likewise, Korea has witnessed a series of major social dialogue failures, though concertation may have alleviated the economic crisis, which doubled the unemployment rate in 1996-98. What discouraged this concertation and resulted in Korea's characteristically distrustful labor relations?

[2] To evade tripartite discussion of wage moderation, the FKTU established the National Economic and Social Council (NESC) as an exclusively labor-management forum for economic and social policy discussion, and refused discussion of wage guidelines.

III. A. No Opportunism Condition: Defect where defection is rewarding; for high values d

The first two conditions, the "No-Opportunism" and "Deterrence" Conditions obviously have roles in the determination of dialogue's resolution, but game theory highlights more nuanced elements of cooperation and defection's appeal.

The NESC was a clear case where defection at the grassroots-level was very appealing; as local bargaining immediately promised much greater real wages than those offered under the wage moderation talks. This coupled with the inability of the FKTU to moderate these local agreements spelled the failure of the forum—in this case, the absence of free association may be partially to blame for the lack of legitimacy required to broker and enforce an amenable moderation regime.

The internal defection from the NESC may evidence the conundrum cited by Panitch (1979), Offe (1981), and Streeck (1982), that organizations must possess sufficient hierarchical controls to prevent opportunism at lower levels, or, as Baccaro suggests, they must possess a sufficient sense of procedural fairness for elective commitment. However a tight labor market allowed suppressed wages to quickly accelerate, shielding workers from the inefficient unemployment generated by defection in free and equilibrated markets, so that the punishments associated with the market-mechanism may not be valid in this scenario; because unemployment held between 2% and 3% up to the 1997 crisis (Korean National Statistical Office), and because the state was already hostile to their movement, there were little economic or political costs to deter labor from defection.

In addition to the favorable labor market climate that allowed an appealing outside option to concertation, it is also clear why the FKTU would drag its feet entering into wage moderation guidelines that would rely on it to hierarchically police its own members. Accounting only 17.2% of non-agricultural regularly employed workforce (Koo 2001), it would bear the immediate brunt of adjustment alone while the labor market benefits would share its benefits. Therefore, labor organizations must indeed be "strong and representative;" labor organizations must have the authority and capacity to prevent potential internal freeriders from opportunism that would yield a collectively sub-Pareto result, and the size to speak and bargain for the benefit of labor as a whole.

Naturally, the iterated prisoners' dilemma assumes players observe each other's play in the previous period. In practice, this can be associated with a "identification time" and a "response time," where defection rents are preserved for as long as it takes the other to observe the defection and employ the triggered non-cooperative strategy. If the response time could be shortened (or may be believed to be short), then defection payoffs would decline, and it could be avoided *ex ante*.

Therefore, we can construct some theoretical environmental characteristics conducive to social dialogue. For the costs and benefits of curbing wage inflation to be internalized, labor and employers must possess sufficient horizontal integration to prevent lateral defection (ie, among other central organizations), and vertical integration to prevent internal (or subunit) defection. For economic outcomes to be mutual, markets should be relatively equilibrated. Furthermore, when designing a dialogue forum, this condition highlights certain characteristics that a competent authority could implement to make defection less appealing, thus providing the institutional characteristics that promote dialogue's success. To reduce identification time, compliance to agreement guidelines should be complemented by active monitoring systems. To reduce response time, a quick retaliatory mechanism must be institutionally embedded, perhaps accelerating the ability of other partners to suspend their own obligations in defensive retaliation.

III. B. Deterrence Condition: Defect where cooperation holds less appeal; for low values ci

Naturally, defection is encouraged where the sustained losses associated with non-cooperation are minimal. Where the prisoners' dilemma relationship holds, we may add that defection is encouraged where the period of defection rents are extended and the duration of non-cooperation is short. The importance of deterrence is highlighted by the experiences of Korea's 1996 Presidential Commission on Industrial Relations Reform.

In 1995, President Kim Young-Sam pushed a slew of economic reforms in a bid to enter the OECD. In March 1996, he created the Presidential Commission on Industrial Relations Reform (PCIRR), a tripartite dialogue forum charged with negotiating a very broad revision of the labor code (Lee and Lee 2003). Although the illegal KCTU was not formally invited to participate in discussions, the state recognized the necessity of including the democratic movement following the failed implementation of the NESC wage guidelines, and invited one of the KCTU's affiliates. Although progress was made over minor issues, no agreement over the hot topics of freedom of association, mandatory topics of bargaining, and layoffs could be forged. By September, public interest representatives tabled a discussion paper outlining the stances of social partners, and recommending solutions. The paper, which was criticized by the KCTU as having "made no progress on these central issues of labor law reform," became the crux of the severely distorted draft submitted to the legislature.

On December 26th, 1996, in a pre-dawn session in absence of opposition members, the ruling party of the National Assembly circumvented the PCIRR by unilaterally steamrolling the Trade Union Act with less than seven minutes of discussion, granting employers greater power to layoff workers, hire temporary workers and strike replacements, and extending the ban on multiple unions. The ensuring general strike was Korea's largest since the Korean War, crippling its heavy industries in the first days of the strike. While the strikes were suspended for the New Year holidays, leading unionists and government officials believed the strike would calm down. In contrast, workers from a wide variety of white collar industries joined the strike, which swelled to some three million participants. In January, President Kim pledged to return to dialogue, and on March 10th, a new Code was promulgated that allowed the existence of multiple peak labor federations, third party support for concerted activity, and political involvement. Despite burgeoning unemployment and economic crisis, social dialogue remained paralysed until late 1997, when President-elect Kim Dae-Jung's promise to bring industrial stability materialized in the formation of the Tripartite Commission.

Authors posit a variety of reasons why the Act was promulgated as it was. Koo (2001) hypothesizes that the timing of the reform reflected a belief that tensions would be cooled by the New Year holidays. It is also notable that Korea had very recently gained membership into the OECD, partially owing to the efforts at consultative reforms embodied by the Commission. prompting the second largest general strike in the nation's history. Moreover, the strike enjoyed the support of the ILO Committee on Freedom of Association and the OECD Trade Advisory Committee, largely due to Korea's continued non-adherence to the principles of free association and the right to organize and collectively bargain.

The massive failure of the PCIRR was largely a product of distorted incentives. Where Korea had once stood to lose OECD membership for antagonistic labor relations, its entrance in October reduced costs associated with defection. Because Korea's entry into the OECD was not contingent on its ratification of international labor standards, and owing to political instability, the “long shadow of the future” was shortened and lightened. If Koo's hypothesis that the Act's promulgation was strategically and opportunistically placed at the New Year, then it was perceived that retaliation would be alleviated and the c_i reduced.

III. C. Longevity Condition: Defect if the probability that dialogue ends in the next period p is sufficiently great

Intuitively, this condition states that, where the probability that dialogue will be discontinued, partners will be encouraged to maximize short-term gains through defection, the most extreme case of this ($p = 1$) reverts to the single-shot prisoners' dilemma. To be certain, it is not fair to strictly equate this parameter to the probability that any given forum is sustained; in this scenario, cooperation would be impossible in expressly *ad hoc* fora. Rather, a broader definition of dialogue must be adopted, and within the language of social dialogue and game theory alike, it can be considered pertinent to model the probability of continued discourse with any party with which it might construct a reputation. Therefore, while the classic construction iterated prisoners' dilemma hypothesizes an infinite-horizon, in practice dialogues and players develop their reputation over finite tenures. This parameter is instrumental to modeling the values of stable social partners and dialogue regimes, and highlights a role for legislation to provide structural embedded assurances against defecting strategies. We illustrate the importance of stability by the attempted revival of the 1998 Tripartite Commission.

Entering the 1997 East Asian financial crisis, South Korean labor relations were among the least stable in the world, plagued by a history of debilitating distrust. In December of the previous year, the National Assembly's unilateral circumvention of tripartite talks and imposition of a highly contentious labor code prompted the largest sustained national strike Korea had seen for fifty years. Yet, one year later, newly inaugurated President Kim Dae-Jung outlined his plan for a presidential Tripartite Commission, which in March 1998 produced a promising landmark agreement in which partners agreed to split the burden of economic recovery following the East Asian financial crisis. However, the Commission eventually broke down during the drafting process, amidst accusations of collusion and lethargy on the part over the government on responding to the recommendations of the Tripartite Commission. In a bid to compel the FKTU and KCTU to return to negotiations, the Assembly passed the Tripartite Commission Act, which established the Commission as a permanent national institution (rather than a presidential one) and mandated the government to act with reasonable haste to its recommendations (OECD 2000).

How could we theoretically break down the Tripartite Commission Act's attempt to reinvigorate dialogue? First, by establishing the permanency of the Tripartite Commission, the Act sought to bring stability to the dialogue process that had been as volatile as the government. By establishing the forum's permanency, it sought to signal that the Commission will endure despite volatile politics, modeled by a reduction in the p value above. Secondly, the Act's mandate that the state make reasonable efforts to address the recommendations of the Commission could be said to mandate a response to which it could not credibly commit; that is, the guarantee to make reasonable attempts to respond to the Commission's recommendations would use the classical

mechanism of structural embeddedness to assure against potentially harmful indefinite stagnation. Although Act did initially motivate the Federation of Korea Trade Unions (the larger, government-sanctioned peak labor organization) to return to the forum, its guarantees failed to re-attract the more militant and non-sanctioned Korean Confederation of Trade Unions, which conditioned their return upon certain pre-negotiation concessions (Young-Ki 2000).

This models several scenarios where labor or employers organization may be adverse to cooperation: where a presumably fleeting political party cannot credibly commit to future policies, where partners suspect its sustained commitment to dialogue process, where transparency and enforcement is lagged or limited, or where it simply has a reputation of failing to meet commitments (thus invoking the "trigger").

It is also clear that the sustainability of dialogue is particularly suspect in environments of political instability; here, it is particularly difficult for political actors to build a reputation, and similarly it gives reason for partners to suspect their commitment to making long-term investments in the health of labor relations. This feature is particularly salient in the South Korean case, where opposition parties aligned to the *chaebol* may be suspected to fail to adhere to agreements. In this way, the *p* parameter may be related to the conundrum posed by Acemoglu (2002) and Acemoglu and Robinson (2001), that transient political institutions have limited ability to commit to future policies.

This parameter, particularly within the light of the GEC, suggests that such conditions of political instability and poor reputation may only be overcome where defection or non-cooperation is made very unappealing. Thus, where *p* is high (owing to ill reputation, political instability, or so forth), then an effective state remedy may include: building coalitions with opposition parties and affirming their commitment to sustained dialogue, empowering a third party (eg the ILO) to monitor discussions for evidence of collusion, giving cooperation more immediate appeal to social partners, or signalling a commitment to dialogue through confidence-building concessions, forum institutionalization, or politicizing cooperative labor relations.

III. D. Farsightedness Condition: Defect if the time-value discount rate r is sufficiently great

If a player heavily discounts future gains relative to immediate gains, it might prefer the immediate gains of non-cooperation to the benefits of sustained cooperation and strong relations. Economic and dialogue literature also refers to this discount as myopia, impatience, or short-termism. Here, we examine the experience second round of the 1997 Tripartite Commission negotiations.

Between 1996 and 1997, the Korean economy entered a period of decline. In December 1997, the government received a $57 billion bailout from the IMF, which called for greater flexibility to catalyze economic restructuring. President-elect Kim Dae-Jung consulted with representatives from labor and employer federations to create the Tripartite Commission to ease this transition. By February, the Commission had produced a historic accord that extended beyond labor issues to address economic and political reform. In a reversal of its PCIRR stance, the KCTU agreed to emergency layoffs in exchange for public sector unionism (Koo 2001). However, this produced a crisis within the rank and file of the KCTU, and within three days, a delegation denounced the accord and elected the hard-line president of the Hyundai-Heavy Industries union as its new leader.

Again, this condition is in harmony with ILO literature, and explaining the role of short-termism has been the subject of a number of scholarly articles, noting that "survivalist options" exacerbate crises and make recovery more costly. Lucio Baccaro (2002) surveys the hypothesis that there is a conflict between grassroots union membership that exhibits myopic preferences while the leadership that coordinates for the organization's strategic goals and sustainability—a hypothesis that would seem to be evidenced here. The theoretical solution is for organizations to impose some degree of top-down controls on the membership, or rely on collective identity or democratically-inspired procedural justice to counter short-termism; organizations with high turnover, a crisis that threatens the continued existence of the organization, or a general lack of collective identity may be more at risk for exhibiting myopic preferences.

III. E. Cooperative Tradition Condition: Bilateral cooperation in previous rounds is a necessary condition of cooperation in any round where the trigger strategy is employed; otherwise defect

One of the greatest advantages of the iterated-dilemma perspective is that it accounts for the significance of past play—it formalizes the understanding of trust, reputation, and commitment, and shows why social dialogue regimes may be either historically defective or healthy, though both are composed of rational actors, even where partners are faultless and satisfy all of the conditions for a "trigger strategy" above.

This account for hysteresis is empirically evidenced by the milieu of cooperative traditions, and those trying to "start over," and why rising political parties committed to labor may possess that blank slate. Returning to

Korea, we can consider a simple generalization as to why its dialogue regime has been so fruitless—its fragmented regime was cultivated as its burgeoning independent union movement was under severe surveillance and repression.

IV. Conclusions

First and foremost, this paper tries to promote the exchange of insights from bargaining theory and social dialogue. To do so, it presents an accessible historical account of the literature considering dialogue's enabling conditions, and then employs Friedman's formal exposition of the conditions for cooperation in an iterated prisoners' dilemma (namely, the Folk Theorem) to hypothesize a single holistic enabling condition for social dialogue. It shows that the classical observations of the environmental characteristics that appear to promote and discourage effective dialogue are also revealed at their essence through this application of the Folk Theorem. The model's unified framework may provide a foundation for more rigorous analysis of impediments and effective solutions for countries implementing social dialogue systems. Where dialogue is defective, an authority may be interested in the conditions necessary to break a sour tradition, and game theory appears to provide one possible and powerful account of why distrust makes dialogue systems difficult to resolve, and why the potential for mutual gain is often insufficient to compel even rational parties to cooperation.

Historically, the language of social dialogue has revolved around the conditions set forth by the ILO, namely that effective and sustainable dialogue is characterized by: strong, independent, and representative social partners; a political will and commitment to engage in dialogue; a respect for the rights of freedom of association and collective bargaining; and appropriate institutional support. The model posited here suggests slightly different but related enabling conditions. Assuming rationality and complete information, and using the dilemma of macroeconomic coordination described by Tarantelli, we find that partners must be sufficiently (i) *integrated*, (ii) *stable*, (iii) *reactive*, and (iv) *farsighted,* and that (v) partners cannot have a defective reputation. Moreover, we can now add the very important caveat that any elements of conditions (i) – (iv) can actually compensate for each other.

This is not to say that these characteristics do not *by nature* constitute social dialogue. Our model necessarily defines success as bilateral cooperation, presumably sustained through stability and the existence of a sub-game perfect Nash equilibrium for players to employ the trigger strategy. However, to attain the necessary standards of integration, stability, reactivity, and farsightedness, social dialogue may be placed under non-democratic constraints. For example, one could hypothesize that some state corporatist arrangements use coercion to guarantee integration, resources and recognition to provide stability and farsightedness, and because agreements are subject to the state's hegemony over bargaining power, it can guarantee its own adherence, supplanting the need for reactivity.

[INSERT TABLE ABOUT HERE]

This exposes why the ILO's “enabling conditions” may be something of a misnomer, as one could argue that the requirement that partners adhere to the principles of freedom of association and collective bargaining are considered a *definition*, separate from the other “enabling conditions” for conclusive dialogue.

In addition to the ILO's articulated enabling conditions, the model's theoretically-derived conditions offer a new perspective to promoting the effective implementation of dialogue fora. This analysis exposes the values of broad coverage, political and institutional stability, a reputation for credible efforts to address dialogue's recommendations, and institutionally embedding monitoring and response mechanisms, providing a theoretical principles for each and noting how a failure to fulfill the enabling conditions may arise from these institutional characteristics.

While the theory of iterated games may shed light on the calculus appropriate under the non-cooperative game hypothesis, and the iterated prisoners' dilemma may be a theoretically plausible and empirically-evidenced reduction of the dilemma of macroeconomic coordination, their application must naturally carry with it the caveat born of its unrealistic assumptions. Partners are not perfectly rational and self-serving, elected agents for negotiations do not necessarily act strictly in the organization's best interest, and the principals (e.g. the union membership) has only an incomplete understanding of activities at the peak level. Calculating all of the factors that affect the utility of an agreement isn't possible for either the rank-and-file, the representative, or the researcher, but a better understanding of how procedural fairness, collective identity, bounded rationality, and other analytical influences affect this calculus can advance a game-theoretic perspective, rather than constitute a fundamentally different approach.

The model posited here does not seek to challenge the ILO's reminder “that there is no fixed formula that can guarantee successful outcomes in an industrial relations reform process.” However, it does try to give existing literature a theoretical backbone, and an avenue for enabling conditions to be tested through

econometric means with identifiable assumptions. Case studies may be further employed to refine this perspective, or it can be adapted using other literature to account for other initial conditions. Additional work may be done to refine the model, treat bargaining within a different class of games, or argue how social dialogue topics other than macroeconomic coordination should be modelled. From a game theoretic perspective, behavioral theories may be adapted to further develop the theoretical skeleton from which we can flesh out national experiences, and deduce testable models of the enabling conditions of successful and democratic social dialogue.

TABLE: TRADITIONAL AND MODELLED ENABLING CONDITIONS

Source	Conditions	Related Parameter	Modeled Statement	Effective Response	RELEVANT EMPIRICAL RESEARCH
ILO	Strong, Independent, Representative Social Partners	*c*	Sufficiently horizontally-integrated ("strong," "representative") partners	Broaden representation for wide bargaining coverage and effective coordination	Tarantelli
			Sufficiently vertically integrated ("strong") partners, preventing subunit defection*	Depends on system[1]	Baccaro
		p	Sufficiently stable ("strong") partners to credibly commit to future recognition of agreements	Encourage stability among partners, institutionalize dialogue and agreements	Acemoglu
	Political Will and Commitment to Engage in Dialogue Among Partners	Prima Facie	Game exists with rational players		
	Respect for Freedom of Association and Collective Bargaining	*c*, *p*	A prerequisite for integrated and stable ("strong, independent, and representative") partners characterizing social corporatist systems, see above	Depends on system[2]	
	Appropriate Institutional Support	*d*	Sufficiently *reactive* partners	Embed monitoring system to *quickly identify and respond* to action	Heise
		p	Mandate to bargain	Forum permanency to signal commitment to dialogue, resolution to act upon and/or legislate agreements	
		c	Institutions may affect payoffs (c_i) endogenized by prisonner's dilemma[2]	Efficient dialogue systems	
Other Cited Conditions	Farsightedness	*r*	Partners must be sufficiently *farsighted*[5]	Researchers have posited resolutions including hierarchical controls, democratically-inspired procedural justice, affective commitment, short-term agreements	Offe, Streeck, Pantich, Bacarro
	Tradition of Good-Faith Bargaining	Modeled Condition	Trigger strategy: Cooperation in iterated prisoner's dilemma is conditioned upon observed mutual cooperation in all previous rounds	"Reset" the game; change payoffs (eg crisis, resolution of commitment to dialogue), change players (eg new labor or political representatives with reputation of cooperation)	
	Willingness to Share Information	Prima Facie	Assumption of Complete Information[3]	Encourage players to share information (preferences, strategies)	

[1] Hypothetically, independence promotes vertical integration as typified in social corporatist models. In state corporatist models, stable partnership might be a result of non-democratic means, eg provision of state sponsorship, protection, and/or resources.

[2] Our model examines a round of dialogue leading to an agreement as a period; further breakdown may show value of institutions, eg if institutions reduce information asymmetries, accelerate or reduce the cost of bargaining, Rubinstein's alternating-offers game shows these effects may avert an end-game punishment (like a strike)

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The Day of the Week Effect in Istanbul Stock Exchange During 1988-2006

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ABSTRACT

This paper analyzes the day of the week effect on stock returns in Istanbul Stock Exchange from 1988 to 2006 by using the GARCH (1,1) model. Tha data in the study are taken from the daily values of ISE 100 closing index. Because one of the main objects in the study is examining the magnitude of the anomaly in different time periods, three sub-periods are also investigated in addition to whole data range. It is indicated in the paper that the day of the week effect is present on returns for ISE during 1988-2006 by three significant coefficients. However, when the sub-periods are considered the significance of the anomaly has been disappearing for 5 years as a consequence of the increased market efficiency and stability in this period. The findings also imply the fact, whilst the return at the beginning of the week (Monday and Tuesday) is low, it is steadily increasing towards the end of the week.

A. INTRODUCTION

The seasonal (calendar) anomalies of various financial tools have been examined systematically as a popular topic of the finance literature in recent times. These documented anomalies emphasize the fact that, historical returns and volatilities of financial assets may exhibit consistent but unreasoned behaviors particular to specific time periods on the contrary to the 'random walk theory[1]'. *The Holiday effect, the January effect*, and *the Day of the Week effect* are well-known seasonal patterns which have been detected by academicians in the financial markets so far. On the other hand, still there is no consensus in the financial literature about the possible causes (explanations) of the observed anomalies.

Brooks and Persand (2001) define the day of the week phenomena as "the tendency of financial asset returns which display regular patterns at certain days of the week." Therefore, it is assumed that there exists a serial correlation between asset returns and volatilities which vary across days of the week. Whilst some specific days in a week (e.g. Friday, Thursday) have higher returns and lower volatilities; several days (e.g. Monday, Tuesday) are assorted with lower returns and higher volatilities. Nevertheless, these particular days can change across the different markets in the world. For example, although Mondays have the lowest return for Dow Jones Index in US (Gibbons and Hess 1981 - Lakonishok and Smidt 1988); the minimum returns are recorded on Tuesdays in Japan capital markets (Jaffe and Westerfield 1985. As an investor it would be flashing to know the best investing time and take positions accordingly. However there exist some limitations, like transaction costs, in practice as regards to employing seasonality strategies.

Thus far, empirical researches on the day of the week effect have been generally conducted by two main methodologies; the *Standard Linear Regression* and the *Generalized Autoregressive Conditional Heteroskedastic (GARCH) models*. Even if the linear regression method is less complex and easier to implement; the GARCH models give more accurate and realistic results as a result of releasing the rigid and inconsistent assumptions[2] of the linear regression on the daily stock return series. Connolly (1989) demonstrated that the stock returns have time-varying volatility and the required heteroskedasticity corrections on the data are applicable with addressing the GARCH models. Moreover, Choudry (2000) highlights the GARCH models which are capable of covering three important features of the stock return data; leptokurtosis, skewness and volatility clustering.

The objective of this paper is examining the existence of the day of the week effect in Istanbul Stock Exchange (ISE) for the period between 1988-2006 and more importantly if the anomaly observed in the market, whether its magnitude changes in different time periods as yet. The empirical investigation of the study is driven by using the Generalized Autoregressive Conditional Heteroscedastic model (GARCH) related to mentioned strengths of the method against the linear regression. In spite of the existence of numerous GARCH

[1] Random Walk Theory states that stock market prices evolve according to a random walk and thus the prices of the stock market cannot be predicted.

[2] homoscedasticity of errors (constant variance) and no serial correlation between errors.

derivations (GARCH – M, t-GARCH…) in this field, commonly used GARCH (1,1) is preferred in this paper as the fundamental model.

The rest of the paper is organized as follows; second part (B) discloses the existing literature on the day of the week effect; third part (C) provides a description and analysis for the data; as following fourth part (D) explains the methodology. The next part (E) interprets the empirical results and the last part (F) concludes.

B. LITERATURE REVIEW

There exists significant number of studies on the day of the week anomaly all over the world. But it is widely accepted view that Fama's paper in 1965 ("The behavior of stock market prices") is placed in the center of these arguments as a milestone. He examined the reality of the *Efficient Market Hypothesis* and concluded that the distribution of stock price changes didn't best fit with the data through normal distribution. Following to the Fama's findings; Cross (1973), French (1980), Gibbons and Hess (1981), Lakonishok and Levi (1982), Abraham and Ikenberry (1994) and Pearce (1996) analyzed the US stock markets and indexes to mark the day of the week effect in different periods. The crossing point of all these studies highlights the finding of lower (or negative) Monday returns and higher Friday returns of investigated time-series. Nevertheless, the reasons of abnormal daily returns could not be expressed -except few suggestions- satisfactorily.

In international context there are also many evidences (from developed and emerging markets both) concerning with the day of the week pattern. Jaffe and Westerfield (1985) studied with the returns of five well-known stock markets- U.S., U.K., Japan, Canada and Australia- and different from the previous findings of the U.S. market; they found the lowest returns on Tuesdays (instead of Monday) for Japanese and Australian stock exchanges. Aggarwal and Rivoli (1989) expanded the existing literature on the day of the week effect by examining the four Asian stock markets-Hong Kong, Malaysia, the Philippines and Singapore-. They are confronted with minimum (negative) returns in a week on either Monday or Tuesday for these countries. Another day of the week inquiry for Southeast Asian markets is driven by Brooks and Persand (2001). They detected significant positive Monday return for Thailand and Malaysia markets which is completely contrasting compared to world markets. The lowest returns for both countries are observed on Tuesdays. Furthermore, Kohers, Kohers and Pandey (2004) analyzed the largest capital markets of four continents from 1980 to 2002 by the means of the day of the week effect. They discussed that parallel to the improvement of the market efficiencies recently, the day of the week phenomena is started to disappear in the world markets. Even though this anomaly is more noticeable in 1980s for given markets; it began to loose its magnitude with the beginning of 1990s. In a more recent paper; Ajayi, Mehdian and Perry (2004) investigated the eleven Eastern European emerging markets and indicated that six of the markets have negative Monday returns consistent to the previous studies. However, five of the eleven markets characterized with positive Monday returns. It is also concluded in the paper that there is no evidence about the presence of the day of the week anomaly in Eastern European emerging markets significantly.

Despite the Turkish stock market (ISE) does not have a long history (just 19 years) as developed markets, it is also analyzed many times regarding to the day of the week effect. Balaban (1995) determined that the lowest returns occur on Tuesday and the highest returns on Friday in ISE for the period of 1988-1994. Karan and Demirer (2000) searched the anomaly in ISE from 1988 to 1996. Different from other studies, the inflation and interest rate effects on stock prices are eliminated by adjusting the data, to reflect the main characteristics of Turkish economy for given period. They resulted that there is no clear evidence for the day of the week effect. Moreover, Bildik (2001) indicated that the market shows significant day of the week effect by performing low or negative return over the first part of the week (Monday through Tuesday) and high and positive returns over the second part of the week (Wednesday through Friday) besides volatility reached the highest and lowest values in a week on Mondays and Fridays respectively for the period of 1988-1999. At last Berument, Inamlik and Kiymaz (2004) tested the 1986 – 2003 period of the ISE to evaluate the existing seasonal effects by using the GARCH models. According to their findings, Monday and Friday are described as the lowest and the highest return days of the week correspondingly. Nevermore, it is observed in the study that whilst Monday has the highest deviation; Friday holds the lowest deviation of the week contrast to its higher returns.

C. DATA

The data used in the study consist of the daily values of ISE 100 closing index (as the main indicator of national market) and it covers the period from 05.01.1988 to 15.12.2006 with 4708 observations totally. To emphasize one of the essential objects in the research –comparing different time periods- the data is divided into three sub-periods as in the following:

Period-1: 05.01.1988 – 30.12.1994 by 1751 observations

Period-2: 02.01.1995 – 28.12.2001 by 1728 observations

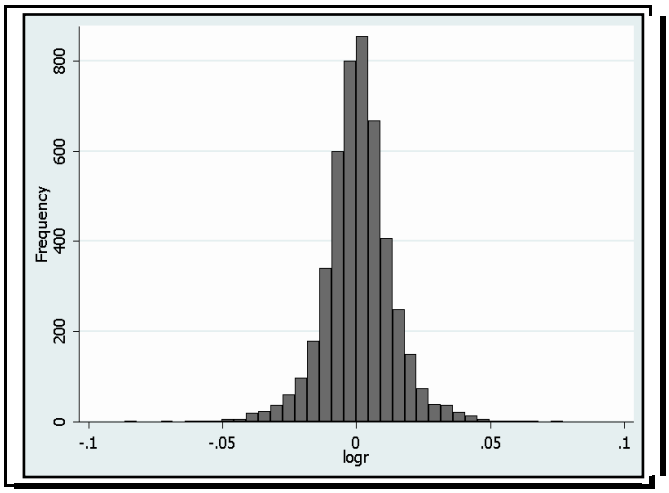
Period-3: 02.02.2002 – 15.12.2006 by 1229 observations

When the Augmented-Dickey Fuller test was applied to ISE-100 daily closing values to check stationary of the data; it is estimated that the closing values are non-stationary (Ref: Appendix) which exhibit the unfortunate property that previous values of the error term will have a non-declining effect on the current value of parameter as time progresses[3]. As a consequence of the unit root in ISE-100 index, the data is required to adjust for making it stationary as the following transformation formula;

$$R_t = \log[y_t / y_{t-1}] \qquad (I)$$

where y_t and y_{t-1} represent the daily closing values of ISE-100 index at time t and t-1 respectively. R_t demonstrates the return on ISE-100 index. Subsequent to the adjustment of data, Augmented-Dickey Fuller test is applied once more and it is reported that data become stationary form through rejecting the existence of unit-root hypotheses significantly (Ref: Appendix). The frequencies of the return values provided from the logarithm transformation can be shown as in the figure below.

Figure-I: Frequencies of Logarithmic Returns



Descriptive Statistics

The following table presents summary statistics of ISE-100 index log returns used in the analysis, by covering each period (I,II and III) and whole data range (shown in the table as "All") separately. Supplementary statistics for each week day for entire data are also represented in the same table. Such an analysis would be meaningful to compare returns and deviations for each week day individually.

Table-1: Basic Statistics of daily returns

	Mean	Median	Max	Min	S.D	Variance	Skewness	Kurtosis
Period-1	0,09%	0,03%	4,46%	-5,47%	0,01323	0,0017	-0,03090	4,2201
Period-2	0,10%	0,07%	7,71%	-8,67%	0,01448	0,0020	-0,08815	6,4 2814
Period-3	0,04%	0,08%	5,12%	-5,79%	0,00941	0,0008	-0,05596	6,8 6724
All	0	0,	7	-	0,	0,0	-	6,0

[3] Indrotuctiory Econometrics for Finance, Chris Brooks, 2002

	,08%	07%	,71%	8,67%	01285	0016	0,04803	6278
Monday	-	-	6	-	0,	0,0	-	4,8
	0,03%	0,05%	,12%	6,86%	01524	0023	0,04680	8235
Tuesday	-	-	7	-	0,	0,0	0,031	5,8
	0,01%	0,04%	,71%	4,31%	01221	0014	07	5204
Wednesda	0	0,	7	-	0,	0,0	-	7,9
y	,10%	09%	,42%	8,67%	01256	0016	0,33386	4585
Thursday	0	0,	5	-	0,	0,0	-	5,1
	,14%	12%	,12%	6,10%	01261	0016	0,22568	0070
Friday	0	0,	6	-	0,	0,0	0,389	6,7
	,19%	18%	,79%	5,22%	01118	0012	06	8450

As demonstrated in the table, Period-2 has the highest mean return among all periods. Nevertheless recent stable trend in the economy caused to lower the volatility measure of Period-3 by providing nearby half standard deviation and variance numbers compared to other periods. The maximum and minimum daily returns are recorded as 7.71% and -8.67% respectively during 1988-2006. Kurtosis values of logarithmic returns given in the table are largely positive and that signals the leptokurtic (non-normal) distribution of stock returns. On the other hand contrary to the *Efficient Market Hypothesis*' framework (higher return on a particular day is just a reward for higher risk on that day); Monday has the lowest mean return (negative) although the highest variance is observed on that day, besides Friday has the highest mean return as a weekday with the lowest volatility among other days.

D. METHEDOLOGY

The GARCH (p,q) model which is introduced by Bollerslev (1986) underlines the fact that the variance of error terms for stock return data are not constant over time (so called "heteroscedastic") as assumed in linear regression; hence past variances are considered as the explanatory of current variances. It is also included in the model that there is serial correlation between error terms in opposition to other assumption of the linear regression. These both factors, constant variance and no serial correlation between error terms, are accepted as the drawbacks of the linear regression method by Berument and Kiymaz (2001). Moreover, Akgiray (1987) concluded in his study that the conditional heteroscedastic processes fit to stock return data very satisfactorily and provide improved forecasts of volatility; in addition GARCH (1,1) model demonstrates the best fit and forecast accuracy within GARCH derivations.

The equations of mean return and conditional variance[4] in GARCH (p,q) process concerning to analyze the day of the week effect are specified as follows;

$$r_t = \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \varepsilon_t \quad \textbf{(mean equation)} \quad \textbf{(IV)}$$

$$\varepsilon_t^2 | \psi_{t-1} \approx N(0, h_t^2) \quad \textbf{(V)}$$

$$h_t^2 = \delta + \sum_{i=1}^{p} \lambda_i h_{t-i}^2 + \sum_{j=1}^{q} \theta_i \varepsilon_{t-j}^2 \quad \textbf{(conditional variance)}$$

(VI)

where r_t represents log returns of ISE-100 Index, D_n (n=1 through 5 for Monday to Friday; i.e. D_1=1 if the day is a Monday and D_1 = 0 otherwise.) is used for dummy variables in the model to emphasize daily seasonality, also β_n represents the day coefficient of GARCH estimations (n=1 through 5 used for the days Monday through Friday) and ε_t is a random error term while ψ_{t-1} coefficient indicates available past information that has an effect on error term. The conditional variance in the model is demonstrated by

[4] formulated by Bollerslev (1986)

h_t^2 coefficient; λ and θ coefficients reflect heteroscedasticity feature of the return data and δ is used as a constant in the variance equation. The day of the week effect regarding to the return component can be asserted in the model with statistically significant (1% and 5% levels) β_n findings.

E. EMPIRICAL RESULTS

The results from the GARCH (1,1) model corresponding to the day of the week effect on stock returns are summarized in Table-2. As in previous tables, the results are presented separately for each period and entire data set. The day of the week effect appears in non-normal return series; thus to check the normality of daily returns, the Shapiro-Wilk normality test is applied initially. Due to the Shapiro-Wilk test result, the normality of return data is rejected at 1 percent significance level for all periods. The Lagrange-Multiplier test[5] is also performed to investigate heteroskedasticty feature of the residuals and the presence of heteroskedasticity is captured through the test estimations (the null hypothesis of constant variance is rejected at 1% level) significantly by supporting the need of *Conditional Heteroskedastic* models to achieve more accurate results in the study. In order to verify the validity of GARCH (1,1) model, the Ljung-Box Q statistics[6] is employed on the standardized residuals[7] as the last specification test. The Q-statistics of each period and entire data imply that there is no serial correlation in the standardized residuals; consequently the GARCH (1,1) specification has some capability in explaining the time-varying volatility in the data satisfactorily.

As reported in Table 2, the day of the week effect is apparent in ISE-100 index during the period (1988-2006) under study by the means of return. The findings exhibit that the coefficients for Wednesday, Thursday and Friday are statistically significant at 1 percent level. Nevertheless, the returns on these days are positive and higher respectively (Friday has the highest mean return followed by Thursday). Thus, while the start of the week (Monday and Tuesday) has negative (for Monday) and lower mean returns; the tendency of mean values at the end of the week (Wednesday, Thursday and Friday) is signed by positive and higher returns. This estimation is greatly consistent with the Bildik's (2002) investigation. On the other hand, low Monday-high Friday returns in the analysis can be perceived as the existence of a 'Weekend Effect' in ISE-100 Index returns during 1988-2006, which is supported by the findings of Berument, Inamlik and Kiymaz (2004).

Table-2: Results of GARCH (1,1) Model

Coefficients	Period-1	Period-2	Period-3	All
Mean Equation				
β1	0.00037	-0.00118**	-0.00005	-0.00015
	(0.62)	(-2.11)	(-0.12)	(-0.57)
β2	0.00032	0.00075	0.00007	0.00039
	(0.57)	(0.95)	(0.13)	(1.23)
β3	0.00083	0.00110	0.00076	0.00088*
	(1.60)	(1.71)	(1.73)	(2.65)
β4	0.00014	0.00227*	0.00086	0.00099*
	(0.29)	(3.61)	(1.74)	(3.17)
β5	0.00122*	0.00151**	0.00126**	0.00137*
	(2.35)	(2.09)	(2.07)	(3.91)
Conditional				

[5] ARCH-LM test, by Engle (1982), is a procedure which tests the existence of possible ARCH effects in the data under the null hypothesis of 'No ARCH effect'. 10 lags are used to test the residuals in this study.

[6] Ljung-Box Q statistics is employed to check the serial correlation of standardized residuals. If there is serial correlation in residuals, the validity of the model estimations would be questionable. 10 lags are used to test residuals in this study.

[7] standardized residuals are defined as ε_t^2 / h_t^2

Variance				
δ	0.00001*	0.00003*	0.00005*	0.00006*
	(7.83)	(16.94)	(8.44)	(11.78)
λ	0.27726*	0.21702*	0.12412*	0.16469*
	(9.60)	(9.46)	(8.16)	(16.50)
θ	0.67072*	0.63013*	0.81525*	0.80439*
	(27.79)	(31.20)	(60.33)	(89.44) *
Log Likelihood	5278	4997	4061	–
Q-statistics (10)	10.55	6.73	15.34	12.57
ARCH-LM Test (10)	254.66	198.65	102.29	594.30
Shapiro-Wilk Test (w-value)	0.9827	0.9626	0.9632	0.9670

t-statistics of each coefficient are presented in parentheses

* and ** indicates statistical significance at 1% and 5% levels respectively

It is also emphasized in the table that each sub-period has different characteristics regarding to the day of the week effect on stock returns. Even if the anomaly is not clear in Period-I and Period-III (just Friday coefficient is significant at 1 and 5 percent levels respectively), it is much more intense in Period-2 with three significant coefficients belonging to Monday, Thursday and Friday. Therefore, we can claim that the magnitude of the anomaly in ISE have been changing as time goes by. Different economic conditions constituted in the country especially in last 10 years could be possible reason of this change. In Period-2 where the day of the week effect is more visible than other periods, the volatility of the stock market is extremely high as a consequence of the unstable macroeconomic environment (high inflation, 2001 financial crisis) and this corrupts the stock market efficiency with the evidence on the magnitude of day of the week anomaly for the same period. Although the significance of coefficients is changed among periods; mean returns of each week day show similar patterns at one point with the whole data. The largest positive returns are recorded on Thursday (Period 2) and Friday (Period 1 and Period 3) in the sub-periods whilst the minimum returns are found on Monday (Period 2 and Period 3) and Thursday (Period 1).

F. CONCLUSION

This study investigates the Day of the week effect on returns in an emerging stock market, Istanbul Stock Exchange (National 100-Index), from 1988 to 2006 by using the GARCH (1,1) empirical model. Meanwhile, the magnitude of the anomaly is also examined in different time periods by dividing the whole data set into three sub-periods relative to the changing conditions of the economy and financial markets. The GARCH (1,1) model has an advantage of taking into consideration heteroskedasticity feature of the time-series and provides more accurate estimations correspondingly. .

As a result, the presence of the day of the week effect is reported significantly for the market during 1988-2006 (entire data). Accordingly, the coefficients of Wednesday, Thursday and Friday have statistical significance at 1 percent. The mean returns on these days are also positive and large comparing to beginning of the week. Monday has the lowest return (negative) of the week followed by Tuesday.

When the model is replicated to detect the day of the week effect in sub-periods (Period-1, Period-2 and Period-3); it is observed that the significance of the effect is not same for each period. Even the anomaly is founded for any period, it is much more apparent in Period-2 with three significant coefficients. However, just the coefficient of Friday has significance (1% and 5% respectively) in Period-1 and Period-3. This finding provides us to make an implication on the changing magnitude of the Day of the Week effect in the market relative to the different time intervals. Since the sub-periods in the paper are determined corresponding to the different macroeconomic conditions (stability, inflation,...) formed in the country during 1988-2006, it can be suggested that the Day of the Week effect has been disappearing in Istanbul Stock Exchange since the beginning of 2002 as a consequence of the increased efficiency in the market.

APPENDIX

Table-3:Augmented – Dickey Fuller Unit Root Tests

	Before Transformation	After Transformation
Period-1	0.3080	-11.013*
	(0.9777)	(0.0000)
Period-2	-0.9910	-11.847*
	(0.7565)	(0.0000)
Period-3	-0.027	-10.485*
	(0.9562)	(0.0000)
All	1.2020	-18.968*
	(0.9960)	(0.0000)

The values in brackets indicate corresponding p-values of t-statistics placed in the first row. The null hypothesis of the test is 'there is unit root in the time series'.1% statistical significance is shown by * symbol. 10 lag differences are used in the test.

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ECONOMIC GROWTH

Liberalization, TFP and Growth: Argentina and Turkey since the 1970s

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Abstract

This paper employs the Great Depressions methodology to analyze the macroeconomic experiences of two countries over the past three decades; namely Argentina and Turkey. Both countries have suffered from highly volatile macroeconomic conditions, both struggled with high and hyper inflation, and both have been large debtors. With IMF conditional assistance deployed in an attempt to resolve their economic problems and indebtedness burdens, both employed primarily exchange rate based stabilization programs together with liberalization reforms in line with the "Washington Consensus" in an attempt to resolve their macroeconomic problems. Here, we compare the aggregate performances of these two countries, using a simple neoclassical growth model. We find that TFP is the driving force behind the performance of both countries, and argue that any positive growth has been the outcome of liberalization policies that raise TFP. Turkey has fared better than Argentina, experiencing relatively less depression in economic activity. However, both countries' economic performances are poor relative to the two percent growth rate of world production knowledge criterion adopted by Kehoe and Prescott (2002). The paper concludes with some conjectures regarding the reasons for the failure of liberalization policies to stimulate TFP in a sustainable manner.

JEL Classification codes: O4, O57

Keywords: Argentina, Turkey, growth accounting, total factor productivity.

1. Introduction

Argentina and Turkey have been model cases of neo-liberal restructuring in the 1980s and 1990s. By the end of the 1990s, Argentina and Turkey were the two poster boys for the "Washington Consensus"[1]. These two countries, more than any other emerging market, conformed to IMF advice over the course of restructuring, perhaps with only the exception of Chile under Pinochet during the 1970s. Their respective liberalization policies included, among others, the implementation of fiscal discipline, tax reforms, interest rate liberalization, trade liberalization and the liberalization of inflows of foreign direct investment, privatization, deregulation, the securing of property rights, and redirection of public expenditure priorities toward fields offering high economic returns. Hence, many parallels have been drawn between Argentina and Turkey.

Following the implementation of an extensive version of the liberalization program under the presidency of Carlos Menem in the early 1990s, Argentina managed to recover from a "great depression" – which will be carefully defined below - and enjoyed high rates of economic growth for the first time in the post-war period. However, Argentina's positive growth experience came to an end with a complete collapse of the economy following a major financial crisis in yet another great depression in 2002. On the other hand, rather than the "shock-treatment" implemented in Argentina in the early 1990s, Turkey's liberalization reforms can be traced back to 1980, and have been spread over two decades. Furthermore, Turkey's growth performance was relatively stable compared to that of Argentina, although still poor relative to the average 2 percent per annum growth of real GDP per working age person benchmark commonly employed – a benchmark which also will be explained below.

One of the many senses in which Argentina and Turkey are similar concerns their common problems with high and hyper inflation. Figures 1 and 2 depict the annual percentage change in consumer price indexes - CPI inflation – in the two countries. Both Turkey and Argentina, under close advisement from the IMF, employed exchange rate based stabilization programs to overcome their respective inflation problems. Argentina, to establish credibility, adopted a strict version of the program known as the "convertibility plan" which fixed the

[1] The phrase is first udes by John Williamson in 1990 to refer to the lowest common denominator of policy advice being addressed by the Washington-based institutions to developing countries. These policies include, fiscal discipline, tax reforms, interest rate liberalization, a competitive exchange rate, trade liberalization, liberalization of inflows of foreign direct investment, privatization, deregulation, securing property rights, and redirection of public expenditure priorities toward fields offering both high economic returns and the potential to improve income distribution, such as primary health care, primary education, and infrastructure.

I would like to thank Caroline Betts and Selahattin Imrohoroglu for valuable comments and suggestions. All errors are mine

Argentinean peso one for one with the US dollar under a currency board regime, whereas Turkey adopted a more flexible, crawling peg regime through her central bank. These exchange rate based stabilization programs were backed by many other institutional and legal reforms, and monetary support from Washington based institutions. What is obvious from the pictures is that Argentina's more extreme exchange rate stabilization was far more successful in eradicating high inflation than Turkey's more moderate plan.

An additional sense in which Argentina and Turkey are similar is that, during the course of restructuring, both countries became increasingly externally indebted. Starting off with external debts lower than 5 percent of their respective GDPs in the late 1960s, both countries ultimately secured debts more than 60 percent of their respective GDPs by 2003. Figure 3 depicts the external debts of the two countries as percentages of their respective GDPs. To illustrate the financial involvement of the IMF in the accumulation of this external debt, in Figure 4 we depict the use of IMF credit by the two countries as a percentage of GDP.

As is evident from the figure, Argentina and Turkey, besides being closely advised by the IMF, were also financially "supported" by the IMF. Credits used by the two countries amount to, on average, 1.5 percent of their respective GDPs with an increasing trend and an explosion in the last three years of the sample period.

Given the liberalization programs and restructuring efforts of Argentina and Turkey, as well as the advice and financial support of Washington based institutions like the IMF, the question we address in this paper is, How successful were these two countries in improving their productivity and achieving acceptable growth performance?

Argentina's performance over the postwar period in isolation has been analyzed in detail[2] and many attempts have been made to explain both the depression of 1974-1990 and the strikingly good recovery over the course of 1990s, which was followed by a total collapse of the economy in 2002. Turkey's performance on the other hand has not been extensively studied. In this study, we adopt a comparative approach to the experiences of Argentina and Turkey by employing the Great Depressions methodology developed by Cole and Ohenian (1999) and Kehoe and Prescott (2002).

2. Great Depressions Methodology

Studying depressions using the neoclassical growth model is a relatively new methodology. First applied by Cole and Ohanian (1999) to the Great Depression of the 1930s in the United States, the successful application led to the study of depressions for many other countries using this method. Details on the methodology, as well as a collection of applications, can be found in the January 2002 volume of the *Review of Economic Dynamics.*

The great depressions methodology considers the growth of a country's real GDP per working-age person relative to a trend. The methodology focuses on, in contrast to the more common economic growth research focus on per-capita real GDP, GDP per working age person, since this measure of economic activity is consistent with the theoretical specification of a standard neoclassical growth model economy. The analysis employs a Cobb-Douglas specification of the aggregate production function

$$Y_t = A_t K_t^{\alpha} L_t^{(1-\alpha)}$$

where K_t is the capital stock at time t , L_t is hours worked, and A_t is Total Factor Productivity (hereafter, "TFP"). When TFP grows at a constant rate, and is given by $A_t = Ag^{(1-\alpha)t}$, the neoclassical growth model implies a unique balanced growth path in which output and capital per worker grow at the same constant net rate, $g-1$. A country's performance is measured relative to this trend growth rate.

Kehoe and Prescott (2002) argue that this trend growth represents the growth rate of the world stock of production knowledge, and that this knowledge is not country specific. They define the trend growth rate to be 2 percent per year, taking the growth rate of GDP per working-age person for the United States over the period 1900-2000 as the benchmark, since the US is a large, relatively stable country and is the industrial leader.

The stock of world production knowledge, according to Kehoe and Prescott (2002), is common across countries, but countries differ in their institutional structures. This implies that - even though all countries on a balanced growth path grow at the same rate - each country is on its own growth path at any point in time with a different level of output per capita. The institutional structures that determine these growth paths include competition policy, bankruptcy systems, trade policy, and the legal system. Changes in institutions change the path of TFP, moving a country to a new growth path. One of the central premises of the great depressions methodology is that explaining movements in TFP involves identifying the sources of changing institutions.

[2] See for example, Kydland and Zarazaga (2002), Kehoe (2002), Buscaglia (2002) and Krueger (2002).

Kehoe and Prescott (2002) consider two characteristics in defining a great depression: First, the deviation from trend of output per working-age person must be large and, second, this deviation must occur quickly. Their definition of a great depression is motivated by the U.S. experience of 1929-1939, during which real output per working-age person fell by more than 37 percent compared to the 2 percent growth trend in five years' time between 1929 and 1933. By 1938, US real output per working age person was still almost 29 percent below trend.

In this paper, we assess the macroeconomic performance of Argentina and Turkey using the Great Depressions methodology. The underlying premise of this assessment is that the liberalization and restructuring policies enacted in the two countries over the past two decades represent changes in institutions that should have promoted TFP growth and moved the two countries to higher growth paths. As we will see, while TFP is the primary source of economic fluctuations over our sample period, TFP improvements have not led to the sustainable enhancement of macroeconomic performance relative to the Great Depressions benchmark.

3. An Assessment of Growth Performances

To make concrete the object of our study, in this section, we illustrate the growth performances of Argentina and Turkey between 1968 and 2003. Figures 5 and 6 illustrate the real GDP per working age person and detrended[3] real GDP per working age person respectively.

Both countries started off in late 1960s with growth rates of real GDP per working age person close to the benchmark 2 percent trend growth rate suggested by Kehoe and Prescott (2002), with minor business cycle deviations. In 1974 both countries' growth started to slow down. Turkey experienced a 15 percent fall in real GDP per working age person between 1974 and 1985, however, she managed to recover and near the end of the period of 1974-1990 was close to the 2 percent growth path once more, with an average growth rate of 1.5 percent, whereas Argentina found herself submerged into one of the greatest depressions of the century. Compared to the 2 percent trend growth rate benchmark, Argentina's real GDP per working age person fell by almost 40 percent over this period of time, 25 percent of which occurred during the first decade of the period. Real GDP fell by an average of 1 percent annually. Even ignoring the trend, the fall in real GDP per working age person almost 25 percent, which makes this experience a great depression by any reasonable definition.

Over the period 1990-1998 Turkey maintained a steady average annual growth rate of 1.5 percent annually, ultimately offsetting even the substantial 10 percent decline in real GDP per working age person in 1994. Argentina's performance was more striking, with a cumulative growth of almost 35 percent, almost 17 percent more than the cumulative growth implied by a 2 percent growth path, with a slight downturn in 1995 associated with the "Tequila Crisis", a financial crisis which originated in Mexico. However, starting in 1998, both countries returned to negative average annual growth rates. Again, Turkey ended the period more strongly than Argentina with average annual fall in real GDP per working age person of 0.1 percent, whereas Argentina entered into yet another great depression with a cumulative fall in real GDP per working age person of almost 30 percent.

The figures confirm that Argentina and Turkey performed poorly between 1968 and 2003. Turkey, although the recessions she faced were not as severe as Argentina's, still appears to be 20 percent below the level of GDP per working age person implied by a 2 percent growth path by 2003, and starting in 1974 she steadily diverges from the 2 percent growth path. Argentina, on the other hand, despite her strikingly good growth performance between 1990 and 1998, appears to be 40 percent below the level of GDP per working age person implied by a 2 percent growth path by 2003.

Combining the evidence of these poor performances, with the fact that both Argentina and Turkey were adopting policies to improve institutional structures that would allow them to better adopt the world stock of production knowledge, the question we now ask is, what was the driving force behind these poor performances?

4. Growth Accounting

To get a feel for the driving forces of growth, we first employ a simple decomposition of real GDP per working age person into labor productivity and number of workers relative to adult population as in Cole, et al. (2004). This decomposition uses the fact that

$$\frac{Y_t}{N_t} = \frac{Y_t}{L_t}\frac{L_t}{N_t}$$

[3] For detrending we use the 2 percent trend growth rate suggested by Kehoe and Prescott (2002).

It therefore attributes changes in real GDP per working age person to either changes labor productivity or to changes in the employment rate. Figures 7 and 8 show that labor productivity is the key factor in accounting for the fluctuations of real GDP per working age person in both of the countries. Furthermore, while driving real GDP per working age person, labor productivity also seems to offset the changes in the opposite direction of employment rate.

A more complete analysis of the sources of changes in real GDP per working age person should involve identification of TFP and its relation to the growth of real GDP per working age person, since changes in labor productivity might be due to changes in the amount of capital per worker but also due to the efficiency with which workers transform capital into output. Another reason to identify TFP is its relation to the effects of policy actions which do not pass through changes in capital or labor inputs, as we now discuss.

Both Argentina and Turkey adopted liberalization and restructuring policies to overcome their relative macroeconomic instability. Both countries were being advised closely by the IMF on a common denominator of policy. The most extensively adopted policies include fiscal discipline, exchange rate management policies, trade liberalization and liberalization of inflows of foreign direct investment, privatization, and deregulation. All of these policies – particularly those involving liberalization – are relevant to the argument by Kehoe and Prescott (2002) that the ability of countries to adopt the common world stock of production knowledge depends on them having good institutional structures which promote competition and free trade. It is apparent that both of the countries were taking policy actions to better adopt this stock of knowledge, the effects of which would not show up in capital or labor input growth necessarily, but which - according to Kehoe and Prescott (2002) - would show up as improvements in TFP.

To analyze the contributions of capital, labor and TFP to the growth of output per working age person, we employ growth accounting techniques based on the neoclassical growth model. We employ the Cobb-Douglas production function

$$Y_t = A_t K_t^{\alpha} L_t^{(1-\alpha)}$$

We compute TFP growth as a residual, after accounting for the contribution to production growth of capital and labor input growth. Given series for Y_t , K_t , and L_t , we can compute a series for the TFP by choosing a value for α. We choose α to be 0.3 in our study. For example Maia and Nicholson (2001) find the labor share – which corresponds to $1-\alpha = 0.7$ in our production function- to be between 0.571 and 0.601 in Argentina. However, measured labor compensation in countries like Argentina and Turkey usually fails to account for most self-employed and family workers. Gollin (2002) shows that if there is sufficient data to adjust for the mis-measurement, labor shares tend to be close to the value in the US. Therefore we choose labor's share to be 0.7 which implies $\alpha = 0.3$.

To obtain a capital stock series, we use the perpetual inventory method to cumulate investment given an initial condition for capital

$$K_{t+1} = (1-\delta) K_t + I_t$$

where δ is the depreciation rate and is chosen to be 0.05 in our study. We obtain capital stock series for Argentina, for the period 1992-2001 from Kehoe (2002). For 2001-2003 and for 1968-1991, we cumulate gross capital formation data from World Bank Development Indicators over the capital stock values. Similarly, for Turkey, the capital stock series for 1972-2000 is obtained from Saygili et al. (2002) and the remaining years are again obtained by cumulating gross capital formation over the capital stock values.

Given the constructed capital stock series, together with output series, labor hours series and a value for α, we calculate the TFPs for Argentina and Turkey. Figures 9 and 10 depict the strikingly similar fluctuations in calculated TFPs and real GDP per working age person for the two countries. It is apparent from the figures that growth of real GDP per working age person is driven by the TFP. The correlation between real GDP per working age person and TFP is 0.88 for Argentina and 0.97 for Turkey. Although the correlation is very high, the contributions of capital and labor input growth to real GDP per working age person growth are not negligible.

To better assess the contributions of TFP, capital, and labor to the growth of real GDP per working age person, we follow Hayashi and Prescott (2002) in taking the natural logarithms of the production function and rearranging terms to obtain

$$\log\left(\frac{Y_t}{N_t}\right) = \frac{1}{1-\alpha}\log A_t + \frac{\alpha}{1-\alpha}\log\left(\frac{K_t}{Y_t}\right) + \log\left(\frac{L_t}{N_t}\right)$$

where N_t is the number of working age persons. To decompose the change in real GDP per working age person from period t to period $t+s$ we further rearrange terms to obtain

$$\frac{\log\left(\frac{Y_{t+s}}{N_{t+s}}\right)-\log\left(\frac{Y_t}{N_t}\right)}{s}=\frac{1}{1-\alpha}\left(\frac{\log A_{t+s}-\log A_t}{s}\right)$$

$$+\frac{\alpha}{1-\alpha}\left[\frac{\log\left(\frac{K_{t+s}}{Y_{t+s}}\right)-\log\left(\frac{K_t}{Y_t}\right)}{s}\right]+\frac{\log\left(\frac{L_{t+s}}{N_{t+s}}\right)-\log\left(\frac{L_t}{N_t}\right)}{s}$$

The first term on the right hand side captures the contribution to growth of changes in TFP; the second term captures the contribution of changes in the capital output ratio; and the third term captures the contribution of changes in hours worked per working age person. On a balanced growth path, where output per worker and capital per worker grow at the same rate and the capital output ratio and hours worked per working age person are constant, the above specification of growth accounting attributes all growth to changes in TFP. Therefore, the second and third terms capture the contributions to growth of deviations from balanced growth path behavior. Table 1 summarizes the results of the growth accounting exercise.

These results confirm the impression given by the comparison of TFP and real GDP per working age person for the two countries in figures 9 and 10. Most of the fluctuations in real GDP per working age person are accounted for by changes in TFP rather than in the capital-output ratio or working hours. In Argentina, TFP seems to be driving force of the 1974-1990 depression with an average fall of 1.69 percent per annum, which offsets the increases in the capital output ratio and labor hours, resulting in a fall of real GDP per working age person of 0.94 percent per annum. The same driving force of TFP can be observed in the 1991-1997 boom with an average annual increase of TFP of 8 percent resulting in 4.9 percent increase in real GDP per working age person. Finally between 1998 and 2003 TFP fell an average of 2.2 percent annually while real GDP per working age person followed with an average fall of 2.5 percent per annum.

In Turkey, on the other hand, volatility in employment plays a non-negligible role in accounting for the growth rate of output per working age person; nonetheless the driving force is TFP. The average increase of 1.5 percent in the real GDP per working age person between 1974 and 1990 and between 1990 and 1998 was driven by the 2.3 percent and 2.6 percent average annual increases in TFP respectively. Similarly, in the recessionary period of 1998-2003 with a 0.16 percent average annual fall in real GDP per working age person, TFP increased by only 0.2 percent and was ultimately offset by the fall in hours worked, which also offset the increase in the capital output ratio.

Overall, the 0.51 percent average annual increase in real GDP per working age person in Argentina was accompanied by a 0.74 percent average annual increase in TFP, whereas in Turkey the respective numbers were 1.27 percent for real GDP per working age person and 2.2 percent for TFP. Hence, despite the implementation of liberalization reforms which did seemingly lead to temporary improvements in TFP and GDP per working age person growth rates in both countries, other factors appear to have caused reductions in the TFP growth rate which were equally reflected in the growth rate of GDP per working age person. Given the timing of reductions in TFP and GDP per working age person growth rates, these "other" factors appear to be related to the incidences of crises in the two countries. We return to this theme below.

5. Model

Although growth accounting attributes most of the changes in growth to changes in TFP in Argentina and Turkey, the effects of changes in the capital output ratio and the changes in hours worked per working age person are not negligible. In this section we try to see how much of the changes in the capital-output ratio and hours worked per working age person can be accounted for as equilibrium responses to observed TFP changes in a general equilibrium model based on the neoclassical growth model.

In an economy where consumers have perfect foresight over the TFP shock sequence, the representative consumer maximizes the utility function

$\Sigma^{\infty}_{t=1968}\beta^t\,[\,\gamma\ log\ C_t + (1 - \gamma)\ log\ (\ \underline{h}N_t - L_t\ )\ ]$

where C_t is consumption, $\underline{h}$ is the number of available hours taken to be 100 hours per week, ($\underline{h}N_t - L_t$) is leisure, γ is the share of consumption in utility, and β is the discount factor.

The budget constraint faced every period by the consumer is

$C_t + K_{t+1} - K_t = w_t L_t + (r_t - \delta) K_t$

where w_t and r_t are the marginal products of the production function $A_t K_t^{\alpha} L_t^{(1-\alpha)}$ with respect to labor and capital, and δ is the depreciation rate. We also have to provide an initial condition on capital. Given the production function, the feasibility conditions of the model are

$C_t + I_t = A_t K_t^{\alpha} L_t^{(1-\alpha)}$

$K_{t+1} = (1 - \delta) K_t + I_t$

$C_t , I_t \geq 0$

Note that in this closed economy model government spending and net exports are (implicitly) included in consumption.

Using the first order conditions of the problem we can obtain

$\beta = C_t / C_{t-1} (1 + r - \delta)$

$\gamma = C_t / C_t + w_t (\underline{h}N_t - L_t)$

Using these first order conditions and data from World Bank Development Indicators Database, we calibrate β and γ to be able to run simulations. Consumption data is obtained by aggregating consumer expenditures, government expenditures and net exports consistent with the model specification. The return to capital is calculated by using the derivative of the production function with respect to capital, data on capital, hours worked and the calculated TFP series. We estimate β to be 0.9671 for Argentina and 0.9696 for Turkey. For γ, a similar estimation based on consumption, returns to labor and hours worked data, gives a value of 0.247 for Argentina and 0.3077 for Turkey. We set the depreciation rate equal to 0.05 and the capital share parameter equal to 0.3, to be consistent with the growth accounting exercise.

We set the capital stock in 1968 to its value in the calculated capital stock series, and compute the perfect foresight equilibrium in which the calculated TFP series are fed into the model. The model is truncated by assuming that equilibrium converges to the balanced growth path by 2015. TFPs for 1968-2003 are given by the data. After 2003 they are assumed to grow at the same average annual rate as they did over the period 1968-2003.

6. Results

Results of our simulations in comparison with the actual data for real GDP per working age person, the capital-output ratio, and the investment rate for the two countries are summarized in figures 11, 12 and 13.

Figures 11-A and 11-B depict the results of our simulation for real GDP per working age person for Argentina and Turkey respectively. The model captures very well the timing of directional changes; however the magnitudes of the fluctuations are slightly over predicted by the model. Nevertheless, the correlation between the simulated series and the data is 0.9 for Argentina and 0.97 for Turkey. There might be many reasons for the over-predictions of the fluctuations. For example, the model abstracts from frictions or rigidities in factor markets; it abstracts from distortionary taxes; also, the model assumes perfect foresight over TFP changes and this might be too strong of an assumption.

Again, for the above mentioned reasons, our simulation tends to produce much more volatile investment rates for the two countries than is observed in the data, as can be seen in figures 12-A and 12-B. Notice that the non-negativity constraint on investment actually binds for Argentina around 1990. However, the correctness of the timing of fluctuations helps us argue that the equilibrium responses in the model are in line with the actual data, although magnitudes of fluctuations are over predicted. The excess volatility observed in the simulated data is due to the absence of capital income taxes, and capital market or investment frictions in the model which are almost certainly present in the data.

For the capital output ratio too, the timing of the fluctuations in the simulated results are in line with data, with over predicted magnitudes of the fluctuations. The simulation results for capital output ratios are depicted in figures 13-A and 13-B.

Our parsimonious way of modeling is an attempt to see whether the optimal responses of agents in the two model economies to the observed TFP shocks under the respective resource and budget constraints can

simulate the observed pattern in the data. We find that the model does a good job of capturing the directional changes in real GDP per working age person, the investment rate and the capital output ratio, with some over-prediction of the magnitudes of fluctuations.

Combining the results of our growth accounting exercise with the simulation results suggest that TFP is the key factor driving the growth experiences of the two countries. However, explaining the fluctuations in TFP requires a detailed analysis of the institutional changes and policy actions corresponding to the swings of TFP.

7. Institutions, Policy and TFP

Although there is no widely accepted theory of TFP, the institutional structure of a country likely plays an important role in the evolution of her TFP[4]. Important institutions affecting the evolution of TFP include government regulation of industries and control of prices, openness to foreign competition, legal structure (for example, bankruptcy laws), and efficiency of the banking sector. The analysis of the previous sections confirm that the growth experiences of Argentina and Turkey are driven by TFP, and calls for the challenging task of identifying the institutional and policy changes that led to the fluctuations in TFP.

Both countries' experiences between 1968 and 2003 are marked with significant changes in policy and institutions. Both countries experienced military regimes following prolonged periods of economic and social instability. Argentina was ruled by the military between 1966 and 1983, whereas Turkey experienced a military regime of a relatively short duration between 1980 and 1983. One can argue that the military interventions brought about relative stability, an environment in which growth could occur. However, costs associated with military interventions like the disruption of the labor force and resources, are likely to decrease TFP. In the case of Turkey, military intervention was followed by a slight recovery of the economy from the recession dating back to 1975. However the effect of the military intervention is difficult to analyze in isolation since Turkey was also undergoing intensive liberalization policies following the military intervention. The liberalization and opening up of the economy in the mid 1980s show up as improvements in TFP in the case of Turkey. However, increased sensitivity of the economy to external shocks and foreign capital flows mark the end of the improvements with a financial crisis in 1994.

In the case of Argentina, adoption of the convertibility plan in 1990 was successful in overcoming the inflation problem and together with the extensive liberalization programs, showed up in increases in TFP and GDP per working age person. However, to lend credibility to the stabilization programs, Argentina took the risk of exposing the economy to fluctuations in the relative value of the major currencies, and made it very costly to abandon the convertibility plan. One of the measures taken to sustain the convertibility plan restricted depositors' access to bank accounts (corralito) and this imposed the greatest cost on the economy in 2001, and marked the collapse of the Argentinean economy by the year 2002. Turkey's relatively flexible crawling-peg regime was also somewhat successful in dealing with the inflation problem, besides being less costly than that of Argentina's. However, Turkey also had to devalue and float in 2001 following a banking crisis. The result was a sharp acceleration of inflation, explosion of public debt (owing to high interest debt and bank recapitalizations) and a precipitous decline in real GDP. These experiences illustrate the credibility and coordination problems brought about by adopting exchange rate based stabilization programs, and difficulty of exiting the regime without causing a crisis. The effects of these problems are evident as declines in TFPs of the two countries starting in the late 1990s as the banking sector collapses in both economies after the break down of the exchange rate based stabilization programs.

It is also important to note that the improving performances of the two countries in the early 1990s do correspond to a period of extensive privatization efforts. As pointed out by Bergeoing et al. (2002), privatization was one of the key elements in the successful performance of Chile during 1970s and early 1980s although less important than reforms in banking systems and bankruptcy laws. By the mid 1990s Argentina had privatized all public utilities and public industrial enterprises through one of the most intense and far reaching privatization programs of the recent era. Privatization revenues have been utilized to counter fiscal and current account imbalances and helped to maintain the fixed exchange rate. However these once and for all injections have been only temporary remedies for the fiscal and current account imbalances. Furthermore, Argentina found it more and more difficult sustain fiscal and current account balance as the privatization revenues were depleted. Combined with a federal structure in which municipal authorities enjoyed a high degree of fiscal autonomy and were willing to incur large fiscal deficits, the privatization experience, has only provided a temporary remedy to fiscal and capital account imbalances, and later brought about more fragility. The privatization efforts are one of the contributing factors to the increase in TFP in the early 1990s. However, the fragility brought about by the unsustainable nature of the expansionary fiscal policies financed by the once and

[4] See the book "Barriers to Riches" by Parente and Prescott (2000) for an extensive discussion of TFP and alternative explanations of the driving forces of growth.

for all privatization revenues is, on the other hand, one of the factors contributing to the break down of the Argentinean economy in 1998.

Turning to the Turkish case, privatization has been a rather slow and gradual process compared to the Argentinean experience. As of today, Turkey is still in an effort to privatize major public utilities and enterprises. It is hard to argue that privatization is the major factor contributing to the increases in TFP for the case of Turkey. Following the reasoning for the Argentinean case, it is hard as well to argue that improper privatization efforts are contributing factors to the consecutive crises in 1994, 2000 and 2001.

The first of the three crises Turkey confronted in 1994 was a financial crisis brought about by the distorted incentives faced by both domestic and international investors. The opening up of the capital account in August 1989 provided a temporary breathing space to the economy and was one of the factors contributing to the increasing trend of the TFP. However, during the course of late 1980s and early 1990s, Turkey was not as successful as Argentina in overcoming the inflation problem. Combined with the lack of fiscal commitment on the part of successive coalition governments, Turkey was not able to attract long term foreign investment on which the growth strategy was based. Consequently, because of the distorted set of incentives caused by the lack of fiscal commitment and inflation growth, Turkey faced her first major crisis in which real GDP per working age person declined by 10 percent in a year.

In terms of banking reforms, Argentina and Turkey made little progress. Furthermore one of the reasons for the 2001 crisis in Turkey was the collapse of the banking system. Complete protection of deposits by the government allowed banks that were under growing competitive pressure to gamble for survival and engage in fire sales of government securities, which resulted in rising interest rates and investors exiting the market. The Central Bank, because of its commitment to maintaining the crawling peg regime, was unable to inject liquidity into the system. Finally, after a three month period of volatility, the government had to take over many bankrupt banks, which imposed an even greater cost on the government besides the increased debt burden resulting from high interest rates. These incidences correspond to the sharp fall in Turkey of TFP in 2001, and illustrate the importance of the banking system. In Argentina, rather than being a cause of the 2001 crisis, banking system was the medium through which the crisis elevated. Doubts about debt and exchange rate stability caused by the mounting political opposition to austerity in fiscal policy led depositors to flee the banking system. Access to the remaining deposits was restricted by the government which further elevated the loss of public support to the government policies. Finally, by the end of 2001 the Argentinean economy came to a collapse with sharp decline in TFP and real GDP per working age person.

It is also important to note that in the Turkish case, the signing of the Customs Union with European Union which came into effect in 1996 after a decade of gradual opening up, helped to recover from 1994 crisis and contributed to the increasing trend of TFP and real GDP per working age person. However, without the prospect of full EU membership, the Customs Union agreement failed to provide an external anchor which would improve the efforts on the part of policy makers to correct the endemic imbalances of the economy which showed up with the 2000 and 2001 crises.

8. Conclusion

Argentina and Turkey experienced very unstable macroeconomic conditions over the course of the last three decades. Besides the similar problems of inflation and debt they have been facing, the liberalization and restructuring programs adopted by the two countries in line with the Washington Consensus, under close advisement from IMF, were also very similar. By employing the Great Depressions methodology, we found that the efforts of the two countries to deal with their poor macroeconomic performance proved to be disappointingly unsuccessful, especially for Argentina, according to the 2 percent growth of real GDP per working age person criteria suggested by Kehoe and Prescott (2002).

Our output decomposition and growth accounting exercises identify TFP as the driving force behind the fluctuations in real GDP per working age person. Feeding TFP into an applied general equilibrium model where consumers have perfect foresight over the TFP shocks, the model is able to produce - as equilibrium responses to the observed TFP shocks - series for real GDP per working age person, the directional changes of which are in line with the actual data. However, magnitudes of the fluctuations in real GDP per working age person, the capital output ratio and the investment rate are somewhat over predicted by the model.

The specified applied general equilibrium model, although parsimonious, is able to account for the directional changes in real GDP per working age person as equilibrium responses to observed TFP shocks in a frictionless setting. To better match the levels and the magnitudes of the fluctuations, an immediate extension would be to introduce some capital investment frictions into the model. One can expect to see smoother investment series as a direct result of the frictions, which in turn is likely to produce smoother series for hours

worked per working age person and the capital-output ratio, and hence for real GDP per working age person. Distortionary taxes can also be incorporated into the model which would again produce smoother simulated series.

This paper provides another example where TFP is identified to be the driving force behind the growth experiences, and is an attempt to show the parallel between institutional and policy changes and TFP swings.

What is apparent from the discussion in previous sections is that, both Argentina and Turkey have experienced temporary improvements in their respective growth experiences as they engaged in liberalization and restructuring. However, neither of the two countries was able to sustain solid growth since the late 1960s. Considering the extreme nature and close conformity to text book principles, the experiences of Argentina and Turkey are quite instructive in terms of both the potential and the limits of neo-liberal restructuring efforts. The experiences of the two countries, in a rather dramatic fashion for Argentina, expose the fragility of growth strategies based on, foreign borrowing, capital inflows and exchange rate based stabilization. Furthermore, the time consistency problem associated with the coordination of monetary and fiscal policy also plays a crucial role in the experiences of the two countries.

In terms of evaluating the role of the involvement of international institutions like the IMF and the World Bank, it is fair to say that these institutions have typically been involved in problematic rather than inherently successful cases. Yet these problematic countries have generally been characterized by deep deficiencies in their domestic political and institutional environments which also play a crucial role in the outbreak of the recurrent crises. Hence, it would be misleading to attribute to international institutions and their policies all the responsibility of the outbreak of crises in Argentina and Turkey, as well as similar crises that have taken place in other parts of the world.

Evidently, the strength of the real economy and the long-term competitiveness is critical in the growth strategies of developing countries. Given the limitations of the programs deployed by the international institution, domestic authorities need to be concerned with providing the understructure and mobilization of domestic resources, to establish sustainable growth based on competitiveness, rather than securing temporary recovery through foreign aid.

As a final note, recent data show slight turnarounds in the real GDPs of the two countries starting around early 2003 which suggest that the depressions are “bottoming out”. As more data becomes available regarding the recent recessions and depressions, we believe Argentina and Turkey will provide an interesting case to study in further detail.

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Appendix

Tables and Figures:

Table 1. Growth Accounting Results for Argentina and Turkey

Country	Variable	% Change			
Argentina		1974-1990	1991-1997	1998-2003	1968-2003
	Real GDP per working age person	-0.94005	4.94070	-2.52300	0.51085
	Due to				
	Total Factor Productivity	-1.69975	8.05177	-2.22250	0.74549
	Capital Output Ratio	0.99951	-2.03113	0.96531	0.30713
	Hours Worked	-0.23981	-1.07993	-1.26582	-0.54177
Turkey		1974-1990	1991-1997	1998-2003	1968-2003
	Real GDP per working age person	1.54788	1.50549	-0.16640	1.27329
	Due to				
	Total Factor Productivity	2.38465	2.67508	0.22919	2.20747
	Capital Output Ratio	0.54167	0.41808	0.54209	0.35579
	Hours Worked	-1.37844	-1.58768	-0.93768	-1.28997

Figure 1. Argentina's CPI Inflation

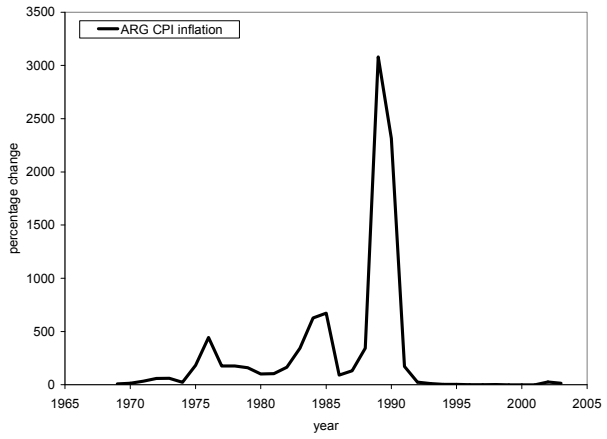


Figure 2. Turkey's CPI Inflation

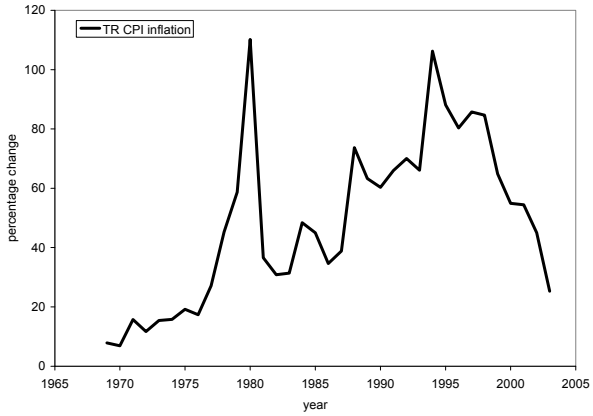


Figure 3. External Debt as a Percentage of GDP

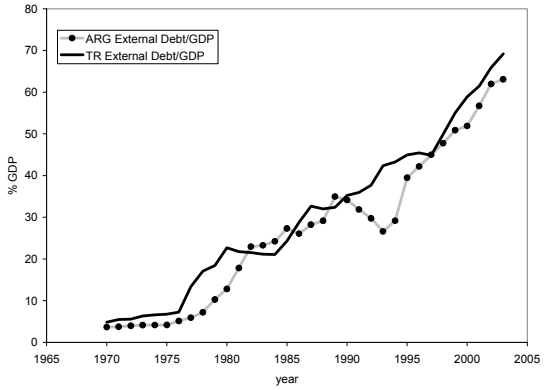


Figure 4. Use of IMF credit

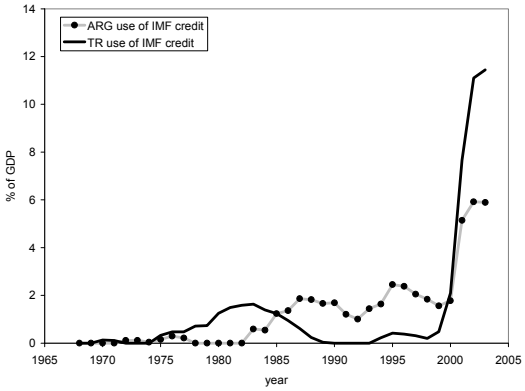


Figure 5. Real GDP per working age person

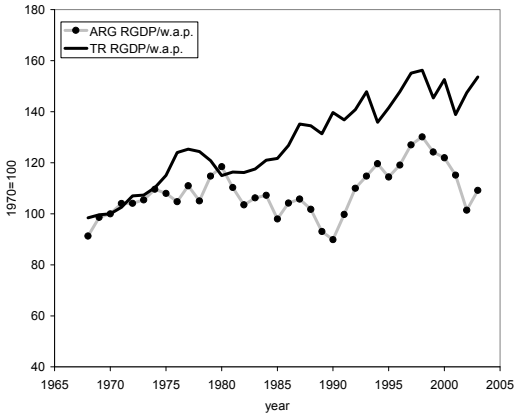


Figure 6. Real GDP per working age person detrended by 2 percent

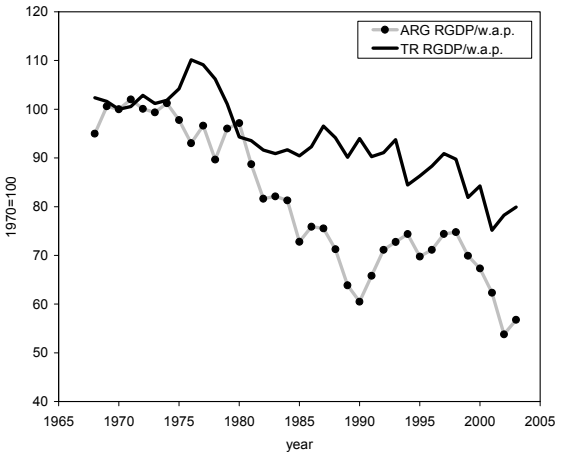


Figure 7. Argentina Output Decomposition

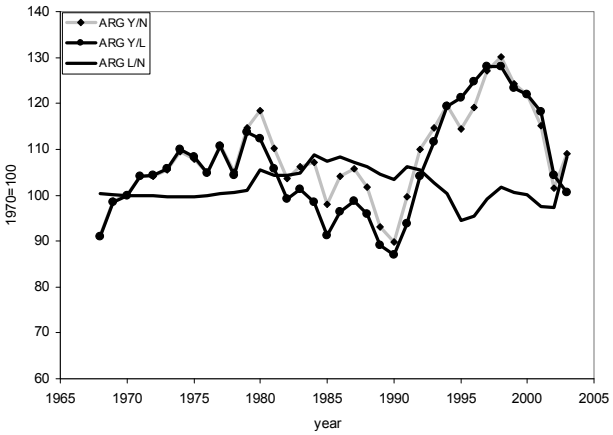


Figure 8. Turkey Output Decomposition

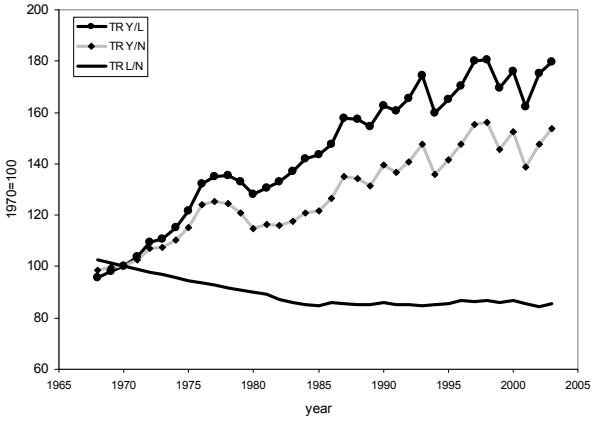


Figure 9. Argentina's Real GDP per working age person and TFP

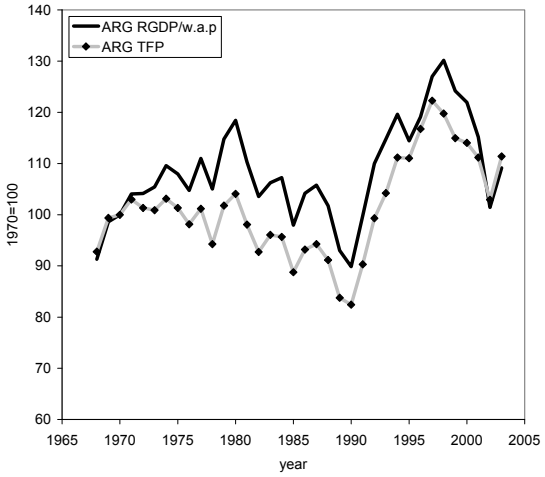


Figure 10: Turkey's Real GDP per working age person and TFP

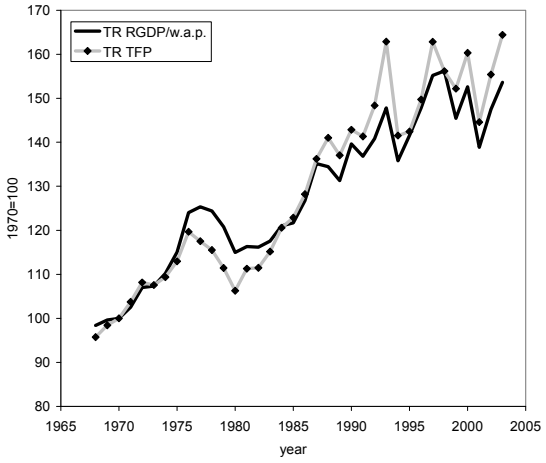


Figure 11-A. Argentina's Real GDP per working age person: Data vs. Model

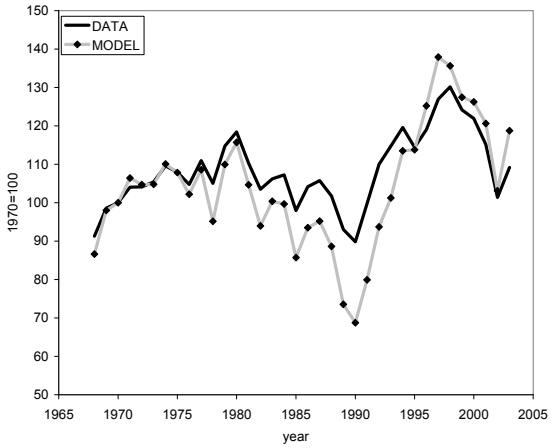


Figure 11-B. Turkey's Real GDP per working age person: Data vs. Model

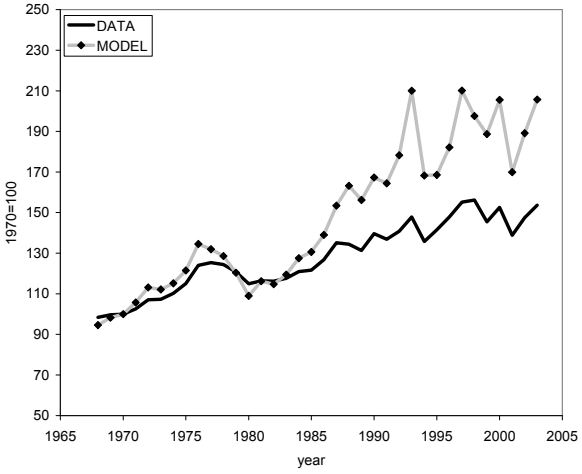


Figure 12-A. Argentina's Investment Rate: Data vs. Model

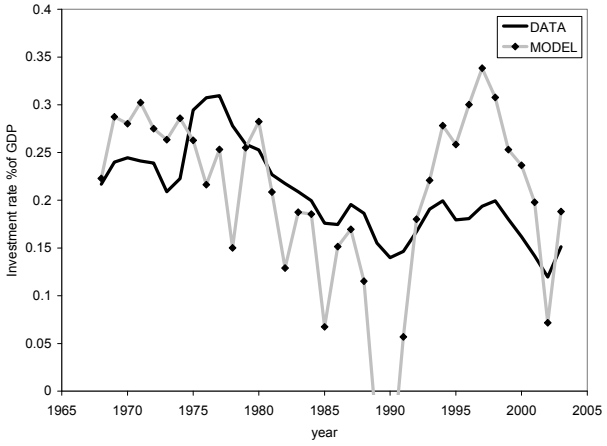


Figure 12-B. Turkey's Investment Rate: Data vs. Model

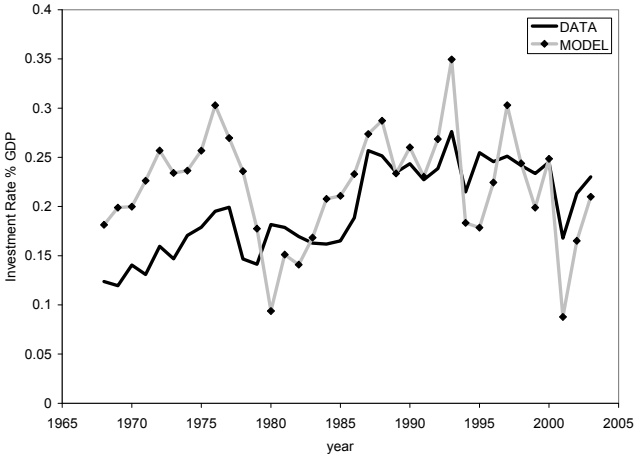


Figure 13-A. Argentina's Capital Output Ratio: Data vs. Model

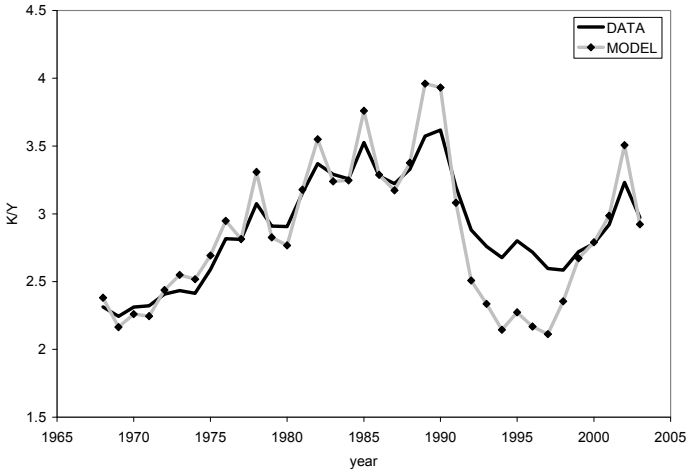
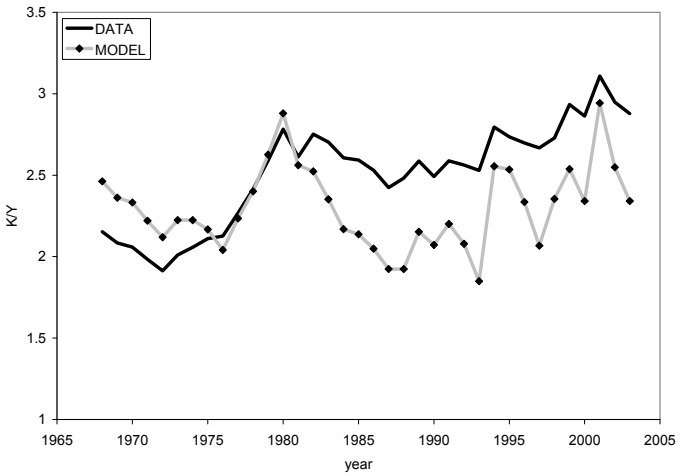


Figure 13-B. Turkey's Capital Output Ratio: Data vs Model



Data Sources:

All series except unemployment rate and capital stock are from World Bank Development Indicators (WDI) database. (http://devdata.worldbank.org/query)

Unemployment rate series are obtained by splicing series from World Bank Development Indicators Database and International Monetary Fund, International Financial Statistics database. (http://ifs.apdi.net/imf/)

Capital stock series for Argentina for the period 1992-2001 are obtained from Kehoe (2002). For the period 1968-1991, the capital stock value in 1992 is decumulated going backwards using gross capital formation data from WDI. Similarly, for 2002-2003, gross capital formation is cumulated over the value in 2001. For Turkey, series for 1972-2000 are obtained from Saygili et al. (2002). 1968-1971 and 2001-2003 values are obtained in the same fashion as was the case with Argentina.

Finance-Growth Nexus in Sudan: Empirical Assessment Based on an Application of the Autoregressive Distributed Lag (ARDL) Model

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Abstract

This study investigates the effect of financial development on economic performance in Sudan over the period (1970- 2004). The short-run and long-run relationship between financial development and economic growth and other conditioning variables on economic growth are estimated by using the most recently developed autoregressive distributed lag (ARDL) approach to co- integration analysis proposed by Pesaran and Shin (1999).The results overwhelmingly indicate a weak relationship between financial development and economic growth in Sudan. Although the coefficient of M3/GDP is significance, but it is negative, whilst the impact of credit to private sector by banks to real GDP is negative and insignificant. These incredible findings may be attributed to the inefficient allocation of resources by banks, along with the absence of an appropriate investment climate required to foster significant private investment and promote growth in the long run, and to the poor quality of credit disbursal of the banking sector in Sudan. Moreover, the econometric analyses suggest that the speed of adjustment in the estimated models is relatively high and had the expected significant and negative sign.

Keywords: Financial development, ARDL, ECM, Economic growth, Sudan

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1. Introduction

The financial sector usually plays a central role in the process of economic development and growth in a country. Banks as financial intermediaries play a key role in transforming deposits into financial assets. They channel funds from entities with surplus liquidity to those lacking it, thereby facilitating capital formation and trade. Banks also play a key role in filtering information by screening borrowers and monitoring their activities in financial systems characterized by incomplete and asymmetric information. Their improved efficiency is therefore quite crucial in ensuring the success of financial liberalization (Ephraim&Montfort, 2004). In this context, well-developed financial systems can be expected to accelerate the development process by channeling financial recourses to the most productive use. The most influential works that underpin this hypothesis are perhaps (Levine and King 1993a, 1993b) which suggest that better financial systems lead to more robust economic growth.

However, despite the major role played by the financial sector in the process of growth and development, its role remains quite limited in many developing countries, especially sub-Saharan African countries. This due to the fact that, the financial sector in most countries remains highly fragmented and inefficient, protected from competition or is highly segmented and regulated, with little deeping (either in term of monetization or wider clientle).

In the mid 1980s, many countries in sub-Saharan Africa (SSA) initiated financial Policy reforms as part of structural adjustment programs. As a result, most SSA governments shifted their economies from the state of" control" model to more market based systems as a means of promoting a stable economic environment. This was particularly relevant in the financial sector where it was hoped that streamlining the sector would stimulate domestic resource mobilization and increase the capacity of the banking system to support private sector participation in economic development.

As in most developing countries, the Sudanese financial market is still young and underdeveloped following years of repression, political and economic instability up healed by long chronic civil war. To develop the financial sector the government embarked upon policies to reform it. These reforms, which took a variety of forms, started long years ago and can be traced back to the years following the independence in 1956, but these reforms had shown little improvements in the Sudan financial sector because they were not implemented under formal structural economic programs.

As part of its economic and structural adjustment program, the government has adopted a comprehensive package of financial policy reforms in the early 1990s.The claimed objective is to at create an improved business environment through relaxing some of the financial sector restrictions, modernize the financial sector to cope with the new achievements in the banking industry and to build more efficient financial market to promote economic growth through a more efficient allocation of credit.

This paper is concerned with the short and long run determinants of economic growth in the context of Sudan. It uses the bounds testing procedure to examine empirically the impact of the financial sector development on economic growth in Sudan by employing data for the period 1970-2004.Other objective of the present study is , to investigate the impact of the formal financial sector reform on economic issues in Sudan. Different economic and financial indicators are separately discussed to measure how far Sudan has benefited from the reform policy. In this study we are going to question whether financial development, in the sense of deregulated environment can be expected to act as "engine of growth" in the development process, and we argue in favor of a more cautions approach to financial sector reform.

The paper proceeds as follows: section tow, provides a brief review of the Sudanese economic development, besides an overview of the Sudanese banking system. The section also shows the experience of the financial sector reform in Sudan and its impact on economic issues. Section three, briefly reviews the extensive literature on the growth- finance nexus. Section four, specify the model and indicates the sources of data and setting up the econometric methodology used in the study. Section five, contains the main findings of the study, their analyses and assessments, and the final section contains policy implications and conclusions

2- Economic and financial development in Sudan

2.1 A Brief Review of the Sudanese economic development

Sudan is the largest country in Africa[1], with significant human capital and vast natural resources base providing enormous development potential. Sudan is predominantly agricultural economy. The agricultural sector remains the most important sector in the economy; it contributes by 38.7 percent to GDP (2003) and employs about 80 percent of the population (1998). Despite of its major contributions to the Sudanese economy, the agricultural sector was crippled by a series of cumbersome bureaucratic procedures such as import licensing, registration of exports, reporting of stocks and restrictions of crop movement. These administrative interventions greatly discouraged production and exports. Moreover domestic policies were unstable, which was clearly manifested in the pricing and marketing of agricultural products .However, the declining of the growth rate of exports in last years is closely related to the declining share of agriculture in the domestic economies of Sudan and the expansion of the non-trade service sector.

In the late 1970 and like other sub-Saharan African countries. Sudan's economy began to experience severe interdependent structural problems that inhabited economic growth (world bank, 1985). The average performance of the economy has worsened over the last two decades. And by the turn of the 1980's decade economic conditions in Sudan assumed crisis propositions. A steadily declining income and consumption per capita, persistence deficit in the balance of payment and external debt have characterized this period. These structural imbalances had attributed mainly to the failure of the ambitious development programmes in the early 1970's.In that period the government was not in a position to raises sufficient resources to finance the development prorammes. To fill this gap, the government resorted to both internal and external finance. Internally, expansionary monetary policy and deficit financing were used to correct the domestic deficit and externally through massive borrowing from abroad. However, this situation leads to more deterioration in the performance of the Sudanese economy, which manifested by the prevailing balance of payment problems and the serious indebtedness. In 1984, Sudan outstanding external debt reached US $ 6 billion and is currently estimated at US$ 16.09 billion for 2004. The inability to finance the debt has constrained Sudan's access to international financial assistance, which in turn has restricted investment and economic growth.

It is generally agreed however that, the poor performance of Sudan remains by and large a legacy of a long history of domestic policy mistakes. However, the spreading civil war, government's economic policies, and mismanagement of resources at the macro level have played significant roles in debilitating the economic structures, resources and its overall growth throughout the national governance regimes since independence, in 1956.

To address these issues, the government initiated a series of reform efforts aimed at arresting economic deterioration. The first reform attempt was in 1978 when the Sudanese government requested the IMF financial

[1] Sudan is Africa's largest country (2, 5 million square kilometres) and the ninth largest country in the world.

assistance to tackle its internal and external imbalances. But the reforms covering this period (1978-84) were neither well sequenced nor fully implemented. A second wave of reforms known as Sudan's structural adjustment policies (SAP) was initiated under the Program of the National comprehensive Plan (1992-2002). However, this program of economic reform (namely, SAP) was both successful and unusual. It was successful because it restorted macrocosmic stability, revived economic growth, and resulting in increasing per capita income (World Bank, 1998). It was unusual in the sense that "as the name implies", these policies were homegrown and were pursued without external financing or technical assistance either from the World Bank or the IMF.But, since 1997, the Macroeconomic stabilization program has monitored by the IMF.From then, Sudan has seen stable progress on basic economic indicators. Growth has been relatively steady, despite the civil war. Annual GDP growth rate averaged in excess of 5 per cent during the period 1995-2002, reflecting the package's success and the important role of oil, of which the country became a net exporter in 1999.The joint world bank/UNDP – led assessment team concluded that the package had yielded macroeconomic stability but at a high price in terms of unequal distribution of the economic gains, unsustainable levels of public debt and poor access to services.

2.2. Overview of the Sudanese Banking System

2.2.1 Structure of the Sudan's banking sector

Like many developing countries, the Sudanese financial sector was dominated by commercial banks' rather than by bonds and equity markets, which require a mature system of accounting and financial information. The financial system in the Sudan has undergone significant developments since the establishment of the Bank of Sudan on February 22, 1960. Now, Sudan's financial system consists of the central bank of Sudan (CBOS); 25 commercial banks, 16 of which are completely or mostly privately owned, and seven state-owned commercial banks. The sector also includes four specialized state-owned banks, two investment banks and a number of non-bank financial intermediaries (NBFIs), mainly insurance companies.

Historically, Sudan's financial system has been characterized by heavy government interventions and regulations, centralized lending by the central bank to public enterprises, absence of indirect monetary policy instruments, Lax bank supervision and an inadequate accounting system. According to (Kireyev, 2001), the Sudanese banks still remains very small even by the modest international standard as compared with Islamic banks in other countries. The total amount of deposits of the banking system has been hovering around $ 500 million since mid-1990 and is dominated by demand deposits with a share of over 70% whereas saving and investment deposits remain relatively small. According to him, this reflects the cash nature of the Sudanese economy where individuals prefer to have instant and easy access to their funds.

It is apparently from the consolidating balance sheet of the central bank of Sudan that the commercial banking sector constitutes the major source of credit in Sudan. This can be reflected in the size and the amount of deposit liabilities deposited in the commercial banks. Due to the fact that deposit liabilities of non- banking financial institutions are relatively insignificant, a close approximation to the community's aggregate savings in financial forms can be observed by the size of the deposit liabilities of the commercial banks. Table (1), shows the growth of the central government and private sector deposits with commercial banks for the period (1990-2001). It is relatively apparent from the table that private/pubic sector deposits dominate the total deposit liabilities of the commercial banks reaching 92.8% of the total in 1990 and 97.4% in 2001.The substantial increase in these deposits is attributed firstly to the rise in the commercial banks nominal interest rate to 8% (the period of the conventional banking system) and the rise in the profit margins of Murabaha (for the Islamic banking system) and secondly to the continuous spread of commercial banks branches.

Table (1):

***Growth of the Central Government and Private Sector's Deposits with Commercial Banks – (SD* 000's)**

Year	Government Deposits	Public Institutions and Private Deposits	Total
1990	122	1582	1704
1991	172	2817	2989
1992	236	9209	9445
1993	639	16095	16734
1994	806	22630	23436
1995	315	41327	41642

1996	767	67026	67793
1997	400	96354	96754
1998	424	119689	120113
1999	3527	141992	145519
2000	6352	190872	197224
2001	7076	267112	274188

Source: Bank of Sudan Annual Reports (1990-2001).

In general, commercial banks lending in Sudan is predominantly short term and is heavily concentrated in traditional sectors, such as trade, and profitable short-term activities. As table (2) below shows the whole pattern of lending has been dominated by the financing of foreign trade. This has been especially the case with respect to advances to finance exports which increased to 69% in 1990.

Despite the fact that, the agricultural sector in Sudan constitutes the backbone of the Sudanese economy, but advances to this sector is relatively small. Commercial bank's lending to agriculture was minimal and accounted for less than 1% of their total credit prior to 1990.With the aim of pooling resources for increased lending to agriculture a commercial Banks Consortium (CBC) was formed in 1992 .As a result, Commercial banks were instructed to channel one-third of their mandatory lending to agriculture through CBC.This policy substantially raised the share of agricultural lending in total commercial bank credit in 1990s, reaching 35.3 in 1993.

This trend has been gradually reversed since the start of the financial reform and liberalization program in 1997.By 2003, lending to agriculture amounted to only 12% of total bank credit (Elhiraika, 2005).The decline of credit to agriculture and according to (Kireyev 2001) is mainly attributed to the fear of banks which consider the risk of extending credit to all sectors, other than trade as being unjustifiable high. Credit to all other sectors, in particular to agriculture, is perceived by all banks as an extremely risky business because about 85% of all non performing loans originate in agriculture. In addition, some Islamic modes of financing (Salem, Musharaka) do not seem to be operationally efficient, in financing agriculture. Under Salem, banks often cannot sell in-kind repayments at a price allowing them even to recover the value of the initial credit. Some banks are reluctant to enter in a Musharaka contract with the agricultural producers because this mode of financing requires bank's participation in the management of the financed project, which banks are not always willing to do.

Table (3):

Commercial bank's lending by economic sector (SD 000's)

Year	Agriculture	Industry	Exports	Imports	Local Trade	Others	Total
1990	(15%) 0.08	(19%) 0.18	(69%) 1.22	(1%) 0.02	(5%) 0.08	(11%) 0.19	100% 1.77%
1991	(26%) 0.27	(20%) 0.28	(19%) 0.26	(2%) 0.03	(14%) 0.19	19%) 0.27	100%) 1.4
1992	(34%) 1.12	(14%) 0.46	(17%) 0.57	(1%) 0.04	(12%) 0.38	(22%) 0.74	(100%) 3.31
1993	(53.4%) 1.865	(15.7%) 728	(21.9%) 1.154	(0.8%) 43	(6.0%) 318	(20.2%) 1.066	(100%) 5.273
1994	(29.3%) 2.946	(18.3%) 1840	(22.2%) 2.236	(1.1%) 105	(5.6%) 567	(23.5%) 2.379	(100%) 10.073
1995	(24.7%) 2.579	(18.0%) 2.618	(27.1%) 3.947	(8.5%) 1.227	(2.9%) 419	(18.8%) 2.7	100% 14514
1996	(26,5%)	(18.8%)	(19.6%)	(5%)	(3.6%)	(26.5%)	(100%)

	8.997	6.643	6.643	1.705	1.216	9.002	33.948
1997	(30.5%) 12.522	(17.8% 7.284	(20.4%) 8.387	(2.1%) 857	(4.2%) 1.738	(2550 10.766	(100%) 41.556
1998	(33.3%) 16,763	(18.8%) 8.908	(17.1%) 8.114	(0.7%) 325	(4.3%) 325	925.8%) 12.235	(100%) 47.383
1999	(30.0%) 14.833	(15%) 7.784	(17%) 8.359	(3%) 1.519	(6%) 2.816	(30.0%) 14.833	(100%) 48.732
2000	(22.5%) 17.807	(10.5%) 14.035	(21.2%) 16.839	(1.4%) 16,839	(10.4%) 8.243	(33.9%) 26.867	(100%) 79.224
2001	(7.6%) 19.605	(14.8%) 16.445	(15,7%) 17.726	(3.7%) 4.106	(18.8%) 20.900	(29.2%) 32.558	(100%) 111.340
2002	14.3% 22.857	13.0% 20.850	13.7% 21970	4.4% 7.078	22.6% 36.230	32.0% 51.055	100% 160.020
2003	12.5% 26.881	11.4% 24.637	12.70% 27.512	0.50% 1.107	32.3% 69.735	30.60% 66.177	100% 216.028
2004	9.50% 27.339	11.50% 32.820	10.20% 29.129	1.20% 3.328	36% 103.832	31% 89.470	100% 285.964

Source: Bank of Sudan Annual Reports (1990-2004).

Numbers in brackets shows percentage of sector of finance to total finance.

2.2.2 Financial Sector Reform[2] in Sudan

It is widely recognized that financial liberalization is an integral part of financial sector development .As such; policies on trade liberalization, interest rate deregulation, capital account opening may have an important implication on financial development and hence economic growth. However, a large body of literature to address the issue of the importance of financial liberalization in facilitating economic development and growth has been undertaken by many economists (see for example, Schumpeter (1911), McKinnon (1973) and Show (1973).

In Sudan, historical experience shows that sporadic attempts were undertaken to reform the financial system since independence in 1956.First attempts to reform the financial sector shown by the considerable attention that was given within the framework of the first economic plan to the importance of the financial sector for allocating credit for development projects. But, dissatisfaction with the banking institutions performance led the government to support "supply-leading finance approach"[3] and thus got involved in the financial system by setting up specialized[4] financial institutions to cater for the financial needs of the different sectors of the economy. The second major development was the nationalization of the banking system in may 1970 as part of the whole nationalization policy adopted by Numiri regime. The third development was the adoption of the "Open-Door Policy" in 1977 to attract foreign investment and as a result both foreign and joint-venture commercial banks have been increased.

But the major financial sector reform in Sudan was the islamization of the banking system in the early 1980's following the announcement of the islamization of the entire Sudanese economy. Accordingly the

[2] The term "financial reform" is used interchangeably with the terms "financial liberalization", "financial deregulation: and "financial deeping". Financial reform is the process of moving or substantially reducing financial market distortions created by government intervention in setting interest rates and allocating credit. Financial reform may be a gradual process or sudden dismantling of all repressive regulations (Wilbert O.Bascom, 1994, the economics of financial reform in developing countries. The Macmillan press.Ltd.London

[3] The supply –leading approach aims to create more developed financial institutions to cater for financial services that are likely to induce investment and hence economic growth.

[4] Four Specialized banks were established, the Agricultural Bank of Sudan (1959), the Industrial Bank of Sudan (1961), the Estate Bank of Sudan (1967) and the Sudanese Saving Bank (1974).

banking sector became one of very few countries in the world with its financial system built completely on Islamic finance principles[5].

The period since the early 1990's has been the most crucial in recent economic history of Sudan as it is marked by the explicit commitment of the Sudanese government to a policy of market economy based on private sector. The government launched the Economic Reform and Structural Adjustment Program. The program included a variety of measures such as commodity price liberalization, privatization of some state-owned enterprises, reduced taxation of the corporate sector and, providing incentives to foreign investment. However, through these measures the program intends to stabilize the economy by reducing the rate of inflation, the fiscal deficit, the balance of payment deficit and developing the financial system by reforming it.

On the other hand, Reforms in the Sudan's financial sector focused mainly on introducing some new measures with the aim of strengthening the financial system, notably the tightening of capital adequacy ratios and the establishment of new paid-in capital minimum. Previously, there had been no minimum capital requirements, and the introduction was designed both to make the sector more robust and to force Sudan's smaller banks to merge. Classification and provisioning regulations against bad and suspect loans were also tightened, internal liquidity ratios revised upward and central bank monitoring and supervision requirements strengthened. In addition, the central bank reformed its liquidity management tools to encourage the development of a more active inter-bank local and foreign-currency market. In 1993, the Central bank of Sudan (CBOS), which is the monetary authority in the country "abolished the individual bank credit ceiling; Tightened conditions for extending lending to non-banks: and introduced requirements for inter-bank control, loan classifications and provision of capital adequacy (Kireyev, 2001).

It is worth mentioning that, the period (1997-2002) witnessed the first involvement of the IMF to monitoring the government macroeconomic stabilization package (program), which started in 1992.The financial sector reform program under the direct supervision of the IMF now consists of, tightening and reorienting monetary policy to lower the rate of inflation, introduce new instruments of indirect monetary policy control, abolishment of interest rate ceiling, credit ceiling and loan to priority sectors. The program also included deregulation, gradual opening up of the financial sector for foreign participation, privatization of banks and other financial institutions and increasing competition.

Controlling monetary growth was one of the key variables identified by the IMF when its adjustment programme was drawn up in 1997.As a result, the central bank of Sudan introduced in 1998 the central bank Musharaka ("profit sharing") certificates (CMCs) as short- term instruments sold at weekly auctions to mop up liquidity. Longer-term Government Musharaka certificates were also established for the same purpose.

In addition the central bank strengthened its monitoring of the commercial banks, required them to comply more closely with minimum reserve requirements, and established a discount window for short-term bank credit. Extending credit by banks to the private sector is one of the major components of the IMF reform program. Between 1996 and 1998 commercial banks claims on the private sector fell markedly in real terms, and even dropped in nominal terms between 1998 and 1999.To compact this, the central bank introduced a series of reforms[6] in 2000 aimed at strengthening the (mainly state-owned) banks and increasing their commercial independence, while tightening supervision.

The reform program also included policies intended to reduce the role of the state in the management of banks. As such, there has been a move toward privatizing or part privatizing the state-owned commercial banks. The first bank to be sold is the Bank of Khartoum (Sudan's oldest commercial bank), following a government announcement in late 2002 that it was seeking to sell a 74% stake to private investors, with the remaining 26% staying in state hands. The state-run agricultural bank (one of four specialized banks alongside the Real Estate bank, the saving and Social Development bank and the Workers bank) has also been the subject of restructuring. In addition, and to comply with the international standards on banking regulations, banks were required to meet the prudential ratios designated by the Basle committee.

2.2.3 The Impact of Reforms[7]

[5] In addition to Sudan, there are only two other countries, Iran and Pakistan, that have fully adopted the Islamic financial sytem.Approximately 50 other countries operate conventional interest-based banking system alongside Islamic financing.

[6] The government introduced the comprehensive banking policy program (1999-2002) as part of its policy reform to developing and creating competent and efficient banking system to cope with the developments in the international monetary, financial and banking industry.

[7] For more details on the impact of financial sector reform see (Kireyev, 2001).

Following the reforms, financial intermediation activity has certainly experienced relative expansion. The bank deposits have increased from around 6 per cent of GDP in 1996 to 10.6 percent in 2002.Simalrly, the ratio of M3 to GDP rose from 9 per cent in 1997 to 11, 12, 14 per cent in 2000, 2001, 2002 respectively (see Tabe3).

Table (3) Selected Monetary Ratios in Sudan: 1990-2002

Year	M2/GDP Ratio	Velocity GDP/M2	Currency with the public/M1 Ratio	M3/RDP Ratio	Total bank Deposit/GDP Ratio
1990	17	0.42	47	20	8.9
1991	14	0.37	49	18	7.4
1992	15	0.30	67	21	11
1993	16	0.35	70	21	9.5
1994	14	0.46	60	17	9.9
1995	13	0.29	60	17	10.1
1996	9	0.76	58	11	6.1
1997	8	9.97	58	9	6.1
1998	8	9.6	63	9	6
1999	10	9.5	64	9	5.9
2000	11	8.57	61	11	6.6
2001	12	8,7	56	12	8.1
2002	14	7.8	55	14	10.6

Source: World Bank development indicators, 2004 and own calculations

based on bank of Sudan annual reports (various issues)

Moreover the period of adjustment witnessed increased macroeconomic stability. Budget deficit/GDP ratio dropped drastically from 4.4 per cent in 1993/93 to 1.8 percent in 2001.The rate of inflation has been reduced from more than 130 percent in 1996 to one single digit in 2000 and 2001 with an average of 8 and 6 per cent respectively. In addition, the money supply growth rate ranges between 23 to 30 per cent during the period (1999 –2002) from an average of 66 per cent in 1996.This mainly due to the reduction of domestic credit and reform policies that have taken place in commercial banks'. An impressive growth in real GDP has also been achieved negative trends in real GDP growth rate were reversed. The economy improved from -5% annual growth rates in 1990 (The pre-reform period) to relatively steady growth rate of about 6 per cent during the reform period. However, to ascribe this impressive performance in real GDP growth rate only to financial sector reform would be dubious. In 1991, the immediate year preceding the reform, real GDP grew by 8 percent where as it dropped to 7, 5, and 1 percent in 1992, 1993 and 1994 respectively (the first years of reforms). The channels through which the reform would have led to improved growth have been shown to deteriorate during the first years of the reform. Financial savings, efficiency, credit flow to the private sector became poorer during the reform period. Thus forces outside the financial sectors must have influenced the growth in real GDP.

Fig.1:Real GDP in sudan (constant 2000 US$)

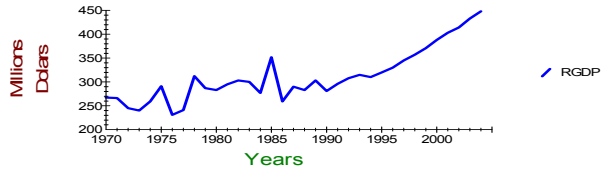
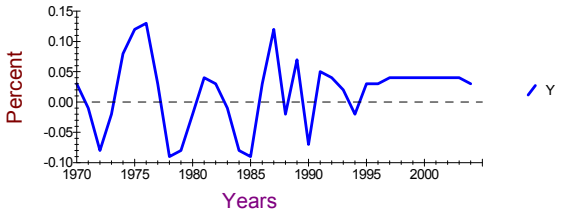


Fig.2 :GDP Percapita (annual growth rate(1970 2004)



To sum up, the reform policy shown some progress specially in the relative success of stopping the disintermediation process. Some indicators have been improved during the the reform period but still remains lower if compared with other developing countries. For instance, the ratio of broad money to GDP is about 10 percent in Sudan, compared with 30 to 40 percent in Pakistan, Kenya and Tanzania, and 50 to 90 percent in GCC countries (Jbili et. al., 1998).

However, in many respect, the financial sector is far to achieve the full efficiency since

some recent reforms have not already produced their expected effect especially those designed to promote long-term savings mobilization and financing investment.

3. Financial Sector Development and Growth: A brief review of the literature

Financial systems have long been recognized to play an important role in economic development and growth. Their role in economic growth has attracted much interest among academics, policy makers and economist around the world and has resulted in a large body of literature, both at the theoretical and empirical levels, that addresses the potential links between financial development and economic growth.

The debate on the causal links between financial development and economic growth can be traced back to the pioneering contribution of Bagehot (1873), Schumpeter (1912), Gold Smith (1955). Cameron (1967), Hicks (1969), McKinnon (1973) and Show (1973). They all emphasized that; the financial sector would be a catalyst of economic growth if it were developed and healthy. However, well-functioning financial systems are able to mobilize savings, allocate resource efficiently, pooling risks, induce liquidity, and reducing transaction costs. In recent years, latter studies both theoretical and empirical have been carried out to examine the nature of the relationship between financial development and economic growth. Studies conducted by King and Levine (1993a, 1993b, 1993c), Rajan and Zingales (1998), Gibson and Tsakalatos (1994), Fry (1995), Levine and Zervos (1998), Okedokum (1998), all provide empirical evidence supporting this relationship. All point to the importance of an economy's financial development for the growth of GDP real per capita income.

Throughout the survey of the literature, it was observed that, economists don't all seem to agree on the importance of the role played by finance in promoting economic growth and consequently they hold different views regarding the theoretical link between financial development and economic growth. Economists such as Schumpeter (1991), Gold smith (1969), King and Levine (1993a, 1993b), Fry (1978, 1988), McKinnon (1973)

and Show (1973), have argued that more developed financial system promote or "lead" economic growth. Goldsmith (1969)' for example, was the first to reveal the positive correlation between financial development and economic growth. This early work served as the impetus for those other researcher to delve further into this aspect of growth theory. Moreover, Schumpeter (1911) has highlighted the role played by the banking sector in allocating the necessary funds for promoting long- run growth. He proposes that the services provided by the financial sector are essential drivers for innovation and growth.

The above argument on the possible positive effect of the financial sector development on growth was also highlighted by McKinnon (1973) and show (1973). The McKinnon – Show School proposes that government quantitative restrictions on the banking system (such as interest ceiling, high reserve requirement and direct credit programs) restrain the volume and productivity of investment and impede the process of economic growth. The endogenous growth literature has revealed the same argument that financial development has a positive effect on economic growth (se for example, Bencivenga and Smith (1911), Greenwood and Jovanovic, 1990)

Contrary to the above hypothesis which states that, financial development lead economic growth, Robinson (1952) provides an alternatives view. She points out that finance does not exert a causal impact on growth. Instead financial development follows economic growth as a result of higher demand for financial services. In this case a financial institution is a mere reflection of the growth of the economic activity. Market participants simply acquire a demand for financial services that is a reflection of the entrepreneurial activities they are undertaking. Empirical support for this second view can also be found in some recent studies (Demetrides&Hussien (1996), Ireland (1994).

So far, empirical studies for the effects of financial development on economic growth have produced mixed evidence. Patrick (1966) reached in his study the conclusion that causation runs from financial to economic development (i.e. a supply leading relationship) in the early stage of development while the direction of causation is reversed (i.e. a demand following relationship prevails) in the later stage. By employing the causality-testing framework proposed by Granger (1969), the same conclusion was arrived at by Fritz (1984) on the basis of data for Philippines.

In some cross- section study, Jao (1976) found no role for financial development in explaining per capita real GDP.But in another, Wai (1980) evaluated the effects of real value of domestic credit on real GDP by employing time series data for each of 13 developing countries and significant positive impacts were detected in virtually all the countries.

Many other empirical analysis of these issues have been undertaken since then, most of which provide further evidence of the positive relationship between financial sector development and growth (see for example, Lanyi and Saaloglu (1983), Gupta (1986), Glb (1989), Gertler & Rose (1994), Roubini &Sala-Martin (1992), Easter (1993) etc. King and Levine (1993a, 1993b, and 1993c) provided also the same evidence for 80 countries over the period 1960-1989.Using different measures of economic growth and financial development; they have shown that financial market development affects economic growth positively. The measures of economic growth they used are (a) the average growth rate of per captia real GDP (b) the average growth rate of capital, (c) the investment ratio (as a percentage of GDP), (d) a proxy of productivity investment. They used different financial development variables (a) liquid liabilities/GDP (b) commercial bank domestic credit/ (commercial bank domestic credit + central bank domestic credit), (c) claims on the non - financial private sector/domestic credit and (d) gross claims on private sector/GDP. They found evidence of strong, positive relationship between the various financial development indicators of growth.

At the outset, it can be noted that, although numerous studies have been undertaken in this area on the importance of the impact of the banking sector development on economic growth, this paper contributes to this debate and improves on previous studies by using a new econometric technique called the ARDL framework proposed by Pesaran et al. (2001).The new framework reduces the shortcomings of small sample biases.

4. Model, Data sources and Methodology

4.1 Model and Data Sources

Following the literature (see, king and Levine 1993a, 1993b; Allen and Ndikumana 1998) and taking into account constraints relating to data availability in Sudan, we estimate the following model:

GRGDP = f (TRD, INF, INV, GEX, CPS, or M3Y)

Economic growth is proxies with the variable GRGDP which is defined as the growth rate of real GDP. This is consistent with earlier studies (Gelb, 1989; Roubini and Sala-I-Martin, 1992; King and Levine, 1993a, 1993b; Demetriades and Hussein, 1996; Allen and Ndikumana, 1998; Rousseau and Wachtel, 1998 and Beck, Levine and Loayza, 2000) on financial intermediation and economic growth. This measure provides a high indicative power of the quality and quantity of economic growth.

The selection of key variables to measure the level of financial services produced in the economy and to measure the extent and efficiency of financial intermediation is the major problem in an empirical study of this nature. Construction of financial development indicators is an extremely difficult task due to the diversity of financial services catered for in the financial system. What represent an appropriate measure of financial development (FD) seems to be controversial in the literature Several measures (proxies) representing the liquid liabilities of the financial system, such as M1/GDP, M2/GDP, or M3/GDP have been widely used in econometric models (see, for example, Goldsmith 1969, Gelb, 1989, World Bank, 1989, King and Levine 1993a, 1993b).These measures are not good proxies of financial development since they are likely to measure the extent to which transactions are monetized rather than the ability of the financial system to channel funds from depositors to investment opportunities As an alternative measure, bank credit to the private sector is often argued to be a more superior measure of functioning financial development because it is a measure of the quality and quantity of investment (see De Gregario and Guidotti, 1995, Demetriades and Hussein, 1996 Levine et al, 2000 for similar argument).

In the light of the preceding arguments, and to ensure robustness, we use two alternative measures of financial market development. The first proxy for financial development (FD) is the ratio of M3/GDP denoted by M3Y.M3 as a percentage of GDP has become a standard measure of financial depth and an indicator of the overall size of financial intermediary activity in cross-country studies. The choice of M3Y may be seen in accordance with the inside money model of McKinnon (1973) where the accumulation of real money balances is a required condition for investment. An increase in M3Y may be interpreted as an improvement in financial deeping in the economy.

The second proxy of financial development is the value of credit offers by the commercial banks to the private sector divided by GDP denoted by CBS is used to measure the private sector financing role of commercial banks and is in line with De Gregario and Guidotti (1995). This proxy does not include credit to the private sector by non-deposit money banks, the central bank; credit issued to governments or public enterprises and hence is an exclusive measure of the intermediary role of commercial banks. This proxy represents the financial intermediary in one of its main function namely that of credit intermediation by channelling savings to investors. .This indicator represents an accurate indicator (proxy) of functioning of financial development because it is a measure of the ability of the banking system to provide finance-led growth (Levine and Zervos, 1998).

Clearly, factors other than financial development impact on economic growth. We therefore introduce control variables that have been shown empirically to be robust determinants of growth in the literature. These control variables include, a measure of openness to trade (TRD), inflation (INF), gross investment as percent of GDP (INV) and, size of government (GEX).

The effects of internal trade on growth are captured by openness variable, which is measured as the sum of imports and exports as a percentage of nominal GDP (Levine et al, 2000). Theoretically the effects of trade can be positive or negative, as such, the net effects can be determined only empirically.

The inflation rate and extent of government expenditure are commonly used as indicators of macroeconomic stability (Eastrly and Rebelo, 1993; Fischer, 1993; Allen and Ndikumana 1993, and Levine et al, 2000). High inflation distorts economic activity and reduces investment in productive enterprises, thus reducing economic growth. This study uses change in inflation rate. Government expenditure could reduce economic growth because of the crowding out effect on private investment and the inflationary pressure it can lead to (Allen and Ndikumana (1998). This study employs the ratio of government expenditure to GDP as a measure of the size of the government. The share of investment in GDP is considered as one of the few economic variables that have robust effect on economic growth (Levine and Renelt, 1992).

In addition to the five variables described above we introduced a dummy variable which takes the value of zero from 1970 to 1990 and the value of one afterwards, to account for the islamization program of the banking system launched in Sudan during 1990's.

Accordingly, we estimate two versions of the model to investigate the impact of financial development on real output in Sudan, using annual time series data for the period 1970 to 2004.The two models are:

Model 1:

$$\mathbf{lnGRGDP_t} = \alpha_0 + \alpha_1 \mathbf{lnINV_t} + \alpha_2 \mathbf{lnGEX_t} + \alpha_3 \mathbf{lnTRD_t} + \alpha_4 \mathbf{lnM3Y_t} + \alpha_5 \mathbf{TREND_t} + \alpha_6 \mathbf{D90_t} + \boldsymbol{\varepsilon_{1t}}$$

Model 2:

$$\mathbf{lnGRGDP_t} = \beta_0 + \beta_1 \mathbf{lnINF_t} + \beta_2 \mathbf{lnINV_t} + \beta_3 \mathbf{lnGEX_t} + \beta_4 \mathbf{lnCBS_t} + \beta_5 \mathbf{TREND_t}$$

$$+\beta_6 \mathbf{D90_t} + \boldsymbol{\varepsilon_{2t}}$$

Here, lnRLGDP is the natural log of real GDP.lnINV is the natural log of investment.lnGEX is the natural log of government spending. lnTRD is the natural log of trade openness lnINF is the natural log of inflation.D90 is a dummy variable and TREND refers to the time trend and ε is a white noise error term.

Data are obtained from the World Bank's Development indicators 2005 CD-ROM and various issues of the Central Bank of Sudan Annual Reports. All variables in our data set are expressed in natural logarithms and the time span of the study ranges annually from 1970 to 2004.The choice of annual data is due to the fact that most of the available data are reported annually. Furthermore, researchers like (Shiller and Perron, 1985; Campbell and Perron, 1991 and Hakkio and Rush, 1991) found that the power of the time series analysis with particular emphasis on cointegration lies in the span of data rather than the number of observations.It is for these reasons that in this study annual data is used.

4.2 Econometric Methodology

This study utilises the newly proposed autoregressive distributed (ARDL) bounds test

proposed by Pesaran, *et al*. (2001) to examine the co- integration relationship between financial development and economic growth..This procedure has several advantages over several methods available for conducting the co-integration test such as two-step residual based Engle-Granger (1987) test, and the maximum likelihood based Johansen (1991; 1995) and Johansen-Juselius (1990) tests. The main advantage of ARDL modeling lies in its flexibility that it can be applied when the variables are of different order of integration (Pesaran and Pesaran1997). Another advantage of this approach is that the ARDL is more appropriate measure in the case of small samples, while the Johansen co-integration techniques still require large data samples for the purpose of validity. Given that our sample size is limited with a total of 35 observations only, conducting bounds test will be appropriate.

Moreover, the ARDL modelling approach to cointegration, involves OLS estimation of an unrestricted Error Correction Model (ECM) of the following type as a first stage:

$$\Delta \mathbf{Y_t} = \boldsymbol{\alpha_0} + \boldsymbol{\alpha_1} \mathbf{T} + \boldsymbol{\omega_1} \mathbf{Y_{t-1}} + \boldsymbol{\omega_2} \mathbf{X_{1,\,t-1}} + \text{----} + \boldsymbol{\omega_k} \mathbf{X_{k,\,t-1}} + \sum_{i=1}^{p-1} \beta i\, \Delta \mathbf{Yt\text{-}i} + \sum_{i=1}^{q-1} \boldsymbol{\omega_1}\, \Delta \mathbf{X_1,\, t\text{-}i} + \text{---} \sum_{i=1}^{qk-1} \Phi ki\ \Delta \mathbf{X1,\, t\text{-}i} + \boldsymbol{\varepsilon_{1t}}$$

Where Δ is the difference operator, α_0 is a constant, *T* is a time trend, *Y* is the dependent variable, *Xi* (*i* = 1, 2, . . . , *k*) are explanatory variables, $\boldsymbol{\varepsilon}$ is the error term, *p* and *q* are maximum lag orders, and the rest are coefficients.

The implementation of ARDL approach involves two stages. At the first stage, the existence of the long-run relation between variables under investigation is tested by computing the F-statistics for testing the significance of the lagged levels of the variables in the error-correction form of the underling the ARDL model. Pesaran et al (1996) tabulated two sets of appropriate critical values for different number of regressors (k), and whether the model contains an intercept or trend or both. One set assumes that all the variables in the ARDL model are of 1(0), and another assumes all the variables are 1(1).If the *F*-statistic lies above the upper bound critical value for a given significance level; the conclusion is that there is a nonspurious long-run level relationship with the dependent variable. If the *F*-statistic lies below the lower bound critical value, the conclusion is that there is no long-run level relationship with the dependent variable. If it lies between the lower and the upper limits, the result is inconclusive. The general form of the null and alternative hypotheses for the *F*-statistic test is as follows:

$$H_0: (\varphi_1 = \varphi_2 = \cdots = \varphi_k = 0)$$

$$H_1: (\varphi_1 \neq 0, = \varphi_2 \neq 0, \ldots, \varphi_k \neq 0)$$

At the second stage of analysis one can estimate the long-run coefficient and make inference about their values. The estimate of the long-run coefficients may differ depending upon the model selection criteria used. In our case the Schwarz Bayesian Criterion (SBC) is used. In this step, the resulting underlying ARDL equation

is also verified with all its statistical diagnostic properties in order to get unbiased and consistent/efficient estimates. The test for serial correlation, functional form, normality and heteroscedasticity are carried out to ensure that the models are well specified and congruent with data. The error correction version of ARDL equation can then, be estimated in this stage. The adjustment parameter, as reflected in the coefficient of error correction term indicates the extent of adjustment of the dependent variable to the deviations from its long-run equilibrium value

5. Empirical Results

Autoregressive Distributed Lag Estimates

ARDL (1,0,1,0,2) selected based on Schwarz Bayesian Criterion

Dependent variable is lnRLGDP

Repressor	Coefficient	Standard error	t-statistics(prob)
LnGRGDP	0.796	0.0796	9.996 [0.000]
LnINV	0.117	0.031	3.77 [0.001]
LnINV(-1)	0.175	0.031	5.633 [0.000]
LnGEX	-0.234	0.1246	-1.876 [0.074]
LnINF	-0.014	0.0072	-1.914 [0.690]
LnCBS	-0.047	0.028	-1.711 [0.101]
LnCBS (-1)	0.0160	0.029	0.564 [0.570]
LnCBS(-2)	-0.118	0.030	-3.944 [0.001]
CONST	3.507	1.193	2.939 [0.000]
TREND	-0.0017	0.038	-0.450 [0.032]
D90	0.489	0.027	0.0176 [0.986]

5.2 Short run Dynamics

The fact that the variables in our model are co- integrated provides support for the use of an error correction model mechanism (ECM) representation in order to investigate the short run dynamics. The estimates of the error – correction model are given in tables (8) and (9) for both model 1 and model 2. The adjusted R-squared of the error correction model is 0.75 and 0.78 in model 1 and model 2 respectively, implying that the fit of the models in each case is good.Also,the short-run models pass all the diagnostic tests for autocorrelation, functional form, normality of the residuals and heteroscedasticity, and supports the overall validity of the short run model.

It is known that the error correction term EC_{t-1} measures the speed of adjustment to restore equilibrium in the dynamic model. The EC_{t-1} coefficient shows how quickly/slowly variables return to equilibrium and it should have a statistically significant coefficient with a negative sign. Bannerjee *et al.* (1998) states that a highly significant error correction term is further proof of the existence of a stable long-term relationship. Tables (7) and (8), shows that the error term EC_{t-1} is statistically significant in each model with the expected negative sign. This confirms once again, the existence of the co- integration relationship among the variables of these two models. The coefficients of ECt_{-1} are equal to (-0.37) and (-0.20) for models (1) and (2) respectively and imply that deviations from the long-term growth rate in GDP are corrected by 37 percent in model (1) and 20 percent in model (2) between two successive time periods. This means that the adjustment takes place relatively quickly in model 1 and 2.

Table 8: Error –correction estimates of model 1

ECM - ARDL (1, 0, 1, 0, 2) Selected based on Schwarz Bayesian Criterion

Dependent variable is ΔlnRLGDP

Repressor	Coefficient	Standard error	t-statistics(prob)
ΔLnINV	0.098	0.035	2.76 [0.011]
ΔLnGEX	-0.460	0.146	-1.876 [0.004]
ΔLnGEX1	0.323	0.133	-1.914 [0.023]
ΔLnTRD	-0.001	0.029	-1.711 [0.970]
ΔLnM3Y	0.042	0.064	0.564 [0.515]
ΔCONST	5.810	1.370	2.939 [0.000]
ΔTREND	0,011	0.0036	-0.450 [0.004]
ΔD90	-0.106	0.0460	0.0176 [0.030]
ΔECM(-1)	-0.373	0.0902	-4.142 [0.000]
R^2 0.75		S.E. of regression	0.035
R-Bar-Squared 0.62		F.Stat. F (10, 22)	7.949(0.000)

Table 9: Error –correction estimates of model 2

ECM - ARDL (1, 0, 1, 0, 2) selected based on Schwarz Bayesian Criterion

Dependent variable is ΔlnRLGDP

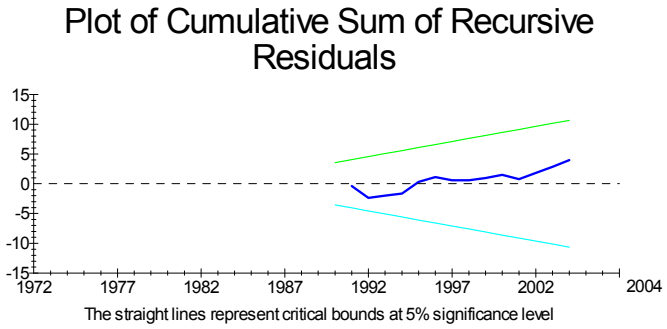
Repressor	Coefficient	Standard error	t-statistics(prob)
ΔLnINV	0.1174	0.0311	3.77 [0.001]
ΔLnGEX	-02338	0.1245	-1.8775[0.73]
ΔLnINF	-0.0138	0.0072	-1.914 [0.068]
ΔLnCBS	-0.0472	0.0276	-1.710 [0.100]
ΔLnCBS1	0.1184	0.030	3.944 [0.001]
ΔCONST	3.507	1.193	2.939 [0.007]
ΔTREND	-0.0017	0.0038	-0.450 [0656]
ΔD90	-0.4899	0.0276	0.0176 [0.986]
ΔECM(-1)	-0.203	0.079	-2.5616[0.017]
R^2 0.79		S.E. of regression	0.033
R-Bar-Squared 0.68		F.Stat. F (10, 22)	9.815(.000)

5.3- Testing for the stability of the model

To complement this study it is important to investigate whether the above long run and short run relationships we found are stable for the entire period of study. The stability of the model is evaluated using the

cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) of the recursive residual test for structural stability proposed by Brown *et al*. (1975).A graphical representation of CUSUM AND CUSUMQ statistics are shown in fig.3 and fig.4.If the plot of the CUSUM and CUSUMSQ remains within the 5 per cent critical bound the null hypothesis that all coefficients are stable cannot be rejecteted.As it is clear from fig.3 and fig.4 ,the plots of both the CUSUM and the CUSUMQ are within the boundaries and hence these statistics confirm the stability of the long run coefficients of the RGDP function in model 1 and 2.

Fig. 3: Plots of CUSUM and CUSUMQ statistics for stability test (model1)



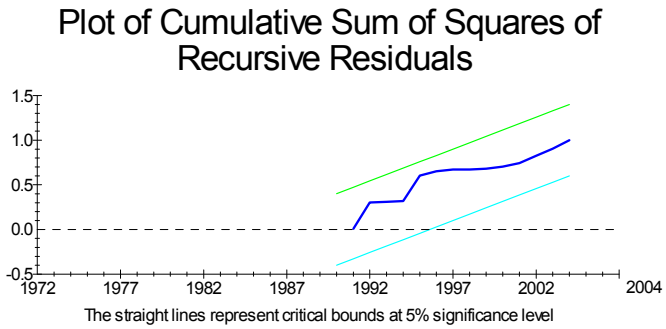
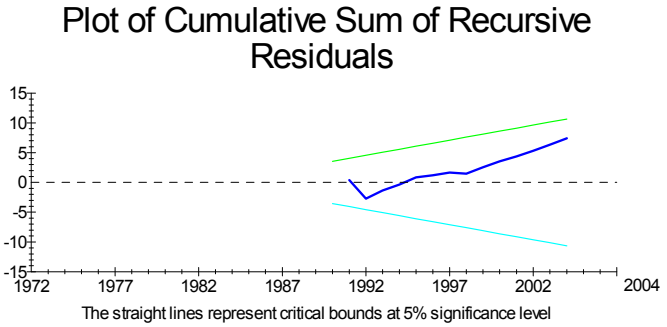
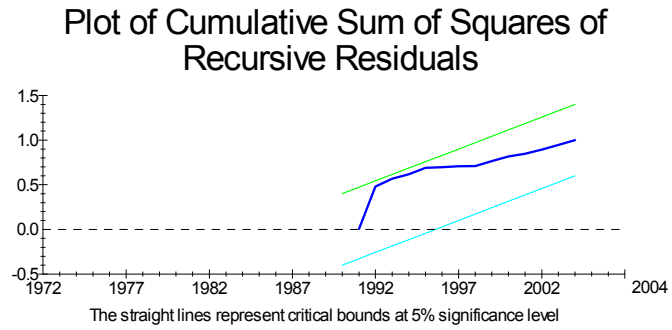


Fig. 4: Plots of CUSUM and CUSUMQ statistics for stability test (model 2)





6- Conclusion and Policy implications

The study attempts to evaluate the impact of financial development on real GDP in Sudan using a more robust econometric technique, the ARDL framework. Our findings suggest that that the financial development indicators does not have a direct impact on real output.These weak findings may be attributed to the inefficient allocation of resources by banks, along with the absence of an appropriate investment climate required to foster significant private investment and promote growth in the long run, and to the poor quality of credit disbursal of the banking sector in Sudan. Moreover, the econometric analysis of the model shows that the other macroeconomic variables provide little proof in explaining real GDP growth in Sudan. Although, the level of investment exerts a positive and statistically significant impact on real GDP in the long run, the relationship between them in term of elasticises remains very weak i.e. a one percent increase in investment leads to a respective real GDP increase of 0.098 only. Government spending and inflation variables appear with the correct sign but with mixed results in the short and long run. For example, government spending variable is statistically significant for model 1 in both the short and long run analysis, but it is insignificant in model 2 when we replacing trade openness by inflation variable. The results also showed that the error correction coefficients, which determine the speed of adjustment, had an expected and highly significant negative sign. Also, both models have passed all the diagnostic tests for autocorrelation, functional form, normality of the residuals and heteroscedasticity, and support the overall validity of the short run model.

As mentioned earlier, the financial sector reform conducted in Sudan in the early 1990s was mainly to accumulate financial savings to finance productive investment endeavours and hence promote long term economic growth. But, the Sudanese experience of financial reform show that enhanced investment has not

taken place yet, and that growth performance is far from being satisfactory in a country where 40 percent of the population lives below the national poverty line.

One of the most obvious implications of our results is that if Sudan is to realize its target growth rate it needs to create a stable political and economic climate conducive to investment. It follows from this that political stability and policies designated to raise investment are a precondition for Sudan's economic success.

Appendix 1

Main Islamic financial instruments used in Sudan

Musharaka (Partnership):

Under Musharaka the investment is necessarily be implemented between two or more parties, each of them contribute a share of the total capital. It works according to the following conditions;

1. The capital of Musharaka is generally paid in liquid money; however, payment in kind is also acceptable. In this case, the value of that property (not the property of per se) is considered for determining the percentage age of his contribution to the capital and his obligations toward any liability.

2. A partner ought to enjoy full legal capacity to act on his own and on behalf of others (partners) with respect to the different dealings of Musharaka.

3. The means by which profits and losses are distributed among partners must be stated.

4. It is acceptable for a partner who contribute more effort than others and/or who enjoys more experience to take a %age in profit in lieu of his extra labor and expertise but lossesare always incurred in direct proportion to the respective shares in capital.

Mudaraba:

Mudaraba is a special type of Musharaka. In a Mudaraba contract, one partner contributes the capital and the other partner provides labour and expertise. Common conditions for this mode of Islamic finance include:

1. Capital of Al-Mudaraba must be identified, known to the parties, and delivered to the investor (entrepreneur), and it should, under no circumstances, be a debt resting with the investor (entrepreneur).

2. The duty of the investor (entrepreneur) is to exert his best effort for investing the capital and at the same time to take all precautionary measures to protect the assets of the project under the Mudaraba financing.

3. The investor (entrepreneur) is a trustee. He is, therefore, under no obligation to guarantee any damage or loss incurred in the due process of investment. In this case, the damage and loss are borne by the investor (entrepreneur). However, the investor (entrepreneur) is pounded to pay any damages and bear losses if he transgresses the limits as a trustee, through will-full acts, negligence and breach of contract.

4. The distribution of the profit must be explicitly agreed to and in such a way as to ensure its distribution between the parties i.e. in percentage. However, losses are borne by the owner of capital.

Muzara'a:

Al Muzara'a is a type of sharecropping agricultural partnership. Traditionally the landowner would provide the land and inputs while the farmer provides labour. The yield is distributable among the partners in accordance with their predetermined contract. The increasing cost of inputs and production often lead to changing the formula. Some new forms may be illustrated as follows: the contract of Muzara'a may be undertaken by:

1. The landowner, the expert farmer and the owner of irrigation scheme.

2. The landowner who also undertakes to administer the farm and the bank that provides the inputs.

Murabaha:

The steps to be followed for the formation of this sale contract may be summarized as follows:

1. The intending buyer asks the would-be seller creditor (Islamic bank) to buy a commodity, the intending buyer promises to buy that commodity for mark-up price (margins) that is determined by the monetary authorities.

2. If the creditor (Islamic bank) agrees to enter into that transaction, it has to buy the demanded commodity from the original owner according to the guidelines of the commodity under financing.

3. Having that commodity, creditor (Islamic bank) has to make a fresh offer -depending of course on the previous negotiations and promise to the buyer.

4. According to the preponderant Shariah point of view and despite his previous promise, the buyer has the right to accept or reject that offer, and in case of acceptance, a valid contract of sale is concluded between the two parties.

5. In case of rejecting the offer, the ownership of the community rests with creditor (Islamic bank).

Istisna'a

Istisna'a is a sale contract whereby the buyer asks the seller to manufacture and sell acommodity well defined. Or that the seller commodity might be specified without necessarily manufacturing it, e.g. forming a contract with a factory for agricultural capital goods, and other inputs to be delivered by specification within a definite period of time. The dominate point of view among jurists is to the effect that the contract of Istisna'a is not obligatory on the two parties i.e. any one of them has the right to withdraw without a prior notice.However, among leading Hanafi's jurists there is an opinion that Istisna'a is as binding on its parties as any other pecuniary contract. This view is the more acceptable one for dealings in Sudan.

Ijarah:

Ijarah refers to a leasing contract in which some specified assets (e.g. tractor) are leased for use by a farmer/client according to an agreed price and for a specific period of time.

Salam:

Salam is a special type of sale contract, which is valid for both agricultural and industrial products. It is exactly the reverse of the deferred sale. In this contract, the price has to be paid immediately, whereas, the delivery of the commodity agreed on with specifications has to take place at a specific future period. The following terms must be satisfied for the validity of the contract of Salam.

1. The price (known as capital of Al-Salam) must be identified and known

2. The price should be paid immediately after the constitution of the contract. Nevertheless, a delay for short period is condensable according to the Maliki School.

3. The sold commodity must be known by specifications, in order to provide the seller with wide room to get the commodity from wherever it is available.

4. Its delivery should be postponed to a specific time in the future; therefore, the availability of the commodity in the market is usually the main determining factor for fixing a time in the contract.

5. To avoid uncertainty, the place of delivery has to be stated in the contract.

6. The seller ought not to have stipulated that he would honor his obligation from specific source such as his farm or farms in specific area. Therefore, if the seller is unable to secure the commodity due to its unavailability in the markets, the buyer has two options; either to wait for its availability or to resign the contract and recover the paid up price.

Source: Alherika (2004)

Appendix 2: Recent Islamic Monetary Policy Tools in Sudan

Central Bank Musharaka Certificates (CMCs)

The Bank of Sudan introduces these certificates in June 1998.They were issued by

The Sudan Financial Services Company (SFSC) on behalf of the Bank of Sudan and the government of Sudan. Essentially they represent a limited number of shares in a special fund composed of the pool of government investments in nine commercial banks. The CMCs allow its owner to share with the bank of Sudan and the ministry of finance the benefit of investing in banks wholly or partially owned by them. The High Shari'a Supervisory Board (HSSB) approved these certificates for the banking system and other financial institutions as the first Islamic interest free instrument used to manage liquidity and conduct open market operations.

The utilization of CMCs to conduct open market operations are considered to be more effective in influencing liquidity when compared with the statutory reserve ratio. If the bank of Sudan wishes to reduce liquidity of the commercial banks, then it would sell certificates with the amount of money it wants to withdraw from the banks, and the reverse is true, if it wishes to pump liquidity into the national economy.

Government Musharaka Certificates (GMCs)

The Government Musharaka Certificates (GMCs) are also equity-based financial securities that were introduced in 1999, as an Islamic-oriented means for financing the budget deficit. It offers the Bank of Sudan an additional effective tool for liquidity management. These certificates allow their owner to share the profit or a loss resulting from the operations of all government companies and corporations whose equity capital constitutes the fund from which these certificates were issued. The issuing of these certificates achieves the following objectives:

Managing liquidity on the macroeconomic level through open market operations (OMO)

Covering part of the budget deficit instead of printing more paper money by the bank of sudan. Accumulating national savings and encouraging investment through increasing awareness among the general public with the benefits associated with this investment.

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Real Exchange Rate and Economic Growth: Turkey

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ABSTRACT

This paper assesses the relationship with real exchange rate and growth using quarterly data of 1989:Q1-2005:Q2. Integration level of the variables are investigated using with DF, PP, KPSS, Ng-Perron Tests and according to the test results, it is decided that all series are first order integrated. Using Johansen Cointegration Test this paper finds evidence that one cointegration vector based on two groups of variables. Vector Error Correction Models were estimated that incorporates the long run behavior variables and short run adjustment dynamics. For both of two VEC models Impulse- Response Functions and Variance Decomposition Analysis are studied. Formed impulse-response functions, RER shock increases GDP in the models for the short run but then decreases successor periods. In Variance Decomposition Analysis, it is evident that the sources of variance in output are the own shocks and also observed that RER's explanatory ratio on GDP does not disappear in the long run.

Keywords: Real Exchange Rate, Economic Growth, Vector Error Correction

JEL Codes: F31, F43

1. INTRODUCTION

Exchange rate management is one of the most important challenges facing developing countries. This issue is most often framed as a choice between fixed and flexible exchange rates or maintenance of an exchange rate regime. The classical wisdom, the real depreciations are contractionary and discouraging imports in favor of domestically produced goods, and subsequently increase output.

Turkey has experienced two major economic crises in 1994 and 2001. The first one that surprisingly attracted very limited international interest occurred at the beginning of 1994, the second crisis is more severe as the Turkish currency lost more than half of its original value. After these crises the nominal domestic currency depreciated 62% and 53% respectively, such as large devaluations or high levels of depreciation in domestic currency were experienced after both the 1994 and the 2001 crises. The 2001 crisis was probably caused by immature dollarization policies and weaknesses in the banking system. during the this two crises the major economic problem had been inflation, and many stabilization programs had been implemented.

The mentioned crises have similar effects which caused huge exchange rate depreciation, output declines and high interest rates. Because the fact that this paper assesses effects of real exchange rate on the economic growth of Turkey by considering quarterly data from 1989:Q1 to 2005:Q2.

Kamin and Rogers (2000), Berument and Pasaogullari (2003) testing the contractionary devaluation hypothesis focus on Mexico and Turkey respectively. This study mainly uses the method proposed by this two papers which found empirical evidence for contractionary devaluation for investigated countries by analyzing the output and inflation response to real exchange rate movements.

There is little theoretical consensus on how inflation affects economic performance. Much of the empirical literature looks for a negative influence of inflation on growth. Apart from the effect of trend inflation, inflation uncertainty may also influence output growth.

This rest of the paper is organized as follows. Section 2 contains a brief review of the real exchange rate measurement, macroeconomic importance of the real exchange rate and historical analysis of exchange rate movements in Turkey. Section 3 reviews the existing literature on real exchange rate on economic growth. Section 4 presents the empirical results and finally section 5 concludes.

2. REAL EXCHANGE RATE AND THEORETICAL FRAMEWORK

The nominal exchange rate is the rate at which a person can trade the currency of one country for the currency of another. The real exchange rate (RER) is the relative price of the goods of two countries. That is, the real exchange rate tells us the rate at which we can trade the goods of one country for the goods of another.

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The real exchange rate is sometimes called the terms of trade and rate can be defined as the nominal exchange rate that takes the inflation differentials among the countries into account. RER[1] is calculated as:

$$RER = \frac{eP*}{P} \qquad \textbf{(2.1)}$$

In this definition, P, P* and e stand for the domestic and international prices nominal exchange rate respectively. Thus, the real exchange rate depends on the nominal exchange rate and on the prices of goods in the two countries measured in the local currencies. If the real exchange rate is high, foreign goods are relatively cheap, and domestic goods are relatively expensive. If the real exchange rate is low, foreign goods are relatively expensive, and domestic goods are relatively cheap. In practical usage, there are many foreign currencies and price level values to take into consideration. Correspondingly, the model calculations become increasingly more complex.

"How the real exchange rate is determined" is the best question to choose our data which could be used in this paper. The real exchange rate is related to net exports. When the real exchange rate is lower, domestic goods are less expensive relative to foreign goods, and net exports are greater. According to this theory export and export must be data of studies about RER.

2.1. Theoretical Framework

A famous hypothesis in economics, called the law of one price, states that the same good cannot sell for different prices in different locations at the same time, namely purchasing-power parity (PPP). Although the doctrine of purchasing-power parity does not describe the world perfectly, it does provide a reason why movement in the real exchange rate will be limited. There is much validity to its underlying logic: the farther the real exchange rate drifts from the level predicted by purchasing-power parity, the greater the incentive for individuals to engage in international arbitrage in goods. Although we cannot rely on purchasing-power parity to eliminate all changes in the real exchange rate, this doctrine does provide a reason to expect that fluctuations in the real exchange rate will typically be small or temporary.

Second hypothesis in economics about exchange rate is Marshall-Lerner Condition. The condition says that, for a currency devaluation to have a positive impact in trade balance, the sum of price elasticity of exports and imports (in absolute value) must be greater than one. As a devaluation of the exchange rate means a reduction on price of exports, demand for these will increase. At the same time, price of imports will rise and their demands diminish. Given the export elasticity e_X , and import elasticity e_M, the inequality above can be written as follows:

$$(e_X + e_M - 1)>0 \quad \text{or} \quad (e_X + e_M) > 1 \qquad \textbf{(2.2)}$$

In the textbook open economy macro model, real depreciations are growth enhancing. They stimulate the external demand for a country's exports and increase the internal demand for the country's products relative to imported goods.

What determines the country's long run exchange rates? The leading theory is Balassa- Samuelson[2] hypothesis (Balassa, 1964; Samuelson, 1963). It is argued that the traded goods sector has a higher productivity growth than the non-traded goods sector. Therefore the relative slower rate of growth in the non-traded goods sector result in higher relative non-traded goods prices.

The diagram of ''Salter–Swann'' presented in Kamin and Rogers (2000) is called a useful heuristic device to sort out the various factors underlying the observed relationship between real exchange rates and output in Mexico.

In figure 1 real exchange rate is plotted against the level of real income in a small open economy. The internal balance curve IB represents the locus of points in which the supply of non-traded goods is equal to its demand. The external balance curve EB represents combinations of real exchange rates and income that equate the trade deficit with the capital account surplus.

[1] The various definitions of the real exchange rate. See Kipici and Kesriyeli 1997.

[2] The Balassa-Samuelson hypothesis assumes that purchasing power parity holds for the market of traded goods, but that ratio of prices of traded and non-traded goods may evolve differently in one country than in another, as productivity in poorer countries grows faster in the traded-goods sector than in the nontraded goods sector. In poor economies is primarily due to productivity growth in the tradable goods sector where prices tend to be equal across all countries.

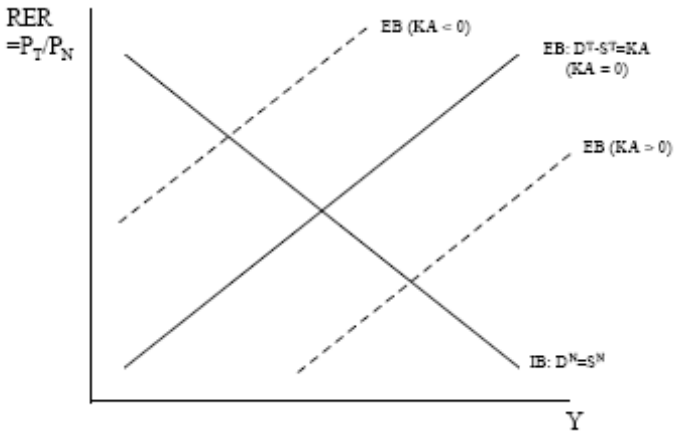


Figure 1: Salter-Swan Diagram

Increases in income raise the demand for non-traded, thereby raising their price relative to that of traded goods and appreciating the real exchange rate along the IB curve. The real exchange rate that used the scheme represents the ratio of traded to non-traded prices. For a given capital account, increases in income expand the demand for traded and require an offsetting depreciation of the real exchange rate to keep the trade balance constant. Increases in the capital account surplus allow the economy to run larger trade deficits and shift the EB curve to the right; conversely, decreases in the capital account balance shift the EB curve to the left.

This paper does not take into account the potential existence of Balassa-Samuelson effect, RER misalignment or PPP. These are beyond the scope of this paper.

2.7 Historical Analysis of Exchange Rate Movements in Turkey

The period since the late 1980's is characterized by increasing inflation and several stabilization programs. Nominal anchoring and monetary tightening were used in these programs without any serious effort to reduce the public sector borrowing requirement. In 1989, Turkey applied to the IMF for the full convertibility of the Turkish and the capital account was fully liberalized. The initial effect of the liberalization of the capital account was a rapid capital inflow to the Turkish economy. The Gulf Crisis created uncertainties about the exchange rate and The Central Bank of the Republic of Turkey (CBRT) aimed at keeping these uncertainties to minimum levels. However, the real exchange rate depreciated 8.3% in 1991. In 1992, the exchange rate policy was quite different from the 1989-1990 period and CBRT did not allow the exchange rate to appreciate in real terms. The exchange rate basket (1 US dollar + 1.5 Deutsche Mark) depreciated by 1.4% in 1992. In 1993, the real exchange rate did not appreciate much and stayed approximately around the same level during the year, but at the end of 1993 there was a 19% appreciation of Turkish lira stemming from the 1989-1990 period. By the end of 1994, about 50 percent of the total deposit base was held in the form of foreign-currency deposits, up from 1 percent in 1993. The downgrading by credit-rating agencies and a lack of confidence in the government's budget deficit target of 14 percent of GDP for 1994 triggered large-scale capital flight and the collapse of the exchange.

After the general elections, and the earthquakes of 1999, the fiscal balance deteriorated. In December of 1999, a stand-by agreement was signed with the IMF with the crawling peg regime being the major disinflation tool. In this year an overvalued exchange rate and high real interest rates were still a problem in terms of causing increased imports.

From January 2 of 2000 to February 22 of 2001, the CBRT publicly announced the daily quotations of the nominal exchange rates every morning and committed itself to intervene in the exchange rate market. With the 2000 Disinflation Program, a crawling peg regime in the exchange rate policy was adopted starting on January 2, 2000. The 2000 Disinflation Program was an exchange rate-based disinflation strategy with prudent fiscal measures and an ambitious structural reform agenda. The CBRT announced the path of the nominal exchange rate basket (1 US dollar +0.77 Euro) on a sliding 12-month scale every three months.

In 2002 and 2003 high growth rate attained along with the declining inflation. Achievement of inflation target, the quality of inflation target as a reliable nominal anchor has improved for 2004 and later. The downward trend in inflation continued in 2005, albeit at a lower pace compared with the preceding four years. However, inflation expectations maintained their favorable course under the cautious stance of monetary policy and budget discipline. CBRT adopted an inflation targeting regime starting in January 2006. The Inflation

Report is one of the main communication tools of the Monetary Policy Committee (MPC) under the new regime.

3. PREVIOUS EMPIRICAL STUDIES

Generally there are many empirical studies investigating the effect of changes in the real exchange rate on output. Specifically in Turkish economy least squares analyses and VAR models have been used previously to investigate empirically the effects of the real exchange rate on macro economical variables. Literature review of this paper generally focused on Bilgili (2000), Berument and Pasaliogullari (2003) used least squares analysis and VAR models respectively for Turkish economy.

Domac (1997), found that unanticipated devaluations increase output in but anticipated devaluations do not exert any significant effect Turkey using nonlinear three-stage-least-squares for the 1960-1990 period. Ozmen and Furtun (1998) investigated "export-led growth" hypothesis based on Turkish quarterly data for the 1970:Q1-1995:Q4. They used seasonally adjusted series and found that there were no cointegration with real export and real income. Upadhyaya (1999) used ADL (Autoregressive Distributed Lag) models for six Asian countries[3] using annual data 1963–1993 with the RER and GDP data. They found that all variables are first order integrated. Main results of this paper are devaluation is contractionary for long run in Pakistan and Thailand, expanditionary in other investigated countries.

Kamin and Rogers (2000) found that once interest rates and income were included in money demand equations for Mexico, other variables such as inflation or the rate of exchange rate depreciation were not significant. Kamin and Rogers (2000) examined Mexican data by a VAR model with four endogenous variables where they employed the US interest rate, the real exchange rate, inflation and output for 1980:Q1–1996:Q2 period on a quarterly basis and found that although the variation of output is explained mostly by its own innovations, the response of output is permanent and negative. Kandil (2000) studied the effect of the exchange rate fluctuations on output using cross country data. She found that an unanticipated positive exchange rate shock leads to output contraction due to the significant increase in inflation and decrease output.

Bilgili (2000) examines the effect of reel exchange rate misalignment (RERMIS) on economic growth in Turkey. She estimated regression models for 1978–1998 annual data. According to the textbook model she found that Turkish data did not confirm any positive or negative effects of RERMIS on growth and trade balance was not sensitive to changes in RER. Bilgili (2000) has a some contradictions with econometric theory about methods that used. She investigated integration level of the variables and decided that all series are first order integrated. In contrast the unit root tests, she used level series in regression models. When the stochastic error of a regression is unit root nonstationary, the regression is called a spurious regression[4]. This is because the standard t test tends to be spuriously significant even when the regressor is statistically independent of the regressand in Ordinary Least Squares. Second negation is interpreting statistically insignificant coefficients of models. If the coefficient is statistically insignificant it cannot be interpret.

Bleaney and Greenaway (2001) investigated effects of terms of trade and RER volatility on growth and investment in fourteen sub-Saharan African countries[5] using GARCH models. They used annual data for 1980-1995. According to GARCH model volatility of RER has a negative impact on growth and investment.

Berument and Pasaogullari (2003) adapted Kamin and Rogers (2000) model and investigated the effects of real depreciation on the economic performance of Turkey by considering quarterly data from 1987:Q1 to 2001:Q3. They constructed five alternative VAR models one of were named as a core. They used the real exchange rate, the real GDP, inflation and the nominal US interest rate in the core model. The real exchange rate is computed by the nominal exchange rate basket, which is chosen in line with the official definition of the exchange rate basket adopted in the sample period and which is deflated by the inflation used in the study. In the bivariate analysis, for most of the transformations and lags, they found a negative correlation between output and the real exchange rate. The empirical findings of this analysis suggest that the response of output is negative and permanent after a real devaluation.

Faria and Ledesma (2003) investigating Balassa- Samuelson effects on growth and PPI[6]. His results showed that RER has a strong impact on relative growth. They used Pesaran at al bounds test for quarterly data from 1960:Q1 - 1996:Q4 .

[3] India, Malaysia, Pakistan, Philippines, Sri Lanka, Thailand

[4] Time series econometric study is not complete without performing stationarity test on variables used for the study. Regression run on non-stationary time series variables produces spurious results, which are meaningless. Therefore, it is important to make sure that variables are stationary.

[5] Botswana, Burkina Faso, Cameroon, Cote d'Ivoire, Gambia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, Tanzania, Togo and Zimbabwe

4. DATA AND EMPIRICAL APPLICATION

4.1 Data

To analyze the relationships between output and the real exchange rate in Turkey, we have used the real exchange rate, the real GDP, inflation in the core model and import and export are added on former variables in the expanded model. All variables are obtained from the web page database (http://tcmbf40.tcmb.gov.tr/cbt.html) of the Central Bank of Turkey (see Appendix A). The real exchange rate is calculated as Real Effective Exchange Rate[7], growth is GDP, WPI[8] used as inflation, and other variables are export and import. The sample period covers quarterly data from 1989:QI to 2005:Q2. In addition we form four dummies for crises and structural break as a D94Q2, D00Q4, D01 and D01Q1. Dummy variable D94Q2 is associated with the 1994 currency crisis in Turkey and designed in the following way: 1 for t=1994:Q2 and 0 otherwise. The second crisis which named as "The Turkish Liquidity Crisis of 2000" by Alper (2001) [9] is incorporated in the model by dummy variable D00Q4 designed in the following way: 1 for 2000:Q4 0 otherwise. Models contains dummy variable D01 that is included in order to take care of structural break is mentioned in cross correlation analysis which equals 0 prior to 2001:Q3, thereafter 1. We described D01Q1 which equals 1 for 2001:Q1 0 otherwise as a 2001 crisis . Logarithmic transformation is applied to all series. All series are seasonally adjusted using additive models. Table 1 presents scaling factors of series.

Table 1: Scaling Factors

	Variable				
Period	LEX	LGDP	LIM	LRER	LWPI
1	-0.024	-0.220	-0.094	0.011	0.005
2	-0.069	-0.071	-0.014	-0.013	0.023
3	-0.037	0.290	-0.001	-0.003	-0.015
4	0.130	0.000	0.109	0.005	-0.013

Table 1 shows that the most important source of seasonality is GDP and export variables. GDP has a great seasonality in first and third period, export has a fourth period.

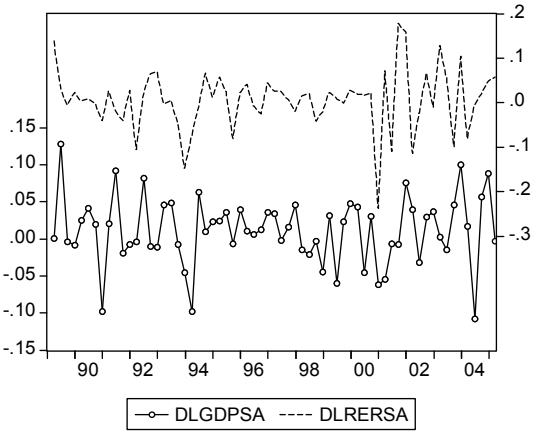


Figure 2: Real GDP and Real Exchange Rate in 1989:Q1-2005:Q2 period

[6] In this study he used Germany, United Kingdom, USA and Japan.

[7] Method: http://www.tcmb.gov.tr/yeni/evds/yayin/reel_efktf/YontemselAciklama.pdf

[8] The name, contents and the weight of goods in the wholesale price index has been changed in 2005. We calculated chained index by using the quarterly percentage change of the new index.

[9] Alper. C. Emre, Russian and East European Finance and Trade (2001). Vol. 37, No. 6, pp. 51-71.

Figure 2 shows the first differenced real GDP and the first differenced RER on a quarterly basis. As seen in the figure, declines in RER are coupled with declines in output. The figure suggests a mostly positive relationship between those two variables.

4.2 Statistical Preliminaries

In order to properly estimate any relationship between the real exchange rate process and output, we must determine the order of integration of the series, choose models for each series, and then construct a methodology.

4.2.1. Order of Integration

Integration levels of the variables are investigated with the using DF, PP, KPSS (Kwiatkowski, D., et al, 1992.) and Ng-Perron (Ng S. and Perron P., 2001.) tests. Lags are selected using SIC. Based on the test results, we have decided that all series are first order integrated.

Table 2: Unit Root Tests

	ADF		**KPSS**		**Phillips – Perron**	
	Constant	Constant + trend	Constant	Constant + trend	Constant	Constant + trend
	τ_μ	τ_T	η_μ	η_T	Z_α	Z_t
LEXSA	1.686	-1.802	1.011***	0.117	2.229	1.845
LGDPSA	-1.242	-3.200*	1.000***	0.126*	-1.073	-3.164
LIMSA	-0.597	-2.712	0.987***	0.082	-0.519	-2.392
LRERSA	-2.261	-2.603	0.429*	0.213**	-2.266	-2.622
LWPISA	-2.326	2.578	1.037***	0.220**	-2.285	1.815
Δ LEXSA	-	-	0.500**	0.187**	-	-
Δ LGDPSA	-	-	0.114	0.107	-	-
Δ LIMSA	-	-	0.075	0.068	-	-
Δ LRERSA	-	-	0.131	0.087	-	-
Δ LWPISA	-	-	0.568**	0.228***	-	-
	Ng-Perron					
	Constant			Constant + trend		
	MZt	MSB	MPt	MZt	MSB	MPt
LEXSA	0.868	0.543	27.853	-	0.071***	1.296***
LGDPSA	0.796	0.657	35.267	-2.430	0.203	7.699
LIMSA	0.880	0.591	31.195	-2.725*	0.175*	6.233*
LRERSA	-1.484	0.211	4.757	-2.381	0.192	7.938
LWPISA	-0.830	0.370	9.379	-0.357	0.337	31.627
Δ LEXSA	-0.391	0.751	30.500	-	0.529	51.013
Δ LGDPSA	-	0.100**	0.497***	-	0.111***	2.261***
Δ LIMSA	-	0.128***	0.810****	-	0.127***	2.967***
Δ LRERSA	-1.358	0.366	6.609	-	0.143**	3.978***
Δ LWPISA	-	0.134***	1.202***	-	0.132***	3.458***

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level, respectively

Table 3 gives the unit root tests of these variables. The Ng-Perron test states that export is stationary when model has constant and trend and RER is I(2) with constant model. KPSS and Ng-Perron found that export is stationary with constant and trend model. GDPSA is stationary according to ADF test which contains constant and trend.

4.2.2. Cross Correlation between the RER and Output

To analyze relationships between real exchange rate and output, we first perform the cross correlations between LRER - LGDP and LRERSA-LGDPSA. We repeat the cross correlation analysis with different transformations.

In Table 3, we show the cross correlations between the quarterly real GDP and the real exchange rate after various transformations. We have evaluated the cross correlations up to four periods. The lag number indicates the number of quarters by which the LRER is lagged relative to the LGDP. (-) values for periods indicate that the LRER is lagged relative to the LGDP. We use different transformations, namely level, first difference, deviation from a linear trend, deviation from a quadratic trend, deviation from a cubic trend and trend obtained by HP filter (see Hodrick J. R. and Prescott E. C., 1997) because there is no general agreement about equilibrium values of the variables. Thus different assumptions of equilibrium variables for the real exchange rate and output tested.

Table 3 : Cross correlations between LRER LGDP

Lags	Level	First difference	Deviation linear trend	Deviation quadratic trend	Deviation cubic trend	HP filtered
1989:Q1-2005:Q2						
0	0.224*	-0.142	-0.038	0.073	0.049	0.026
-1	0.206*	-0.060	0.013	0.088	0.080	0.063
-2	0.241*	0.213*	0.129	0.206*	0.213	0.206*
-3	0.170	0.079	0.054	0.145	0.132	0.126
-4	0.030	-0.181	-0.108	-0.074	-0.100	-0.111
1989:Q1-2001:Q3						
0	-0.086	-0.033	0.006	0.127	0.121	0.095
-1	-0.099	-0.108	-0.031	0.019	0.032	0.011
-2	-0.051	0.096	0.010	0.031	0.058	0.046
-3	-0.033	0.042	-0.015	0.061	0.072	0.068
-4	-0.158	-0.109	-0.123	-0.069	-0.067	-0.074

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level, respectively

We performed the analysis for sub-sample and full sample. We used sub-sample to compare results with Berumet and Pasaogullari (2003). Thus, the sub-sample is chosen to be the period from 1989:Q1 the beginning period of our full sample to 2001: Q3.

The attained results showed that 1989:Q1-2001:Q3 sub-sample and full sample had differentiations in values and in terms of statistically significancy. Considering the fact that this differentiation can be an indicator for structural break in economy, dummy variable D01 which represents this type of break in the established models is used in the upcoming subsections. But we have to more data for investigating structural break. It may have done successor researches. In sub sample there is no transformation that gives a statistically significant results. It is evident that there is a positive correlation between the real exchange rate and output. It seems contradiction with Berumet and Pasaogullari (2003) but our index is calculated such that an increase is a real appreciation their study RER was calculated such that an increase is real depreciation. These findings are parallel to Berumet and Pasaogullari (2003).

And then we used seasonally adjusted logarithmic real GDP and seasonally adjusted logarithmic RER because GDP displays an apparent seasonality and the LRER and LRERSA has a nearly same figure . In Table 4, we show the cross correlations between LRERSA and LGDPSA. In table (-) values indicate same sense.

Table 4.: Cross correlations between LRERSA LGDPSA

Lags	Level	First difference	Deviation linear trend	Deviation quadratic trend	Deviation cubic trend	HP filtered
1989:Q1-2005:Q2						

0	0.454**	0.279**	0.254**	0.611**	0.578**	-0.612
-1	0.391**	0.321**	0.275**	0.575**	0.557**	-0.596
-2	0.002**	-0.095	0.139	0.318**	0.289**	-0.291
-3	0.224	0.104	0.080	0.230	0.181	-0.181
-4	0.147	-0.068	-0.030	0.063	-0.012	0.028
1989:Q1-2001:Q3						
0	-0.0456	-0.3381**	0,2769**	0.724**	0.697**	-0.721
-1	-0.0296	0.3119**	0.1935	0.540**	0.545**	-0.574
-2	-0.0977	0.0058	0.0165	0.219	0.247*	-0.250
-3	-0.1351	0.0185	-0.1789	-0.034	-0.000	0.008
-4	-0.210	-0.107	-0.265	-0.158	-0.143	-0.074

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level, respectively

Table 4 shows that full sample have more significant values and level of significancy stronger than sub-sample. These results can be an indicator for structural break in economy too. Significant values are evident that there is a positive correlation between the real exchange rate and output except first difference zero lad variable of sub sample.

4.2.2. Granger Causality between RER and Output

We need to capture any relevant relationship between the mean of the real exchange rate and growth. Granger causality test is held both for level and also for seasonally adjusted data using various transformations of these data for two samples. It is observed that obtained results are different when series are seasonally adjusted and also when the sub-sample are studied for two different periods. The analysis held again denotes a structural refraction for the sub-sample.

Table 5: Granger Causality Tests

	Level	First difference	Deviation linear trend	Deviation quadratic trend	Deviation cubic trend	HP filtered
1989:Q1-2005:Q2						
LGDP—LRER	0.121(5)	0.100(4)	0.077(5)*	0.048(5)**	0.048(5)**	0.055(5)*
LRER—LGDP	0.000(5)***	0.000(4)***	0.000(5)***	0.000(5)***	0.000(5)***	0.000(5)***
1989:Q1-2001:Q3						
LGDP—LRER	0.418(5)	0.335(4)	0.506(5)	0.177(5)	0.136(5)	0.202(5)
LRER—LGDP	0.000(5)***	0.003(4)***	0.006(5)***	0.004(5)***	0.002(5)***	0.005(5)***
1989:Q1-2005:Q2						
LGDPSA-LRER	0.202(4)	0.611(4)	0.125(3)	0.353(3)	0.443(5)	0.062(2)
LRER-LGDPSA	0.004(4)***	0.002(4)***	0.152(3)	0.106(3)	0.003(5)***	0.005(2)***
1989:Q1-2001:Q3						
LGDPSA-LRER	0.099(4)*	0.197(2)	0.079(3)*	0.084(4)*	0.063(4)*	0.143(4)
LRER-LGDPSA	0.002(4)***	0.107(2)	0.237(3)	0.013(4)**	0.010(4)**	0.009(4)***

1989:Q1-2005:Q2						
LGDPSA-RERSA	0.665(5)	0.725(4)	0.394(5)	0.419(3)	0.453(5)	0.486(3)
LRERSA-LGDPSA	0.003(5)***	0.002(4)***	0.012(5)**	0.109(3)	0.003(5)***	0.015(3)**
1989:Q1-2001:Q3						
LGDPSA-LRERSA	0.407(4)	0.421(2)	0.412(1)	0.207(1)	0.131(1)	0.478(1)
LRERSA-LGDPSA	0.003(4)***	0.095(2)*	0.390(1)	0.027(1)**	0.050(1)*	0.001(1)***

*, **, *** denote rejection of the null hypothesis that says there is no causality at the 10%, 5%, and 1% level, respectively. Lags are reported next to p-values, in parentheses.

The null hypothesis that the real exchange rate does not Granger cause real output is rejected at the 1% level of significance in full sample but in sub-sample there is weak significance or no significant values. This analysis results also described indicator of the structural break after sub-sample. Berument and Pasaliogullari (2003) re-performed the analysis for different sub-samples and they rejected the hypothesis that output Granger causes the real exchange rate in the sub-sample of 1995:Q3-2000:Q4 and 1995:Q3-2001: Q3 period.

4.3. Co-integration Tests

In order to analyze whether there exists any long-run relationship among variables, we perform Johansen co-integration test and compute the trace and max eigenvalue test statistics.

First of all, we want to assess a long-run relationship among the variables for a minimum number of variables. Hence, the first setting explores for a long-run relationship among the real exchange rate, inflation and output and then expanded model. In these models D94Q2, D00Q4, D01 and D01Q1 are kept exogenous.

Table 6: Johansen Cointegration Tests

Core Model			**Expanded Model**		
Hypothesized No. of CE(s)	**Trace Stat.**	**Max Eigenvalue Star.**	**Hypothesized No. of CE(s)**	**Trace Stat.**	**Max Eigenvalue Star.**
None	53.424**	44.284**	None	88.289***	44.782**
At most 1	9.139	8.743	At most 1	43.507	28.445*
At most 2	0.396	0.396	At most 2	15.061	12.261
			At most 3	2.799	2.448
			At most 4	0.351	0.351

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level,

As Table 6 suggests, there exists a long-run relationship among the core model variables and expanded model variables. The λ-trace and λ-max test statistics also show that there is only one co-integrating vector in this setting. Normalized cointegration vectors are:

Normalized cointegrated vector of core model;

LGDPSA = 11.78445 +4.467LRERSA + 0.095LWPISA

t stat. [-8.16619] [-4.38383]

Normalized cointegrated vector of expanded model;

LGDPSA=11.812+ 4.086LRERSA+ 0.074LWPISA- 3.289LIMSA+ 3.700LEXSA

t stat.	[-3.94742]	[-0.91609]	[5.86445]	[- 4.97357]

The numbers in parentheses under the estimated coefficients are the t statistics. In the core model, coefficients are statistically significant. In the core model WPI and RER are observed to have positive effects on GDP The interpretation of first model is that holding other variables constant, 1 percent increase in RERSA leads on the average to about 4.5 percent increase in the GDPSA and 1 percent increase in WPISA leads on the average to about 0,1 percent increase in the GDPSA.

In the second model, WPI seemed to be statistically insignificant. In the second model, it is observed that real exchange rate had positive effects on GDP whereas import has negative effects. The interpretation of second model is that holding other variables constant, 1 percent increase in RERSA leads on the average to about 4 percent increase in the GDPSA, 1 percent increase in IMSA leads on the average to about .3,3 percent decrease in the GDPSA and 1 in EXSA leads on the average to about 3,7 percent decrease in the GDPSA. A result shows that in long run relationship among variables, generally LRERSA, LEXSA and LWPISA has a positive impact on LGDPSA and LIMSA has a negative impact.

4.4. Vector Error Correction Models

Vector Error Correction, (VEC), models can lead to a better understanding of the nature of any nonstationarity among the different component series and can also improve longer term forecasting over an unconstrained model. In this study lags determined by LR criteria. Johansen estimates of the cointegrating vector based on the eigenvector identification, and the corresponding adjustment coefficients; then the normalized estimates treating the first variable as the dependent variable, which are the same as the ones given above. (see Appendix B)

We found that two groups of variables supported in the long run relationship and one cointegrated vector but only second group of variables adjust. The cointegration term is known as the error correction term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments. Our core model adjustment coefficient does not work. The adjustment coefficients of VEC2 are shown in Table 7. See Ugurlu (2006) for adjustment coefficient of VEC1. A vector error correction model for VEC 2 is:

$$\Delta LGDPSA_t = \delta_{10} + \phi_1(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{11}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{12}\sum_{I=1}^{3}\Delta LRERSA_{t-i} + \delta_{13}\sum_{I=1}^{3}\Delta LUFESA_{t-i} + \delta_{14}\sum_{I=1}^{3}\Delta LIMSA_{t-i} + \delta_{15}\sum_{I=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{11} K94Q2 + \theta_{12} K00Q4 + \theta_{13} KO1Q1 + \theta_{14} KO1 + u_{1t}$$

$$\Delta LRERSA_t = \delta_{10} + \phi_2(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{21}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{22}\sum_{I=1}^{3}\Delta LRERSA_{t-i} + \delta_{23}\sum_{I=1}^{3}\Delta LUFESA_{t-i} + \delta_{24}\sum_{I=1}^{3}\Delta LIMSA_{t-i} + \delta_{25}\sum_{I=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{21} K94Q2 + \theta_{22} K00Q4 + \theta_{23} KO1Q1 + \theta_{24} KO1 + u_{2t}$$

$$\Delta LUFESA_t = \delta_{30} + \phi_3(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{31}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{32}\sum_{I=1}^{3}\Delta LRERSA_{t-i} + \delta_{33}\sum_{I=1}^{3}\Delta LUFESA_{t-i} + \delta_{34}\sum_{I=1}^{3}\Delta LIMSA_{t-i} + \delta_{35}\sum_{I=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{31} K94Q2 + \theta_{32} K00Q4 + \theta_{33} KO1Q1 + \theta_{34} KO1 + u_{3t}$$

$$\Delta LIMSA_t = \delta_{40} + \phi_4(LGDPSA_{t-1} - \alpha_1 LRERSA - \alpha_2 LUFESA - \alpha_3 LEXSA - \alpha_4 LIMSA) + \delta_{41}\sum_{i=1}^{3}\Delta LGDPSA_{t-1}$$
$$+ \delta_{42}\sum_{I=1}^{3}\Delta LRERSA_{t-i} + \delta_{43}\sum_{I=1}^{3}\Delta LUFESA_{t-i} + \delta_{44}\sum_{I=1}^{3}\Delta LIMSA_{t-i} + \delta_{45}\sum_{I=1}^{3}\Delta LEXSA_{t-i}$$
$$+ \theta_{41} K94Q2 + \theta_{42} K00Q4 + \theta_{43} KO1Q1 + \theta_{44} KO1 + u_{4t}$$

$$\Delta LEXSA_t = \delta_{50} + \varphi_5(LGDPSA_{t-1} \quad \alpha_1 LRERSA \quad \alpha_2 LUFESA \quad \alpha_3 LEXSA \quad \alpha_4 LIMSA) + \delta_{51} \sum_{i=1}^{3} \Delta LGDPSA_{t-1}$$
$$+ \delta_{52} \sum_{l=1}^{3} \Delta LRERSA_{t-i} + \delta_{53} \sum_{l=1}^{3} \Delta LUFESA_{t-i} + \delta_{54} \sum_{l=1}^{3} \Delta LIMSA_{t-i} + \delta_{55} \sum_{l=1}^{3} \Delta LEXSA_{t-i}$$
$$+ \theta_{51} K94Q2 + \theta_{52} K00Q4 + \theta_{53} KO1Q1 + \theta_{54} KO1 + u_{5t}$$

In this model it is the adjustment coefficients on the error correction mechanism that are of particular interest ϕ_i are the adjustment coefficients. They indicate how each of the five variables in the system adjust to restore equilibrium following a shock to the error correction mechanism. In the core model returning to equilibrium in the short run is not observed whereas in the second expanded model in the short run the vector adjusts.

Table 7: Adjustment Coefficients of VEC2

LGDPSA=11.812+ 4.086LRERSA+ 0.074LWPISA- 3.289LIMSA+ 3.700LEXSA					
Dependent Variable	**Δ LGDPSA**	**Δ LRERSA**	**Δ LWPISA**	**Δ LIMSA**	**Δ LEXSA**
Coefficient	-0.016	0.031	0.054	-0.162	-
T stat	[-1.135]	[1.151]	[3.063]	[-3.731]	[-

The error correction (or adjustment) coefficient must be significant and expected negative sign. For the VEC 2; the error correction term is statistically significant in the import equation (where Δ LIMSA is dependent) it enters with a negative sign and is significant in the inflation equation (where Δ LWPISA is dependent) where it enters with a positive sign. Adjustment to deviations from the long-run relationship through import changes, short run the vector adjusts in six (1/0.16) periods.

4.5 Impulse-Response Functions

In Figure 3, the impulse responses of the core VEC model, which includes the real exchange rate, output and inflation for 20 periods are presented. (See Appendix B)

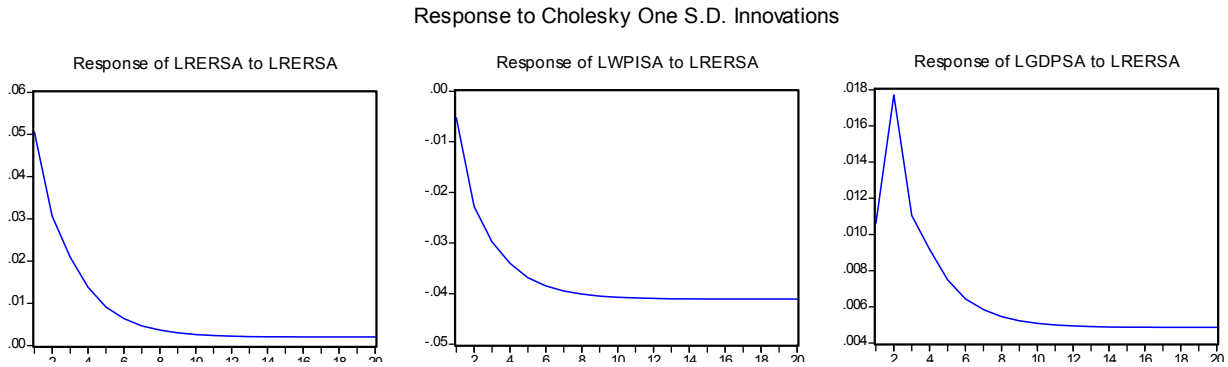


Figure 3: VEC1 Impulse-Response Functions

In Figure 3, we present the responses of inflation and growth to the real exchange rate shocks of impulse of LRERSA. A positive real exchange rate shock increases the growth for the first three quarters, decreasing effect occurs after the 4th quarter, but the effect of the real exchange rate on output is not negative any period. A positive real exchange rate shock decreases the inflation for the first forth quarters.

In Figure 4, we present the responses of variables of expanded model against impulse of LRERSA. (See Appendix B)

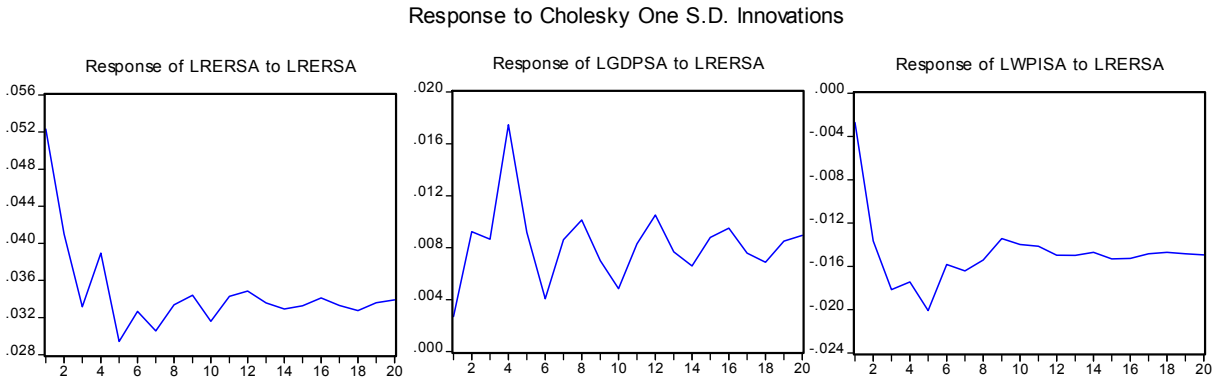


Figure 4: VEC2 Impulse-Response Functions

In figure 4, a positive real exchange rate shock increases the growth for the first four quarters, decreasing effect occurs after the 4th quarter and after the observed decrease it continues its movement in the seasonal fashion and the effect not negative any period. A positive real exchange rate shock decreases the inflation for the first fifth quarters inflation occurs after the fifth quarter. A positive real exchange rate shock decreases the inflation for the first forth quarters.

This is parallel to the findings of Kamin and Rogers (2000) and Berument and Pasaogullari[10] (2003), which supports the contractionary devaluation hypothesis for Mexico and Turkey respectively.

4.6 Variance Decomposition

In order to show variable's own innovations or the innovations of the other variables The variance decomposition of the variables will give information about shocks that have explanatory power to forecast of variables. In Ugurlu (20006) before Variance Decomposition was calculated, series aligned with two different approaches since the alignment of the series in the model effects the results of this analysis. The first approach is Block Exogeneity Test whereas second approach is observation of variables and in which order they will react to an economic shock based on economic policy. In this paper only block exogeneity test approach is used. (see Ugurlu, 2006 for second approach results)

Table 8: Block Exogeneity Tests

Core Model				Expanded Model			
Dependent	Chi-	df	p-value	Dependent	Chi-Sq	df	p-value
Δ LGDPSA	6.6039	2	0.0368**	Δ LGDPSA	54.883	12	0.0000***
Δ LWPISA	1.3072	2	0.5201	Δ LWPISA	24.9526	12	0.0150**
Δ LRERSA	6.1079	2	0.0472**	Δ LRERSA	23.0414	12	0.0274**
				Δ LEXSA	18.4759	12	0.1020
				Δ LIMSA	29.1791	12	0.0037***

*, **, *** denote rejection of the null hypothesis at the 10%, 5%, and 1% level. The statistic is the chi-squared statistic for joint significance of all other lagged endogenous variables in the equation.

According to block exogeneity test results, ordering of variables; LWPISA, LRERSA, LGDPSA and EXSA, LRERSA, LWPISA, LIMSA, LGDPSA in core model and expanded model respectively.

There is one important results in block exogeneity test. It shows that export is exogenous for Turkish economy. This is the important finding about Turkish export industry. Planners hoped Turkey could experience export-led growth over the long run but in this analysis we found that export is exogenous. We claim that it

[10] Don't forget; in this paper index is calculated such that an increase is a real depreciation.

depends on Turkish production process. Production has become more dependent on intermediate imports of an increased variety in Turkish economy after liberalization programs.

Table 9 and 10 present the variance decompositions of GDP . These give the fraction of the forecast error variance for each variable that is attributable to its own innovations and to innovations in the other variables in the system. First column provides period, other columns provide the variance decompositions estimated from two models; results are reported for 1, 2, 3, 4 quarter as a first year and 8,12,16,20 quarter as a second, third, fourth and fifth year respectively.

Table 9: VEC1 LGDPSA Variance Decomposition

Period	LGDPSA	LRERSA	LWPISA
1	94.903	3.848	1.2475
2	90.173	8.5812	1.245
3	86.716	12.090	1.193
4	84.570	14.295	1.133
8	82.330	16.592	1.077
12	82.108	16.541	1.350
16	81.564	16.634	1.800
20	80.765	16.911	2.322

Table 10: VEC2 LGDPSA Variance Decomposition

Period	LGDPSA	LRERSA	LWPISA	LIMSA	LEXSA
1	68.817	0.9325	0.188	22.919	7.141
2	62.108	6.7046	0.960	26.363	3.862
3	59.691	10.036	1.630	25.257	3.384
4	43.193	19.248	3.846	22.484	11.228
8	38.743	18.484	10.178	20.764	11.828
12	38.168	17.945	11.529	21.152	11.204
16	37.375	17.732	12.691	21.607	10.593
20	36.935	17.555	13.498	21.877	10.132

In all models, the predominant source of variation in GDP forecast errors are ‘‘own shocks’’ to GDP. These are account for %94 in core model and %68 in second model.

Conclusively, it is observed that RER first period to explain GDP 1% especially after eighth period and finally reaches 16% at the last analyzed period in the core and expanded model. It is also observed that this explanatory ratio does not disappear in the long run. Innovations in the GDP account for 1-2% of the variance of inflation in the core model.

In the second model; import shocks are third most important source of variation in GDP errors, accounting for about 22%–26%. However, in model, export shocks explain 7%–10% of GDP. Although the export is the third important and inflation is the fourth source of variation in GDP in first quarter, at the twentieth period inflation is third variable. This results suggest that inflation has a stronger impact that import on GDP variations.

5. SUMMARY AND CONCLUSION

In this study, we have investigated the relationship between the real exchange rate and growth in Turkey. Integration levels of the variables are investigated with the using DF, PP, KPSS and Ng-Perron tests. Based on the test results, it is decided that all series are first order integrated.

The application of bivariate data analysis held for RER and GDP variables to study the relationship between them. RER and GDP series are used together with different transformations of seasonally adjusted version of

these series are used so that cross correlation values of these variables are calculated as full sample and for a sub-sample. The attained results showed that 1989:Q1-2001:Q3 sub-sample and full sample had differentiations in values and in terms of statistically significances. Considering the fact that this differentiation can be an indicator for structural break in economy. Granger causality test is held both for level and also for seasonally adjusted data using various transformations of these data for two samples. It is observed that obtained results are different when series are seasonally adjusted and also when the sub-sample are studied for two different periods. The analysis held again denotes a structural refraction for the sub-sample.

Using Johansen Cointegration Test, one cointegration vector is detected based on two groups of variables. First assessed a long-run relationship among the variables for a minimum number of variables, RER, WPI, GDP, and then secondly import and export variables are added. Furthermore, as a result of the test, the paper seeks to find out whether there is at least one cointegrated vector by estimating a Vector Error Correction Model that incorporates the long run behavior of variables and short run adjustment dynamics.

In all established models lag lengths are determined by applying AIC, SIC, HQ, LR, FPE criteria and autocorrelations are tested. We found that two groups of variables supported in the long run relationship and one cointegrated vector but only second group of variables adjust. When long run relationship is studied all variables in the model called as the core model are found to be statistically significant. In the second model, WPI seemed to be statistically insignificant. In the core model WPI and RER are observed to have positive effects on GDP. In the long run linear regression model, real exchange rate is found to be the most effective policy tool on GDP. In the core model returning to equilibrium in the short run is not observed whereas in the expanded model in the short run the vector adjusts in six periods.

For both of these models Impulse- Response Functions and Variance Decomposition Analysis studied. Formed impulse-response functions, a positive RER shock increases GDP in the core model for the first three periods but then decreases. In the other model on the other hand, it increases during the first fifth periods and after the observed decrease it continues its movement in the seasonal fashion. It is also observed that this explanatory ratio does not disappear in the long run and the variation of output is explained mostly by its own innovations . Our findings suggest that an overvalued domestic currency increased output in the short run but cause subsequent output losses.

Our findings suggest that an overvalued domestic currency may initially result in increased output in the short run but in the long run detrimental effect occurs. Growth can be controlled by not only RER but also import. Import is found crucial for upgrading growth of the economy.

APPENDIX A: DATA SOURCES

EX	Export, Broad Economic Categorization (BEC) (TURKSTAT) (Monthly, $ Millions)
GDP	GDP at Fixed (1987) Prices (TURKSTAT) (Quarterly, YTL Thousand)
IM	Import, Broad Economic Categorization (BEC) (TURKSTAT) (Monthly, $ Millions)
RER	WPI based real effective exchange rate index .Weights for 19 countries including Germany, USA, Italy, France, United Kingdom, Japan, Netherlands, Belgium, Switzerland, Austria, Spain, Canada, Korea, Sweden, Taiwan, Iran, Brazil, China and Greece. (1995=100). An increase in the index denotes an appreciation
WPI	Wholesale Prices Index (1987=100) (TURKSTAT) (Monthly), 2005: Wholesale Prices Index (2003=100)(Wholesale Prices Index) (Monthly)

APPENDIX B: EMPRICAL RESULTS

Johansen Cointegration Test 1 - Lag Length Criteria

VAR Lag Order Selection Criteria

Endogenous variables: LGDPSA LRERSA LWPISA

Exogenous variables: C K94Q2 K00Q4 K01Q1 K01

Date: 01/26/07 Time: 18:51

Sample: 1989Q1 2005Q2

Included observations: 61

Lag	LogL	LR	FPE	AIC	SC	HQ
0	58.17566	NA	4.88e-05	-1.415595	-0.896528	-1.212168
1	343.6630	496.0928 *	5.66e-09*	-10.48075*	-9.650247*	-10.15527*
2	349.8865	10.20240	6.25e-09	-10.38972	-9.247773	-9.942181
3	356.2957	9.876446	6.89e-09	-10.30478	-8.851387	-9.735179
4	366.5070	14.73116	6.76e-09	-10.34449	-8.579664	-9.652840
5	378.2844	15.83191	6.36e-09	-10.43556	-8.359286	-9.621846

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Autocorrelation Test

VAR Residual Serial Correlation LM Tests

H0: no serial correlation at lag order h

Date: 05/01/06 Time: 18:01

Sample: 1989:1 2005:2

Included observations: 65

Lags	LM-Stat	Prob
1	5.415304	0.7967
2	13.26106	0.1511
3	12.89530	0.1674
4	26.48497	0.0017
5	6.561935	0.6826

Probs from chi-square with 9 df.

Johansen Cointegration Test2 - Lag Lenght Criteria

VAR Lag Order Selection Criteria

Endogenous variables: LRERSA LWPISA LGDPSA LIMSA LEXSA

Exogenous variables: C K94Q2 K00Q4 K01Q1 K01

Date: 01/26/07 Time: 18:59

Sample: 1989Q1 2005Q2

Included observations: 61

Lag	LogL	LR	FPE	AIC	SC	HQ
0	171.9802	NA	5.57e-09	-4.819025	-3.953912	-4.479979
1	510.5010	566.0512	1.94e-13	-15.09840	-13.36817*	-14.42030
2	545.9980	53.53635	1.42e-13	-15.44256	-12.84722	-

						14.42542*
3	579.4204	44.92846 *	1.16e-13	-15.71870	-12.25825	-14.36252
4	606.7904	32.30563	1.23e-13	-15.79641	-11.47085	-14.10118
5	641.3510	35.12720	1.11e-13*	-16.10987*	-10.91920	-14.07560

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Autocorrelation Test

VAR Residual Serial Correlation LM Tests

H0: no serial correlation at lag order h

Date: 05/01/06 Time: 18:08

Sample: 1989:1 2005:2

Included observations: 61

Lags	LM-Stat	Prob
1	32.75695	0.1373
2	28.69930	0.2767
3	33.23633	0.1253
4	28.23714	0.2971
5	18.63813	0.8141

Probs from chi-square with 25 df.

VEC1 Model

Vector Error Correction Estimates

Date: 01/26/07 Time: 19:02

Sample (adjusted): 1989Q3 2005Q2

Included observations: 64 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:

B(1,3)=1

Convergence achieved after 1 iterations.

Restrictions identify all cointegrating vectors

Restrictions are not binding (LR test not available)

Cointegrating Eq:	CointEq1
LRERSA(-1)	-4.467033
	(0.54702)
	[-8.16619]
LWPISA(-1)	-0.095493
	(0.02178)
	[-4.38383]
LGDPSA(-1)	1.000000
C	11.78445

Error Correction:	D(LRERSA)	D(LWPISA)	D(LGDPSA)
CointEq1	0.118519	0.074739	0.008009
	(0.02497)	(0.01561)	(0.01983)
	[4.74640]	[4.78759]	[0.40394]
D(LRERSA(-1))	0.090417	-0.019989	0.209195
	(0.11636)	(0.07275)	(0.09240)
	[0.77703]	[-0.27477]	[2.26399]
D(LWPISA(-1))	-0.374372	-0.118927	0.027474
	(0.15219)	(0.09515)	(0.12085)
	[-2.45986]	[-1.24992]	[0.22733]

D(LGDPSA(-1))	-0.093176	-0.100696	-0.152923
	(0.16556)	(0.10350)	(0.13146)
	[-0.56281]	[-0.97289]	[-1.16323]
C	0.031181	0.131206	0.007304
	(0.01995)	(0.01247)	(0.01585)
	[1.56264]	[10.5176]	[0.46093]
K94Q2	-0.111648	0.248770	-0.091816
	(0.05351)	(0.03345)	(0.04249)
	[-2.08668]	[7.43695]	[-2.16102]
K00Q4	0.041892	-0.045685	0.009919
	(0.05299)	(0.03313)	(0.04208)
	[0.79050]	[-1.37891]	[0.23571]
K01Q1	-0.205121	-0.024912	-0.070922
	(0.05217)	(0.03261)	(0.04143)
	[-3.93195]	[-0.76382]	[-1.71203]
K01	0.086030	-0.034837	0.015502
	(0.02061)	(0.01289)	(0.01637)
	[4.17336]	[-2.70315]	[0.94701]
R-squared	0.504147	0.791323	0.260208
Adj. R-squared	0.432023	0.760970	0.152602
Sum sq. resides	0.140507	0.054918	0.088599
S.E. equation	0.050544	0.031599	0.040136
F-statistic	6.989998	26.07064	2.418149
Log likelihood	105.0721	135.1337	119.8287
Akaike AIC	-3.002254	-3.941678	-3.463396
Schwarz SC	-2.698661	-3.638085	-3.159803
Mean dependent	0.004273	0.111183	0.011124
S.D. dependent	0.067066	0.064632	0.043600

Determinant resid covariance (dof adj.)	3.70E-09
Determinant resid covariance	2.35E-09
Log likelihood	363.3825
Akaike information criterion	-10.41820
Schwarz criterion	-9.406225

VEC1 Model - Autocorrelation Test

VEC Residual Serial Correlation LM Tests

H0: no serial correlation at lag order h

Date: 05/01/06 Time: 18:09

Sample: 1989:1 2005:2

Included observations: 64

Lags	LM-Stat	Prob
1	16.08505	0.0651
2	24.04457	0.0042
3	10.16191	0.3375
4	27.79453	0.0010
5	5.625393	0.7767

Probs from chi-square with 9 df.

VEC2 Model

Vector Error Correction Estimates

Date: 01/26/07 Time: 19:14

Sample (adjusted): 1990Q1 2005Q2

Included observations: 62 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:

B(1,5)=1

Convergence achieved after 1 iterations.

Restrictions identify all cointegrating vectors

Restrictions are not binding (LR test not available)

Cointegrating Eq:	CointEq1
LRERSA(-1)	-4.086066
	(1.03512)
	[-3.94742]
LWPISA(-1)	-0.074793
	(0.08164)
	[-0.91609]
LEXSA(-1)	-3.700010
	(0.74393)
	[-4.97357]
LIMSA(-1)	3.289952
	(0.56100)
	[5.86445]
LGDPSA(-1)	1.000000
C	11.81231

Error Correction:	D(LRERSA)	D(LWPISA)	D(LEXSA)	D(LIMSA)	D(LGDPSA)
CointEq1	0.031426	0.054722	-0.049156	-0.162142	-0.016114
	(0.02730)	(0.01786)	(0.03120)	(0.04345)	(0.01419)
	[1.15122]	[3.06312]	[-1.57548]	[-3.73154]	[-1.13532]
D(LRERSA(-1))	-0.214429	-0.054005	-0.446538	-0.225769	0.045595
	(0.17332)	(0.11342)	(0.19809)	(0.27588)	(0.09011)
	[-1.23721]	[-0.47613]	[-2.25418]	[-0.81837]	[0.50597]
D(LRERSA(-2))	-0.347656	-0.001576	-0.213058	-0.225094	-0.023095
	(0.16054)	(0.10507)	(0.18350)	(0.25555)	(0.08347)

	[-2.16549]	[-0.01500]	[-1.16111]	[-0.88083]	[-0.27668]
D(LRERSA(-3))	0.080562	0.054109	-0.131721	0.162116	0.188493
	(0.14801)	(0.09687)	(0.16917)	(0.23560)	(0.07696)
	[0.54429]	[0.55860]	[-0.77861]	[0.68809]	[2.44929]
D(LWPISA(-1))	-0.266543	-0.018819	0.569752	0.440748	0.049541
	(0.16429)	(0.10752)	(0.18778)	(0.26151)	(0.08542)
	[-1.62236]	[-0.17503]	[3.03413]	[1.68537]	[0.57995]
D(LWPISA(-2))	0.386512	-0.006513	0.004306	0.513285	0.133444
	(0.15936)	(0.10429)	(0.18215)	(0.25367)	(0.08286)
	[2.42533]	[-0.06245]	[0.02364]	[2.02344]	[1.61048]
D(LWPISA(-3))	-0.009524	0.081585	0.090336	0.275071	0.070836
	(0.16631)	(0.10884)	(0.19008)	(0.26472)	(0.08647)
	[-0.05727]	[0.74960]	[0.47524]	[1.03909]	[0.81920]
D(LEXSA(-1))	-0.175210	0.171690	-0.565017	-0.572002	-0.199836
	(0.16134)	(0.10559)	(0.18441)	(0.25682)	(0.08389)
	[-1.08596]	[1.62605]	[-3.06398]	[-2.22729]	[-2.38219]
D(LEXSA(-2))	-0.055784	0.122298	-0.648416	-0.420741	-0.072205
	(0.15459)	(0.10117)	(0.17669)	(0.24606)	(0.08038)
	[-0.36086]	[1.20887]	[-3.66988]	[-1.70989]	[-0.89834]
D(LEXSA(-3))	0.086932	0.004255	-0.387486	-0.047332	0.109895
	(0.13792)	(0.09026)	(0.15764)	(0.21953)	(0.07171)
	[0.63031]	[0.04714]	[-2.45809]	[-0.21560]	[1.53249]
D(LIMSA(-1))	0.128435	-0.043353	0.112714	0.198051	0.099974
	(0.11738)	(0.07682)	(0.13416)	(0.18684)	(0.06103)
	[1.09419]	[-0.56437]	[0.84015]	[1.06001]	[1.63811]
D(LIMSA(-2))	0.089406	-0.078435	0.150217	0.199440	0.002272
	(0.11548)	(0.07557)	(0.13198)	(0.18381)	(0.06004)

	[0.77425]	[-1.03789]	[1.13814]	[1.08504]	[0.03784]
D(LIMSA(-3))	-0.140113	-0.089600	0.312200	0.217741	0.115332
	(0.10203)	(0.06677)	(0.11661)	(0.16240)	(0.05305)
	[-1.37328]	[-1.34191]	[2.67720]	[1.34074]	[2.17409]
D(LGDPSA(-1))	-0.338416	-0.259000	0.467923	0.867381	-0.160616
	(0.29389)	(0.19233)	(0.33591)	(0.46781)	(0.15281)
	[-1.15149]	[-1.34662]	[1.39301]	[1.85415]	[-1.05111]
D(LGDPSA(-2))	0.015850	-0.089971	0.102594	0.251925	-0.240930
	(0.29219)	(0.19122)	(0.33396)	(0.46509)	(0.15192)
	[0.05425]	[-0.47051]	[0.30720]	[0.54166]	[-1.58589]
D(LGDPSA(-3))	-0.342299	-0.171045	-0.378612	-0.175392	-0.256772
	(0.28177)	(0.18440)	(0.32205)	(0.44851)	(0.14650)
	[-1.21482]	[-0.92758]	[-1.17563]	[-0.39106]	[-1.75268]
C	-0.015478	0.105302	-0.034615	-0.079357	-0.013517
	(0.03051)	(0.01997)	(0.03487)	(0.04857)	(0.01586)
	[-0.50727]	[5.27346]	[-0.99257]	[-1.63393]	[-0.85204]
K94Q2	-0.122784	0.231195	0.037718	-0.146201	-0.078518
	(0.06005)	(0.03930)	(0.06864)	(0.09559)	(0.03122)
	[-2.04462]	[5.88273]	[0.54953]	[-1.52948]	[-2.51468]
K00Q4	0.021671	-0.055272	-0.045248	0.001599	0.011328
	(0.05649)	(0.03697)	(0.06457)	(0.08992)	(0.02937)
	[0.38361]	[-1.49502]	[-0.70077]	[0.01779]	[0.38568]
K01Q1	-0.211071	-0.027075	0.096869	-0.137101	-0.096164
	(0.05713)	(0.03739)	(0.06530)	(0.09094)	(0.02971)
	[-3.69431]	[-0.72410]	[1.48341]	[-1.50754]	[-3.23717]
K01	0.085491	-0.003750	0.066251	-0.090997	0.001035
	(0.03378)	(0.02211)	(0.03861)	(0.05377)	(0.01756)

	[2.53098]	[-0.16964]	[1.71605]	[-1.69247]	[0.05893]
R-squared	0.602744	0.816284	0.625015	0.573065	0.718760
Adj. R-squared	0.408960	0.726666	0.442096	0.364805	0.581570
Sum sq. resids	0.112217	0.048061	0.146596	0.284323	0.030336
S.E. equation	0.052316	0.034238	0.059796	0.083275	0.027201
F-statistic	3.110398	9.108502	3.416888	2.751672	5.239155
Log likelihood	107.7738	134.0608	99.48928	78.95395	148.3246
Akaike AIC	-2.799156	-3.647122	-2.531912	-1.869482	-4.107245
Schwarz SC	-2.078675	-2.926641	-1.811431	-1.149001	-3.386764
Mean dependent	0.003986	0.110942	0.028113	0.031219	0.009521
S.D. dependent	0.068050	0.065487	0.080055	0.104487	0.042051

Determinant resid covariance (dof adj.)	2.63E-14
Determinant resid covariance	3.33E-15
Log likelihood	593.5749
Akaike information criterion	-15.59919
Schwarz criterion	-11.82524

VEC2 Model Autocorrelation Test

VEC Residual Serial Correlation LM Tests

H0: no serial correlation at lag order h

Date: 05/01/06 Time: 18:12

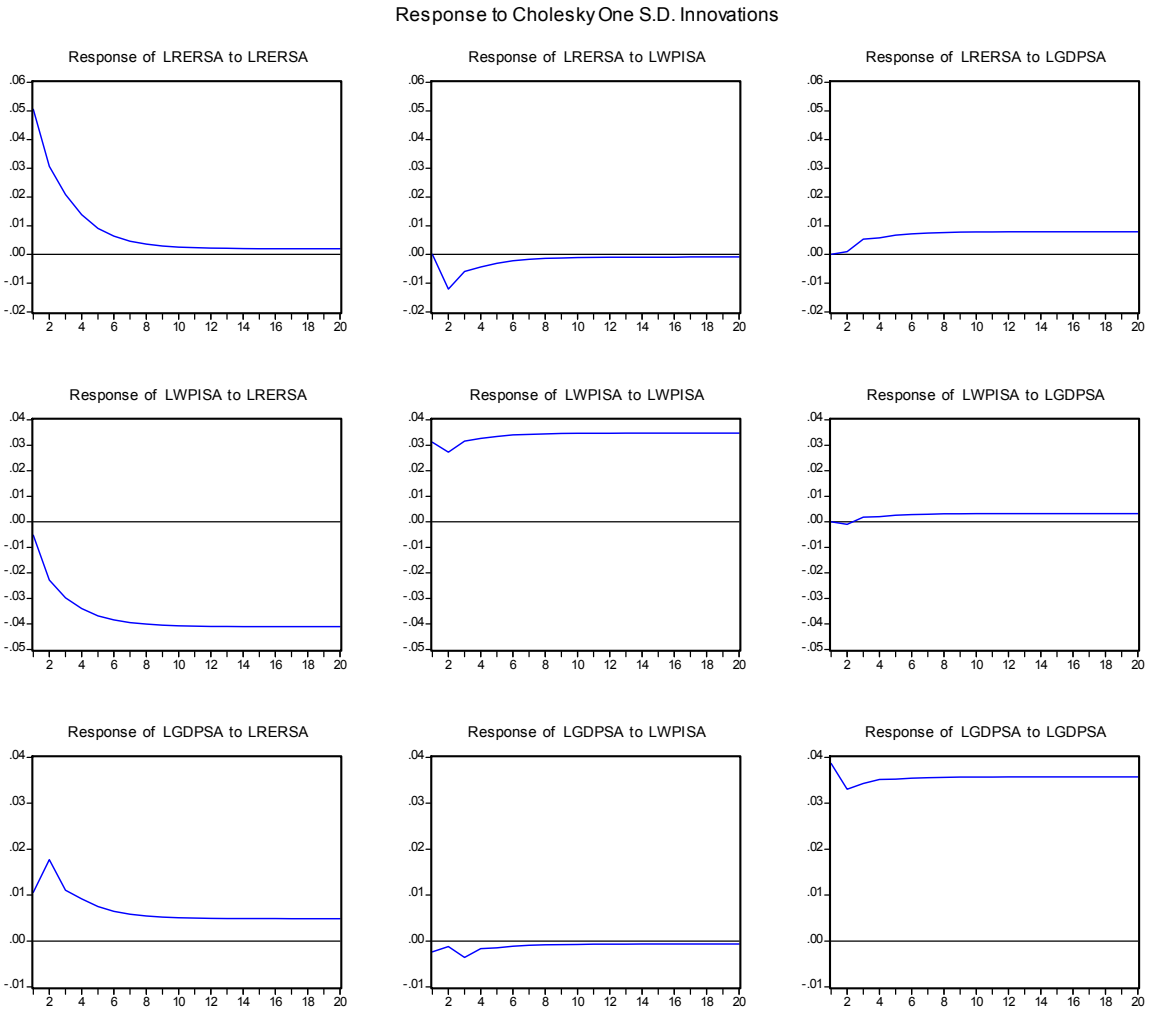
Sample: 1989:1 2005:2

Included observations: 62

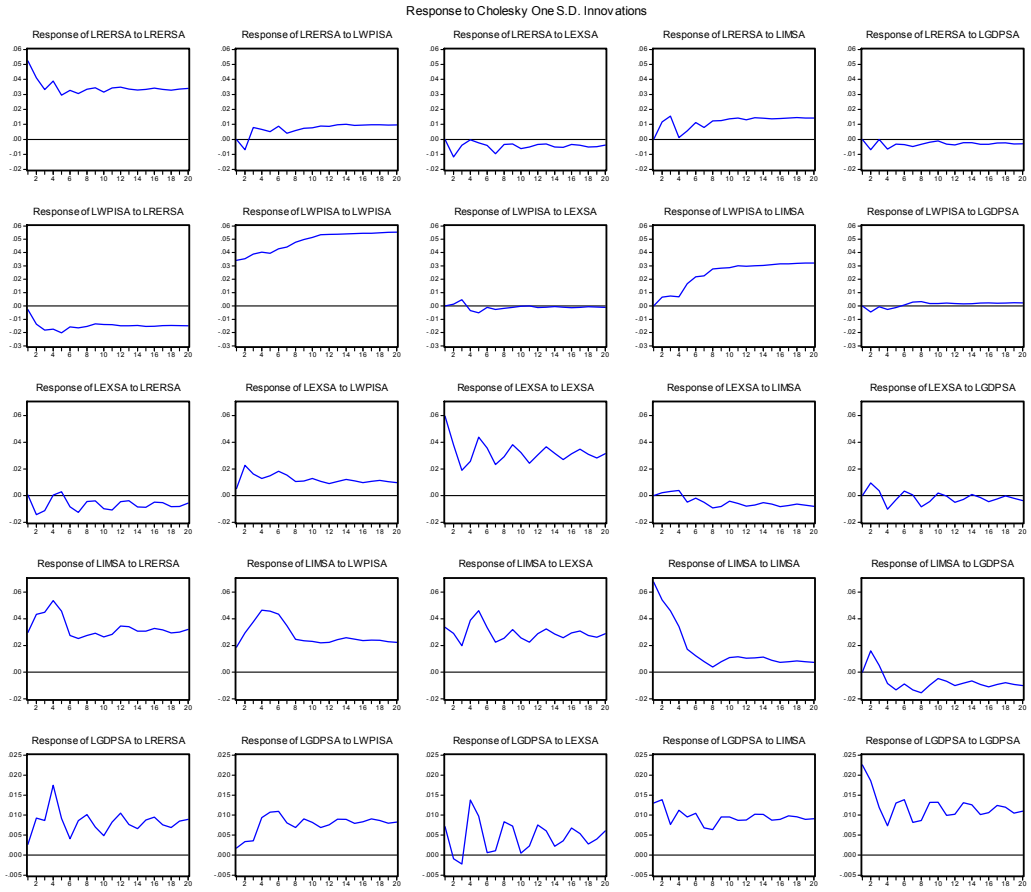
Lag	LM-Stat	Prob
1	22.50982	0.6062
2	42.43155	0.0161
3	21.65445	0.6556
4	31.40200	0.1761
5	20.61356	0.7139

Probs from chi-square with 25 df.

VEC1 Impulse Response Functions



VEC2 Impulse Response Functions



VEC1 - Block Exogeneity Test

VEC Pairwise Granger Causality/Block Exogeneity Wald Tests

Date: 05/01/06 Time: 18:24

Sample: 1989:1 2005:2

Included observations: 64

Dependent variable: D(LRERSA)

Exclude	Chi-sq	df	Prob.
D(LWPISA)	6.050921	1	0.0139
D(LGDPSA)	0.316750	1	0.5736
All	6.107981	2	0.0472

Dependent variable: D(LWPISA)

Exclude	Chi-sq	df	Prob.
D(LRERSA)	0.075496	1	0.7835
D(LGDPSA)	0.946514	1	0.3306
All	1.307287	2	0.5201

Dependent variable: D(LGDPSA)

Exclude	Chi-sq	df	Prob.
D(LRERSA)	5.125636	1	0.0236
D(LWPISA)	0.051681	1	0.8202
All	6.603935	2	0.0368

VEC2 - Block Exogeneity Test

VEC Pairwise Granger Causality/Block Exogeneity Wald Tests

Date: 05/01/06 Time: 18:25

Sample: 1989:1 2005:2

Included observations: 62

Dependent variable: D(LRERSA)

Exclude	Chi-sq	df	Prob.
D(LWPISA)	8.226506	3	0.0416
D(LIMSA)	4.136734	3	0.2471
D(LEXSA)	3.289950	3	0.3490
D(LGDPSA)	3.165415	3	0.3668
All	23.04140	12	0.0274

Dependent variable: D(LWPISA)

Exclude	Chi-sq	df	Prob.

D(LRERSA)	0.859303	3	0.8352
D(LIMSA)	2.470764	3	0.4806
D(LEXSA)	4.199533	3	0.2407
D(LGDPSA)	2.303624	3	0.5118
All	24.95269	12	0.0150

Dependent variable: D(LIMSA)

Exclude	Chi-sq	df	Prob.
D(LRERSA)	2.733816	3	0.4345
D(LWPISA)	10.12191	3	0.0176
D(LEXSA)	7.443656	3	0.0590
D(LGDPSA)	4.160816	3	0.2446
All	29.17916	12	0.0037

Dependent variable: D(LEXSA)

Exclude	Chi-sq	df	Prob.
D(LRERSA)	5.088431	3	0.1654
D(LWPISA)	10.04100	3	0.0182
D(LIMSA)	7.691239	3	0.0528
D(LGDPSA)	4.393355	3	0.2220
All	18.47591	12	0.1020

Dependent variable: D(LGDPSA)

Exclude	Chi-sq	df	Prob.
D(LRERSA)	8.526949	3	0.0363
D(LWPISA	4.552845	3	0.2076

)

D(LIMSA)	7.164870	3	0.0668
D(LEXSA)	17.22394	3	0.0006
All	54.88306	12	0.0000

VEC1 - Variance Decomposition

Variance Decomposition of LUFESA:

Period	S.E.	LUFESA	LRERSA	LGDPSA
1	0.032205	100.0000	0.000000	0.000000
2	0.049114	90.53195	9.279771	0.188281
3	0.064727	81.36206	18.40165	0.236287
4	0.079261	74.69200	25.10156	0.206431
5	0.092773	69.96562	29.87256	0.161822
6	0.105373	66.54034	33.33378	0.125877
7	0.117184	63.98067	35.91614	0.103193
8	0.128315	62.01166	37.89635	0.091982
9	0.138861	60.45866	39.45225	0.089089
10	0.148899	59.20767	40.70066	0.091668
11	0.158493	58.18198	41.72045	0.097569
12	0.167698	57.32832	42.56638	0.105300
13	0.176557	56.60868	43.27745	0.113877
14	0.185109	55.99524	43.88209	0.122677

15	0.193387	55.46721	44.40147	0.131322
16	0.201418	55.00876	44.85165	0.139595
17	0.209226	54.60762	45.24500	0.147386
18	0.216833	54.25416	45.59119	0.154645
19	0.224257	53.94073	45.89790	0.161367
20	0.231514	53.66117	46.17126	0.167568

Variance Decomposition of LRERSA:

Period	S.E.	LUFESA	LRERSA	LGDPSA
1	0.053493	1.699283	98.30072	0.000000
2	0.062452	1.882500	97.63775	0.479751
3	0.065847	2.011911	96.88175	1.106343
4	0.067403	2.102510	96.25608	1.641408
5	0.068203	2.167310	95.80540	2.027290
6	0.068647	2.215257	95.50224	2.282498
7	0.068906	2.252057	95.30470	2.443239
8	0.069064	2.281314	95.17710	2.541589
9	0.069165	2.305346	95.09395	2.600700
10	0.069231	2.325685	95.03850	2.635815
11	0.069276	2.343376	95.00013	2.656494
12	0.069308	2.359146	94.97229	2.668569

13	0.069333	2.373513	94.95094	2.675543
14	0.069352	2.386854	94.93365	2.679495
15	0.069367	2.399446	94.91890	2.681658
16	0.069381	2.411492	94.90575	2.682757
17	0.069392	2.423148	94.89363	2.683222
18	0.069403	2.434527	94.88217	2.683304
19	0.069413	2.445719	94.87113	2.683154
20	0.069422	2.456789	94.86035	2.682861

Variance Decomposition of LGDPSA:

Period	S.E.	LUFESA	LRERSA	LGDPSA
1	0.038201	1.247541	3.848780	94.90368
2	0.047370	1.245085	8.581222	90.17369
3	0.051924	1.193662	12.09001	86.71633
4	0.054378	1.133909	14.29526	84.57083
5	0.055717	1.086034	15.54773	83.36624
6	0.056439	1.059134	16.19451	82.74636
7	0.056822	1.056292	16.48812	82.45559
8	0.057023	1.077263	16.59210	82.33064
9	0.057131	1.120031	16.60526	82.27471

10	0.057194	1.181788	16.58385	82.23436
11	0.057239	1.259531	16.55781	82.18266
12	0.057280	1.350415	16.54159	82.10800
13	0.057323	1.451917	16.54095	82.00713
14	0.057371	1.561901	16.55707	81.88103
15	0.057425	1.678611	16.58887	81.73252
16	0.057485	1.800636	16.63438	81.56498
17	0.057550	1.926856	16.69140	81.38174
18	0.057619	2.056397	16.75784	81.18576
19	0.057693	2.188578	16.83187	80.97955
20	0.057769	2.322875	16.91196	80.76517

VEC2 - Variance Decomposition

Cholesky Ordering: LUFESA LRERSA LGDPSA

Variance Decomposition of LEXSA:

Period	S.E.	LEXSA	LRERSA	LWPISA	LIMSA	LGDPSA
1	0.059796	100	0	0	0	0
2	0.07641	88.3309	3.734003	6.327128	0.078568	1.5294
3	0.081318	84.19395	5.26535	8.768247	0.2213	1.551153
4	0.086946	83.11987	4.606011	9.143021	0.390822	2.740275
5	0.098706	85.23788	3.636396	8.345195	0.553638	2.226895
6	0.106929	84.62435	3.776243	9.105571	0.502148	1.991685
7	0.111355	82.86813	4.822721	9.800083	0.669901	1.839162
8	0.116382	82.51733	4.577102	9.446823	1.249339	2.20941
9	0.123377	83.38637	4.197678	8.773999	1.552017	2.089935
10	0.128635	83.35995	4.480227	8.675478	1.540086	1.944264

11	0.131913	82.8576	4.955291	8.670824	1.666938	1.849342
12	0.136078	83.06962	4.781191	8.366277	1.905811	1.877103
13	0.141553	83.71142	4.504317	8.001211	2.008223	1.774828
14	0.145912	83.75817	4.609986	7.940606	2.017675	1.673563
15	0.149203	83.57867	4.767101	7.930479	2.113309	1.610441
16	0.153117	83.70517	4.645871	7.737356	2.296679	1.614929
17	0.157673	84.02801	4.504876	7.530014	2.388148	1.548947
18	0.161456	84.0329	4.585149	7.472783	2.431691	1.477476
19	0.164615	83.94267	4.673305	7.420734	2.527837	1.435455
20	0.168204	84.05042	4.598324	7.276888	2.650962	1.423404

Variance Decomposition of LRERSA:

Period	S.E.	LEXSA	LRERSA	LWPISA	LIMSA	LGDPSA
1	0.052316	0.008571	99.99143	0	0	0
2	0.069211	2.977529	92.46296	0.715746	2.841974	1.001793
3	0.078796	2.426101	89.0787	1.646975	6.075212	0.773012
4	0.088397	1.933542	90.17539	1.886455	4.845567	1.159043
5	0.093562	1.751462	90.38435	2.020312	4.693527	1.15035
6	0.100266	1.612999	89.3296	2.584999	5.351906	1.120495
7	0.105748	2.158704	88.70386	2.543431	5.381582	1.212424
8	0.111826	1.980746	88.24597	2.581213	6.02096	1.171109
9	0.117959	1.810102	87.82517	2.743721	6.541047	1.079956
10	0.123263	1.831608	87.0153	2.950377	7.206571	0.996149
11	0.129175	1.762762	86.29413	3.204181	7.775029	0.9639
12	0.134799	1.648275	85.94197	3.377314	8.075693	0.956746
13	0.140064	1.544619	85.35472	3.645624	8.54539	0.909642
14	0.145039	1.51479	84.76878	3.917842	8.927614	0.870971
15	0.149841	1.494762	84.36239	4.090381	9.190474	0.861992
16	0.154673	1.424518	84.04696	4.242205	9.433346	0.852969
17	0.159225	1.372664	83.6929	4.406168	9.7018	0.826468
18	0.163604	1.358328	83.29292	4.56508	9.982504	0.801171
19	0.167997	1.335687	83.00129	4.683281	10.18886	0.790884

20	0.172319	1.292612	82.76941	4.785857	10.37191	0.780206

Variance Decomposition of LWPISA:

Period	S.E.	LEXSA	LRERSA	LWPISA	LIMSA	LGDPSA
1	0.034238	0.744998	0.638404	98.6166	0	0
2	0.051739	1.005654	7.296351	89.28892	1.615334	0.793742
3	0.067824	1.913098	11.47945	83.9707	2.164868	0.471888
4	0.0812	1.334926	12.6243	83.37962	2.22627	0.43488
5	0.09415	1.030178	13.93179	79.92783	4.770212	0.339987
6	0.106902	0.856299	13.0066	77.96369	7.904395	0.269021
7	0.119048	0.698801	12.39505	76.67755	9.954347	0.274253
8	0.132177	0.594022	11.42068	75.24621	12.45793	0.281158
9	0.144717	0.542805	10.39155	74.60747	14.20781	0.250366
10	0.156867	0.530057	9.642142	74.14497	15.45624	0.226593
11	0.169007	0.527998	9.012113	73.77143	16.47719	0.211266
12	0.18041	0.496289	8.600852	73.52583	17.18044	0.196582
13	0.191242	0.475856	8.270323	73.30875	17.76342	0.181658
14	0.201598	0.469693	7.977724	73.12463	18.25786	0.170086
15	0.211622	0.456804	7.76565	72.90044	18.71211	0.164987
16	0.221326	0.439949	7.577232	72.68903	19.13265	0.161138
17	0.230608	0.428323	7.395659	72.52286	19.49726	0.1559
18	0.239635	0.425029	7.226722	72.36615	19.8298	0.152298
19	0.248457	0.420376	7.080978	72.22335	20.12462	0.150678
20	0.257004	0.412472	6.957223	72.10252	20.37921	0.148575

Variance Decomposition of LIMSA:

Period	S.E.	LEXSA	LRERSA	LWPISA	LIMSA	LGDPSA
1	0.083275	18.06212	12.51625	3.574617	65.84701	0
2	0.117026	16.5615	19.86567	7.013774	54.70983	1.849218
3	0.140237	14.33332	24.00725	11.40716	48.84041	1.41186
4	0.165693	17.07157	27.52973	14.86909	39.25311	1.2765
5	0.185038	21.1098	28.05891	16.95333	32.33255	1.54541
6	0.195519	22.54968	27.06747	19.44192	29.35119	1.589737

7	0.202022	22.72774	26.87554	20.82028	27.64674	1.929712
8	0.207553	23.32555	27.18994	20.87732	26.22643	2.380766
9	0.213637	24.55236	27.48298	20.62786	24.88577	2.451029
10	0.218342	25.14174	27.73827	20.64993	24.0743	2.395755
11	0.222828	25.36174	28.23338	20.62307	23.38503	2.396783
12	0.228882	25.86939	29.00054	20.28771	22.37286	2.469501
13	0.235328	26.65734	29.49467	20.01563	21.3734	2.458971
14	0.240785	27.11999	29.76601	20.05516	20.6352	2.423632
15	0.245703	27.3615	30.13232	20.08734	19.94992	2.468927
16	0.251064	27.78352	30.52978	19.93396	19.19206	2.560677
17	0.25636	28.32158	30.78699	19.80305	18.50069	2.5877
18	0.26084	28.65475	30.98202	19.79887	17.97336	2.591002
19	0.265122	28.87425	31.25568	19.75616	17.48364	2.630269
20	0.269808	29.19223	31.56279	19.60804	16.95611	2.680831

Variance Decomposition of LGDPSA:

Priod	S.E.	LEXSA	LRERSA	LWPISA	LIMSA	LGDPSA
1	0.027201	7.141336	0.932592	0.188889	22.91972	68.81746
2	0.037088	3.862189	6.704694	0.960916	26.36393	62.10827
3	0.040846	3.384531	10.03606	1.63014	25.25745	59.69182
4	0.049307	11.22806	19.24801	3.846479	22.48442	43.19303
5	0.054648	12.99084	18.42734	6.379025	21.33601	40.86678
6	0.058527	11.40416	16.54506	8.99845	21.78871	41.26362
7	0.060655	10.71206	17.41621	10.08311	21.55106	40.23755
8	0.063351	11.82851	18.48474	10.17892	20.764	38.74383
9	0.066789	12.09567	17.70741	10.73484	20.712	38.75008
10	0.069403	11.23407	16.88495	11.30785	21.06857	39.50455
11	0.071499	10.75646	17.24641	11.51677	21.32585	39.15451
12	0.074291	11.20454	17.94508	11.52951	21.15283	38.16804
13	0.077266	11.1515	17.56276	11.84124	21.30242	38.14207
14	0.079748	10.61376	17.16197	12.30984	21.62794	38.28649
15	0.081806	10.36703	17.45472	12.5629	21.70021	37.91513
16	0.084195	10.59358	17.7321	12.69193	21.60721	37.37518
17	0.086654	10.5183	17.49263	12.9633	21.68337	37.3424

18	0.088736	10.19162	17.27722	13.2542	21.84721	37.42975
19	0.090645	10.0462	17.42878	13.40992	21.90225	37.21285
20	0.092766	10.13216	17.55565	13.49874	21.87766	36.93579

Cholesky Ordering: LEXSA LRERSA LWPISA LIMSA LGDPSA

Acknowledgements

The author wishes to thank Prof. Dr. Burc Ulengin for his invaluable comments. This paper finished as Ugurlu was a senior MA student in Istanbul Technical University. All errors remain of my own. The author is also grateful to Prof. Dr. Umit Senesen for the perspective he brought to my lectures in Statistics and Prof. Dr. Oner Guncavdi for the perspective he brought to my lectures in Macroeconomics.

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MONEY MARKETS AND INFLATION

Is Budget Deficit Inflationary: Evidence from Turkey

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ABSTRACT

The purpose of this paper is examining the long-run relationship between budget deficit and inflation in the fiscal aspect and understanding the causality of budget deficit on inflation. It is certain that budget deficit causes inflation in the way of financing the deficit by printing money. In this paper it is examined whether the deficit causes inflation without seigniorage. To control the fiscal effect of budget deficit, money supplies (through narrowest to broadest) will be added one by one to each model. Engle Granger test and bounds test is applied to the period between 1975 and 2004 in order to analyze the long-run relation between the inflation and budget deficit. The direction of the relationship is investigated by using Granger Causality Test. Also 1994 and 2001 crisis effects are tested with dummy variables. It is found that the effect of budget deficit on inflation is based on financing it through printing money rather than its fiscal effect. It is also found a significant effect of 1994 crisis on inflation.

Keywords: Budget Deficit, Inflation, Money Supply

1. INTRODUCTION

Two of the most important macroeconomic issues are inflation and budget deficit. Inflation shows the increase in general price level and budget deficit occurs when current expenditures exceed current revenues. Most frequently, the budget deficit is used to describe the situation in which government revenues fail to cover government expenditure. So the size of governmental budget deficit is often an important political issue as well as an economic issue. Inflation is the main concept that is considered by Central Banks. For example, monetary tools are applied for the stabilization of inflation by Turkish Republic Central Bank or as another example European Union set an inflation restriction to accept the member countries to the union.

It is often argued that monetization of budget deficit and fiscal unstability are the basic causes of inflation, especially in developing countries such as Turkey. The existence of policies that increase budget deficit further may enhance inflation. Although there is no monetization of deficit by Central Bank, the condition in the private sector that is occurred by the high current deficit policies can cause inflation. When public sector borrowing requirement is high in a country, the interest rate of bond that is issued for financing budget deficit will be also high. This high interest rate has a negative effect on the private sector and its investments. The decrease in the investment leads to diminish in the production level. As a result the general price level increases in the scarce production level, even though money supply is not increased by Central Bank.

On the other hand, because of high interest rates demand for financial instruments (such as T-bond, T-bills etc) that are risk-free and liquid as money becomes intensive. Holding of these instruments create monetization of deficit by the private financial sector instead of government, which increases the effect of high budget deficit policies on the inflation. (Akcay et al, 2001)

Budget deficit is the main reason of inflation in Turkey. The most important problem is financing the public debt rather than the ration of Public Debt/GNP. Till 80's, budget deficit is used to finance by seigniorage. 24 January 1980 policies limited the use of Central Bank resources by the government. As a result, internal debt became the most common finance resources. The reason of this was Monetarist approach was common in this period. Policymakers thought that inflation cannot increase without an increase in money supply. In contrast of this common idea there was not any decrease in inflation, so the relationship between budget deficit and inflation became important to investigate.

The papers on the topic show that there is not a unique view about the relation. Lots of papers claim that inflation is caused by monetization of deficit (which means increasing money supply) rather than the hand of private sector. The rest of the papers advocate the opposite. This indecisiveness makes us wonder about the Turkish case. Also no recent paper can be found about the relationship. In addition, the papers do not take into account the effect of financial crisis.

The purpose of this paper is examining the long-run relationship between budget deficit and inflation in the fiscal aspect and understanding the causality of budget deficit on inflation in Turkey. In this paper, to control

the fiscal effect of budget deficit and understand the effect of monetization, money supplies (through narrowest to broadest) are added one by one to each model. Engle Granger test and Bounds test are applied to the period between 1975 and 2004 in order to analyze the long-run relation between the inflation and budget deficit. The direction of the relationship is investigated by using Granger Causality Test. Also 1994 and 2001 crisis effects are tested with dummy variables.

The paper is organized as follows. In section 2, we present the literature survey.

Section 3 describes data, model and methodology. In Section 4 we represent the empirical results. At the end of the paper we evaluate the findings and conclude.

2. LITERATURE SURVEY

There are lots of papers that investigate the relationship between budget deficit and inflation. Although there are some papers that support this relation, there is significant number of papers that supports the opposite. The opponents of the relationship between budget deficit and inflation advocates that inflation arises because of the monetization of budget deficit rather than the budget deficit itself.

Sargent and Wallace (1981) argue that the monetarist arithmetic might be misleading as it ignores the fact that governments are constrained by their intertemporal budget. According to Sargent and Wallace, tight money may lead to an unsustainable debt financing process and thus higher inflation in the long run. In this framework, inflation is a fiscal-driven monetary phenomenon, and nominal monetary growth is endogenously determined by the need to finance exogenously given deficit to satisfy the budget constraint. However, in the fiscal theory of the price level (FTPL), there is virtually no role for money in the determination of prices in a non-Ricardian world. According to the FTPL, prices adjust to increases in nominal private sector wealth resulting from bond-financed deficits. In this non-Ricardian world, inflation is a symptom of too much nominal wealth chasing too few goods. (Gunaydin, 2004)

Hondroyiannis and Papapetrou (1994) supports in their paper that there is a long-run relationship between government budget and price level and support the hypothesis of bidirectional causality between the two variables.

According to (Özgün,2000), in order to obtain a permanent decrease in inflation permanent improvements in the fiscal deficits are essential. Besides this, Vamvoukas (1998) suggests a significant and positive relationship between budget deficits and the demand for money support the Keynesian model.

Also Dornbush and Fisher (1981), Darrat (1985), Metin (1998), Darrat (2000), Koru and Ozmen (2003) have found statistical evidence to support the relationship between budget deficit and inflation.

Some studies could not state the relationship and support the monetarist view. Consolidated budget deficit does not have a long-run component like the inflation rate.(Akçay, Alper and Özmucur,2001). Also Niskanen (1978), Barnhart and Darrat (1988, 1989) Karras (1994), Abizadeh and Yousefi (1998), Sikken and Haan (1998) could not find a direct relationship between budget deficit and inflation. They support that the inflation is caused by the increase in money supply rather than budget deficit itself.

3. MODEL AND DATA

Two models are used in order to examine the relationship among consolidated budget deficit, money supply and inflation. The difference of the two models is the money supply measures. The narrowest (M1) and the broadest definition (M2Y) of money supply are used. The main models are as follows;

$$\text{Wholep} = \beta_0 + \beta_1 \text{Buddef} + \beta_2 \text{lnM1} + \varepsilon_{1t} \qquad (1)$$

$$\text{Wholep} = \alpha_0 + \alpha_1 \text{Buddef} + \alpha_2 \text{lnM2Y} + \varepsilon_{2t} \qquad (2)$$

Wholep = wholesale price index[1]

Buddef = consolidated budget deficit[2]

LnM1 = the natural logarithm of the money supply M1

LnM2Y = the natural logarithm of the money supply M2Y

[1] 1963 was taken as base year for % change of wholesale price index between 1975 and 2004.
[2] The observations have nominal values.

Additionally, two dummy variables are used separately to see the effect of 1994 and 2001 crisis at the end of the paper. Four models are constructed because of this purpose as follows;

$$\text{Wholep} = \varpi_0 + \varpi_1 Buddef + \varpi_2 \ln M1Y + \varpi_3 dummy1 + \varepsilon_{1t}$$

$$\text{Wholep} = \phi_0 + \phi_1 Buddef + \phi_2 \ln M1Y + \phi_3 dummy2 + \varepsilon_{2t}$$

$$\text{Wholep} = \gamma_0 + \gamma_1 Buddef + \gamma_2 \ln M2Y + \gamma_3 dummy1 + \varepsilon_{3t}$$

$$\text{Wholep} = \vartheta_0 + \vartheta_1 Buddef + \vartheta_2 \ln M2Y + \vartheta_3 dummy2 + \varepsilon_{4t}$$

Dummy1	D = 1	for 2001 crisis
	D = 0	otherwise
Dummy2	D = 1	for 1994 crisis
	D = 0	otherwise

Wholesale price index shows the percentage change, so natural logarithm is used in order to explain money supply as percentage. The budget deficit is not used as logarithm to understand its original effect, since budget deficit has negative values. M2Y is used to clear the special bounds of Turkish inflation and foreign exchange.

The data is taken from State Planning Organization (DPT), Turkish Republic Central Bank (TCMB) and IMF Statistics. The data set covers the period between 1975 and 2004. 1975 was the beginning year because it shows the first indications of increasing budget deficit. The data are used annually.

4. METHODOLOGY

A. UNIT ROOT TEST

The stationarity property of data can be found with using unit rot tests. Most common method for unit root test is Augmented Dickey- Fuller Test (ADF). In this paper ADF test will also used.

Augmented Dickey-Fuller Test (ADF)

The ADF test is applied for a time series as Y_t is based on t-statistic of coefficient in the following model.

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum_{i=1}^{p} \Psi_j \Delta Y_{t-i} + \varepsilon_t$$

In order to correct the autocorrelation effect in the error term (ε_t) one lag of Y_t must be added to the model. The optimal lag interval that corrects autocorrelation is denoted by Akaike Information Criteria (AIC). The optimal lag can be found by using minimum AIC value. After the appropriate model is established the null hypothesis and alternative hypothesis can be constructed as follows,

$H_0 : \delta = 0$ (There is unit root)

$H_1 : \delta < 0$ (There is no unit root)

Rejecting H_o shows that series do not have a unit root. Then ADF test is applied for the first difference of the series to determine the order of integration. In this stage if H_o is rejected, the series are difference stationary, I(1). If it is not rejected, the same procedure is applied for the second difference of series that shows the integrated order 2, I(2).

B. COINTEGRATION

After the analysis of unit root test, the long-run relation between variables can be investigated. In this paper Engle Granger Cointegration Test (1987) and bounds test (2001) are applied.

Bounds Test

To investigate cointegration, it is necessary that the variables are integrated of same order. For example; both variables must be I(0) or I(1). But, this condition sometimes does not hold. For these cases Pesaran et al (2001) developed bounds test. The other advantage of bounds test is that it gives reliable results in small

samples. Bounds test is based on the estimation of unrestricted Error Correction Model with using OLS. The Error Correction Model's equation is as follows,

$$\Delta Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 x_{t-1} + \sum_{i=1}^{p} \beta_3 \Delta Y_{t-i} + \sum_{j=0}^{p} \beta_4 \Delta x_{t-j} + \varepsilon_j$$

In this model, β_0 is constant term; β_1 and β_2 are long-term coefficient. The lagged values of ΔY_t and the current and lagged values of Δx_t are inserted to explain the effect of short-run dynamics. Pesaran et al. (2001) proposed the Wald Test (F-Test) to test coefficient of Y_{t-1} and x_{t-1} overall significance in order to determine the long-run relations. The calculated F-value is compared with critical values of bounds test. If the calculated F-statistics is greater than I(1) bound, then there is cointegration; if the calculated F-statistics is less than I(0) bounds, then there is no cointegration. If the calculated F-value is between I(1) and I(0) bounds, this condition shows indecision area, and it has to be controlled integration levels. (Kasman et al, 2005)

Engle-Granger Cointegration Test

First of all, the model must be estimated and the residuals must be obtained. Then the ADF Test is applied to residuals. The optimal lag is found by minimum AIC and the calculated ADF value is compared with Engle-Granger critical values (tau-statistics). If the calculated value exceeds the critical value, the conclusion would be that the estimated residual values is stationary (it does not have unit root) and therefore they are cointegrated.

H_0 : There is no cointegration

H_1 : There is cointegration

C. ERROR CORRECTION MECHANISM

Although there is a long-run relationship between variables, there may be disequilibrium in the short-run. Therefore the error term can be treated as equilibrium error. The error term is used to link short-run behavior of dependent variable to its long-run value. To apply ECM, following model should be taken into consider

$$\Delta Y_t = \beta_0 + \beta_1 \Delta x_t + \beta_2 e_{t-1} + \varepsilon_t$$

Δ denotes first difference; e_{t-1} is the one-period lagged value of the residual from original model. The error correction term e_{t-1} captures the adjustment toward the long-run equilibrium. To understand the correction effect of e_{t-1}, the significance of its coefficient must be investigated by t-statistics. If β_2 is statistically significant, it tells what proportion of the disequilibrium in dependent variable in one period is corrected in the next period.

D. GRANGER CAUSALITY

In order to understand the causality between variables, the Granger Causality is used. The test involves estimating the following regressions;

$$Y_t = \sum_{i=1}^{n} \alpha_i x_{t-i} + \sum_{j=1}^{n} \beta_j y_{t-j} + \varepsilon_{1t} \qquad (1)$$

$$X_t = \sum_{i=1}^{m} \phi_i y_{t-i} + \sum_{j=1}^{m} \sigma_j x_{t-j} + \varepsilon_{2t} \qquad (2)$$

Where it is assumed that the disturbances ε_{1t} 1t and ε_{2t} are uncorrelated.

Equation (1) shows that the current dependent variable is related to past values of itself as well as past values of independent variable and second equation postulates a similar behavior for independent variable (x_t). Equation (1) The null hypothesis is $\Sigma \alpha_i = 0$ that is lagged x_t values do not belong in the regression. To test this hypothesis, the Wald Test (F-test) is applied given;

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/n-k}$$

Where m is the number of lagged x_t terms, k is the number of parameters estimated in the unrestricted regression.

If the computed F value exceeds critical F value as the chosen level of significance, the null hypothesis can be rejected. This is another way of saying that independent variable (χ_t) causes dependent variable (Y_t). The same procedure is applied for the second equation.

5. EMPRICAL RESULTS

In order to find the unit roots Augmented Dickey Fuller Test is used. The ADF results are reported in Table 1.

Table 1. ADF Test Results

ADF	Wholep		Buddef		LnM1		LnM2Y	
	c	c+t	c	c+t	C	c+t	c	c+t
Level	-2,5308 (0)	-2,2818 (0)	-1,7537 (0)	-2,648 (0)	0,2923 (1)	-1,7446 (1)	-0,5739 (1)	-1,9979 (1)
FD	-6,6727* (0)	-6,8177* (0)	-5,932* (0)	-5,8135* (0)	-3,1541** (0)	-2,9735** (0)	-2,5841 (0)	-2,2995 (0)
SD							-8,0525* (0)	-8,5089* (0)

FD refers to the first differences of series and SD refers the second differences.

The values in parentheses show the optimal lags obtained according to Akaike Information Criteria (AIC).

*, **, *** respectively show the rejection of null hypothesis at %1, %5, and % 10 levels.

According to unit root test results above;

Wholesale price index (wholep) is non-stationary in level but it is stationary in its FD. This shows that there is unit root in level but no unit root in FD.

Budget deficit (buddef) is non-stationary in level but it is stationary in its FD. This shows that there is unit root in level but no unit root in FD.

LnM1 is stationary only in FD with intercept at %5 and %10 levels. In other conditions it is non-stationary. So it can be accepted as I(1). This shows that there is unit root in level but no unit root in FD.

LnM2Y is non-stationary in level and FD but it is stationary at SD. This shows that there is unit root in level and FD but no unit root in SD.

After the investigation of unit root, we can pass to cointegration test to understand whether a long run relationship exist between variables or not. Since each of the variables in model 1&2 are found to be I(1), we use the Engle Granger Cointegration Test. The results are reported in Table 2.

For model (1);

Table 2. Engle-Granger Cointegration Test Results

	ADF test statistic
Residual(-1)	-3.852903 ** (0)

The values in paranthesis show the optimal lags according to Akaike Information Criteria (AIC).

*, **, *** respectively show the rejection of null hypothesis at %1, %5, and % 10 levels.

Critical values are based on MacKinon (1992)

According to the results obtained from Engle Granger Cointegration Test above;

It can be concluded that there is cointegration between variables which means there is long run relationship between inflation, budget deficit and money supply. So the estimation results of first model are not spurious and they are reliable.

For model (2);

LnM2y is I(2) and other variables are I(1), so bounds test is used for the second model. The constracted three models are as follows;

$\Delta wholep = \wp_1 + \wp_2 wholep(-1) + \wp_3 lnM2Y(-1) + \wp_4 buddef(-1) + \sum \wp_5 \Delta wholep(-1 \text{ to } -1) + \sum \wp_6 \Delta buddef(-1 \text{ to } -1) + \sum \wp_7 \Delta lnM2Y(-1 \text{ to } -1)$

Table 3. Bounds Test Results

Bounds	F-statistics	I(0)	I(1)
(1)	3,25	3,79	4,85

(0) and I(1) critical values are at %95 confidence level.

Model's calculated F-statistic is less than I(0) at 5% significance level. It shows that there is no cointegration among wholep, lnm2y and buddef ; between wholep and buddef.

Then, we applied Error Correction Model (ECM) for the model (1) that has cointegration. The results are reported in Table 4. We cannot apply ECM for model (2) because we cannot find integration between variables from the results of bounds test

Table 4. Error Correction Model Results for Model (1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBUDDEF	1.65E-06	9.71E-07	1.703636	0.1009
DLNM1	45.99144	30.19222	1.523288	0.1402
C	-16.77234	13.34205	-1.257103	0.2203
RESID(-1)	-0.739603*	0.192853	-3.835067	0.0008

* indicates significance at 1% level

According to ECM results, the probability of error correction term (resid(-1)) is lower than even 1% significance level, so it is statistically significant. Also its coefficient is negative as expected. The error correction term shows that it takes approximately 1.37 years which makes 16-17 months to pull the system back to its long run equilibrium due to short run shocks.

In order to examine the causality and its direction Granger Causality is needed to apply to following original models;

$Wholep = \beta_0 + \beta_1 Buddef + \beta_2 lnM1 + \varepsilon_{1t}$ (1) (optimal lag that is obtained from VAR system is 2)

$Wholep = \alpha_0 + \alpha_1 Buddef + \alpha_2 lnM2Y + \varepsilon_{2t}$ (2) (optimal lag that is obtained from VAR system is 1)

According to obtained results for model(1);

Null Hypothesis:	Obs	F-Statistic	Probability

BUDDEF does not Granger Cause WHOLEP	29	1.05995	0.36280
WHOLEP does not Granger Cause BUDDEF		2.09507	0.14593
LNM1 does not Granger Cause WHOLEP	29	0.12373	0.88420
WHOLEP does not Granger Cause LNM1		4.96654	0.01611
LNM1 does not Granger Cause BUDDEF	29	2.72920	0.08639
BUDDEF does not Granger Cause LNM1		5.60032	0.01043

Wholep Granger causes lnM1 at %5 significance level; buddef Granger Causes lnM1 at %5 significance level and lnM1 Granger causes buddef at 10% significance level.

According to obtained results for model (2);

Null Hypothesis:	Obs	F-Statistic	Probability
LNM2Y does not Granger Cause WHOLEP	29	0.01038	0.91964
WHOLEP does not Granger Cause LNM2Y		16.2687	0.00043
BUDDEF does not Granger Cause WHOLEP	29	1.42924	0.24268
WHOLEP does not Granger Cause BUDDEF		0.51562	0.47912
BUDDEF does not Granger Cause LNM2Y	29	40.2335	1.0E-06
LNM2Y does not Granger Cause BUDDEF		4.73624	0.03881

Wholep Granger causes lnM2Y; buddef Granger Causes lnM2Y even at %1 and lnM2Y Granger causes buddef at 5% significance level.

At last, for evaluating the crisis effect on the relationship between variables that are used in the model the estimation of the models is done with dummy variables. The regression results are as follows.

wholep = -11.29614 + 2.34E-06 buddef + 7.681915 lnM1+ 4.226815 dummy1

(1) t-stat. : (4.610605) (5.063819) (0.167577)

S_e : (0,00) (1.517020) (25.22307)

wholep = -7.791919 + 2.13E-06 buddef + 7.115418 lnM1 + 43.42165 dummy2

(2) t-stat. : (4.553322) (4.907365) (1.928749)

S_e : (0,00) (1.449947) (22.51286)

wholep = -5.604145 + 2.24E-06 buddef + 6.384404 lnM2Y + 2.439712 dummy1

(3) t-stat. : (4.501222) (5.012369) (0.096214)

S_e : (0,00) (1.273730) (25.35715)

wholep = -2.456582 + 2.05E-06 buddef + 5.907681 lnM2Y + 43.27395 dummy2

(4) t-stat. : (4.451392) (4.847072) (1.909826)

S_e : (0,00) (1.218814) (22.65858)

According to calculated results;

For (1), dummy 1 is not statistically significant; lnM2Y and buddef are statistically significant at all levels.

For (2), buddef and lnM1 are statistically significant at all levels, but dummy 2 is statistically significant at %10 significance level.

For (3), dummy 1 is not statistically significant; lnM2Y and buddef are statistically significant at all levels.

For (4), dummy2 is statistically significant at %10 significance level. But lnM2Y and buddef are statistically significant at all levels.

6. CONCLUSION AND EVALUATION

wholep = $\beta_0 + \beta_1 buddef + \beta_2 \ln M_1$

wholep = $\alpha_0 + \alpha_1 buddef + \alpha_2 \ln M_2 Y$

wholep = -11,31 + 2,31E-06 buddef + 7,68 lnM1 (1)

t-stat	:	(4,82)	(5,16)
S_e	:	(0,00)	(1,49)

R^2 : 0,52 Adjusted R^2 : 0,49 Durbin-Watson : 1,41

For model (1),

According to empirical results budget deficit, money supply (M1), inflation are cointegrated. This means that even though there would be a short-run shock on the variables, they converge their original path in the long-run. So the long-run equilibrium would be established. As a result, the estimation of original model is valid. The relationship between budget deficit and inflation is weak, if there is 1000 YTL increase in budget deficit, $2{,}31 \times 10^{-6}$ point will increase wholesale price index. But if there is 1% increase in money supply (M1), wholep will increase by 7,68 points. So, we can conclude that *the effect of budget deficit on inflation is based on monetarist effect rather than its fiscal effect.* The fitted value of model 52% is in an acceptable interval because there are many other factors that effect inflation such as devaluation, negative productivity shocks, increase of important input prices, economical expectations, and wage/price rigidity. According to Granger Causality Test, we can see clearly that the budget deficit is financed through monetization.

For model (2);

The results of bounds test that is applied for model(2) show that there is no cointegration neither among budget deficit, inflation, money supply(M2Y) nor between inflation and budget deficit. The cointegration is found only between inflation and money supply (M2Y) as expected, since in Turkey the inflation used to depend greatly on foreign currencies. Because of non-cointegration of budget deficit with other variables, the estimation is not reliable (spurious regression). According to Granger Causality results, budget deficit Granger causes money supply (M2Y) which shows the monetization of deficit, as it was the case in the first model. However, there is no statistically significant evidence to infer that budget deficit causes inflation.

The results of crisis effect show that 2001 crisis does not cause any strong change in inflation (The results can be seen from the last part of the empirical results). It cannot be concluded that there is statistically significant 2001 crisis effect on the series. However, there is enough evidence to infer that 1994 crisis creates a structural break and affects series. It is found that the inflation increases 43 points in 1994 when comparing with other years.

In conclusion the weak relation in model (1) and no existence of cointegration in model (2) make it acceptable that there is no direct link between budget deficit and inflation. Budget deficit has indirect relationship with inflation through financing deficit in the way of seigniorage.

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Quantity Theory of Money: A Multi Country Analysis

Egemen Eren

Abstract

Using a sample of 12 countries which include high-inflation, medium-inflation and low-inflation countries, two propositions of the quantity theory of money are subjected to empirical tests. These two propositions are proportionality of average money growth and inflation and super neutrality of money. Three different types of money supply has been employed to test these propositions, namely "money" (M1), "money plus quasi-money" (M2) and "reserve money". After the empirical analysis, the proportionality proposition failed although the relation between average money growth and inflation is justified for all three types of money supply. On the other hand, super neutrality of money holds for some countries, but does not hold for some other.

Keywords: inflation, proportionality, money, super neutrality, quantity theory of money.

1. Introduction

Despite its presence since the emergence of the modern economic thought, quantity theory of money (QTM) has played a leading role in contemporary monetary economics after the rise of monetarism. Milton Friedman on his *"Quantity Theory of Money: A Restatement"* makes some claims about the quantity theorists such as; quantity theorists accepts the empirical hypothesis that the demand for money is highly stable...The quantity theorists not only regards the demand function for money as stable; he also regards it as playing a vital role in determining variables that he considers of great importance for the analysis of the economy as a whole, such as the level of money income or of prices."[1] In the light of this statement, Friedman challanged the previous theories about inflation by claiming that "[i]nflation is always and everywhere a monetary phenomenon, produced in the first instance by an unduly rapid growth in the quantity of money."[2] Furthermore, Lucas argued that in the long-run, average money growth will be neutral such that it will not affect the real income growth and there is a linear relationship between money growth rate and the inflation rate.[3] In the light of Friedman's quantity theory, many Central Banks have become independent from the government and they have been given the power to control the money supply in order to fulfill their primary goal: keeping the price stability.

QTM can be expressed as $MV = py$ where M is the money supply, V is the velocity of money, p is the price level obtained from the implicit GDP deflator; which is nominal GDP divided by real GDP and y is the real GDP of the economy. This simple relation can easily be transformed into growth rates by taking the logarithm of both sides:

$$\log M + \log V = \log p + \log y \qquad (1)$$

Therefore, differentiating equation (1) with respect to time, we obtain the following equation:

$$\frac{\Delta p}{p} = \frac{\Delta M}{M} - \frac{\Delta y}{y} + \frac{\Delta V}{V} \qquad (2)$$

Equation (2) yields a linear relationship between the variables. Grauwe and Polan (2005) argue that when the identities of the equation are transformed into the quantity theory, two aspects of the QTM are revealed: "The proportionality prediction says that a permanent increase in the money growth leads to an equal increase in the rate of inflation in the long run."[4] Furthermore, through finding the slope coefficient, elasticity of money supply on the price levels will be obtained.

QTM indicates no certain type of money supply that would affect the price levels. In the study, three types of money supply will be employed in order to shed light on how and to what extent different characteristics of different types of money supply affects the price levels. Three definitions which are; 'Money', 'Money plus Quasi-Money' and 'Reserve Money' will be tested. [5] 'Money' definition includes currency, demand deposits, traveler's checks and checkable deposits. 'Money plus Quasi-Money' includes saving deposits and time

[1] Friedman 1969 p. 62-63
[2] Friedman 1968, p.18
[3] Lucas 1996, p.665
[4] Grauwe and Polan 2005 p. 240
[5] The definitions are from International Financial Statistics. "Money" is M1 and "Money plus Quasi-Money" is M2.

deposits in addition to 'Money'. [6] 'Reserve Money' comprises notes and coins issued, deposits of commercial banks, securities issued by the Central Bank.[7] For each type of money supply, average money growth will be taken into consideration.

Together with the propositions related with the price levels, another proposition of the QTM is the long run super neutrality of money, such that money growth remains the output and velocity unaffected in the long run.[8] The paper also aims to seek evidence to test this proposition as well.

A multi-country research is conducted with a sample of 12 countries, of which there are low-inflation, medium-inflation and high-inflation countries in order to perform the empirical analysis. The sample contains Argentina, Brazil, Canada, China PR, Denmark, Japan, Republic of Korea, Mexico, Switzerland, Thailand, Turkey and the United States of America. Data for 18 years, from 1987 to 2005 is gathered from the International Financial Statistics database of the International Monetary Fund. In order to capture more evidence, the primary target was to collect quarterly time series data and regress it yearly for the sample. However, with the selected countries, there has been a limitation which is the lack of quarterly data for all the countries. Therefore, yearly change of the quarterly data was employed for Canada, Denmark, Japan, Republic of Korea, Mexico, Switzerland, Turkey and the United States. For the rest of the sample, yearly changes in the annual frequencies have been used.

2. Review of the Empirical Literature

Empirical findings on the first proposition of the QTM yield positive relationship between the money supply and inflation. Vogel (1974), Barro (1990), Pakko (1994) and Herwartz and Reimers (2006) tested the QTM on different samples and different time periods. They used narrow money supply and concluded that there is a positive relationship between money supply and the price levels. Dwyer and Hafer (1988) and Poole (1994) confirmed the proposition of the QTM on price levels for broad money. McCandless and Weber (1995) tested the proposition with a larger sample of countries and with three different types of money supply, namely base money, M1 and M2. The positive relation was confirmed again regardless of the specific definition of the money supply. Studies making a high-inflation and low-inflation differentiation challenges the outcomes of the previous studies, finding an evident positive relationship between average money growth and inflation. De Grauwe and Polan (2005) and Moroney (2002) found out that QTM explains the inflation as a monetary phenomenon for the high-inflation countries, whereas for low-inflation countries, inflation cannot be solely explained by the money growth.

Empirical studies reveal that the long-run super neutrality of money is ambiguous. There is not as much consensus in the empirical literature as there is for the strong and positive relation between average money growth and inflation. [9] Dwyer and Hafer (1988) found that although there is no linkage between money growth and real output growth, their study indicated a relationship between the money growth and the real output level. Furthermore, Moroney (2002) analyzed long-run super neutrality of money and concluded that money is neutral for some of the countries and it is not for some other. However, McCandless and Weber (1995) justified the long-run super neutrality of money for all definitions of money. However, they could not justify is for the OECD countries.

Taking into consideration the previous empirical studies on the QTM, too few of them put emphasis on the high-low inflation differentiation which is regarded as a weakness of the previous empirical analyses. Furthermore, 'reserve money' supply was not tested, thus the possible effects of it to the changes in the price level is not clear. Also, the relationship between money growth and real output growth remains ambiguous. Hence, this paper will try to contribute filling in these deficiencies.

3. Empirical Analysis

3.1. Modeling

This paper targets to study the effects of average money growth on inflation and test the long-run super neutrality of money. With the selected sample of countries and the selected time period, two different regressions, one testing the price levels and the other testing the long-run super neutrality of money will be used to make estimations. The first model is:

[6] Dornbusch 2004 p. 392-393
[7] IFS Yearbook p. 94
[8] same as 3
[9] Stiver 2003 pg. 7

$$p_i = \beta_1 + \beta_2 m_i + \beta_3 y_i + \varepsilon_i \quad (3)$$

In equation (3), 'p' stands for the change in the price level, 'm' stands for the average money growth for each type of money supply used in the analysis, 'y' stands for the real output growth and $'\varepsilon'$ is the residual term. One limitation of the model is that there is no data available to estimate the velocity changes. Thus, velocity change is included in the residual term. Quantity Theory of Money estimates the slope coefficients as $\beta_2 = 1$ and $\beta_3 < 0$. [10]

The long-run super neutrality of money can be tested by using the following model:

$$y_i = \alpha_1 + \alpha_2 m_i + u_i \quad (4)$$

In equation (4), 'y' stands for the real output growth, 'm' stands for the average money growth for each type of money supply used in the analysis and 'u' is the residual term.

3.2. Empirical Evidence

After the model specification and data collection, for each type of money supply considered in the paper, separate regressions were used. For a selected sample of 12 countries, coefficients of the regressors, their standard errors, t-statistics, p-values and R^2 are given. As the model is a log-model, the coefficients are the elasticities. E-Views software was utilized and for each regression, as there was evidence for heteroscedastic errors, White Heteroscedasticity-Consistent Standard Errors & Covariance was used. First, the proposition that "inflation is always and everywhere a monetary phenomenon" was tested. The main target was to observe how money supply affects inflation and which type of money supply affects it more. Table 1 shows the results of the regressions with average supply of "money" which comprises currency, demand deposits, traveler's checks and checkable deposits.

Table 1. Testing the QTM by "Money"

Country	β_2 **(standard error of** β_2 **)**	**t-statistic for** β_2 **(p-value)**	β_3 **(standard error of** β_3 **)**	**t-statistic for** β_3 **(p-value)**	R^2
Argentina	0.379112 (0.255003)	1.486696 (0.1578)	-22.69164 (19.93131)	-1.138492 (0.2728)	0.447165
Brazil	1.001754 (0.216470)	4.627681 (0.0030)	34.01339 (79.38839)	0.428443 (0.6744)	0.701461
Canada	-0.084537 (0.011277)	-7.496400 (0.0000)	0.019662 (0.074746	0.236049 (0.7933)	0.240006
China	0.188445 (0.198580)	0.948964 (0.3577)	0.970924 (0.658344)	1.474796 (0.1609)	0.276510
Denmark	-0.005536 (0.025997)	-.0212963 (0.8320)	-0.303571 (0.090069)	-3.370432 (0.0012)	0.163486
Japan	-0.126695 (0.037779)	-3.353600 (0.0013)	-0.000868 (0.083489)	-0.010402 (0.9917)	0.126791
Korea	0.005572 (0.047154)	0.118169 (0.9063)	0.154746 (0.117273)	1.319543 (0.1913)	0.034831
Mexico	0.563500 (0.199631)	2.822716 (0.0062)	-2.608655 (0.659383)	-3.956204 (0.0002)	0.468413

[10] De Grauwe and Polan 2005 pg. 242

Switzerland	-0.089582 (0.022256)	-4.025018 (0.0001)	-0.198065 (0.139763)	-1.417154 (0.1609)	0.208643
Thailand	0.083944 (0.128709)	0.652202 (0.5241)	-0.031174 (0.160893)	-0.193754 (0.8490)	0.028472
Turkey	0.767175 (0.110117)	6.966892 (0.0000)	-1.423086 (0.429353)	-3.314488 (0.0015)	0.512899
United States	0.032760 (0.015032)	2.179326 (0.0327)	-0.187788 (0.056436)	-3.327452 (0.0014)	0.147041

According to the Quantity Theory of Money, β_2 should be equal to 1. The upper bound for the coefficient is 1.001754 which is the coefficient for the average M1 growth in Brazil. The lower bound for the β_2 coefficient is the average M1 growth in Japan, which is -0.126695. Taking into account the β_3 coefficients, QTM suggests that it should be negative; meaning an increase in the real output level should affect the inflation negatively and vice versa. However, β_3 coefficient for Brazil, Canada, China and Korea is positive. An increase in the real output level tends to increase the price levels. R^2 for Brazil is the highest, whereas it is the lowest for Thailand and Korea. Yet, R^2 for each regression reveals, that the phenomenon of inflation cannot solely be explained with M1 growth.

Table 1 makes it evident that for the M1, the elasticity of money growth on inflation is higher in high-inflation countries. β_2 coefficient is the highest for Brazil which experienced high and even hyper inflation for some period. The coefficient is also higher for the other countries which experienced high-inflation such as Argentina, Mexico and Turkey. For some low-inflation countries, β_2 is positive but very close to 0, yet for some low-inflation countries such as Canada, Denmark and Switzerland, it is negative. Japan, which has experienced liquidity trap and deflation seriously for years, has the lowest β_2 coefficient. Thus, the results yield opposite claims to the consensus in the empirical literature that "inflation is always and everywhere a monetary phenomenon". For M1 supply, inflation is more of a monetary phenomenon in the high-inflation countries. Yet, R^2 for high-inflation countries is also not very high, thus the reasons of inflation cannot solely be explained by the QTM when the M1 money supply is the regressor.

Table 2 shows the results regressing "money plus quasi-money" which in addition to M1 contains time deposits and saving deposits.

Table 2. Testing the QTM by "Money plus Quasi-Money"

Country	**β_2 (standard error of β_2)**	**t-statistic for β_2 (p-value)**	**β_3 (standard error of β_3)**	**t-statistic for β_3 (p-value)**	**R^2**
Argentina	0.733463 (0.379137)	1.934561 (0.0721)	-15.89663 (14.21030)	-1.118760 (0.2809)	0.554377
Brazil	0.798587 (0.148538)	5.376315 (0.0001)	105.7463 (98.57459)	1.072754 (0.3003)	0.485497
Canada	-0.026174 (0.004974)	-5.262109 (0.0000)	-0.010553 (0.074972)	-0.140759 (0.8885)	0.155750
China	0.497898 (0.158651)	3.138314 (0.0068)	0.448255 (0.409467)	1.094728 (0.2909)	0.550059
Denmark	-0.031147 (0.023517)	-1.324465 (0.1897)	-0.326036 (0.095866)	-3.400940 (0.0011)	0.177160
Japan	0.198794 (0.042771)	4.647835 (0.0000)	-0.137281 (0.080554)	-1.704210 (0.0928)	0.331522

Korea	0.049016 (0.070860)	0.691727 (0.4914)	0.143970 (0.129728)	1.109781 (0.2709)	0.044712
Mexico	0.385877 (0.172748)	2.233760 (0.0287)	-2.046663 (0.601589)	-3.402097 (0.0011)	0.267648
Switzerland	-0.026900 (0.032667)	-0.823458 (0.4131)	-0.024100 (0.141635)	-0.170153 (0.8654)	0.008298
Thailand	0.374746 (0.113156)	3.311762 (0.0047)	-0.312797 (0.149838)	-2.087568 (0.0543)	0.517462
Turkey	0.729009 (0.060720)	12.00617 (0.0000)	-0.073764 (0.315592)	-0.233733 (0.8159)	0.716542
United States	-0.051449 (0.017808)	-2.889075 (0.0052)	-0.171868 (0.055027)	-3.123358 (0.0026)	0.157514

The upper bound for the β_2 coefficient is 0.798587 which is again the elasticity of average money plus quasi-money growth in Brazil. The lower bound for the β_2 coefficient is the average money plus quasi-money growth in the United States, which is -0.051449. Considering the β_3 coefficients, except for Brazil, China and Korea, β_3 is negative, however, it is statistically significant for only a few countries.Furthermore, an important difference between M1 growth and money plus quasi-money growth is that the extent that the regression captures a relationship increased for money plus quasi-money growth. For most of the countries, R^2 increases when money plus quasi-money growth is employed instead of M1 growth. Comparing the R^2 for each regression, for Turkey it is the highest, whereas for Switzerland, it is almost possible to say that money plus quasi-money growth plays no role in determining inflation.

The significant outcomes of these regressions using money plus quasi-money growth are the overall increase in R^2 and the differences in elasticity for high-inflation and low-inflation countries. Moroney (2002) claims that the reason for higher R^2 for money plus quasi-money (M2) than R^2 for M1 is due to the broader range of assets included in M2. Also, the increase in the β_2 coefficient mostly in the high and hyper inflation countries is that, in those countries, citizens have an incentive to hold most M2 assets as M1 to be spent promptly to minimize inflation tax. Moreover, also for the low-inflation countries, M2 is held to a larger extent as non-transaction assets. Hence, M2 supply explains inflation for both high-inflation and low-inflation countries.[11] Yet, although there is a strong and statistically significant relationship for most of the countries, proportionality proposition i.e. x% increase in the money supply will increase price levels by x%, fails for low-inflation countries. Furthermore, although the coefficient is relatively higher in high-inflation countries, there is no one-to-one relationship.

The third type of money supply tested is "reserve money". Reserve Money comprises notes and coins issued, deposits of commercial banks, securities issued by the Central Bank. It is a narrower type of money supply. Table 3 shows the result of the regression using the reserve money.

Table 2. Testing the QTM by "Reserve Money"

Country	β_2 **(standard error of** β_2 **)**	**t-statistic for** β_2 **(p-value)**	β_3 **(standard error of** β_3 **)**	**t-statistic for** β_3 **(p-value)**	R^2
Argentina	0.379112 (0.255003)	1.486696 (0.1578)	-22.69164 (19.93131)	-1.138492 (0.2728)	0.447165
Brazil	0.788854 (0.168987)	4.668145 (0.0003)	50.05591 (91.44543)	0.547386 (0.5922)	0.571494
Canada	-0.106082	-1.698274	0.034440	0.401286	0.045963

[11] Moroney 2002 p. 402-403

	(0.062464)	(0.0940)	(0.085823)	(0.6894)	
China	0.494410	7.237170	0.615912	1.759940	0.720780
	(0.068315)	(0.0000)	(0.349962)	(0.0988)	
Denmark	-0.013312	-2.990967	-0.312568	-3.649688	0.224784
	(0.004451)	(0.0039)	(0.088930)	(0.0005)	
Japan	-0.047962	-2.159495	0.044789	0.512464	0.068979
	(0.022210)	(0.0343)	(0.087398)	(0.6100)	
Korea	0.009500	3.728363	0.018462	0.135509	0.125903
	(0.024005)	(0.0004)	(0.136243)	(0.8926)	
Mexico	1.299524	4.786070	-1.432678	-3.860735	0.645885
	(0.271522)	(0.0000)	(0.371089)	(0.0003)	
Switzerland	-0.080287	-2.611053	-0.141325	-0.892082	0.071559
	(0.030749)	(0.0111)	(0.158422)	(0.3754)	
Thailand	0.284431	2.288927	-0.182391	-1.380097	0.329135
	(0.124264)	(0.0370)	(0.132158)	(0.1878)	
Turkey	0.762198	8.364007	-0.224604	-0.541660	0.577380
	(0.091128)	(0.0000)	(0.414659)	(0.5899)	
United States	-0.062789	-2.497032	-0.181427	-3.075308	0.172223
	(0.025145)	(0.0149)	(0.058995)	(0.0030)	

Using the reserve money definition, there is a statistically significant relationship between money supply and inflation for all the countries in the sample except Argentina and Canada. However, as reserve money does not include as many assets as M1 or M2, for most of the countries, the coefficients are lower and R^2 is also lower. Mexico has the highest β_2 coefficient and Switzerland has the lowest. For reserve money definition, the proportionality proposition fails again although there is a relation between money supply and inflation for 10 countries in the sample. Also, testing the β_3 coefficient, it is significantly negative for only Denmark, Mexico and the United States as the QTM proposes. However, it is either positive or not significant for the other countries in the sample.

After testing the proportionality proposition of the QTM by three different types of money supply, another proposition of the QTM which is the super neutrality of money, namely its inability to influence the real output level. This proposition is also tested by using three different types of money supply. Table 4 shows the results of the regression modeled in equation (4).

According to the quantity theorists, money cannot influence the real output level. Therefore, there is no point in increasing the money supply in order to increase the real output. They claim that the only outcome will be the increase in the price levels. Empirical literature could not reach to consensus on the super neutrality of money. Emerging from the results of this study, for the sample used, there are contradictory results for the countries. After performing a two-tailed t-test for the slope coefficients for the countries and using M1 money supply, for Japan and Switzerland average M1 growth significantly affects the real output level negatively. For Korea, there is a significant positive relationship. As far as money plus quasi-money (M2) growth is concerned, Thailand and Japan has a significant positive relationship between M2 growth and the real output level. This time, for Turkey the relationship is significantly negative. For Japan, when time and saving deposits are included, the negative relationship turns out to be positive which is an interesting fact. Also, the results of the regression using the reserve money is similar to the one using M1. For Turkey and Switzerland there is a significant negative relationship and for Korea, there is a significant positive relationship.

Table 4. Testing the "Super neutrality" proposition by using three different types of money supply

	Average Money		**Average Money plus Quasi-Money**		**Average Reserve Money**	
Country	α_2	**t-statistic for**	α_2	**t-statistic for**	α_2	**t-statistic for**

	(standard error of α_2)	α_2 (p-value)	(standard error of α_2)	α_2 (p-value)	(standard error of α_2)	α_2 (p-value)
Argentina	-0.002016 (0.001188)	-1.697233 (0.1090)	-0.003443 (0.001925)	-1.788128 (0.0927)	-0.002016 (0.001188)	-1.697233 (0.1090)
Brazil	0.000273 (0.000677)	0.402865 (0.6924)	-0.000300 (0.000652)	-0.460958 (0.6510)	0.000151 (0.000597)	0.253371 (0.8032)
Canada	0.000051 (0.026001)	-0.001980 (0.9984)	-0.008030 (0.009907)	-0.810549 (0.4204)	0.054054 (0.074406)	0.726481 (0.4700)
China	0.173964 (0.104569)	1.663663 (0.1156)	0.167881 (0.076772)	2.186742 (0.0440)	0.094136 (0.071394)	1.318542 (0.2059)
Denmark	-0.007717 (0.040265)	-0.191647 (0.8486)	-0.083676 (0.039115)	-2.139214 (0.0359)	-0.008061 (0.008414)	-0.958090 (0.3413)
Japan	-0.152362 (0.061883)	**-2.462086 (0.0163)**	0.223113 (0.049143)	**4.540072 (0.0000)**	-0.037931 (0.035217)	-1.077067 (0.2851)
Korea	0.187903 (0.039476)	**4.759925 (0.0000)**	0.110763 (0.064241)	1.724163 (0.0891)	0.143047 (0.031335)	**4.565031 (0.0000)**
Mexico	0.023310 (0.012341)	1.888852 (0.0631)	0.015811 (0.011799)	1.339960 (0.1846)	-0.000124 (0.025208)	-0.004918 (0.9916)
Switzerland	-0.077828 (0.021280)	**-3.657343 (0.0005)**	-0.040868 (0.038009)	-1.075233 (0.2860)	-0.132609 (0.030623)	**-4.330335 (0.0000)**
Thailand	-0.010030 (0.254707)	-0.039378 (0.9691)	0.478807 (0.160022)	**2.992121 (0.0086)**	0.382353 (0.189879)	2.013661 (0.0612)
Turkey	-0.019537 (0.030940)	-0.631447 (0.5299)	-0.070189 (0.020358)	**-3.447733 (0.0010)**	-0.085647 (0.024051)	**-3.561010 (0.0007)**
United States	-0.030276 (0.039212)	-0.772124 (0.4426)	0.092801 (0.050981)	1.820298 (0.0730)	0.052990 (0.055016)	0.963172 (0.3388)

4. Conclusion

The main objective of this paper was to test two propositions of the QTM; proportionality and super neutrality. A sample of 12 countries was used which included low-inflation, medium-inflation and high-inflation countries. In testing the propositions, M1 ("money" in IFS), M2 ("money plus quasi-money" in IFS) and "reserve money" (in IFS) was used as three different types of money supply as there the QTM does not give any specifications about the type of money supply.

Firstly, empirical literature has had a consensus about a strong and positive relationship between average money growth and the real output growth. This paper also found a relationship which is not very strong but significant. However, although the relation is positive, it is impossible to agree the proportionality proposition of the QTM for each type of money supply. Furthermore, M2 captures the relationship between average money growth and the real output growth more compared to both M1 and reserve money, for most of the countries. Secondly, empirical studies on the super neutrality of money could not agree on one single conclusion, yet for some countries money was neutral and for some other it was not. This paper also could not find counter evidence to solve this ambiguity. For some countries money growth actually affected the real output growth.

Another conclusion drawn from the empirical study is that the QTM could explain the phenomenon of inflation to a larger extent for high-inflation countries than it does for the low-inflation countries. Also,

medium-inflation countries tends to act like low-inflation countries. As a result, in implementing policies to keep the price stability in high-inflation countries, QTM and its propositions would help the Central Banks more, whereas it is not quite possible to conclude the same for the low-inflation countries.

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INTERNATIONAL CAPITAL FLOWS

Increasing Private Capital Flows to Developing Countries: The Role of Physical and Financial Infrastructure

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Abstract

This paper aims to assess the impact of physical infrastructure and financial development on developing countries' attractiveness to private capital flows (Foreign Direct Investments -FDI-, Portfolio Investment). We first define two infrastructure indexes: one using a principal components analysis and a second one with standardization method. We then make the distinction between physical and financial infrastructures. From a sample of 61 developing countries over the period 1970-2003, we find (using three stages least square -3SLS-) that physical and financial infrastructures positively and significantly affect private capital flows to developing countries. An analysis of FDI and portfolio investments revealed that physical infrastructure and financial development have a significant effect on FDI and portfolio investments, respectively. This suggests a certain complementarity between the two types of infrastructures in terms of private capital attractivity. Testing a non-linear relationship shows the existence of significant thresholds in the positive impact of the two types of infrastructures. Finally, our results show that better physical infrastructure tends to attract more FDI inflows to Sub-Saharan African countries while there is no empirical evidence of the influence of infrastructure on portfolio investment inflows.

Keywords: Foreign Direct Investment, Portfolio Investment, Physical Infrastructures, Financial Development, 3SLS.

JEL classification: C30, F21, F32, F34.

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I. Introduction

During the last two decades, the international economy was largely marked by financial crises. The first crisis, the debt crisis, occurred in the early 1980's and the second one, which was actually a wave of financial crises, began with the Mexican crisis in 1994 and spread to international scale with the Asian crisis in 1997. The national and international economic environment had great impact on these two episodes of international economic stagnation, but the destination and composition of private capital flows also played an important role in these crises.

According to neoclassical economic theory, assuming free capital market and diminishing returns, capital should flow from capital abundant countries (developed countries) to capital scarce countries (developing countries) leading to the equalization of marginal returns to capital. In reality, this theoretical prediction is not observed, leading to an important paradox in international macroeconomics: the "Lucas paradox". The importance of private capital flow in financing development and more importantly in a context of insufficient and instable aid raises some key questions about why the neoclassic theory is not observed. Why does capital not flow to developing countries where their marginal return is higher? Answering this question necessitates the study of private capital determinants. Lucas argues that this paradox is due to low human capital in developing countries and capital market imperfections. Our study lies within this framework of the "Lucas paradox" explanation, but will specifically focus on two important determinants: physical infrastructure and financial development. Analysis of the contribution of these two determinants has been neglected in previous empirical studies on this issue. For foreign private capital, we consider net flows of FDI, portfolio investments and debt (mainly trade and bank related lending).

Following the Asian crisis, a number of studies on private capital flows emerged, particularly focusing on managing private capital to avoid financial crises. Researchers also studied the determinants of private capital flows. These studies were generally based on an approach that distinguishes external determinants (out of the

[1] The author would like to acknowledge Jean-Louis Combes for detailed comments, suggestions. The author is also grateful for comments from S. Baoudheik, R. Laajaj, C. Sanford, Zeufack A., CERDI seminar participants, 3rd Izmir University of Economics conference participants.

control of the economy which receives capital "*push factors*") and internal determinants (being able to be influenced by the recipient economy[2]: "*pull factors*").

The analysis of external factors explains how the economic conditions of capital-exporting countries (developed countries) influences capital inflows in developing countries. These external factors reflect the opportunity cost of investment in these countries. The international interest rate and world growth rates, generally approximated by those of the United States, are the most influential factors. Low profit in developed countries is a significant cause of capital flows to developing countries where profits' prospects can be more promising. One of the first analyses of private capital flows determinants was made by Calvo, Leiderman and Reinhart (1993). Using a sample of 10 Latin American countries over the period 1988-1991, they find that capital flows are mainly influenced by the external factors, namely the growth rate and the interest rate of developed countries. Many authors also showed the importance of the external factors in the determination of private capital flows (Fernandez-Arias, 1996; Montiel and Reinhart, 1999; Kim, 2000; Ying and Kim, 2001; Ferrucci et al., 2004; Calvo et al., 1996).

In addition to these studies, which accentuate the role of external factors, a greater number of studies reveal the dominating role of internal factors in the explanation of private capital inflows. Generally, the internal factors are the macroeconomic conditions of the recipient country that influence private capital flows to this country. A stable macroeconomic environment is favourable to investment decisions, creation of value added, and productivity. Internal factors include economic growth rate, inflation, trade openness, education, and political stability, which can be influenced by national-level policies. Authors such as Fernandez-Aria, 1996; Bohn and Tesar, 1998; Ahn et al., 1998; Dasgupta and Rahta, 2000; Hernandez et al., 2001 find that these factors play an important role in explaining private capital flows to developing countries. Authors who focus mainly on long term capital flows find similar results (Root and Ahmed, 1979; Schneider and Frey, 1985; Bleaney, 1993; Gastanga et al., 1998; Asiedu, 2002; Morrissey, 2003).

More recent studies use the "Lucas paradox" to explain the determinants of private capital flows[3]. Following Lucas, these studies distinguish the determinants of capital flows into economic fundamentals able to affect the production structure (education, institution, etc.) and capital market imperfections (mainly informational asymmetry). Alfaro et al. (2003, 2005), through a cross-sectional study, finds that the "Lucas paradox" is mainly explained by the quality of institutions in developing countries, although capital market imperfections and some government policies (education, inflation, credit accorded by the banking sector) are also found to influence private capital inflows. According to Reinhart and Rogoff (2004), the "Lucas paradox" exists because of political risk and credit market imperfections. Reinhart and Rogoff argue that reduction of credit market imperfections through better institutions would allow externalities, in particular those related to human capital, to play a more significant role.

All of these studies lead to different conclusions about the factors which significantly influence private capital inflows to a country. Some studies focus on a particular type of private capital or on a particular period. The purpose of our study is to extend the "Lucas paradox" approach (which considers only the economic fundamentals and capital markets imperfections), integrating external factors like the traditional approach ("*push-pull factors*"). While the majority of the studies generally analyze all factors together, we will focus our attention on two determinants of private capital inflows: physical infrastructure and financial development. Their contribution to private capital attractiveness appears important to us, and has received insufficient attention in the literature. We will analyze aggregated private capital and also the components of private capital, considering the potential relation between these different components. Breaking-up components allows us to differentiate between short term and long term flows, which can have some common determinants while other factors are specific to certain flows. In addition, such an analysis highlights the different role which identical factors (especially physical infrastructure or financial development) could have according to each type of private capital.

The rest of the paper is organized in two main sections: the first section is a theoretical review of the literature, an analysis of the relation between private capital flows, financial development and physical infrastructure, and a simple theoretical model based on the "Lucas paradox" approach. The second part of the

[2] Studies also focus on "contagion" phenomena during episodes of massive surges of private capital between large countries and their smaller neighbours who benefit from externalities resulting from the high attractivity of large countries (Calvo et al.. 1996, Hernandez, Medallo, and Valdes 2001). A competition between countries of same area in private capital attractivity can also happen (Kang and al., 2003).

[3] A more recent approach applied to emergent countries consists in the estimation of a model of supply and demand of capital and then starting using the maximum likelihood to estimate the probability of disequilibrium between supply and demand of capital (Mody and Taylor, 2004).

study is devoted to an empirical estimation of the determinants of private capital flows followed by robustness checks. The last part concludes.

II. Physical infrastructures and private capital flows

A considerable number of studies (The World Bank, 1994; Temple 1999; Demurger, 2001; Willoughby, 2003) highlight the role of infrastructure (telecommunications, electricity, etc.) in economic growth and development. Beyond its direct effect on economic growth, infrastructure also affects economic growth by increasing private investment. This relation between infrastructures and private investment was previously underlined by Blejer and Khan, 1984; Greene and Villanueva, 1991; Serven and Solimano, 1993). A greater availability of infrastructure increases the output of private investment by reducing transactions costs and enabling firms to get closer to their customers and suppliers, making it possible for the firms to increase their potential markets and thus their opportunities for profit. Well developed telecommunication infrastructure, for example, can help firms to access financial resources through financial markets. Firms that do not have access to modern telecommunication services, reliable provision of electricity, or developed road systems invest less and have less productive investments (regardless of whether they are local or foreign). When the provision of well functioning infrastructure fails, firms are sometimes forced to pay the costs of providing infrastructure themselves, such as electricity via power generating units, in order to continue their activities. This type of provision is generally more costly than traditional infrastructure provision. In addition to these high costs of provision, the firms also have to support costs due to damages caused by power outages.

In previous studies, the importance of physical infrastructure in determining the attractiveness of foreign private capital essentially focused on the role of physical infrastructures for FDI inflows. In a cross-sectional study over 1977-1982, Loree and Guisinger (1995) find that countries with developed infrastructure (measured by a multidimensional index of infrastructures) receive more FDI from United States than countries with less developed infrastructure. Wheeler and Mody (1992) and Mody and Srinivasan (1996) find similar results. Kumar (2001), with a sample of 66 countries over 1982-1994, finds that the development of infrastructures, measured by a composite index, has a positive effect on FDI inflows. Asiedu (2002), Ngowi (2001), using a sample of African countries, and Jenkins and Thomas (2002), using a sample of Southern African countries, obtain similar results.

Until now, this paper has assumed that infrastructure is supplied by the state. However, in practice, limited public sector resources in developing countries, coupled with profitable opportunities in some infrastructure (electricity, telecommunications, etc.), lead the private sector to provide infrastructure. Given the financial importance of infrastructure investments, the private firms carrying out this type of investment are generally foreign, leading to foreign private capital inflows. Sader (2000) finds that between 1990 and 1998, 17% of FDI flows received by developing countries were dedicated to infrastructure financing. According to Ramamurti and Doh (2004) the FDI dedicated to infrastructure financing accounted for 1/3 of capital inflows to developing countries in the beginning of the 1990's.

III. Financial development and private capital flows

Financial development increases capital accumulation when resources are allocated efficiently to entrepreneurs, and when entrepreneurial activity is monitored. With the emergence of financial intermediaries, financial development reduces transactions costs through lower informational asymmetry, better risk management and coverage, stimulating investment.

One of the theoretical channels through which financial development affects economic growth is the rise of private investment due to efficient firms' better access to financing[4]. The reduction of informational asymmetry through financial intermediaries has a considerable effect on foreign capital and investments. In fact, in addition to the informational asymmetry supported by the local entrepreneurs, the distance between foreign investors and local market generally increases this already existing informational asymmetry. Foreign investors know neither the opportunities nor the risks of the local market as well as local investors do. Therefore, obtaining better information about local market risks through financial intermediaries gives more credibility to profit potential in the country, stimulating the entry of new investors, in particular foreign investors, into the local market.

McKinnon (1973) underlined the fact that financial development and financial liberalization stimulate economic growth by raising private investment and its productivity. Huang (2006), focuses only on domestic investment, but suggests an empirical model for the importance of financial development on investment. Using

[4] See Levine (1997, 2003) for a review of the theoretical and empirical literature.

a sample of 43 developing countries over 1970-1998, he finds that financial development significantly and positively affects private investment. His analysis also concludes that private investment has a positive and significant effect on financial development.

As mentioned by Levine (1997), studies on financial development and investments generally do not distinguish domestic investments from foreign investments. Focusing only on foreign private capital and its components, our study assessed the extent to which financial development affects foreign private capital inflows, thus enriching the scarce literature on this topic. To the best of our knowledge, only three studies deal with the effect of financial development on private capital flows, precisely FDI. Hausmann and Fernandez-Arias (2000) find that the countries with least developed capital markets tend to have more FDI inflows. According to these authors, FDI can be alternative financing for the firms which do not have access to capital markets. However, using a sample of 81 foreign firms based in Southern African countries, Jenkins and Thomas (2002) show that South Africa attracts relatively more FDI than other African countries. The authors suggest that other countries should develop their financial system in order to increase their FDI inflows. Montiel (2006), in a theoretical analysis, argues that Africa does not attract enough private foreign capital to finance sectors with high potential profits, because of Africa's human capital weakness, lack of infrastructures and bad institutional quality. Montiel underlines the fact that when some countries are relatively well endowed in these factors, financial underdevelopment explains their low attractivity to foreign capital.

The importance of financial intermediaries should also vary with the type of private capital. Indeed, even if financial development, and thus financial intermediaries, remains significant in explaining the attractiveness of IDE and debts, financial intermediaries' contribution to the attractiveness of portfolio investments is more significant. Since portfolio investments generally require the pre-existence of a stock market, portfolio investment inflows require a developed financial sector. Financial development itself can imply the entry of new banks or new actors in the local market. The process of financial liberalization with bank privatization implies acquisitions in the form of FDI or portfolio investment and thus an increase of foreign private capital inflows. Bank and trade related lending can also increase with the entry of new banks in the local market, which can be an affiliate of large foreign banks; this would facilitate loans between the plants and headquarter.

IV. The theoretical model

The "Lucas paradox" is issued from a neoclassical growth model assuming a common technology to all economies. Let us consider a Cobb-Douglas production function with constant return to scales, representing a small open economy in which the production (Y) is obtained from the combination of capital (K) and labour (L).

$$Y_t = A_t F(K_t, L_t) = A_t K_t^{\alpha} L_t^{1-\alpha} \quad \text{with } F'(.)>0,\ F''(.)<0,\ F(0)=0 \qquad (1)$$

A is the productivity factor and reflects the technological level which can be stock of human capital, for example (Lucas, 1990). Assuming a common technological level in all economies and perfect capital mobility; capital will flow from most endowed economies (in capital) to the least endowed countries because of the property of diminishing returns. That would lead to a convergence and an equality of interest rates. Considering two economies i and j, the interest rate r_t would be defined as follows:

$$At\, f'(k_{it}) = r_t = At\, f'(k_{jt}) \qquad (2)$$

However this prediction is not observed in reality, giving place to the "Lucas paradox". The explanation of this paradox according to Lucas is mainly due to capital market imperfections (mostly informational asymmetry) and to the differences of economic fundamental between countries, implying a difference of the technological factors (A_t). A reflects the infrastructure available, which is generally external to the firm. If i is a more developed country than j, then Lucas supposes that A_{it} is higher than A_{jt} which explains the fact that country i attracts more capital than the country j ($kit > kjt$) since the return of the capital is higher there. Given up the assumption of common technology between countries, the real return of capital becomes:

$$At\, f'(k_{it}) > At\, f'(k_{jt}) \qquad (3)$$

With more detail, equation (3) can be written as followed:

$$(A_t + I_{it}) f'(k_{it}) > (A_t + I_{jt}) f'(k_{jt}) \qquad (4)$$

With I_{it} or I_{jt} the infrastructure available in country i or j at t and A_t other technological factors such as human capital.

V. Private Capital Flows to developing countries: Some stylized facts.

Since the 2nd World War, developing countries have seen two great episodes of massive surges of capital. The first one is associated with the oil price boom of the 1970's and the subsequent significant foreign investment of oil exporting countries. It has been followed by a crisis of national debt; the consequence of borrower countries unable to payback their loans. The second surge in capital inflows occurred in the second half of the 80's. This second episode gave way to two main financial crises: the Mexican crisis of 1994 and the Asian crisis of 1997.

Figure 1 illustrates the evolution of private capital inflows and their distribution among developing countries.

Figure 1: Private capital flows in developing countries

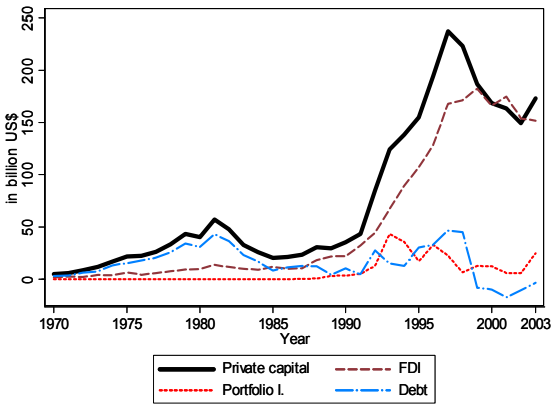

Figure 2: Distribution of private capital between developing

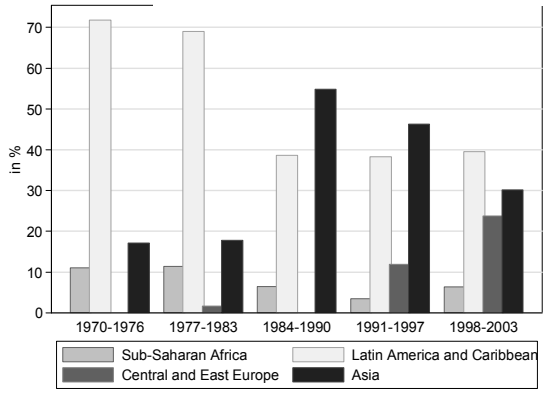

Figure 1 shows that private capital flows to developing countries have evolved from an almost null value to approximately 60 billion US dollars during the first wave of capital inflows to developing countries (from 1970 to the beginning of the 1980's). During this episode, private capital flows are mainly composed of debts. The observed decrease of private capital inflows in the beginning of 1980's illustrates the debt crisis.

Shortly after the debt crisis, developing countries observed a second wave of private capital inflows in the middle of 80's with capital growth from approximately 25 billion US$ to approximately 250 billion US$ in 1997 (when flows reach their maximum level). During this second wave, private capital inflows, which were primarily composed of debts, are matched by FDI, which constitute the major part of private capital flows since the debt crisis of 1988. The FDI rose from US$ 18 billion in 1988 to US$ 168 billion in 1997, with debts increasing from US$ 12 billion to US$ 46 billion during this same period. Portfolio investments, which were negligible in developing countries before 1988, reach more than 43 billion US$ during the 1990's.

The deceleration of capital inflows observed in 1994 is the effect of the Mexican crisis that was largely restricted to countries in the area and affected mainly portfolio investments. Following the Mexican crisis, a new crisis hit the Asian countries in 1997. Capital flows to developing countries during this crisis fell from approximately US$ 250 billion in 1997 to approximately US$ 150 billion in 2002. This decrease corresponds to the decrease in portfolio investment, and especially a decline in debt flows, during this period. Although portfolio investments decreased sharply, (due to contagion effect between short term capital markets), the Asian crisis was mainly due to a decrease in debt (bank and trade related lending). These flows of capital fell from more than US$ 46 billion to negative values just after Asian crisis.

Beyond the evolution of private capital to developing countries, the distribution of capital among them is also important. Indeed, while developing countries attract less capital compared to developed countries, the distribution of private capital between developing countries is far from being equitable. Figure 2 illustrates rather well this unequal distribution between the principal groups of developing countries[5].

The majority of the Central and Eastern European Countries (CEEC) got their independence after 1990; so it is only possible to integrate this group of countries in our analysis for the two last periods. A general

[5] We distinguish as developing country groups, Sub-Saharan Africa, Central and Eastern Europe, Latin America and the Caribbean and finally Asia. We integrate in Asian group some Middle-East and North Africa countries because these countries are in very little number on the one hand (other groups are composed of approximately thirty countries) and on the other hand given the relatively geographical proximity of the countries with Asia.

observation shows that Sub-Saharan African countries attract less capital than any other region at each period. Before the debt crisis, Latin American countries attracted the majority of the private capital (more than 60%) and, coupled with Asian countries, the two groups attracted approximately 90% of the private capital flows to developing countries. After the debt crisis, (1984-1997), Asia and Latin America countries continue to attract approximately 90% of the private capital. The last period (1998-2003) is still dominated by these two groups of countries (approximately 75%). During this period, the CEEC have gained greater importance, attracting more than 20% of private capital flows. The marginalisation of Sub-Saharan African countries is accentuated during the two last periods with this group attracting only 3 to 6% of private capital flows to developing countries.

VI. Empirical analysis

VI.1. Data and variables

The data cover the period 1970-2003 (subdivided into 5 periods of 5 years[6]) and we retain for the regressions 61 developing countries[7]. The private capital flow variables would be FDI, portfolio investments, debts and private capital which is defined as the sum of these three types of private capital[8]. We will retain for the econometric analysis only FDI and portfolio investments as variables of capital inflows for many reasons. After the debt crisis, data on debts contain great measurement error (Alfaro et al., 2003, 2005). The principal reason is the lack of data on the debts between private agents exclusively. The debt data used here are issued by private economic agents (foreign banks mainly) but can be contracted by private or public sector. These debts, contrary to the FDI and portfolio investments, reflect not only the market incentives but also government's decisions. But our objective here is to study the market incentives. After the debt crisis for example, a significant share of private debt was contracted by the government of developing countries[9].

We retain as measures of physical infrastructure, the proportion of the subscribers of fixed and mobile phone service in the population and electric consumption per capita. A third variable able to seize physical infrastructures would be the density of the road network but given the lack of data, we use the first two variables which reflect well the infrastructures available in a country. We use the ratio of liquid liabilities in GDP (M3/GDP) as financial development variables. We also retain the ratio of bank credit to the private sector in GDP and the ratio of financial system deposits in GDP (the variable of deposits will be only considered for the construction of the physical and financial infrastructures index). In accordance with the theoretical and empirical literature, we control for some variables. Appendix 1 gives the list, definitions and sources of the variables used.

VI.2. Estimations

Although our objective is not to show the existence of the "Lucas paradox," but rather its explanation by the infrastructure in particular, it is interesting to investigate whether this paradox, which until now was established between developed and developing countries is also observed among developing countries. In other words, do the most developed of the developing countries attract more capital compared to the less developed ones? The results in appendix 2 show that among developing countries, capital flows more towards countries with greater GDP per capita, which is an illustration of the existence of "Lucas paradox" among developing countries.

The analysis of the effects of physical infrastructure and financial development on private capital inflows is based on the following equation, which includes capital market imperfections and economic fundamental variables to explain the "Lucas paradox" approach. Exogenous variables specific to the developed countries

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[6] The five year periods are: 1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, 1995-1999 and 2000-2003.

[7] Central and Eastern European Countries (CEEC) are not taken into account in the regressions since the majority of these countries was created after 1990 whereas one of our objectives is to evaluate a differentiated effect before and after 1990's financial crises of the years.

[8] Foreign direct investment is net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments.
Portfolio investment flows are net and include non-debt-creating portfolio equity flows (the sum of country funds, depository receipts, and direct purchases of shares by foreign investors).
Bank and trade-related lending covers commercial bank lending and other private credits. (WDI 2005)

[9] We checked the specificity of the debts compared to FDI and portfolio investments by adding to our system of two equations an equation of debts. The results obtained (available upon request) show that the physical and financial infrastructures do not increase debt inflows.

(capital exporters) and which are external to developing countries are also considered in accordance with the "push-pull factors" approach.

$$Ci_{jt} = \lambda_j + \beta Inf_{jt} + \delta Fin_{jt} + \phi X_{jt} + \lambda_t + \varepsilon_{jt} \quad (1)$$

Ci_{jt}, is a type i of private capital flow[10] received by the country j in year t. Inf_{jt} is the variable of physical infrastructures and Fin_{jt} the variable of financial development. X_{jt} is the matrix of the control variables. The country and time fixed effects are respectively λ_j and λ_t while ε_{jt} is the error term. Because our sample is only made up of developing countries, the time fixed effects capture external factors. The growth rate or the interest rate of the developed countries, important variables in the determination of short term capital (especially portfolio), represent common shocks to all developing countries at a given moment and is therefore captured by time fixed effects. Capital market imperfections, which can be approximated by the distance between countries, reflecting informational asymmetry (Coval and Moskowitz, 1999, 2001), are partly taken into account in the country fixed effects.

The two equations of capital inflows could be estimated with standard fixed effect estimation. However this would suppose that the amount of the FDI received by a country is independent of the amount of portfolio investments received by this country. In other words, we suppose that the error terms of our two equations are not correlated. This rather restrictive assumption is not verified since a high number of identical variables explain the two components of capital flows. For example, significant FDI in a country can be the source of more portfolio investment. Thus, it is important to consider the correlation of error terms which can affect the significance of the coefficients. The empirical model for estimation will be a system of equations as follows:

$$\begin{cases} FDI_{jt} = \lambda_j + \beta_1 Inf_{jt} + \delta_1 Fin_{jt} + \phi_1 X_{jt} + \lambda_t + \varepsilon_{jt} \\ PORT_{jt} = \lambda_j + \beta_2 Inf_{jt} + \delta_2 Fin_{jt} + \phi_2 X_{jt} + \lambda_t + \varepsilon \end{cases} \quad (2)$$

FDIjt and *PORTjt* represent net inflows of FDI and portfolio investments in country *j in* year *t,* respectively. The definition of the other explanatory variables remains identical to those given in equation 1. The use of Seemingly Unrelated Regression (SUR) would be more efficient than the standard fixed effect model (Arellano, 1987) since SUR takes into account the correlation between the errors terms. Our objective is to assess the effect of the infrastructure variables on private capital inflows. It is very likely that private capital flows received by a country affect the financial development and the physical infrastructure development of countries. This potential simultaneity can be a source of endogeneity. In order to solve this problem, which is confirmed by the Nakamura-Nakamura test, we define three instruments: the lagged value of physical infrastructure, the lagged value of financial development variables, and the regulation of credit market as financial development variable instrument[11]. For the estimations, we use 3SLS which, like 2SLS, deals with the endogeneity problem but also deals with the correlation between the errors terms of the equations like SUR method. Under the null assumption of good specification of all equations in the model, 3SLS is more efficient since it deals with the correlation of different equations' error terms. However, when at least one equation in the system is misspecified, this misspecification extend to all systems by the correlation of error terms, leading to biased and less consistent coefficients. In this case, the 2SLS estimator, although less efficient, is preferable since there is no correlation in error terms and it is consistent, even in the case of the misspecification of one equation in the system. Although results obtained by the 2SLS (appendix 6) do not differ significantly, a Hausmann test confirms the preference for 3SLS.

VI.3. Results

We first consider an index of physical and financial infrastructure obtained with principal components analysis which avoids possible problems of colinearity between infrastructure variables (appendix 3). We retain as physical infrastructure variables the proportion of subscribers of fixed and mobile phone service in the population and electric consumption per capita. The variables measuring financial development in the principal components analysis are the ratio M3/GDP, the credit to private sector, and the deposits in financial institutions. The following table gives the results of an estimation obtained with 2SLS for the aggregated

[10] In the analysis of private capital determinants, we take as dependent variables capital flows in proportion of the GDP. Beyond the size of the economy and development level taken into account by this specification, such specification allows a simpler interpretation of our coefficients since a great number of our explanatory variables (including our variables of interests) are expressed as a percentage of GDP.

[11] This credit market regulation variable indicates governments' constraints or incentives in term of control of interest rates on deposits and bank loans. An instrument for financial development commonly used in the literature is the legal origin, which cannot be used in our case because it is already included in the country fixed effects.

variable -private capital: FDI plus portfolio investments- and with 3SLS for the estimation of FDI and portfolio investments separately. A second method of aggregation of physical and financial infrastructure variables' in an index is also used: each variable is standardized through the difference between the variable and its average and the result is divided by the standard deviation of the variable. The index is simply the sum of the standardized variables. This method gives to each variable an equivalent weight in the calculation of the index.

Table 1: Estimation with physical and financial infrastructures index

	Dependants Variables					
	Private capital	**FDI**	**Portfolio I.**	**Private capital**	**FDI**	**Portfolio I.**
Explanatory Variables	*2SLS*	*3SLS*	*3SLS*	*2SLS*	*3SLS*	*3SLS*
Infrastructure[1]	0.664	0.392	0.191			
	(2.25)**	(1.84)*	(1.88)*			
Infrastructure[2]				0.326	0.220	0.069
				(2.49)**	(2.32)**	(1.53)
Control	-1.303	-0.906	-0.295	-1.219	-0.853	-0.273
	(1.94)*	(1.85)*	(1.27)	(1.83)*	(1.76)*	(1.19)
Growth	0.222	0.198	0.049	0.212	0.199	0.041
	(3.44)***	(4.26)***	(2.19)**	(3.51)***	(4.58)***	(1.97)**
Inflation	-0.0002	-0.001	0.0003	-0.0004	-0.001	0.0002
	(0.35)	(1.55)	(1.37)	(0.59)	(1.73)*	(1.08)
Openness	-1.453	-0.778	-0.621	-1.353	-0.850	-0.478
	(1.19)	(0.87)	(1.48)	(1.18)	(1.01)	(1.21)
Education	-0.303	-0.488	0.199	-0.378	-0.536	0.181
	(0.46)	(1.01)	(0.87)	(0.58)	(1.12)	(0.80)
Political Stab.	-0.003	0.010	-0.014	-0.006	0.008	-0.015
	(0.22)	(1.02)	(3.04)***	(0.46)	(0.80)	(3.22)***
Crisis	-0.704		-0.103	-0.710		-0.097
	(2.69)***		(1.16)	(2.74)***		(1.10)
R^2	0.69	0.73	0.26	0.69	0.73	0.27
Sargan Stat.	0.32	0.10	0.34	0.54	0.26	0.34
(p-value)	(0.57)	(0.25)	(0.44)	(0.46)	(0.39)	(0.44)
Observations	203	203	203	203	203	203
Countries	47	47	47	47	47	47

z statistics in parentheses.

All regressions include time and country fixed effects.

significant at 10%; ** significant at 5%; *** significant at 1%

1 Infrastructure index by principal component analysis

2 Infrastructure index by standardization

Before interpreting the results obtained with the infrastructure index, let us separately estimate physical and financial infrastructures in two different equations in order to address criticisms generally made to aggregate indicators that cannot distinguish the partial contribution of each variable. The following table gives the results of estimation considering a proxy for physical infrastructure (the proportion of fixed and mobile phone subscribers) and another one for financial development (M3/GDP) separately.

Table 2: Estimation in 3SLS with differentiation of physical and financial infrastructure

	Dependant Variables	
Explanatory Variables	**FDI**	**Portfolio I.**
Telephone	0.031	-0.009
	(2.18)**	(1.47)
M3/GDP	-0.010	0.018
	(0.58)	(2.38)**
Control	-0.872	-0.326
	(1.98)**	(1.76)*
Growth	0.113	0.036
	(3.08)***	(2.27)**
Inflation	-0.001	0.0003
	(2.88)***	(1.63)
Openness	1.215	-0.527
	(1.48)	(1.51)
Education	-0.845	0.297
	(1.84)*	(1.53)
Political Stab.	0.007	-0.012
	(0.68)	(2.90)***
Crisis		-0.083
		(1.11)
R^2	0.70	0.21
Sargan Stat.	1.83	0.31
(p-value)	(0.82)	(0.42)
Observations	258	258
Countries	61	61

z statistics in parentheses.

All regressions include time and country fixed effects.

significant at 10%; ** significant at 5%; *** significant at 1%

Instruments diagnostic with first-stage regressions statistics (partial R², Shea partial R², partial F-test, Cragg-Donald Statistics) reject the hypothesis of weak instruments (appendix 5). Sargan overidentification test also do not reject the validity of the instruments. With the index of infrastructure compared to physical and financial infrastructure variables taken separately, the results do not differ significantly for the control variables. Thus, macroeconomic instability characterized by a high inflation or a banking crisis negatively affects inflows of FDI and portfolio investments in developing countries. Capital controls have a negative effect on private capital inflows and a good economic situation characterized by a high growth rate positively influences capital flow to developing countries. Education has a negative effect on FDI and a positive effect on portfolio investments. This result could be due to the fact that some developing countries with low rates of schooling attract FDI for natural resource exploiting sectors (mining for example), which is not the case for portfolio investments. Political stability, measured by regime durability, has a negative effect on portfolio investments inflows. Countries with greater regime duration attract less portfolio investments. This result illustrates the fact that in a consequent number of developing countries, particularly African countries, some leaders have larger tenure generally under autocratic regime which is not necessary the sign of a stable social climate. Let us note that since portfolio investments are short term flows, they are sensitive to sociopolitical troubles, not necessarily involving a regime change.

Concerning our two variables of interest (physical infrastructure and the financial development), the index of physical and financial infrastructure, obtained either by the principal component analysis or by the standardization method, positively and significantly affects private capital flows and each of its components (FDI or portfolio investments). Physical and financial infrastructures have a stronger impact on FDI than on portfolio investments, but this result gives no indication of the respective importance of physical or financial

infrastructures in the attractivity of FDI or portfolio investments. Table 2 deals with this question by underlining the fact that physical infrastructure only affects FDI inflows while financial infrastructures only have a significant effect on portfolio investments. Indeed, a rise of 10 percentage points in the number of fixed and mobile phone subscribers increases FDI inflows by 0.3 percentage points. This result illustrates the existence of a minimal condition in order to guarantee prosperity of investments and thus attract FDI. The implementation of a great number of economic activities (especially industrial ones) requires a minimum of communication infrastructures (telephones, roads, etc.) allowing or facilitating the access to raw and intermediate materials but also access to markets and thus reducing production costs. The government usually provides financing for infrastructure, given that a firm can hardly support the cost by itself. Hence the existence of these infrastructures creates a favourable environment for investments, foreign investments in particular.

Portfolio investments are more volatile, and are relatively scarce in developing countries. Of the two infrastructure variables, only financial development significantly and positively affects portfolio investment flows to developing countries. A rise of 10 percentage points in the liquidity liabilities (M3/GDP) leads to a rise of 0.18 percentage points of portfolio investments. Inflows of portfolio investments require high level of financial development since this type of capital flow is, most frequently, negotiated in stock markets. Well developed financial markets improve information circulation, which reduces the potential risk taken by investors on this market and also transaction cost.[12]

VI.4. ¶Robustness check and African specificity

Alternative explanatory variables

The literature suggests several variables that capture physical infrastructures available or the financial development of a country. We considered the percentage of subscribers of fixed and mobile phone service in the population as a proxy for physical infrastructure and liquid liability (M3/GDP) as a proxy of financial development. Our results can be influenced by the choice of these variables. To address this, we estimate the system of equations with electric consumption per capita to reflect physical infrastructure and credit to private sector (in % of the GDP) as the financial development variable. Our results (appendix 9) are robust to the use of these alternative interest variables.

Our variable of regime durability does not capture all socio-political climate aspects like violent protests without regime change. Property rights protection should be a significant institutional variable capturing this political aspect and expropriation risks, which are important for short term speculators and long term investors. Since portfolio investments are short term flows, high variability in exchange rates could also cause uncertainty in the return on these investments. Considering the property rights and exchange rate variability variables, our main results remain robust (appendix 9).

Non-linear relationship

Up to this point, we tested linear relations whereas the physical infrastructures may have a congestion effect. Even if the number of subscribers to telephone service or electric consumption per capita has a positive effect on capital inflows, it would be possible that this positive effect vanishes above a certain level of telephone subscribers or electric consumption (which could be due to waste for example). Concerning the level of financial infrastructure, a rise in credit or liquid liabilities can be a signal of financial development but an excessive money supply or private credit can also indicate bad management of monetary policy or be the precursory sign of a financial crisis. Appendix 10 shows the results considering possible threshold effects of infrastructures and financial development[13]. Our main results are confirmed with a greater effect of physical and financial infrastructures on FDI and portfolio investment inflows. Considering non linearity leads to a positive effect of physical infrastructures on portfolio investment flows with significant threshold effect for both physical and financial infrastructures in portfolio investments inflows. Although non significant, financial development has a positive effect on FDI inflows, and the positive effect of physical infrastructures also presents a significant threshold.

[12] Our analysis seems to show that in majority FDI and the portfolio investments are explained by identical determinants. It is important to note that some specific determinants of portfolio investment attractivity relate to the international economic situation: mainly international interest and growth rate approximated by those of developed countries. As mentioned above, these important variables for portfolio investment are taken into account in the time fixed effects.

[13] The Ramsey-Reset test confirms the non linearity suspected for the variables of physical and financial infrastructures.

Structural break and African Specificity

As illustrated in the analysis of capital inflows in Section V, private capital inflows, especially FDI to developing countries, started an exponential rise since 1990 with a peak before the Asian crisis. Important reforms in liberalization of current and capital accounts were undertaken by developing countries at the beginning of the 1990's within the framework of the Washington Consensus in order to attract more private capital. A temporal Chow test before and after 1990 enables us to show stability of our coefficients during the two periods. There is thus no differentiated effect on the determinants of private capital due to the reforms, and no specificity before and after the 1990's crises in the private capital determinants[14]. The analysis of private capital inflows to developing countries (Section V) also shows a marginalisation of Sub-Saharan African countries. Analysis of the Sub-Saharan African sample shows African specificity which is confirmed by the Chow test. Considering only Sub-Saharan African countries, the results show that only the physical infrastructures positively and significantly affect FDI inflows. For FDI, this impact of physical infrastructures is relatively more significant compared to other developing countries. A rise of 10 percentage points in the number of subscribers to fixed and mobile phone service increases FDI inflows to Sub-Saharan African countries by 0.52 percentage points. This same increase in phone subscribers increases FDI inflows to all developing countries by only 0.3 percentage points (appendix 11). These results may be explained by the fact that most Sub-Saharan African countries have developed little physical and financial infrastructure but also do not attract significant portfolio investments.

A better investment climate in Sub-Saharan Africa countries should increase private capital flows to these countries. Beyond the econometric analysis, appendix 12 with a simple statistical analysis, show that Sub-Saharan Africa countries have a lower level of physical and financial infrastructure and also attract less private capital compared to other developing countries. On average over the period 1970-2003, Sub-Saharan Africa countries have 2% of their population which are telephone subscribers when this number is 5% for Asian countries and 12% for Latin America countries. For financial development (M3/GDP), Sub-Saharan Africa countries have a ratio of 25, compared to 44 for Asian countries and 39 for Latin American countries (appendix 12). A simple simulation shows that if Sub-Saharan Africa countries reach the same level of physical infrastructure development as Asia countries, this would result to an increase of FDI inflows by 6.1 percentage points. This simulation gives of course a broad idea about the importance of physical infrastructure in Sub-Saharan Africa attractiveness to FDI.

VII Conclusion

The aim of our study was to analyze the effect of physical infrastructure and financial development on private capital flows to developing countries. Using two different methods to calculate an index of physical and financial infrastructures and using 3SLS, we find that infrastructure significantly and positively affects the FDI and portfolio inflows in developing countries. With physical and financial infrastructure variables used separately, the results suggest that physical infrastructure only fosters FDI inflows while financial development has a positive effect on portfolio investments. Considering the existence of threshold effects for infrastructure, which appear to be significant, we show that physical as well as financial infrastructures positively affect both FDI and portfolio investments.

Capital flows to developing countries have been marked by two great episodes. In both periods, Sub-Saharan African countries were marginalised. A study of African specificity (in attracting capital) enables us to underline the relatively more significant role of physical infrastructure in attracting FDI inflows. An improvement of infrastructure and financial service should thus allow developing countries, and particularly Sub-Saharan African countries, to attract more private capital, which is necessary for their development. Physical infrastructure has a more significant role in attracting FDI while portfolio investments are instead affected by financial development and the physical infrastructure; hence the results support a complementarity between physical and financial infrastructure in the attractivity of private capital (FDI and portfolio investment).

Beyond their direct effect on economic growth through increasing productivity, the development of infrastructure should attract more private investments, in particular from abroad. Program such as the NEPAD (New Partnership for Africa's Development), in Africa aims to find more funds for infrastructure. Our study encourages this type of initiative for a continent which should benefit considerably from the development of its infrastructure by attracting private capital, in particular FDI.

[14] Data availability does not allow the test of other dates of potential ruptures or a Andrews-Quandt test which would enable to determine the break point. The choice of the break period, although imposed to us by the data is also justified theoretically.

It is also important to note that three principal financial crises in developing countries were very closely linked to debts and portfolio investments inflows. Policies aiming to attract more private capital must also consider the possible unwanted effects. However, the great majority of private capital flows to developing countries are currently FDI, which are long term stable flows.

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Appendixes

Appendix 1: List of variables

Variables	*Definitions*	*Sources*
FDI	Foreign direct investment, net inflows (% of GDP)	
PORTFOLIO I.	Portfolio investment, equity (% of GDP)	Global Development Finance (2005)
DEBT	Bank and trade-related lending (% of GDP)	
M3/GDP	Liquid liabilities (M3) as % of GDP	
Credit	Domestic credit provided by banking sector (% of GDP)	Financial Structure Dataset (2006)
Deposit	Financial System Deposits (% of GDP)	
Telephone	Fixed line and mobile phone subscribers per 100 inhabitants	
Electricity	Electric consumption per capita	
Growth	Economic growth rate	
Inflation	Inflation rate	World Development Indicators (2005)
Openness	Sum of exports and imports of goods and services as a share of gross domestic product.	
Change	Exchange rate variability (standard deviation)	
Control	Capital control indicator : average of four dummies: Exchange arrangements, payments restrictions on current transactions and on capital transactions, and repatriation requirements for export proceeds	Milesi Ferretti (1970-1997) and Annual Report on Exchange Arrangement and Exchange Restrictions (1998-2003)

Crisis	Financial crisis dummy	Caprio and Klingebel (2003)
Education	Average schooling years in the total population	Barro and Lee (2003)
Political Stab.	Regime durability	Polity IV (2002)
Regulation	Credit market regulation	Fraser Institue (2005)
Property	Property right Protection	

Appendix 2: Illustration of Lucas paradox among developing countries

	Dependant Variable: Private Capital per capita	
Explanatory Variables	*Fixed Effect*	*2SLS*
GDP per capita	0.065	0.061
	(11.68)***	(6.43)***
Constant	-5.301	-15.896
	(0.46)	(0.78)
Observations	668	571
Countries	106	106
R²	0.25	0.29

t statistics in parentheses

All regressions include time and country fixed effects.

significant at 10%; ** significant at 5%; *** significant at 1%

Appendix 3: Correlation between the main variables

	FDI	**Portfolio I.**	**Telephone**	**Electricity**	**M3/GDP**	**Credit**	**Deposit**
FDI	1						
Portfolio I.	0.0812	1					
Telephone	0.2401*	0.0587	1				
Electricity	0.3146*	0.2042*	0.6613*	1			
M3/GDP	0.1080*	0.1006*	0.3543*	0.2998*	1		
Credit	-0.0276	0.2246*	0.2933*	0.4181*	0.7031*	1	
Deposit	0.1849*	0.1408*	0.4365*	0.4170*	0.9506*	0.7109*	1

* significant at 10%

Appendix 4: Eigenvalue and variance with principal components analysis

Principal components	**Eigenvalue**	**Proportion of variance**	**Cumulative Variance**
1	3.07	0.61	0.61
2	1.19	0.24	0.85
3	0.42	0.09	0.94
4	0.27	0.05	0.99
5	0.05	0.01	1.00

	Eigenvectors				
Variable	**1**	**2**	**3**	**4**	**5**

M3/GDP	0.50	-0.36	-0.31	-0.23	0.69
Deposit	0.53	-0.25	-0.26	-0.28	-0.72
Credit	0.47	-0.26	0.60	0.59	-0.01
Telephone	0.34	0.63	-0.49	0.50	0.02
Electricity	0.37	0.59	0.49	-0.52	0.09

Appendix 5: First-stage equation

	FDI		**Portfolio I.**	
Excluded Instruments	Telephone	M3/GDP	Telephone	M3/GDP
Telephone_1	1.979	0.014	1.978	0.007
	(26.85)***	(0.08)	(26.75)***	(0.04)
M3/GDP_1	0.013	0.519	0.013	0.518
	(0.54)	(8.84)***	(0.53)	(8.83)***
Regulation	0.038	0.654	0.035	0.642
	(0.19)	(1.29)	(0.17)	(1.27)
Weak instruments diagnostics				
Shea Partial R²	0.81	0.30	0.80	0.30
Partial R²	0.81	0.30	0.81	0.30
Partial F	269.21	26.52	267.46	26.42
p-values	0.00	0.00	0.00	0.00
Cragg-Donald F stat.	26.10		26.03	
Stock and Yogo Critical values				
10%	13.43		13.43	
15%	8.18		8.18	
20%	6.40		6.40	

* significant at 10%; ** significant at 5%; *** significant at 1%

Appendix 6: 2SLS Regressions with infrastructure index

	Dependant Variables					
Explanatory Variables	**Private capital**	**FDI**	**Portfolio I.**	**Private capital**	**FDI**	**Portfolio I.**
Infrastructure[1]	0.664	0.433	0.196			
	(2.25)**	(1.71)*	(1.62)			
Infrastructure[2]				0.326	0.240	0.071
				(2.49)**	(2.14)**	(1.34)
Control	-1.303	-0.909	-0.302	-1.219	-0.850	-0.279
	(1.94)*	(1.57)	(1.10)	(1.83)*	(1.48)	(1.03)
Growth	0.222	0.203	0.047	0.212	0.203	0.039
	(3.44)***	(3.69)***	(1.78)*	(3.51)***	(3.96)***	(1.58)
Inflation	-0.0002	-0.001	0.0003	-0.0004	-0.001	0.0003
	(0.35)	(1.23)	(1.20)	(0.59)	(1.39)	(0.96)
Openness	-1.453	-0.878	-0.625	-1.353	-0.949	-0.480
	(1.19)	(0.83)	(1.25)	(1.18)	(0.95)	(1.02)

Education	-0.303	-0.486	0.198	-0.378	-0.538	0.179
	(0.46)	(0.85)	(0.73)	(0.58)	(0.95)	(0.67)
Political Stab.	-0.003	0.010	-0.014	-0.006	0.008	-0.015
	(0.22)	(0.86)	(2.55)**	(0.46)	(0.66)	(2.70)***
Crisis	-0.704		-0.143	-0.710		-0.139
	(2.69)***		(1.33)	(2.74)***		(1.31)
R^2	0.69	0.73	0.25	0.69	0.73	0.27
Sargan Stat.	0.32	0.06	0.15	0.54	0.20	0.12
(p-value)	(0.57)	(0.80)	(0.70)	(0.46)	(0.64)	(0.73)
Observations	203	203	203	203	203	203
Countries	47	47	47	47	47	47

z statistics in parentheses. All regressions include time and country fixed effects.

significant at 10%; ** significant at 5%; *** significant at 1%

1 Infrastructure index with principal component analysis. 2 Infrastructure index with standardization method

Appendix 7: 2SLS regressions with physical and financial infrastructure variables

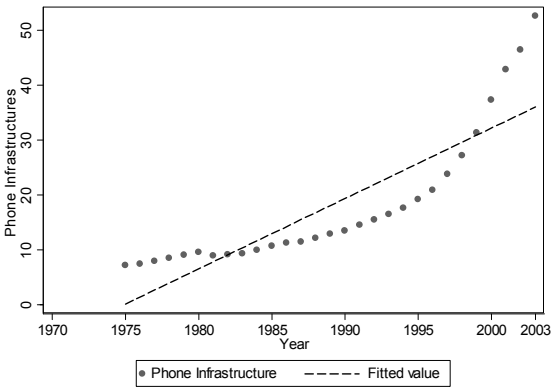
	Dependant Variables	
Explanatory Variables	**FDI**	**Portfolio I.**
Telephone	0.031	-0.009
	(1.86)*	(1.23)
M3/GDP	-0.005	0.019
	(0.22)	(2.04)**
Control	-0.871	-0.327
	(1.68)*	(1.49)
Growth	0.119	0.035
	(2.75)***	(1.87)*
Inflation	-0.001	0.000
	(2.32)**	(1.42)
Openness	1.053	-0.535
	(1.08)	(1.30)
Education	-0.833	0.295
	(1.54)	(1.28)
Political Stab.	0.006	-0.012
	(0.55)	(2.43)**
Crisis		-0.111
		(1.25)
R^2	0.70	0.31
Sargan Stat.	1.724	0.179
(p-value)	(0.19)	(0.67)
Observations	258	258
Countries	61	61

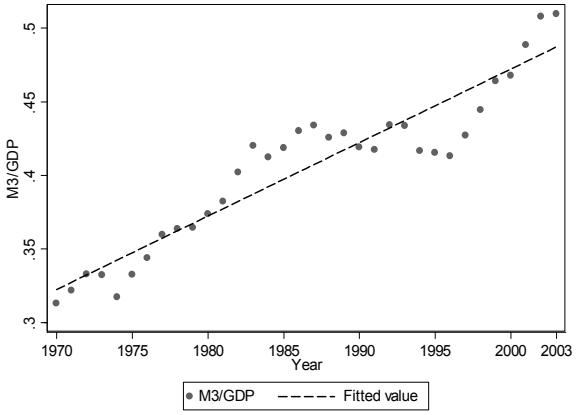
z statistics in parentheses.

All regressions include time and country fixed effects.

significant at 10%; ** significant at 5%; *** significant at 1%

Appendix 8: Evolution of physical and financial infrastructures in developing *countries*





Appendix 9: Robustness checks

	Dependant Variables					
Explanatory Variables	**FDI**	**Portfolio I.**	**FDI**	**Portfolio I.**	**FDI**	**Portfolio I.**
Electricity	0.001	-0.0002				
	(2.21)**	(1.15)				
Credit	1.610	1.231				
	(1.27)	(2.29)**				
Telephone			0.028	-0.009	0.037	-0.011
			(2.05)**	(1.52)	(2.50)**	(1.72)*
M3/GDP			-0.011	0.019	-0.010	0.018
			(0.59)	(2.33)**	(0.54)	(2.33)**
Control	-0.842	-0.180	-0.574	-0.337	-0.764	-0.361
	(2.13)**	(1.07)	(1.31)	(1.72)*	(1.71)*	(1.91)*
Growth	0.167	0.046	0.128	0.043	0.117	0.035
	(4.07)***	(2.62)***	(3.14)***	(2.33)**	(3.16)***	(2.19)**
Inflation	-0.001	0.0001	-0.001	0.0003	-0.001	0.0003
	(2.27)**	(1.03)	(2.82)***	(1.63)	(2.84)***	(1.60)
Openness	-0.190	-0.309	0.734	-0.524	1.148	-0.504
	(0.26)	(1.01)	(0.91)	(1.46)	(1.39)	(1.44)
Education	-0.689	0.217	-0.814	0.318	-0.872	0.305
	(1.85)*	(1.37)	(1.76)*	(1.54)	(1.90)*	(1.57)
Political Stab.	0.009	-0.006	0.009	-0.012	0.007	-0.012
	(0.93)	(1.61)	(0.94)	(2.92)***	(0.71)	(2.93)***
Crisis		-0.092		-0.088		-0.081
		(1.30)		(1.14)		(1.09)
Property			0.023	-0.017		
			(0.26)	(0.44)		
Change					-0.400	0.128
					(1.16)	(0.88)
R^2	0.67	0.20	0.72	0.22	0.70	0.22
Sargan Stat.	0.69	0.75	1.89	0.42	2.22	0.44

(p-value)	(0.59)	(0.61)	(0.83)	(0.48)	(0.86)	(0.49)
Observations	266	266	246	246	258	258
Countries	48	48	61	61	61	61

z statistics in parentheses.

All regressions include time and country fixed effects.

significant at 10%; ** significant at 5%; *** significant at 1%

Appendix 10: Non linearity check

	Dependant Variables	
Explanatory Variables	**FDI**	**Portfolio I.**
Telephone	0.168	0.096
	(2.12)**	(2.48)**
M3/GDP	0.041	0.072
	(0.89)	(2.96)***
Telephone^2	-0.002	-0.001
	(1.76)*	(2.57)**
M3/GDP^2	-0.000	-0.001
	(1.26)	(3.57)***
Control	-0.108	0.122
	(0.22)	(0.53)
Growth	0.134	0.020
	(3.70)***	(1.18)
Inflation	-0.001	0.001
	(1.59)	(2.44)**
Openness	0.522	-0.026
	(0.73)	(0.08)
Education	-1.134	0.063
	(2.27)**	(0.27)
Political Stab.	0.002	-0.018
	(0.24)	(4.11)***
Property	0.016	0.005
	(0.18)	(0.13)
Crisis		0.047
		(0.59)
Change		1.330
		(0.67)
R^2	0.73	0.24
Sargan Stat.	1.60	5.09
(p-value)	(0.79)	(0.97)
Observations	246	246
Countries	61	61

z statistics in parentheses.

All regressions include time and country fixed effects.

significant at 10%; ** significant at 5%; *** significant at 1%

Telephone^2 and M3/GDP^2 are the squared values of Telephone and M3/GDP

Appendix 11: 3SLS estimation for Sub-Saharan Africa

	Dependant Variables					
	Total Sample		***Sub-Saharan Africa***		***Sub-Saharan Africa***	
Explanatory Variables	**FDI**	**Portfolio I.**	**FDI**	**Portfolio I.**	**FDI**	**Portfolio I.**
Telephone	0.029	-0.012	0.052	-0.004	0.178	0.056
	(2.12)**	(1.83)*	(2.15)**	(0.37)	(1.37)	(0.76)
M3/GDP	-0.013	0.018	-0.070	0.004	-0.026	-0.191
	(0.74)	(2.26)**	(1.50)	(0.17)	(0.14)	(1.26)
Control	-0.563	-0.379	0.866	0.090	1.247	-0.388
	(1.28)	(1.90)*	(1.29)	(0.27)	(1.36)	(0.64)
Growth	0.125	0.041	-0.010	-0.020	-0.008	-0.036
	(3.06)***	(2.21)**	(0.23)	(0.90)	(0.19)	(1.28)
Inflation	-0.001	0.000	-0.015	0.000	-0.016	-0.005
	(2.88)***	(1.58)	(3.28)***	(0.03)	(2.69)***	(1.24)
Openness	0.797	-0.492	3.112	0.013	2.814	0.938
	(0.99)	(1.36)	(3.06)***	(0.02)	(1.94)*	(0.97)
Education	-0.830	0.327	-1.163	0.560	-1.546	0.415
	(1.80)*	(1.59)	(1.80)*	(1.74)*	(2.03)**	(0.96)
Political Stab.	0.009	-0.012	-0.000	-0.021	0.002	-0.026
	(0.94)	(2.96)***	(0.02)	(4.61)***	(0.18)	(4.00)***
Property	0.028	-0.016	0.233	0.105	0.197	0.253
	(0.31)	(0.41)	(2.18)**	(1.95)*	(1.17)	(1.92)*
Crisis		-0.089		-0.039		-0.200
		(1.15)		(0.35)		(1.14)
Change		0.155		-0.357		28.223
		(1.05)		(0.01)		(0.68)
Telephone^2					-0.002	-0.002
					(1.00)	(1.41)
M3/GDP^2					-0.000	0.002
					(0.19)	(1.33)
R^2	0.72	0.23	0.83	0.53	0.82	0.37
Sargan Stat.	0.54	1.99	0.50	0.02	0.35	0.03
(p-value)	(0.53)	(0.84)	(0.52)	(0.12)	(0.45)	(0.14)
Observations	246	246	79	79	79	79
Countries	61	61	21	21	21	21

z statistics in parentheses.

All regressions include times and country fixed effects.

significant at 10%; ** significant at 5%; *** significant at 1%

Telephone^2 and M3/GDP^2 are the squared values of Telephone and M3/GDP

Appendix 12: Mean of main variables*

Country Group	***Private Capital***	***FDI***	***Portfolio I.***	***Debt***	***M3***	***Credit***	***Téléphone***	***Electricity***
Developing Countries	0,67	0,46	0,07	0,12	35,70	0,42	6,01	607,13

Sub-Saharan Africa	**0,10**	**0,07**	**0,02**	**0,01**	**25,60**	**0,34**	**2,43**	**449,92**
Latine America and Caribbean	1,13	0,75	0,09	0,26	38,91	0,48	12,28	850,20
Asia	1,01	0,71	0,11	0,13	44,40	0,47	5,27	487,72

*Private capital variables are in US$. Physical and financial infrastructure variables are in % of GDP. Electric consumption is per capita and telephone subscribers in % of the population.

Appendix 13: Sample for estimation

Sub-Saharan Africa	**Latin America and Caribbean**	**Asia**
Benin	Argentina	Algeria
Botswana	Bolivia	Bangladesh
Burundi	Brazil	Egypt
Cameroon	Chile	Fiji
Central African Republic	Colombia	India
Congo, Rep.	Costa Rica	Indonesia
Ghana	Dominican Republic	Iran
Kenya	Ecuador	Jordan
Malawi	El Salvador	Malaysia
Mali	Guatemala	Nepal
Mauritius	Guyana	Pakistan
Niger	Haiti	Papua New Guinea
Rwanda	Honduras	Philippines
Senegal	Jamaica	Sri Lanka
Sierra Leone	Mexico	Syrian Arab Republic
South Africa	Nicaragua	Thailand
Tanzania	Panama	Turkey
Togo	Paraguay	Tunisia
Uganda	Peru	
Zambia	Trinidad and Tobago	
Zimbabwe	Uruguay	
	Venezuela	

The Determinants of Remitances: A Comparison between Albania and Moldova

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Abstract

Using household survey data for Albania and Moldova, this paper compares remittance behaviour between the two countries. We investigate remittances from the receiver's perspective, analysing the characteristics of both the remitter and remittance receiving household. This paper seeks to empirically test the amount of remittances in both countries using Tobit models. We focus on testing the theoretical motives to remit such as altruism, loan repayment, insurance (family or self-provided), the bequest motive and the New Economics of Labour Migration. Although Albania and Moldova are rather similar in terms of social and political background, size and economic situation, we see different remitting behaviour emerge for the two countries. We find evidence for self-provided insurance in Albania. We also find significant results for the bequest motive and altruism. For Moldova, we find significant results for the loan repayment motive with regard to the repayment of migration loans. It is apparent that there are multiple reasons why migrants remit and these depend on the different characteristics of the migrants, the receiving households and causes of migration in both the sending and receiving countries.

Keywords: migration, remittances, Albania, Moldova

1 Introduction

The recorded flows of money sent home from the 191 million worldwide migrants working abroad, known as remittances, have now reached over $200 billion. We know that at least 50 per cent of remittances are sent through informal channels, which are not recorded, bringing the total remittances sent to somewhere around $300 billion (World Bank, 2006). These flows now exceed Official Development Aid (ODA) as well as Foreign Direct Investment (FDI) (World Bank, 2006). For many countries, remittances are a very important source of finance usually making up anywhere between 5 and 40 per cent of the country's GDP.

For countries like Albania and Moldova, remittances are particularly important. With a large portion of their populations abroad, they are highly dependent on remittances as a source of alleviating poverty and they have one of the highest remittances as a percentage of GDP in the world. In this paper, we look at Albania and Moldova as specific cases of remittance receiving countries. We analyse remittances from the receivers' perspective, analysing the characteristics of both the sender (remitter) and remittance receiving household. We also test the motives to remit in both countries and compare the results.

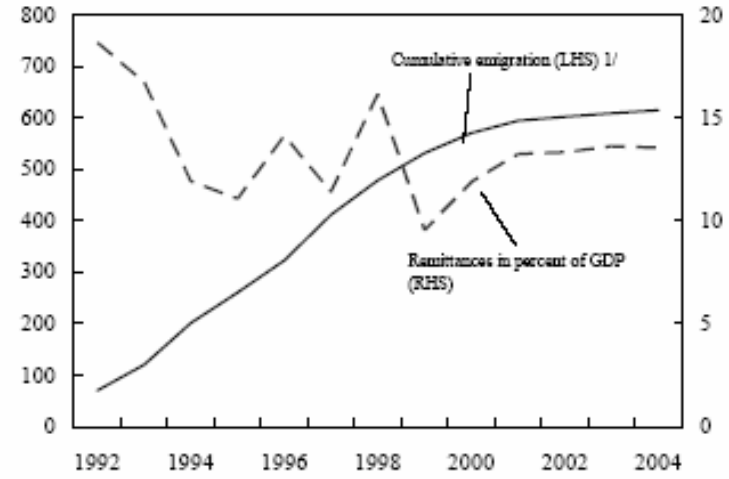
Figure1 shows cumulative migration flows from Albania. Albania has experienced dramatic and dynamic migration outflows since the end of the communist regime in 1991. Between 600,000 and 800,000 Albanians are estimated to have migrated since 1990, mostly to Greece and Italy. According to the 2001 census, 710,000 people out of a population of 3.07 million have migrated, which constitutes 23 per cent of the population (IOM, 2005). Political factors drove some of the early migration but the desperate economic situation was an

[1] We would like to thank Denis de Crombrugghe, Erik de Regt, Pawel Kaczmarczyk, Carlo Azzarri, Hannah Kiiver and Topsy Turton for their helpful comments on an earlier draft of this paper. We would also like to thank Denisa Sologon and Geranda Notten for their time and patience. We thank IMSTAT and the World Bank for the 2003 LSMS data for Albania and the IOM and Matthias Luecke for the CBS-AXA database on Moldova.

important factor from the beginning. Most of the early migrants were young and relatively well-educated, but from large and poor households (Konica, 2006). Seasonal and short term migration was especially common at the Albania-Greece border (Barjaba & King, 2005). In recent years migrants often stay abroad for longer periods of time and reunite with their families (de Zwager et al, 2005), many becoming legalised.

Figure 1 gives an overview of remittances as a percentage of Albanian GDP. Remittances have grown from $150 million in 1992 to $1 billion in 2004. In 2004 remittances made up 13.7 per cent of GDP (Zwager et al, 2005). To give an better indication of the importance of remittances in relation to other relevant indicators, remittances to Albania are 550 per cent of FDI (Schiopu and Siegfried, 2006) and 376 per cent of ODA (CIA World Factbook, 2007). Remittances are also important on the household level: In 2005 68.6 per cent of the migrants sent remittances send remittances home to their families (de Zwager et al, 2005).

Figure 1. Albania emigration and remittances



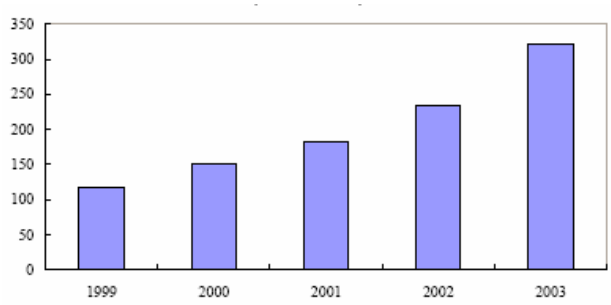
Source: IMF (2006), from IOM-Tirana (Survey estimates)

Moldova also entered an important transition phase at the beginning of the 1990s from central planning to market regulation. Because of Moldova's dependence on Russia, the breakdown of the Russian economy in the early 1990s, threw Moldova into an extreme collapse. This collapse was worse than in other Soviet Republics, in part due to a series of inappropriate policies because of misdiagnosis of the country's characteristics (Cornea et al., 2005).

Migration in Moldova was mainly driven by poverty. In such serious economic conditions, much of the population tried to find employment abroad to mitigate the difficult situation at home. Figure 2 shows the migration trends in Moldova between 1999 and 2003. There were almost 400 thousand Moldavians living abroad by 2004. As Figure 3 shows, remittances began to increase noticeably in 1998 during the regional crisis, which encouraged a continuing large-scale migration. By 2005, migrants accounted for about 28 per cent of the working population and about 18 per cent of the population of Moldova (Government of the Republic of Moldova, 2006). The recovery of the economy after 1999 was primarily driven by remittances (Cornea et. al, 2005). With increased remittances and a growing economy the poverty rate in Moldova has shrunk from 73 per cent in 1999 to around 26 per cent in 2004 (IMF, 2005), but this has not stopped the exodus of workers from Moldova.

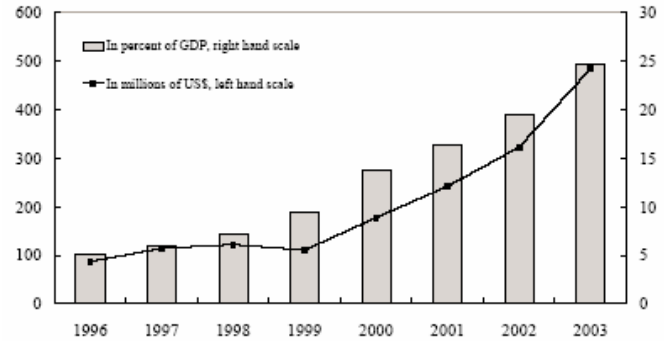
Moldovan migrants keep a strong attachment with their home and remit large portions of their income (IMF, 2005). However, while in Albania family reunification is quite frequent, Moldova also experiences male and female temporary migration. The main bulk of remitters are short-term migrants, many of whom are seasonal (working in agriculture or construction in Russia). 70 per cent of all remittances received are from temporary workers who stay abroad only part of the year (IMF, 2006). In 2004, official estimates of total remittances to Moldova were around $700 million, which is almost 27 per cent of GDP (CBS-AXA, 2005). Remittances are 796.9 per cent of FDI (WDI, 2005) and 700 per cent of ODA (CIA World Factbook, 2007).

Figure 2. Moldovan labour migration in thousands



Source: IMF (2005) from Moldovan Authorities (number of people who have declared to have left to find a job)

Figure 3. *Gross workers' remittances to Moldova*



Source: IMF (2005), National Bank of Moldova

We compare Albania and Moldova because they are in the same geographical region, are of a similar size, have a large part of their population abroad. Both countries come from a similar Communist background, but Albania was one of the most isolated Communist regimes, where no migration at all was allowed and one of the countries that pushed transition the fastest. Nevertheless, their current economic situation is similar: They are two of the poorest countries in Europe, with weak social protection systems and weak financial sectors and rely heavily on remittances as a source of external finance. In Moldova, foreign exchange is equivalent to almost half of export earnings and in Albania remittances are almost as large as exports (Mansoor and Quillin, 2006). Remittances financed the growing trade deficit in both Albania and Moldova.

As was shown above, remittances play an important role for both Albania and Moldova. Remittances have been linked to poverty alleviation and have been found to have a positive impact on poverty reduction in the region (Mansoor and Quillin, 2006). They can be seen as a kind of social protection strategy in countries where government supplied social protection is limited. Since remittances play such an important role on the macroeconomic and microeconomic level in Albania and Moldova it is relevant and interesting to ask what are the driving forces behind remittances. Why and who sends remittances in those countries? These driving forces are of major interest to policy makers wishing to attract more remittances (i.e. investment) as well as to researchers focusing on the determinants of private transfers.

This paper builds on the growing literature on the theoretical and empirical determinants of remittances. We focus on testing the theoretical motives to remit such as altruism, co-insurance, loan repayment, the bequest motive and the New Economics of Labour Migration. We employ a Tobit model to test the motives to remit. We use household survey data from Albania and Moldova that is from the receiving perspective.

Section two discusses the theoretical as well as empirical background of the paper, giving an overview of earlier studies on the probability to remit and the amount of remittances sent. Section three covers the methodology and data used. Section four reports and analyses the results and section five concludes.

2. Literature review of determinants of remittances

In this section we review the current state of literature on the determinants of remittances. While the decision to remit may be clearly linked to the causes of migration, for example, in the theory the New

Economics of Labour Migration, we take the causes of migration literature as given[2] and broadly focus on the determinants of remittances. Most of the literature is based on empirical applications; hence we will focus on clearly summarising existing findings before comparing the results to our own. We start by giving the theoretical background of the determinants of remittances and then briefly discuss the literature that focuses on the macroeconomic level. We conclude with a more extensive section on the empirical applications on the micro-economic determinants of remittances; the focus of our paper.

2.1 Theoretical determinants of remittances

The theoretical debate about the determinants of remittances was triggered by Lucas and Stark (1985) with their ground-breaking paper "Motivations to remit: Evidence from Botswana", which is still the basis of the current discussion and extensions. Lucas and Stark studied remittances on a household level and hypothesized the main determinants to be "pure altruism", "pure self-interest" and "tempered altruism or enlightened self-interest". Any kind of contractual arrangements between the migrant and household left behind can be in the latter category, for example co-insurance, exchange-motives, loan repayment. The theoretical motives and their effects on remittances are summarised in table 2.1.We give a more detailed discussion of the motives below.

Table 2.2. Theoretical determinants of remittances

Effect of ... on level of remittances	**household income**	**migrant income**	**household shock**	**migrant risk level**	**education level of migrant**	**intent to return**	**no. of migrants in HH**	**time**
Pure altruism	-	+	+			+	-	-
Pure self-interest	+	+						
Co-insurance	-		+	+				
Loan repayment	+ / -	+			+			+, later -
Exchange motives	+ / -	+			+			
Strategic behaviour	-	+	+					

It is natural to assume that remittances are sent to the family left behind due to altruistic feelings of the migrant. This can be modelled in a Becker type setting where the migrant derives positive utility from the consumption of the family. The migrant thus cares about poverty, shocks, etc. of the family and consequently sends remittances. In this case, there is a positive relationship between adverse conditions of the receiving household and remittances sent, see Table 2.1. Remittances should increase with migrant income (the migrant has more to share) and altruism and decrease with recipient income (Funkhouser, 1995). However, income does not necessarily have a linear effect. As Cox, Eser and Jimenez (1997) demonstrate, income may have a different effect at different points of the income distribution.[3]

In contrast to altruism, self-interest is also a motivation to remit. In this case a migrant sends remittances with the aspiration to inherit, to demonstrate laudable behaviour as an investment for the future or with the intent to return home. If a migrant wants to invest at home, the household can be a trustworthy and well-informed agent. If a migrant intends to return home, he may already invest in housing, livestock etc. and will ask the family to be the agent. The migrant may also send remittances to invest in his reputation at home. Inheritance may be used as a blackmailing device by the household head to receive remittances. According to this theory, remittances increase with the household's assets and income, the probability of inheriting (dependent on the age of parents, number of siblings, etc.), the migrant's wealth and income, and decreases with risk aversion. Only in the case of the aspiration to inherit, can self-interest be distinguished from altruism in the migrant's behaviour and a larger income and or wealth of the household should lead to more remittances. Finally, in a three generation setting, remittances may be sent to parents to ensure that the remitter's own children also take care of him in old age (Cox & Stark, 1994), known as the demonstration effect. Care and transfers have to be visible to the grandchildren generation for maximum effect.

[2] See Massey, D., Arango, J., Graeme Hugo, Kouaouci, A., Pellegrino, A., & Taylor, E. (1994). Theories of International Migration: A Review and Appraisal. *Population and Development Review,* 19(3) for a summary of the main theories on the causes of migration.

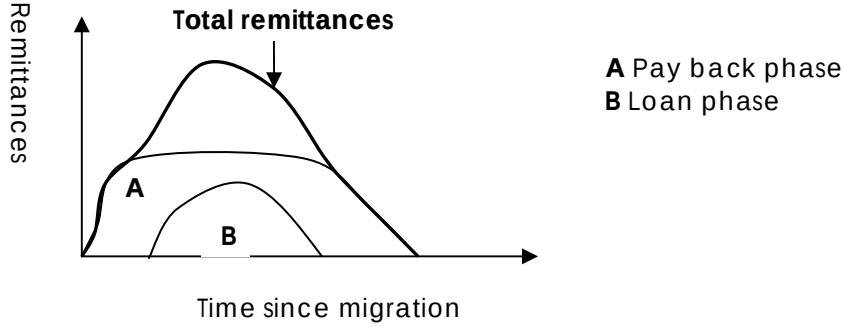
[3] The motive may even change at different points of the income distribution.

A less extreme view of the motivations to remit is tempered altruism. In this case the migrant and the family at home mutually benefit from migration, through some kind of implicit contractual arrangement. Altruism and self-interest can nevertheless play a role here, by making the contracts self-enforcing. The contractual arrangements discussed here are co-insurance, loan repayment and exchange for services.

The New Economics of Labour Migration (NELM) hypothesis states that due to market failures in the source country (for example a poorly developed social protection system), a household member migrates to a non-correlated labour market, entering a type of co-insurance agreement with the household left behind. Remittances are sent home when the household experiences shocks and to enable the household to invest in new technology. At the same time, the household also supports the migrants, e.g. by paying costs of migration or during spells of unemployment. Remittances consequently increase when the household's income decreases or a shock occurs (like for altruism), but also when the risk-level of the migrant increases. Risks at home and risks in the foreign country should not be correlated for this co-insurance agreement to work properly. This agreement reduces uncertainty for all household members. The level of development of the households' community also plays an important role here. While poor economic conditions (e.g. high unemployment) may be a cause of migration, the household's community needs to have a certain level of development for investment by the household to be effective. Consequently it is possible that fewer remittances are sent to underdeveloped communities.

Another type of contractual agreement between the household and family is loan repayment, for example repaying human capital investment or the cost of migration. A household finances a potential migrant's education if the family implicit lending rate is higher than the market interest rate and the youth borrowing rate is higher than the family implicit lending rate (Poirine, 1997). During the next time period the migrant is able to find a better-paid job in the city or abroad due to the education acquired and will send remittances to repay the family for the initial investment. At this stage the migrant might also become a lender, by financing other migrant family members, which increases overall remittances. The U-shaped time profile of remittances is shown below in figure 4. In this case, the family contract has the aim of increasing income instead of reducing uncertainty.

Figure 4. A theoretical average remittance function in the case of loan repayment



Source: Based on Poirine (1997)

In practice, only paying-back can be measured and there should be a positive link between the migrant's education level and remittances. This could also be interpreted as altruism however due to the close link between education and income.

A final contractual arrangement is the exchange motive (Cox, 1987). Here transfers in the wider sense are paid to the household at home for services provided (e.g. child care). The theory can also be applied to remittances, whereby remittances buy various types of services, usually by temporary migrants (Rapaport and Docquier, 2005). If the migrant's income increases, remittances increase. If the household's income increases, thus making the services more expensive, remittances can decrease or increase depending on the migrant's elasticity of demand. If the migrant's demand for the services is elastic, fewer services will be demanded and remittances decrease. If demand is inelastic, the same services will be bought, but at higher price, which leads to more remittances, despite the higher income of the household at home. Higher unemployment in the home country should mean fewer remittances since less money is then needed to make those at home perform their service (the opposite effect is found for altruism).

The strategic model, first explained by Stark (1995) and later by Stark and Wang (2002) stems from a strategic migration decision made because of wage differentials. Since high skilled migrants usually have a larger amount to gain by migrating, they are typically the first to go and then unskilled workers follow. As

individual productivity is unobservable in the rich country, migrants are paid the average productivity of the group with which they are identified. For this reason, skilled workers may have an incentive to remit money home to keep unskilled workers in their home country, since migration of these workers may mean depressed wages for the skilled migrants (Docquier and Rapaport, 1998). The strategic behaviour extension says that remittances increase with income and education of the migrant and with low income at home (Holst and Schrooten, 2006), thus again indistinguishable from altruism.

2.2 Empirical determinants of remittances

2.2.1 Macroeconomic empirical determinants of remittances

While this paper focuses on the household level microeconomic determinants of remittances, it is still important to list the important literature on macroeconomic determinants to have an encompassing view of the remittances situation. Empirical macroeconomic papers usually focus on the number of workers, wage rates and economic situation in host country, economic situation in country or origin, the exchange rates and relative interest rate between the sending and receiving country and political risk and facilities to transfer funds (i.e. institutions).

The stock of migrant workers in a host country is seen to be an obvious determinant of remittances: the greater the volume of workers, the greater the volume of remittances. Freund and Spatafora (2005) estimate that a doubling of the stock of migrants would lead to a 75 per cent increase in recorded remittances.

The economic activity in the migrant workers' host country is important because improved economic conditions in the host country allow migrants to increase their employment and earnings prospects, which in turn allows migrants to send more money home (IMF, 2005). The state of the economy in the migrants' home country is also important since negative shocks in the home country may increase the need for remittances to be sent, which may induce current migrants to send money or cause migration in the first place (IMF, 2005).

Economic policies and institutions in the home country, like exchange rate restrictions and black market premiums, may discourage remittances from being sent and may also shift remittances from the formal to the informal sector (IMF, 2005 and El-Sakka & McNabb, 1999). Macroeconomic instability such as high inflation or real exchange rate hyperinflation may have a similar negative effect. On the other hand, financial sector development, which makes remittances easier and cheaper, should stimulate remittances (IMF, 2005).

General risks in the home country such as political instability or low levels of law and order may deter remittances, since such an environment is not conducive for investment purposes (IMF, 2005). On the other hand, in such times there may be more need for remittances so more remittances may be sent. Investment opportunities in the home and host country may also have an effect on remittances. Greater potential return to assets in the host country (as opposed to the home country) may encourage migrants to invest to in the host country and reduce remittances for investment purposes (IMF, 2005).

One of the focuses of this paper is to look at altruism as a motive to remit. While most empirical papers that test this theory are at the microeconomic level, Bouhga-Hagbe (2006) uses macroeconomic determinants to test altruism as a motive to remit. They use a measure of "hardship" to test altruistic motives in Egypt, Jordan, Morocco, Pakistan and Tunisia and find that as hardship increases so do remittances. Some macroeconomic papers also look at the investment motive of remitters by looking at the macro economic conditions for investment in both the home and host countries (Akkoyunlu & Kholodilin, 2006 and Schiopu & Siegried, 2006). When testing altruism versus investment at a macroeconomic level, Schiopu and Siegried (2006) find evidence for altruism, but little evidence for the investment motive.

Table A2 in Appendix 2 gives a summary of the major empirical papers on the macroeconomic determinants of remittances. It is clear from this table that stock of migrants and the economic situation in the home and host country seem to be the most important factors for increased remittances.

2.2.2 Microeconomic empirical determinants of remittances

This section discusses the literature on the microeconomic determinants of remittances, both from a receiving and sending perspective. The empirical papers are often very creative in measuring the different determinants of remittances because, as was shown in section 2.1, it is difficult to separate other motives from altruism. Nevertheless some explanatory variables are often repeated across studies and these are listed in tables A1.1-A1.3 in Appendix 1. We show how different authors tried to measure the theoretical remittance motives discussed in section 2.1. This will be accompanied by a discussion and comparison of the results of these papers. We conclude with a more extensive analysis of previous papers on Albania and Moldova.

The estimations of the determinants of remittances are either based on household surveys that include remittance-receiving households, e.g. Gubert (2002), or specific surveys of the migrants themselves either in the home country, e.g. Amuedo-Dorantes & Pozo (2006) or the destination country, e.g. Holst & Schrooten (2006). The type of survey sometimes limits the nature of the analysis that can be done, for example, household surveys often do not have much information on the migrant. In addition some of the papers use complementary community-level data e.g. Durand et al. (1996). The countries studied most frequently are Latin-American and African countries and some Pacific and Asian countries. Eastern and Central Europe generally have not been studied much, but the existing literature on Albania and Moldova will be discussed in more detail below.

Most papers measure the altruism motive by looking at the effect of higher household or migrant income on the probability and or amount of remittances (i.e. Osili, 2007). As predicted theoretically (see table 2.1) most papers find a positive relationship for the effect of the migrant's income on remittances[4] and a negative relationship for the effect of the household's income on remittances[5]. As table 2.1 shows, all theories on the determinants of remittances predict a positive relationship between migrant income and remittances and most theories allow for a negative relationship between household income and remittances. Consequently most authors also test the effect of other variables on remittances to separate altruism from other motives.

Under pure altruism, the presence of other migrants in the households might have an effect on a migrant's behaviour. More migrants in the household means that the migrant is not solely responsible for the wellbeing of the household, so there may be a negative relationship between remittances and the number of migrants in the household. As tables A1.1-A1.3 show, most papers do find this relationship[6], which is some evidence for altruism. On the other hand some papers find the relationship to be insignificant, which could mean that altruism is not a determinant of remittances or not the sole determinant.

Length of stay is often related to the altruism motive. The longer a migrant has been abroad, and the less frequently the migrant has visited the home country, the weaker the ties to the home country and household are and the lower the importance of altruism is. Most papers do not find evidence for "remittance decay"[7], which shows that generally migrants keep links to their home country.

Altruistic remitters would be more likely to send remittances and would send greater sums of remittances to larger households or households with a greater dependency ratio, as they are in greater need. This relationship generally does not hold for the probability of remittances[8], but is found by most authors for the level of remittances and the simultaneous estimation of the probability and level of remittances, again some evidence for altruism. Most migrants are more likely to send remittances and send more if the household head is older, which is evidence for altruism towards the elderly.

Married migrants whose spouses are left behind in the home country should also be more likely to send remittances and send greater sums of remittances due to altruistic feelings. All papers that included the marriage variable and found a significant relationship, found a positive effect on the level of remittances and the simultaneous estimation of the probability and level of remittances. All papers find a lower probability of remittances and a drop in the amount of remittances, if the spouse has joined the migrant. This means that for certain family relationships, namely marriage, altruism does play an important role.

Pure self-interest, for example the bequest motive, can be measured by looking at the effect of remittances on household wealth on the intent to return home. In theory migrants with a bequest motive should be more likely to send remittances and send greater sums of remittances if their parents are wealthy (e.g. they own land).[9] Lucas & Stark (1985) do find evidence for the bequest motive: sons in Botswana remit more to families that have larger herds and if the household has a larger income (as predicted by the theory). Brown (1997) finds that those migrants that intend to return home send more remittances, for example as investment in their assets at home. De la Briere et al (1997) also find that young males in the Dominican Sierra, who have the intent to return home, do not adjust their remittance streams as a reaction to shocks their parents experience. The authors thus conclude that their remittances are more self-interested.

[4] The sole exception is Lianos & Cavoundis (2006).

[5] Exceptions are Lucas & Stark (1985) and Itzingsohn (1995).

[6] The following authors found positive relationships: Germenji et al (2001), Hoddinott (1994) and Pleitez-Chavez (2004)

[7] The exceptions are: Banerjee (1984) and Funkhouser (1995)

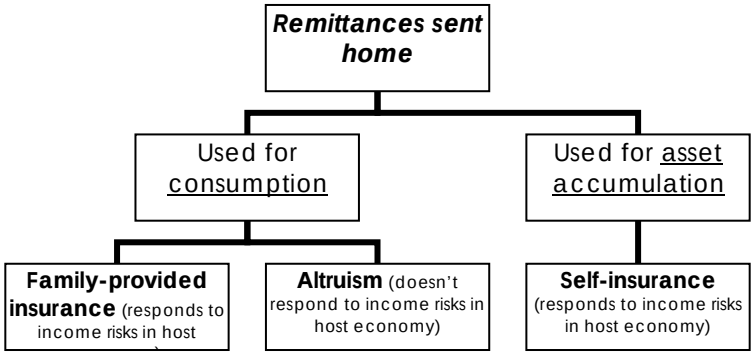
[8] Agarwal & Horowitz (2002) and Osaki (2003) find a negative relationship. Banerjee (1984) and Itzigsohn (1995) find a positive relationship.

[9] Some papers do find this relationship (de la Briere et al (1997), Hoddinott (1994), Pleitez-Chavez (2004), Schrieder & Knerr (2000)), but others do not (Durand et al (1996), Germenji et al (2001), Holst & Schrooten (2006), Lucas & Stark (1985), Osaki (2003), Schrieder & Knerr (2000)).

Whether remittances are sent as part of a co-insurance contract between migrants and households can be measured by analysing the effect of household shocks and migrant (income, employment and living) risk on remittances. According to most studies that included household shocks, shocks of the household (e.g. illness) lead to a higher probability of remittances and larger sums of remittances.[10] Unfortunately, this cannot be distinguished from altruistic behaviour. The variable length of stay can also be used to measure the risk level of the migrant as after a longer stay the migrant generally knows the destination country better, has a steadier job, etc. As mentioned before length of stay generally has a positive effect on remittances. This means that lower risk is accompanied with more remittances (so more insurance), which is some evidence against remittances as insurance. On the other hand, while few papers found a significant relationship for other measures of the migrant risk level (e.g. legal employment), almost all of those that did, found a positive relationship.[11] In these cases, migrants sent home more remittances when they faced greater risks in order to insure themselves against the loss of a job, etc.

Amuedo-Dorantes & Pozo (2006) go further in measuring the insurance motive by distinguishing between self and family insurance and at the same time altruism. They do so by looking at what remittances are used for. Figure 5 outlines their hypothesis.

Figure 5. Insurance motives for remitting



Source: Based on Amuedo-Dorantes & Pozo (2006)

If remittances respond to income risks in the host economy and are used for consumption they are sent to the family as part of a co-insurance agreement. If they are used for asset accumulation instead, the family acts as an investor for the migrant, so it is self-insurance (like saving). The authors' findings show that those migrants with greater income risk remit more and that different types of migrants use different insurance methods. For example, young male migrants who have low levels of education and large families at home are more likely to use co-insurance (Amuedo-Dorantes & Pozo (2006)).

Durand et al (1996) and Sana & Massey (2005) measure the NELM hypothesis more generally by also including community level variables into their analysis, for example the presence of banks, the employment and business opportunities in the home community. Durand et al (1996) find that migrants are more likely to remit to economically dynamic and entrepreneurial communities, which suggests that remittances are sent as co-insurance under the right conditions. Sana & Massey (2005) confirm this finding, because their results show that the community-level variables are only significant for Mexican migrants, not Dominican migrants, where the family and economic structure is totally different.

Loan repayment can be measured by looking at migration costs and the education level of the migrant. It is possible that those migrants that received help from their family in financing migration send more remittances as a loan repayment. This is confirmed by all empirical studies that find a significant relationship. In addition migrants with a higher education level could be sending remittances to repay the investment their parents have made in their education. This relationship is less strong however, because this variable could also pick up income effects. Almost all authors find a positive relationship between the migrant's education level and remittances[12], which provides some evidence for the loan repayment motive.

[10] Only Halliday (2004) finds that for an earthquake shock, less remittances are sent, unlike for an agricultural shock. He attributes this to the fact that households cope with the earthquake by retaining family members at home to help with rebuilding.

[11] Only Durand et al (1996) and Konica (2006) find that those migrants with stable jobs are more likely to remit.

[12] Only two papers find a negative relationship between the migrant's education level and the *probability* of sending remittances: Durand et al (1996) and Osaki (2003).

The exchange motive has not been extensively tested, probably due to data restrictions. Germenji (2001) find that household heads older than fifty receive more remittances and claim that this is an exchange between the migrant and a grandparent, who could be looking after the grandchildren. However, there is no data to prove this, so it could also be another motive, for example, altruism. Secondi (1997) looks at transfers in general in rural China and finds that recipients that are aged sixty and over and have grandchildren living with them, receive higher transfers. However this study has other problems, for example, unsatisfactory proxies for income. Therefore the evidence for the exchange motives is inconclusive.

There are three studies that investigate the determinants of remittances for Albanian migrants. The first study by Konica (2006) is based on a 1996 household survey data. She finds that male, older migrants, who have left their spouse behind or are immediate family of the household head are more likely to remit and remit higher amounts. More interesting is that migrant who knew their job before departure and or are legal migrants, have a higher probability to remit and remit more, which contradicts the self-insurance hypothesis. Konica also finds evidence for remittance-decay: The squared migration experience has a negative effect on the probability to remit.

Germenji, Beka & Sarris (2001) estimated the determinants of remittances in Albania based on a household survey for 2000. Much of their results are insignificant, but generally remittances are targeted towards poorer households, with older household heads, thus consistent with the altruistic motive.

Lianos and Cavoundis (2006) surveyed Albanian migrants in Greece, who had successfully been legalised after an amnesty for illegal migrants in 2000. The following group of migrants have a higher probability to remit: Women, married migrants, when the family of the migrant is not in Greece, when the family at home is more relatively deprived and when the migrant's income decreases. The amount of remittances increases with income, the number of children in Albania and when employment is less stable, which could be interpreted as insurance. Overall however, it is difficult to draw conclusions on the remittance motives of Albanian migrants.

Craciun (2006) is the only paper that econometrically investigates the determinants of remittances in Moldova and it uses the IOM 2004 CBS-AXA survey data, which we will do as well. This paper found that the migrant's gender, age, working experience and destination country, as well as household's income all have an impact on the likelihood and the size of remittances. Although our paper and Craciun's paper both look at the determinants of remittances in Moldova, we use different variables and explicitly test theoretical motives to remit, which Craciun's paper doest not. We also compare the results we obtain with Albania. Sander et al. (2005) also discuss migrant remittances in Moldova but give a more broad description drawing on different studies, report, statistics and their own interviews and focus groups. Other papers[13] also give a general overview of the migration and remittance situation in Moldova., but what is lacking in many of these papers in a proper statistical evaluation of the situation.

The literature on the determinants of remittances is lively and growing. It links up with the general transfers literature and the determinants of migration. While there is agreement on some determinants, e.g. altruism towards spouses, many of the results remain controversial due to a number of methodological problems. First, the decision to remit is often linked to the decision to migrate, which comes with its own methodological problems, e.g. selection bias. Most importantly it is difficult to find variables that measure one determinant only. We keep these problems in mind when analysing the determinants of remittances in Albania and Moldova.

3 Methodology and Data

In this section we first discuss our methodology. We then describe the data sets that we will use to empirically determine the remittance motives in Albania and Moldova and give some descriptive statistics to give a first impression of the remittance situation of the countries. The section is completed with a description of the specific models that we will use and a discussion of the variables employed.

3.1 Methodology

In most studies on remittances, it is assumed that both the decision to migrate and the decision where to migrate to have already been taken (see for example Gubert, 2002). We also concentrate on modelling the remittance decision since we are interested in making inferences about the migrant population. We thus take the decision to migrate as a given and subsequently do not face a bias in our sample of remitters.

[13] See Ghencea and Gudumac (2004) and Cuc, Lundbäck and Ruggiero (2005)

The existing papers on the determinants of remittances have used very different methodologies. While most papers use some kind of econometric analysis, they use everything from OLS to CLAD (See table B in Appendix 1 for an overview of the methodologies used by all papers). Although earlier papers used OLS (for example Lucas & Stark, 1985) to model the remittance decision, we now know that using such a method leads to biased and inconsistent estimates, since a substantial fraction of the migrants does not remit. In recent papers the main methodological distinction is made between modelling the determinants of remittances as a one-stage decision (Tobit) where the decision to remit and the amount of remittances are made together or as a Heckmann two-stage approach (Probit and corrected OLS) where the model separates between the decision to remit and the subsequent decision on how much to remit.

The problem of censoring was first raised in the literature by Banerjee (1984). He showed that the choice of the correct regression model depends on whether the decision to remit is a two-stage sequential process or a one-stage simultaneous process. In a two-stage process one first models the decision to remit using a probit model and then models the decision on how much to remit using the OLS method with a correction made for potential sample bias. This method of modelling the remittance decision is followed by Banerjee (1984) and Hoddinott (1992), see table B in Appendix 1. The advantage of this approach is that it allows a regressor to differently affect the decision to remit and the level or remittances. Amuedo-Dorantes and Pozo (2006) on the other hand argue that using a two-part selection model leads to identification problems, i.e. it is hard to say which variables would matter for one decision and not the other.

An alternative to the two-stage approach is to assume that there is only one remittances decision in which the two stages occur simultaneously. This one-stage decision can be modelled as a single equation estimated by Tobit analysis, using both remitting and non-remitting migrants. Each regressor has the same effect on the probability of being a remitter and on the level of remittances. The convenience of this approach is that it enables the identification of a set of variables that are most significant in influencing "remittance behaviour". It can be argued that a Tobit model may be over restrictive in forcing the regressors to have the same effect on both the decision to remit and how much to remit. Hoddinott (1992, p.209) has noted, however, that in none of the theoretical literature on migration and remittances has a distinction been made between factors influencing the decision whether to remit and the level of remittances. It is therefore assumed in this study, as in many other papers[14], that the remittance decision is a one-stage process.

Since the aim of our paper is to test different theoretical motives to remit, we follow previous research and use Tobit models to find the determinants of remittances. The Tobit model is specified as in equation 1 below:

$$R_i^* = \beta' X_i + u_i \quad u_i \sim N(0, \sigma^{2)} \tag{1}$$

where

$$R_i = \begin{cases} R_i^* if R_i^* > 0 \\ 0 if R_i^* \leq 0 \end{cases}$$

X_i is a vector of explanatory variables

The Tobit model is used for censored data, where the dependant variable R*i is latent. In the following analysis R*i is observed for values that are higher than zero and it captures the i-th individual's propensity to remit. It has a normal, homoskedastic distribution with a linear conditional mean. R_i is the actual observed value of remittances remitted by individual i. It can be either positive or zero and it is positive for those migrants that do remit.

Although the Tobit model is good for dealing with censoring, it has two drawbacks with regard to the assumptions made. The first assumption is assuming the regressors to have the same effect on both the decision to remit and how much to remit, as already discussed above. Another disadvantage associated with the Tobit approach is that the assumption of normally and homoskedastic distributed errors might not hold. If households have more than one remitter, remittances of both remitters partially depend on the same unobservable household characteristics and this results in error terms that are correlated across observations.[15] Since most households in our datasets only have one remitter we assume that this problem is minimal.

3.2 Data

[14] See table B in Appendix 1 for a complete list of papers that uses the Tobit approach.

[15] For a further discussion of this problem see Gubert, 2002.

3.2.1. Data for Albania

We use data from household surveys in the migrant sending country as the basis of our empirical analysis. For Albania, we use the Living Standards Measurement Survey (LSMS) collected by INSTAT in 2003, which is representative on a national level and has a sample of 1780 households. This survey is part of a panel that is available for the years 2002-2004. The survey contains the standard components of household and individual characteristics, as well as more detailed information on credit and the migration history of individuals in the household and some data on remittances. We compliment the household level data with information from a community questionnaire that was collected during the first wave in 2002, under the assumption that the level of development within a community did not change much in one year's time. The community questionnaire was administered to knowledgeable and important people in each community (e.g. the mayor) and has data on basic economic characteristics of the community, as well as on problems that affect the community.

Data on all the remittances received by the household would be ideal for our study, but unfortunately this information is not available for Albania. The 2002 survey has information on transfers that household members received from relatives living elsewhere, in Albania and abroad. Transfers include remittances, but also other payments, for example alimony. In addition we have very little supplementary information on the donors. Therefore we cannot use the 2002 data. The 2003 survey has information on *remittances* received. It has detailed information on the remittances that are sent by children of the household head and spouse that no longer live at home and some less detailed data on remittances sent by siblings, cousins, nephews and nieces and grandchildren of the household head and spouse. This means that remittances sent by spouses of the household head are not included. However, most of the transfers received by households in 2002 were sent by children (53%) and siblings (16%) while spouses (5%) and non-relatives (1%) only contribute a relatively small fraction of total transfers received (Albania LSMS, 2002). Furthermore spouses contribute smaller amounts of transfers on average. We, therefore, conclude that the bias in using the 2003 data is negligible. Other surveys also confirm that most important remittance receivers are parents of migrants (see for example de Zwager et al, 2005 who use a specific migration survey).

We analyze remittances both on a household level and on an individual level. On the household level we examine all remittances received by the household from all remitting children. On the individual level we only examine remittances sent by one migrant of the family. In both cases remittances are normalised to a 12 month period to ensure comparability to the Moldovan data. We disregarded remitting children under the age of 16 since they might be of a different migrant type. All 1780 households combined have 2493 children no longer living at home (an average of 1.4 children per household), out of which 1110 are international migrants and 409 receive remittance. These 1110 migrants are the basis of our individual migrant level analysis, but the sample size varies for different analysis due to missing values for the other variables included.

3.2.2 Moldovan data

The data used for Moldova was collected by CBS-AXA Consultancy for the International Organization for Migration from October to November 2004, covering 3714 households. Of these 3714 households originally surveyed, 1299 had at least one household member living abroad in 2003-2004. 1006 cases of the 1299 were studied with a more in depth survey. Also accompanying the quantitative surveys were qualitative studies including interviews and focus groups. Once missing values are accounted for and the data is cleaned, the number of households shrinks to 929. The data base includes 348 variables with information about migration (current and future) and remittances (sent and received) as well as household and migrant characteristics.

There were two different questionnaires administered: one to the migrant, if he happened to be a home at the time and another to the family, which also asked questions about the migrant abroad. If a family had more than one member abroad, then the family member who had more recently returned was used for the survey and priority was give to those migrants who remit. The rest of the migrants were only registered[16]. Remittances were counted on a household level, but most households only have one remitter. Despite the dataset not being perfectly representative for Moldova, the data is rich and gives a good indication of the remittance situation for the time period stated.

3.3.3. Descriptive statistics

We now discuss some descriptive statistics to gain a broad view of the characteristics of senders and receivers in both Albania and Moldova. We first look at the characteristics of the households that receive remittances and then at the characteristics of the migrants that send remittances.

[16] For a good overview of the methodology used for the interviews see Crăciun, 2006.

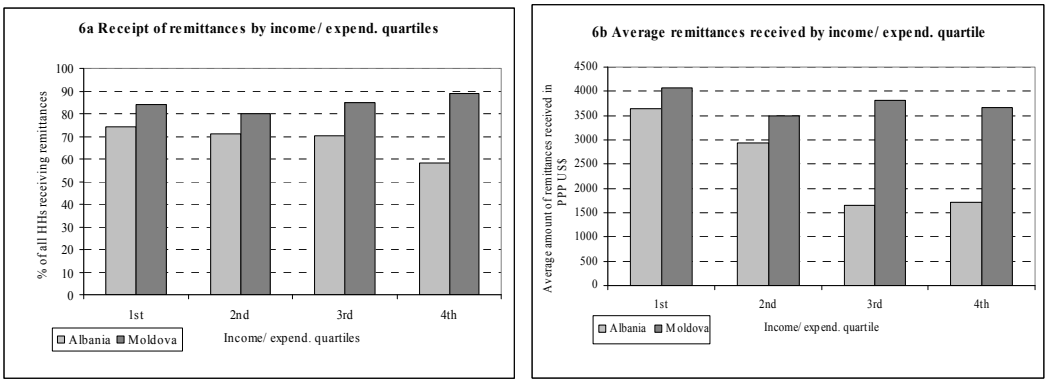
Household characteristics

We only look at households that have migrants since this is the basis of our empirical analysis. The graphs in Figure 6 below show the receipt of remittances and the amount of remittances received by households with migrants in the four different income quartiles. This gives some indication as to who is receiving remittances in the sample population at home and which types of households are receiving higher amounts of remittances. The first quartile represents the poorest quarter of the sample population and the last quartile represents the richest quarter of the sample population.

Figure 6a below shows the receipt of remittances in Albania and Moldova by income or expenditure quartile. In Moldova there does not seem to be a large difference among the income or expenditure groups with regard remittance receipts. Between 80 and 90 per cent of all quartiles in Moldova receive remittances. In Albania a slightly lower percentage of households with migrants receive remittances, but remittances are understated in this dataset. In Albania households in the highest income categories are less likely to receive remittances (58 per cent), whereas households in the lowest income group have a slightly higher tendency to receive remittances (74 per cent) compared to the middle income groups.

Figure 6b shows the amount of remittances received. In this table we see the average amount of remittances per income quartile. In this case, a clear picture emerges for Albania; poorer households receive higher remittances. The first income quartile receives twice as many remittances on average as the third and fourth quartiles. The amount of remittances is more similar for the expenditure quartiles in Moldova, although the poorest quartile also receives the most remittances on average the difference is less pronounced.

Figure 6. Household remittance characteristics in the different income quartiles



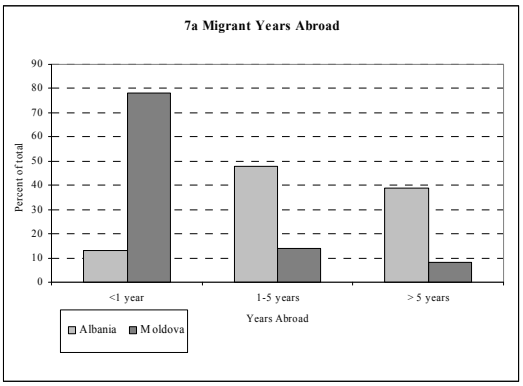
Source: Own calculations using LSMS 2003 and CBS-AXA 2004

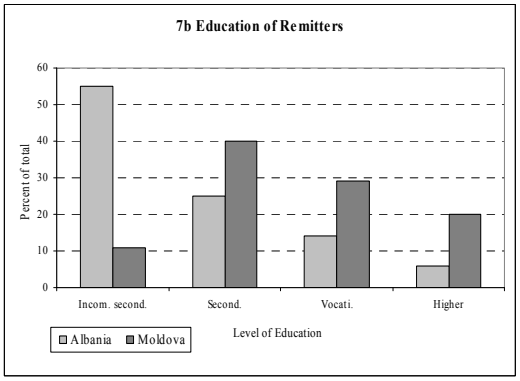
Remitter characteristics

In both Albania (74%) and Moldova (63%), male migrants make up the majority of the remitting population (largely due to the fact that it is mostly males who migrate). In Albania, men also send higher amounts of remittances on average, while in Moldova, women send higher amounts of remittances on average. The fact that women send higher amounts of remittances in Moldova is mainly due to the fact that they work in richer countries like Italy and Greece, which enables them to have more income. Over 60 per cent of the remitting population in both Albania and Moldova is between the ages of 25 and 45, which makes sense since this is the working age population. The majority of remitters in both countries are married and predominantly migrate to two countries: Italy and Greece for Albania and Russia and Italy for Moldova.

In the two graphs below, which look at years abroad and education level of the remitter, we begin to see some real differences in the characteristics of remitters between the two countries. Figure 7a shows the average number or years the migrant has been abroad. It is clear that Moldova is characterised by short term migration. Most migrants stay abroad less than a year and then return to Moldova. This shows a pattern of seasonal migration, usually agriculture or construction in which migrants regularly go to a destination country (mainly Russia) and return home only to leave again the next year. Albanians, on the other hand, seem to stay abroad for longer periods of time before returning home. Although Albanian migrants stay abroad for longer, most still return to Albania.

Figure 7. Years abroad and education level of the remitter





Source: Own calculations using LSMS 2003 and CBS-AXA 2004We continue to assess the individual characteristic of remitters by looking at the effect of education of migrants, the number of years abroad and their most important destination countries on the average amount of remittances sent home by remitters of each group. Table 3.1 presents the average amount of remittances sent by each group in the two countries. The amount of remittances sent by higher educated migrants in the two countries is quite different. In Moldova, the highest average amount of remittances is sent by those migrants who have completed higher education, while this is the lowest remitting group in Albania. As Figure 7b shows, there is a higher percentage of highly educated workers working abroad from Moldova than Albania, which may be explained by the lack of employment for highly skilled workers in Moldova.

As shown in Table 3.1, it is also clear that those Moldovan migrants who are away for short periods of time remit more, while the opposite is true for Albania. Both countries have two major destination countries for migration in which approximately 80 per cent of the migrating population goes. Migrants from both countries that migrate to Italy remit more on average, than those going to the other important destination country, although this is much more pronounced in the case of Moldova.

Table 3.1. Remitter characteristics and average amount of remittances sent in PPP US$

	Education level				**Years abroad**			**Most important destinations**	
	Incomplete secondary	Secondary	Vocational	Higher	<1 year	1-5 years	>5 years	Italy	Greece (A) Russia (M)
A	1722	1633	2519	1150	1256	1758	1964	1739	1558
M	3132	3642	3577	4435	2810	3181	1784	6335	2716

Source: Own calculations using LSMS 2003 and CBS-AXA 2004

After gaining a clearer picture of the household and migrant characteristics in Albania and Moldova, we now turn to econometrically testing these and other characteristics. By doing this, we look for evidence for some of the prevailing theories on the determinants of remittances.

3.3 Models tested and variables used

In this section we explain the different models we use to test some of the theoretical determinants of remittances that are described in section 2.1. Our starting point is a common model that has the same variables for both the Albanian and Moldovan datasets. For this model we measure the theoretical determinants of remittances with regard to altruism versus insurance of the migrant.

Because the data sets are so rich in different ways, this gives us the possibility to model other extensions of the basic model using just one of the countries. In the next three analyses, we model other motives using only the Albanian or Moldovan data. For Albania we first use an extension of the first model in order to more thoroughly test for altruism and self insurance versus family provided insurance. We then use the Albanian data on a household and community level to model the bequest motive, co-insurance and to search for evidence for the theory of NELM. As shown before, the main group of remitters in Albania is the children group, so testing for the bequest motive is highly relevant. Since Moldova is also a poor and underdeveloped country, we would

too like to test for the NELM and co-insurance. However, the dataset does not allow this, so our final model tests the loan repayment motive using only Moldovan data.

In each of the following models, we have split the independent variables into migrant characteristics, household characteristics and specific variables that are used to test certain theories. The migrants and household characteristics are meant to be both control variables and to test some motives.[17] We describe the expected effects of the variables based on the theoretical determinants of remittances, previous papers and the specific situations in Albania and Moldova. The variables are described in more detail in Appendix 2.

In the first model, we test for altruism and insurance of the migrant. The model is outlined in equation 2 below:

$$R_i = \alpha + \beta_1 M_i + \beta_2 H_i + \beta_3 Ri_i + \varepsilon_i \quad (2)$$

where

Variable	*Expected effect*
R=amount of remittances received by the household over the last 12 months	n.a.
M (Migrant variables)	
Age of migrant at departure	control
Gender of migrant	control
Marital status of the migrant	control
Education of migrant	control
Country of migrant destination	control
H (Household variables)	
Household size	+
Per capita income/ expenditures of household in splines	-
Subjective wellbeing of household	-
Remittances used for consumption	+
Other migrants in household	-
Future migrants in household	+
Household lives in urban/ rural area	control
Ri (Risk variables	
Unemployment rate of country of destination	+
Duration of migration, in categories	-
Distance between Albania/ Moldova and capital of destination	+
Similarity of language to language at destination	-

To test the altruismic motive, we mainly look at the following variables: household income, or expenditures[18], subjective wellbeing, number of other migrants in the household and the duration of migration. The coefficient for household income (or subjective wellbeing) should have a negative sign for altruism, indicating more remittances for households with greater need. We use income splines with two cut-off levels to allow remittances to have a different effect for poorer or richer households. The coefficient for number of migrants in the household should have a negative sign since more migrants means, more people to remit, so there is less need to remit from a single remitter. The longer the migrant is abroad, the fewer remittances should

[17] An important control and explanatory variable would be migrant's earnings, which we don't have. This is likely to affect our results.

[18] For the Albanian dataset we only have individual labour income and social assistance received. We summed these per household to get household income. Business, capital and farm income are thus missing from the income variable and labour income is often under-reported in household surveys. Our descriptive statistics confirm that household income/ quartile is indeed far too low. We assume that there is a proportional measurement error and nevertheless use it as a proxy for the true transitory household income. For Moldova we use household expenditures which better measure household's true consumption smoothing abilities and are a more valid measure of permanent income. We tested both income and expenditures for endogeneity with remittances, using the number of children and elderly people in the household, household size, age and education level of the household and a urban/ rural dummy and found no endogeneity. We also tested migrant intent of household members using the same variables and found no endogeneity.

be sent because of weakening ties with the family back home ("remittance-decay"). A larger household at home can be an indication of need; we thus expect a positive relationship with remittances in the case of altruism.[19] If remittances are mainly used for consumption, we also take this as a sign of poverty of the household and expect it to have a positive effect on remittances if altruism is present.

Instead of focusing on household risks that make it difficult to differentiate between altruism and co-insurance, we focus on migrant employment risks. Therefore we test whether the *migrant* insures himself by looking at the effect of employment risk variables on the amount of remittances sent.[20] The basic idea is that the migrant sends more remittances (i.e. a higher "insurance premium") when the labour market situation is more risky to make sure that if the migrant needs more money, the family will send it, or if the migrant has to return home due to lack of work, the migrant will be supported by the family. The measures of risk we use are the unemployment rate in the country of destination, the duration of migration, the distance between the migrant sending country and the country of destination and the similarity of the languages between the two countries.

If the unemployment rate in the country of destination is higher, then it is expected that there is more labour market risk there.[21] The shorter the duration of migration, the more money should be sent, as the migrant is less acquainted with the labour market and probably has not found stable employment yet. The greater the distance between the countries the higher the risk for the migrant, for example financially, as the migration costs are higher, and the more money should be sent. If the migrant does not speak the language of the country he has migrated to, finding stable and safe employment is more difficult and there is more risk. Therefore speaking a different language should mean more remittances.

In our next analysis, which is done for Albania only, we broadly follow the methodology of Amuedo-Dorantes & Pozo (2006) in order to measure what kind of insurance is used by the migrant, see equation 3 below. However, unlike Amuedo-Dorantes & Pozo (2006), we predict the probability to remit for consumption or investment, as we do not know the exact amount of remittances spent on investment or consumption.

$$P_i = \alpha + \beta_1 M_i + \beta_2 H_i + \beta_3 Ri_i + \varepsilon_i \quad (3)$$

where

Variable	*Expected effect*
P=Probability to send remit remittances received by the household over the last 12 months and that are used for investment/ consumption	n.a.
M (Migrant variables)	
Age of migrant at departure	control
Gender of migrant	control
Marital status of the migrant	control
Education of migrant	control
Country of migrant destination	control
H (Household variables)	
Household size	+
Per capita income of household	-
Subjective wellbeing of household	-
Other migrants in household	-
Future migrants in household	+
Household lives in urban/ rural area	control

[19] A higher number of household members can be an opportunity for the household if they are adults potentially earning and income or a risk if the members are children or elderly. Therefore we tried different specifications also using the children or elderly ratio instead of household size, but generally household size gave us the best fit.

[20] For a similar analysis see also Amuedo-Dorantes & Pozo (2006) and Lianos & Cavoundis (2006).

[21] The most popular migration destination countries of Albanian and Moldovan migrants do not include illegal migrants in unemployment insurance schemes. Since many of the Albanian and Moldovan migrants are illegal we can use the unemployment rate as a measure of risk. Legal migrants are more likely to have been in the country longer and we use length of stay as another measure of risk that would also account for legal and longer-staying migrants being covered by official social security agreements and thus being in a less risky position.

Ri (Risk variables	
Unemployment rate of country of destination	+
Duration of migration, in categories	-
Distance between Albania and capital of destination	+

Equation 3 will be estimated twice (using the same variables as for the first analysis), once for remitters that send remittances for consumption and once for remitters that send remittances for investment. As already argued in section 2.2.2, if remittances are used for consumption and the income risk variables matter, remittances are sent as part of a family-insurance arrangement. If they are sent for asset accumulation (investment) they are sent for self-insurance (a form of saving). We will draw conclusions on whether these two forms of insurance are important and compare their importance for different migrant categories.

Next we use data on a household and community level to test for the bequest motive, co-insurance and the NELM theory in Albania. This model is described in equation 4.

$$R_i = \alpha + \beta_1 B_i + \beta_2 C_i + \beta_3 N_i + \varepsilon_i \quad (4)$$

where

Variable	*Expected effect*
R=amount of remittances received by the household over the last 12 months	n.a.
B (Bequest/ household variables)	
Per capita income of household	-/+
Other migrants in household	-/+
Age of household head	+
Wealth index	+
House inherited	+
Number of children in household	control
C (Co-insurance variables	
Adverse general household shocks	+
Adverse health shock experienced by household head or spouse	+
Whether household is borrowing money	-
N (NELM variables)	
Household lives in urban/ rural area	control
Community infrastructure index	+
Credit possibility index	+
Informal credit is a source of borrowing in this community	+
Population of the community	-
Lack of employment opportunities in community	+

To measure the bequest motive, we look at the income of the household, if there are other migrants in the household, the age of the household head, the wealth of the household and whether the house was inherited by the current household. If the coefficient of income of the household has a negative sign then this could be evidence for altruism or insurance, but if the sign is positive, then this could show evidence for the bequest motive, since there is more to gain in inheritance. If there are other migrants in the household, then sending more remittances could be a sign of trying harder to win the bequest; if the coefficient is negative, then it could be a sign of altruism or the fact that the migrant does not think they will inherit, so they do not send more remittances. If the higher age of the household head coincides with higher remittances, this could be evidence for the bequest motive, because the probability of the death is higher (see also Brown, 1997). A positive coefficient could also be evidence for altruism, given that the elderly usually need more assistance. If remittances increase with the wealth of the household, then there is strong evidence for the bequest motive. If the house has been inherited in previous generations, then the migrant can assume that this will happen again, which would mean greater remittances.

To test the more general hypothesis of the NELM which explores community variables, we use the variables community infrastructure, formal and informal credit possibilities, the population of the community, employment possibilities in the community and whether or not the household is in a rural or urban community, thus following the approaches of Durand et al. (1996) and Sana & Massey (2005) as much as possible. If the coefficient of community infrastructure has a positive sign, this is evidence of the NELM, since there needs to be a basic infrastructure if the household wants to invest remittances. If it is negative, then it shows altruism because of need. If the coefficient of formal credit possibility has a negative sign this is evidence against NELM. There are possibilities to obtain money elsewhere, so there is less need for a co-insurance arrangement. If the coefficient of informal credit has a positive sign, then this shows an underdeveloped financial secot, i.e. there is need for co-insurance and evidence for the NELM. If the coefficient of population of the community has a negative sign, it is also evidence for the NELM. As in a larger community there are more opportunities for investments and jobs other than through migration, fewer remittances will be sent as part of a co-insurance arrangement. The sign for the coefficient for lack of employment possibilities should be positive for NELM and altruism. As can be seen from the above explanation, NELM variables mostly test investment possibility variables; so NELM also tests for the investment motive in some respect.

To test co-insurance of a household more specifically, we look at adverse shocks to the household (e.g. loss of crops), health shocks experienced by the household head and or spouse during the past month and whether the household has loans. If either of the coefficients for the variables for shocks have a positive sign, then there is evidence for insurance or altruism. If the coefficient for the borrowing money variable is negative then the household has other means to insure in case of a shock, so co-insurance (i.e. remittances) is not necessary. If the sign is positive it could be an indication of altruism, as the loan could be a sign of household need.

In the final analysis we use only Moldovan data and test for another theoretical motive to remit, namely loan repayment. We estimate the following model:

$$R_i = \alpha + \beta_1 M_i + \beta_2 H_i + \beta_3 L_i + \varepsilon_i \qquad (5)$$

where

Variable	*Expected effect*
R=amount of remittances received by the household over the last 12 months	n.a.
M (Migrant variables)	
Age of migrant at departure	control
Gender of migrant	control
Marital status of the migrant	control
Country of migrant destination	control
Duration of migration, in categories	control
H (Household variables)	
Household size	+
Per capita expenditures of household	-
Subjective wellbeing of household	-
Other migrants in household	-
Household lives in urban/ rural area	control
L (Loan repayment variables)	
Education of migrant	+
Education of household head	+
Motivation to remit loan	+
Cost of migration	+
Return of money borrowed for migration	-

As was stated in section 2, loan repayment here refers to the repaying of human capital investment (education) or the repayment of the financing of migration. The main variables we consider when testing this motive are: education of the household head, education of the migrant, the motivation to remit (why the remitter sent money), the cost of migration, and whether or not the money borrowed for migration was returned. The higher the education of the household head, the better the enforcement of loan repayment (see for

example Hoddinott, 1992). If the migrant is highly educated, then the remittances sent by the migrant should be higher due to the greater cost of his education (Poirine, 1997). One of the motivations to remit can be to pay back a loan. Migration may have been funded by loans that have been given by family, friends or others. If the money borrowed for migration has been returned already, it should have a negative on the level of remittances.

4 Empirical determinants of remittances in Albania and Moldova

4.1 Comparison between Albania and Moldova

We test for altruism and insurance amongst Albanian and Moldovan migrants by estimating a Tobit regression on the amount of remittances sent per migrant over the past year, estimating equation 2. The results are shown in table 4.1 below[22].

Table 4.1: Tobit regression: Amount of remittances per migrant sent over past year

	Albania		**Moldova**	
No. of uncensored observations	426		416	
Log likelihood	-5888.77		-3399.59	
Adjusted R^2	0.17		0.10	
	Coefficient & standard error	*Marginal effect*	*Coefficient & standard error*	*Marginal effect*
Migrant variables				
Age	893.73 (1905.27)	560.91	15.30 (13.21)	10.14
Gender	9051.34 (31571.56)	5649.86	-0.66 (274.94)	-0.44
Marital status	-90030.48 (33197.99)*	-58279.12	-160.44 (262.13)	-106.86
Education [1] (secondary)	55561.31 (31894.26)*	35988.59	151.48 (396.10)	100.65
Education (vocational)	79387.50 (37019.39)**	53022.80	244.47 (426.12)	164.30
Education (higher)	-3180.73 (56642.21)	-1989.47	125.36 (458.06)	83.83
Destintion[2] (Italy)	83228.76 (49727.83)*	53806.01		
Destination (CIS)			111.75 (1415.32)	73.86
Destination (Europe)			-1553.17 (974.46)	-975.34
Household variables				
Household size	-494.42 (6774.45)	-30010.30	-108.28 (104.77)	-71.77
Income or expenditure per capita (below K1) [3]	58.98 (72.70)	37.02	0.22 (1.42)	0.15
Income or expenditure per capita (below K2)	-20.60 (30.61)	-12.93	-1.02 (1.02)	-0.68

[22] The coefficients for the two countries differ because remittances are in Leks in Albania and US dollars in Moldova, whereas income is in local currencies for both countries. The overall size of the coefficients does not matter much for our analysis because our focus is on motives, which means that we want to investigate the effect certain variables have on the amount of remittances.

Income or expenditure per capita (above K2)	-9.45 (3.71)***	-5.93	-0.21 (0.35)	-0.14
Subjective wellbeing (fully satisfied) [4]	-8063.48 (152802.3)	-5012.27	-701.42 (556.34)	-429.63
Subjective wellbeing (rather satisfied)	115232.4 (40456.97)***	78796.28	439.65 (632.09)	305.08
Subjective wellbeing (less satisfied)	-9312.32 (28977.5)	-5850.49	683.98 (207.13)***	446.54
Consumption	-148167 (33315.17)***	-102138.7	-327.83 (300.65)	-222.48
Other migrants	-10728.14 (9366.08)	-6732	-190.02 (211.47)	-125.95
Future Migrants	48060.01 (32378.43)	30162.55	631.51 (266.15)**	432.47
Urban	57548 (27672.64)**	36117.24	2187 (266.57)	148.28
Risk variables				
Unemployment	96075.28 (35137.20)***	60297.03	-22.11 (99.51)**	-147.22
Migration duration (1-5 years) [5]	12178.37 (43295.77)	7656.64	-57.64 (398.04)	-38
Migration duration (>5 years)	73728.11 (45519.99)	46621.35	-179.31 (318.08)	-117.84
Distance	170.62 (59.37)***	107.08	-0.47 (0.23)**	-0.31
Language[6] (similar)			794.77 (487.10)*	548.56
Language (same)			-2165.31 (1218.69)*	-1507.97

[1] Less than secondary education is the base.

[2] Other Europe base for Albanian regression, other base for Moldovan regressions. Greece and Germany dropped in Albanian regression due to collinearity. This is because those variables have few observations and predict remittances perfectly.

[3] The income splines are equally spaced over the range of income per capita/ expenditures per capita, with two cut-off points.

[4] Not satisfied is the base.

[6] Less than one year is the base.

[6] Dropped due to collinearity for the Albanian regression (there are no same/ similar languages)

Standard errors are not corrected for possible heteroskedasticity.

* significant at 10% level

** significant at 5% level

*** significant at 1% level

The significant variable married for Albania confirms what descriptive statistics already showed: married Albanian remitters remit less. This is due to the construction of the dataset. We only capture remittances sent to parents and married remitters are more likely to remit to their own families, thus less to their parents.

Secondary and vocational education are also significant for Albanian remitters and the coefficients have a positive effect. This is because more highly educated migrants (as compared to the base group with primary education) have a higher earnings capacity and this confirms standard economic theory.[23]

Urban households in Albania receive more remittances. The other three significant household characteristic variables for Albania give conflicting evidence for altruism. On the one hand the positive but insignificant coefficient of income for the poorest income group gives clear evidence of targeting towards the poor, i.e. altruism: Even if the poor experience some increase in income, remittances are not decreased. Two other and less direct measures of altruism, whether remittances are used for consumption and subjective wellbeing, give an opposite picture. If remittances are used for consumption, which implies a sign of poverty of the household, fewer remittances are received.[24] If households are rather satisfied as opposed to not satisfied, more remittances are received. This could be an indication that the poorest households cannot even afford to migrate and remit. The same is observed for Moldova where *less satisfied* is significant and positive. In Moldova the more satisfied households received fewer remittances. However, this variables is not significant. The results with regard to subjective wellbeing should be interpreted carefully since there may be reverse causation. If other household members in Moldova plan to migrate in the future, more remittances are received by the household, probably to support the household in paying the cost of migration.

For Albania we have two variables that indicate an insurance motive of the migrant. Both the unemployment rate and distance are highly significant and positive and thus indicate that migrants that are more exposed to risk insure more by sending more remittances. Particularly unemployment has a big marginal effect. The variables are also significant as a group at the one per cent level. In Moldova we find negative signs for the two variables, so we do not find an insurance motive for Moldova. On the other hand migrants in countries speaking the same language, a sign of lower risk, remit less and those in countries speaking a similar language remit more. This probably has less to do with the insurance motive than with the fact that migrants in Russia and Romania (where the same language is spoken) earn less and migrants in Italy (where a similar Romanic language is spoken) earn more. The marginal effect of the variable language same shows that working in Russia has a huge penalty, all other things being equal.

To gain more explanatory power, we tested the different groups of independent variables (migrant characteristics, household characteristics and risk variables) for joint significance. For Albania we found joint significance for all groups of variables, with the risk variables being highly significant with a p-value of less than 1 per cent. The results for Moldova also demonstrate jointly significant household variables and risk variables. In conclusion, we find some conflicting evidence for altruism and some stronger evidence for insurance amongst Albanian remitters. We will further test these motives in section 4.2. For Moldovan remitters no clear picture emerges yet, so we will test another motive, loan repayment, in section 4.3.

4.2 Determinants in Albania

In this section we further test the insurance motive amongst Albanian remitters, as well as testing the bequest motive and the NELM.

Since we found some evidence for the remitter sending money as insurance in Albania, we use the methodology of Amuedo-Dorantes & Pozo (2006) and test whether the remitters used family-based or self insurance. We do this by running two separate probit regressions[25] estimating equation 3; one on the probability of receiving remittances used for consumption and one for the probability of receiving remittances used for investment. The results can be found in table 4.2 below.

Table 4.2: Probit regression: Probability of receiving remittances per migrant sent over past year

	Used for consumption	**Used for investment**
No. of uncensored observations	426	426
Log likelihood	-174.25	-151.81
Adjusted R^2	0.17	0.15

[23] The negative sign for higher education contradicts standard economic theory. This variable is not significant however and has a very small sample size.

[24] The effect is different than expected: This is because a large portion of the population is using remittances for consumption across all income levels, so the variable is not a clear indication of poverty.

[25] We use probit estimations here as we do not have the exact amounts of remittances used for consumption or investment. We only have the main use and used this variable to classify the households as receiving remittances for consumption or receiving remittances for investment.

	Coefficient & robust standard error	*Marginal effect*	*Coefficient & robust standard error*	*Marginal effect*
Migrant variables				
Age	0.04 (0.01)***	0.01	-0.04 (0.01)***	-0.01
Gender	-0.62 (0.24)***	-0.12	0.64 (0.26)***	0.10
Marital status	0.49 (0.19)***	0.12	-0.38 (0.21)*	-0.07
Education [1] (secondary)	-0.9 (0.21)	-0.02	0.03 (0.22)	0.01
Education (vocational)	-0.25 (0.23)	-0.06	-0.06 (0.26)	-0.01
Education (higher)	-0.56 (0.36)	-0.16	0.31 (0.40)	0.07
Destintion[2] (Italy)	-0.02 (0.29)	-0.01	0.16 (0.31)	0.03
Household variables				
Household size	-0.00 (0.04)	-0.00	0.01 (0.04)	0.00
Income per capita	0.00 (0.00)	0.00	-0.00 (0.00)	-0.00
Subjective wellbeing[3] (fully satisfied)	-1.73 (0.70)***	-0.60	0.83 (0.72)	0.23
Subjective wellbeing (rather satisfied)	-0.77 (0.24)***	-0.22	0.56 (0.26)	0.13
Subjective wellbeing (less satisfied)	-0.54 (0.19)***	-0.12	0.55 (0.20)	0.10
Other migrants	-0.13 (0.06)**	-0.03	0.12 (0.06)**	0.02
Future migrants	0.02 (0.19)	0.00	-0.09 (0.20)	-0.02
Urban	-0.17 (0.18)	-0.04	0.33 (0.20)	0.06
Risk variables				
Unemployment	-0.06 (0.19)	-0.01	0.16 (0.21)	0.03
Migration duration[4] (1-5 years)	-0.24 (0.26)	-0.06	0.15 (0.27)	0.03
Migration duration (>5 years)	0.10 (0.28)	0.02	0.14 (0.29)	0.03
Distance	-0.00 (0.00)	-0.00	0.00 (0.00)	0.00

[1] Less than secondary education is the base.

[2] Other Europe base for Albanian regression, Greece and Germany dropped due to collinearity.

[3] Not satisfied is the base.

[4] Less than one year is the base.

* significant at 10% level

** significant at 5% level

*** significant at 1% level

When taking the analysis a step further and differentiating between different types of insurance we do not find evidence for the insurance motive anymore. Here we use a probit analysis and find that while risk variables affect the amount of remittances (see analysis 4.1), they do not the decision to remit. It thus seems that migrants first take the decision to remit based on other characteristics and then base the amount partially on insurance motive.

Migrant and household characteristics are still jointly significant, however, all at the one per cent level and we find interesting differences between the remitters sending remittances for investment and those for consumption. Age and marital status have a positive effect on the probability of sending remittances for consumption and the opposite effect for investment. Female migrants are more likely to send remittances for consumption and male migrants for investment. All households that are more satisfied than not satisfied have a lower probability to send remittances for consumption, probably because they do not need remittances for bare survival. Other migrants in the household have a negative effect on the likelihood of remittances being sent for consumption, maybe an indication of altruism. The opposite effect is found for remittances being sent for investment.

We also test whether Albanian remitters have a bequest motive when remitting. Furthermore we want to test the NELM theory and test whether the level of the development of the community of the household matter to the amounts of remittances sent. At the same time we also investigate the motive co-insurance by looking at the effects of various household shocks on remittances. The results for both tests, estimating equation 4, can be found in table 4.3 below.

Table 4.3: Tobit regression: Amount of remittances received by household over past year		
No. of uncensored observations	293	
Log likelihood	-1701.70	
Adjusted R^2	0.12	
	Coefficient & standard error	*Marginal effect*
Bequest/ household variables		
Income	3.77 (2.23)*	1.23
Age household head	4190.40 (1388.24)***	1364.71
Wealth index	36905.79 (65535.12)	12019.32
House inherited	-2057.24 (32509.16)	-665.93
Number of migrants in household	162995.10 (22502.88)***	65488.59
Number elderly	-19631.25 (18295.74)	-6393.42
Co-insurance variables		
General household shocks	-31828.60 (54637.82)	-9238.89
Health shocks	-13513.47 (21224.84)	-4401.05

Borrowing money	-79817.91 (45968.10)*	-20072.28
NELM variables		
Urban	-39093.40 (58749.23)	-12731.77
Community infrastructure index	-10716.07 (71311.53)	-3489.96
Credit possibility index	-13205.29 (24526.47)	-4710.74
Informal credit	24858.61 (26427.57)	7744.49
Community population	0.06 (0.04)	0.02
Lack employment	-2506.34 (25046.76)	-813.09

Standard errors are not corrected for possible heteroskedasticity.

* significant at 10% level

** significant at 5% level

*** significant at 1% level

The household/ bequest variables are highly significant as a group. The positive and significant sign of income and the positive, but not significant sign of wealth give some initial indication of a bequest motive. The highly significant and positive sign for other migrants in the household indicates a bequest motive. If there are other migrants in the household a migrant has to compete harder for the bequest and thus remits more. This variable has a large marginal effect. The positive and highly significant sign for age of household head could also indicate a bequest motive. The older the household head is, the closer he is to death and the sooner comes a potential inheritance. A migrant thus remits more to be on favourable terms with the household head. It could also be a sign of altruism because the household head is elderly and needs more support.

The co-insurance variables are not significant as a group and only the variable *if the household has borrowed money* is significant and negative. This means that the household has other means to insure in case of a shock, so co-insurance (i.e. remittances) is not necessary.[26] None of the NELM variables are significant and many do not have the expected signs and they are also not significant as a group.

We, therefore, have some evidence for the bequest motive, altruism and insurance on behalf of the migrant being a determinant of remittances in Albania.

4.3 Determinants in Moldova

So far we could not find clear evidence for the motivations of the Moldovan remitters with regard to altruism and insurance. Therefore, we also test for loan repayment. The results for the Tobit analysis, estimating equation 5, can be found in table 4.4 below.

Table 4.4: Tobit regression: Amount of remittances sent by migrant over past year		
No. of uncensored observations	205	
Log likelihood	-1523.73	
Adjusted R^2	0.18	
	Coefficient & standard error	*Marginal effect*
Migrant variables		
Age	3.32 (16.61)	2.04

[26] As a similar test of other types on insurance we included social security income in an earlier regression but it was not significant.

Gender	256.81 (354.13)	155.75
Marital status	37.98 (337.74)	25.26
Education[1] (secondary)	283.01 (510.16)	175.30
Education (vocational)	-177.35 (566.19)	-107.62
Education (higher)	-586.34 (680.11)	-337.19
Destination country[2] (Russia)	-1098.71 (1320.77)	-703.90
Destination country (Europe)	139.87 (1251.26)	86.37
Distance	-0.28 (0.38)	-0.17
Months abroad	-12.42 (6.38)**	-7.62
Household variables		
Expenditure per capita (below K1) [3]	1.04 (1.63)	0.64
Expenditure per capita (below K2)	-1.20 (1.20)	-0.74
Expenditure per capita (above K2)	-0.29 (0.45)	-0.18
Subjective wellbeing[4](fully satisfied)	-126.31 (1275.46)	-76
Subjective wellbeing (rather satisfied)	438.28 (886.20)	285.60
Subjective wellbeing (less satisfied)	592.35 (326.33)*	359.34
Other migrants	-435.04 (315.30)	-267.21
Household size	16.50 (139.32)	10.12
Loan repayment variables		
Education household head[5] (secondary)	322.54 (417.45)	201.53
Education household head (vocational)	526.80 (442.72)	333.89
Education household head (higher)	1677.04 (585.56)***	1208.49
Motives to remit (debt)	822.68 (359.77)**	535.88
Migration cost	0.18	0.11

	(0.21)	
Returned money borrowed	1511.42 (485.37)***	767.66

[1] Less than secondary education is the base.

[2] Other destination is the base.

[3] The income splines are equally spaced over the range of expenditures per capita, with two cut-off points.

[4] Not satisfied is the base.

[5] Less than secondary education is the base.

Standard errors are not corrected for possible heteroskedasticity.

* significant at 10% level

** significant at 5% level

*** significant at 1% level

In this regression we mainly find significant loan repayment variables. However we do find that migrants months abroad has a negative effect on remittances[27] and that subjective wellbeing *less satisfied* has a positive effect on remittances. The level of education dummies are not significant, but migrants with a higher education level do not remit more. Therefore, it does not look like migrants are repaying an education loan. On the other hand there is quite some evidence for remittances being sent to repay migration debts. The *motivation to remit (debt)* has a positive and significant effect on remittances. The household head having a higher education level also has a positive, very significant and big marginal effect on the amount of remittances sent. It is thought that household heads with a higher education level are better able to enforce loan repayment (Hoddinott, 1992), thus the higher remittances. The significant and positive variable *returned loan* has a different effect than expected. Remittances are measured over the whole past year, but we do not know at what point in time the loan was returned, so it is possible that remittances still capture the effect of repaying the loan.

When testing the groups of variables for joint significance, we found that the loan repayment variables where highly significant at the 1% level. This goes further to show that the loan repayment motive is an important determinant of remittances in Moldova.

5 Conclusions

In this paper we have given an encompassing view of remittances in Albania and Moldova. Besides giving descriptive statistics and the background of migration and remittances in the two countries, we also empirically test theoretical motivations to remit. We found differing pictures for Albanian and Moldova, even though they seem to be similar countries in terms of history, size and economic situation.

The descriptive statistics showed that migration and remittances are important for both countries. Males are the leading migrants in both countries and remittances are sent to all types of income groups. Moldova and Albania differ with respect to targeting of remittances: In Albania higher amounts are sent to the poorer households. Albanian men send higher amounts of remittances, while in Moldova women send higher amounts, probably due to the popular migration destination Italy, where salaries are higher. In Albania migration is longer term, especially compared to Moldova, where migration is often seasonal, in the direction of Russia.

To investigate the different motives to remit, we test four different econometrics models. In the analysis in which we compare Albania and Moldova using the same independent variables, we found inconclusive results for Moldova and some evidence for altruism and insurance in Albania. Looking more closely at Albania, we found no evidence of family-provided insurance, only some evidence for self-provided insurance of the remitter. There is also some evidence for the bequest motive. The results care consistent with previous studies on Albania.

In the case of Moldova we did find significant evidence of the loan repayment motive. Loan repayment was used to repay costs incurred from migration and not the cost of education of the migrant. The country of destination matters, as this greatly influences migrant income and remitting potential. We found that the fact that so many migrants go to Russia significantly affects our analysis.

[27] This has to due with the fact that most migrants that are abroad for a smaller period of time, migrate to close by Russia and earn lower incomes.

We specified our models given the possibilities that our very different data sets allowed us. Our results between the two countries are not directly comparable as our analysis is non-nested and the datasets refer to two different years. A major limiting factor in our analysis is that we cannot control for the migrant's earnings. We also do not control for different motives coinciding. Despite these limitations we can draw some general conclusions.

As an extension for Moldova, it may be wise to test more macro-level variables since migrants from all socio-economic groups have migrated and found remittances an important source of funds for themselves and their families at home. As was shown by the insignificance of many individual and household level variables, remittances may have much more to do with the macroeconomic situation in the country.

We show that there is not only one reason which motivates migrants to remit, but instead the mix depends on the different characteristics of the migrants, and the receiving households. Migrant age, sex, marital status and education and household income, wellbeing and migration patterns are influential in determining the amount of remittances received. Other characteristics of the sending and receiving countries matter as well, for example unemployment and language of the destination country and distance to the sending country. It is clear that the causes and patterns of migration in each of the countries influence the remitting behaviour. A combination of these factors determines the amount of remittances sent, thus making the remittance decision highly individual.

Since remittances have been linked to poverty alleviation and development and can be seen as a kind of social protection strategy in countries where government provided social protection is limited, it is relevant and interesting to understand the driving forces behind remittances. Our results show that remittances respond to the poverty situation in the home country, but that there is not one overriding motive behind remittances for all countries, so it is important to analyse each situation separately.

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Appendix 1 Empirical results on determinants of remittances

Micro determinants

Table A1.1 Empirical effects found for probability to remit

Effect of … on probability of remittances	migrant income	migrant gender (base male)	migrant marital status	migrant age	migrant education level	migrant risk level	migration duration	whether spouse joined migrant	migration cost	HH income	HH wealth	no. HH members/ dep. ratio	no. migrants/ other migrants	neg. HH shock	age HHH	education HHH
Agarwal & Horowitz (2002) Guyana, Altruism model		x			+	x	+(1)			-	-	-	-		x	x
Banerjee (1984) India	+				x		+	-				+				
Durand, Kandel, Parrado, Massey (1996) Mexico, [Remittances	x		+	+	-	x(2)	x	-	+		-(3)	x				

& savings]																
Funkhouser(1995) El Salvador & Nicaragua	x(4)	x		x	x		x	x					x			
Germenji, Beka & Sarris (2001) Albania	x	x							x	-	x	x	+		x	x
Hoddinott (1994) Western Kenya					+						+	x				+
Holst & Schrooten (2006) Migrants in Germany	+(5)/ x(6)	+	+	+	+						_(7)	x				
Itzigsohn (1995) Jamaica, Haiti, Dominican Republic & Guatemala			x							_/+/ x(8)		+			x	+/ x(8)
Konica (2006) Albania		+		x		-	+	-					-			
Merkle and Zimmerman (1992) Migrants in Germany	+		+	+	x		x	-								
Osaki (2003) Thailand, [internal migration]		-	x	+	-		+			-	-	- (9)				
Pozo (2005) Latin America, Mexico						+										
Pleitez-Chavez (2004) El Salvador										-	+		+	+	x	
Schrieder & Knerr (2000) Cameroon				+							+(10)/ -(11)			x	+	
SELA(2004) US, focussed on Latin American and Caribbean, [logistic regression]	+(12)	+	x	x	x			+(13)				x				
Crăciun (2006)		x	x	x	x		+/-							+(14)		

We include those variables that are common to most papers.

+: positive effect; -: negative effect; x: included in regression but not significant;

1 > 1 year

2 taxes withheld

3 business owned

4 employment

5 Migrants in Germany

6 income

7 real estate owned

8 depends on country

9 no. children

10 property

11 other wealth variables

12 Employment

13 home visits >=1

14 Unemployment

Table A1.2 Empirical effects found for the level of remittances

Effect of ... on level of remittances	migrant income	migrant gender (base male)	migrant marital status	migrant age	migrant education level	migrant risk level	migration duration	whether spouse joined migrant	migration cost	HH income	HH wealth	no. HH members/ dep. ratio	no. migrants/ other migrants	neg. HH shock	HHH age
Agarwal & Horowitz (2002) Guyana, [Altruism model]		+			x	x				x	x	+	-		-
Banerjee (1984) India	+				+		-	-				+			
Durand, Kandel, Parrado, Massey (1996) Mexico, [Remittances & savings]	+		x	+	+	x	+	x	+		x	x			
Funkhouser (1995) El Salvador & Nicaragua	+(1)	+(2)		x	x		-	-(2)					-(3)/ x(2)		
Germenji, Beka & Sarris (2001) Albania	+								x	-	-	x	x		+(4)
Halliday (2004) El Salvador														+(5)/ -(6)	
Hoddinott (1994) Western Kenya	+			+	+						+	x	+(7)		
Lianos & Cavoundis (2006) Albanian migrants in Greece	+	x	x	x	x	+(8)	x	-							
Lucas& Stark (1985) Botswana, [Urban migrants]	+	-					+			+	-	+		+ (9)	
Osaki (2003) Thailand. [Internal migration]		x	x	+	x		x			-	-(10)	-(11)			
Pozo (2005) Latin America. Mexico						+									
Yang (2005). Philippines										-(12)					
Crăciun (2006) Moldova	+	x	x	+	x		x			-		x			-(13)
Osili (2007) US-Nigeria				x	x					+		+			

We include those variables that are common to most papers.

+: positive effect; -: negative effect; x: included in regression but not significant;

1 employment

2 El Salvador

3 Nicaragua

4 HHH > 50
5 agricultural shock
6 earthquake
7 no. adult sons
8 stability employment
9 drought
10 house
11 no. elderly
12 instrumented
13 general age level in HH

Table A1.3 Empirical effects found for the joint solution of probability & level of remittances (Tobit)

Effect of ... on probability & level of remittances	migrant income	migrant gender (base male)	migrant marital status	migrant age	migrant education level	migrant risk level	migration duration	migrant	migration cost	HH income	HH wealth	no. HH members/ dep. ratio	no. migrants/ other migrants	neg. HH shock	HHH age
Amuedo-Dorantes & Pozo (2006) Mexico		+		+	x	+	x					+			
de la Briere, Janvry, Lambert & Sadoulet (1997) Dominican Republic				x	+		+			-	+			x	x
Brown (1997) Tongan & Samoan migrants in Australia	+				x		x		+(1)						
Funkhouser (1995) El Salvador & Nicaragua	+(2)	+(3)		x	x		-	-(3)					-(4)/ x(3)		
Germenji, Beka, Sarris (2001) Albania	+								x	-	-	x	x		+(5)
Gubert (2002) Mali (Male migrants)			+	+	+		+		+	x		+	-	+	
Hagen-Zanker & Siegel (2007)															
Albania		x	-	x	+	+	+		x	-	x	x	x	x	+
Moldova			x		x	-	x			x					

Holst & Schrooten (2006) Migrants in Germany	+(2)	x	+	+	+						- (6)	x			
Konica (2006) Albania		+		+		-	x	-					-		
Merkle and Zimmerman (1992) Migrants in Germany	+		x	+	x		x	-							
Pleitez-Chavez (2004) El Salvador										-	+			+	+
Schrieder & Knerr (2000) Cameroon				x							- (7)/ +(8)			x	x
Crăciun (2006)	+	-	x	x			+					x (9)			- (10)

We include those variables that are common to most papers.

+: positive effect; -: negative effect; x: included in regression but not significant

1 Samoa

2 employment

3 El Salvador

4 Nicaragua

5 HHH>50

6 real estate owned

7 property

8 other wealth variables

9 children in HH

10 general HH age

Table A2: Macroeconomic determinants for the amount of remittances

Paper	# of workers	Wage rates/ earnings	Econ. situation in host country	Poor econ. situation in origin country	Exchange rate (restrictions)/dual exchange rate	Interest rate gap btw sending and receiving (better int. rate in host country)	Political risk	Infrastructure to transfer funds/ Financial sector development	Macroeconomic instability in home country

Akkoyunlu & Kholodilin (2006)			+	x					
Ayadas, Neyapti & Metin-Ozcan (2006)			+	+	-		-		-
Bouhga-Hagbe (2006)				+					
Buch, Kuchulenz & le Manchec (2002,2004)	x	x	x	_	x	x		x	x/-(1)
Elbadawi & Rocha (1992)	+		+		-	-			-
Faini (1994)					+(2)				
Freund & Spatafora (2005)	+		+		_			-(3)	
Gupta (2005)	+(4)	+	+	+	x	x	x		
IMF(2005)			+	+	-	x	x	x	_
Lianos (1997)	+	+	+	x	-	+			-(1)
Lueth & Ruiz-Arranz (2006)			x(5)						+
Lueth & Ruiz-Arranz (2007)		+	+	+	-				
Russell (1986)	+	+	*	*	*	*	_	+	
Sayan (2006)			x	-					
Schiopu (2006)			+	+		x			
Schrooten (2005)		+	+	+				x	
Schrooten (2006)	x(4)		+					+	

We include those variables that are common to most papers.

+: positive effect; -: negative effect; x: included in regression but not significant

1 Inflation

2 If host country exchange rate is good

3 High fees to send money

4 Increased immigration

5 Shock, natural disaster

Table B: Reasons for methodology used in determinants of remittances papers:

Paper	Tobit	2-stage	Both	Other
Agarwal and Horowitz (2002)		First Probit for decision to remit and then Heckman procedure to correct for selection bias and then use maximum likelihood to obtain consistent and efficient estimates		
Amuedo-Dorantes (2006)	Uses probit model			
Banerjee (1983)			Use both for better explanatory power (robust results)	

Brown (1997)	Because of data censored at zero Tobit is used because OLS is biased			
Cox, Eser, Jimenez (1997)		First uses Probit and then generalized Tobit (inverse Mill's ratio used)		
Crăciun (2006)			Uses both for comparison (Probit and 2-part Cragg's model (1971).	
Elbadawi and Rocha (1992)				OLS to estimate log remittances TSLS to avoid simultaneity bias
Funkhouser (1995)			Uses both to account for selection bias (compare results, robust)	
Germenji, Beka, Sarris (2001)	Tobit used: Decisions made simultaneously because there has been no distinction in the theoretical literature on factors that influence the decision to remit and level of remittances.	First model decision to remit and then use a corrected OLS : application of Heckman 2-step	Uses both	
Gubert (2002)			Uses both	CLAD
Halliday (2004)				Logit for household's migrant investment Ordered logit for southward/northward migration OLS for log of hh remittances
Hoddinott (1994)		Probit and then OLS (paper quoted a lot as one of the fist to do this)…but has to do with selection bias more than separate decisions to remit.		Probit for migration decision
Holst and Schrooten (2006)		First use a probit for the decision to remit and then use a Tobit for the amount of remittance		
Itzigsohn (1995)				Logistic regression on remittance receiving households
Merkle and Zimmermann (1992)	Used Tobit model for remittances amount			Use ordinal Probit (for four groups) for savings as dependent variable Also uses Probit with binary dependent variables of both remittances and savings
Osaki (2003)		Logit for propensity to remit and OLS for factors determining amounts		
Osili (2007)			OLS	

Schrieder and Knerr (2000)	Tobit used to see whether wealthier household members receive more remittances.			Probit is used to estimate determinants of remittee's access to remittances
Schrooten (2006)				Model using first-differenced GMM estimator/ dynamic panel on lagged remittances as % of GDP (Macro paper)
Schrooten (2005)				Model using first-differenced GMM estimator/ dynamic panel on lagged remittances as % of GDP (Macro paper)
Secondi (1997)		Believes the decision to remit is made in two parts Probit for probability of receiving and transfer ant then OLS for amounts		
Stark and Lucas (1988)				OLS
Yang and Choi (2005)				OLS and instrumental variables for change in HH domestic income divided by initial total HH income

Appendix 2: Variable overview

Analysis 1: Testing for altruism vs. insurance (Albania & Moldova):

Variable description (Moldova)	**Mean**	**Std. dev.**	**Variable description (Albania)**	**Mean**	**Std. dev.**
Remittances received by the household over the last 12 months in US dollars	1154	2239	Remittances received by the household from migrant over the last 12 months in Lei	48511	196712
Migrant characteristics					
Age of migrant at departure	34	9.8	Age of migrant at departure	26	8
Gender of migrant (dummy; base female)	.66	.47	Gender of migrant (dummy; base female)	.48	.50
Marital status of migrant (dummy; base not married)	.62	.49	Marital status of migrant (dummy; base not married)	.67	.47
Split into dummies for incomplete secondary, complete secondary, vocational and higher education	.11 .41 .28 .20	.31 49 .45 .40	Split into dummies for incomplete secondary, complete secondary, vocational and higher education	.55 .23 .12 .09	.49 .42 .33 .29
Country dummies and region dummies (Italy, CIS, Europe)	.17 .64 .34	.38 .48 .47	Country dummies (Greece, Italy, Germany, Other Europe)	.19 .16 .01 .07	.39 .36 .08 .25
Household characteristics					
Number of members of the household	2.9	1.3	Number of members of the household	4.24	1.80

Monthly per capita expenditure in Lei in splines	10 38 500	113 189 407	Monthly per capita income in Leks in 3 splines	159 384 5722	1534 2301 4643
Subjective wellbeing of the household in dummies: fully satisfied, rather satisfied, less satisfied and not satisfied	.053 .054 .048 .550	.225 225 .215 .498	Subjective wellbeing of the household in dummies: fully satisfied, rather satisfied, less satisfied and not satisfied	.014 .014 .134 .488	.118 .118 .341 .500
Dummy for whether or not remittances are used most for consumption	.81	.39	Dummy for whether or not remittances are used most for consumption	.78	.42
Number of migrants in the HH	1.3	.58	Number of other migrants in the HH	.62	1.1
Dummy for if there are future migrants in the HH	.33	.47	Number of future migrants in the HH	1.75	.43
Dummy for whether the household lives in an urban or rural area (1 urban, 2 rural)	1.6	.48	Dummy for whether the household lives in an urban or rural area (1 urban, 2 rural)	1.5	.5
Risk variables					
Unemployment rate in country of migrant destination	8.64	1.30	Unemployment rate in country of migrant destination	8.98	.79
Duration of migration in categories: less than 1 year, 1 to 5 years, >5 years	.11 .13 .26	.31 .33 .44	Duration of migration in categories: less than 1 year, 1 to 5 years, >5 years	.18 .43 .39	.38 .50 .49
Distance in Km between Moldova's capital (Chisinau) and the capitals of the other destination countries	1314	621	Distance in Km between Albania's capital (Tirana) and the capitals of the other destination countries	302	436
Dummy for speak the same language or a language similar to that of the migrant	.65 .24	.48 .43	Dummy for speak the same language or a language similar to that of the migrant	---	---

Analysis 2: Testing for altruism and self vs. family provided insurance (Albania):

Variable name	Variable description	Mean	Std. dev.
Received remittances used for consumption	Remittances received by the household from migrant over the last 12 months in Leks that are mainly used for consumption	0.78	0.42
Migrant characteristics			
Age of migrant	Age of migrant at departure	32	8.6
Gender	Gender of migrant (dummy; base female)	.69	.46
Marital status	Marital status of migrant (dummy; base not married)	.67	.47
Education of migrant	Split into dummies for incomplete secondary, complete secondary, vocational and higher education	.52 .27 .14	.50 .44 .35

		.06	.25
Country of migrant destination	Country dummies (Greece, Italy, Germany, Other Europe)	.46 .34 .01 .13	.50 .47 .12 .34
Household characteristics			
Household size	Number of members of the household	3.3	1.76
Income per capita in Leks	Monthly income per capita	5661	4319
Subjective wellbeing	Subjective wellbeing of the household in dummies: fully satisfied, rather satisfied, less satisfied and not satisfied	.002 .169 .517 .311	.046 .375 .500 .463
Other migrants in HH	Number of other migrants in the HH	2.4	1.37
Future migrants	Number of future migrants in the HH	1.76	.43
Urban/Rural	Dummy for whether the household lives in an urban or rural area (1 urban, 2 rural)	1.6	.50
Risk variables			
Unemployment rate	Unemployment rate in country of migrant destination	9.03	.78
Duration of migration	Duration of migration in categories: less than 1 year, 1 to 5 years, >5 years	.14 .44 .42	.35 .50 .49
Distance	Distance in Km between Tirana and the capitals of the other destination countries	666	400

Variable name	**Variable description**	**Mean**	**Std. dev.**
Received remittances used for investment	Remittances received by the household from migrant over the last 12 months in Leks that are mainly used for investment	.17	.37
Migrant characteristics			
Age of migrant	Age of migrant at departure	27	6
Gender	Gender of migrant (dummy; base female)	.93	.26
Marital status	Marital status of migrant (dummy; base not married)	.30	.46
Education of migrant	Split into dummies for incomplete secondary, complete secondary, vocational and higher education	.68 .11 .03	.47 .31 .17
Country of migrant destination	Country dummies (Greece, Italy, Germany, Other Europe)	.44 .36 .01 .15	.50 .48 .1 .36
Household characteristics			
Household size	Number of members of the household	3.67	1.89

Income per capita in Leks	Monthly income per capita	5028	4529
Subjective wellbeing	Subjective wellbeing of the household in dummies: fully satisfied, rather satisfied, less satisfied and not satisfied	.01 .22 .65 .12	.10 .41 .48 .33
Other migrants in HH	Number of other migrants in the HH	2.66	1.58
Future migrants	Number of future migrants in the HH	1.70	.46
Urban/Rural	Dummy for whether the household lives in an urban or rural area (1 urban, 2 rural)	1.78	.41
Risk variables			
Unemployment rate	Unemployment rate in country of migrant destination	9	.77
Duration of migration	Duration of migration in categories: less than 1 year, 1 to 5 years, >5 years	.09 .57 .34	.29 .50 .47
Distance	Distance in Km between Tirana and the capitals of the other destination countries	681	410

Analysis 3: Testing for bequest motive, co-insurance and New Economics of Labour Migration

Variable name	**Variable description**	**Mean**	**Std. dev.**
Amount of remittances	Remittances received by the household from migrant over the last 12 months in Lei	39050	192085
Bequest/ household variables			
Income of the household	Monthly per capita income in Leks	6265	6970
Other migrants in HH	Dummy for if there are other migrants in the HH	.17	.37
Age of household head	Age of the household head	52	14
Wealth index	Wealth index: composed of house, land and animal ownership	.62	.35
Inherited house	Whether or not the current house of the HH was inherited (dummy)	.15	.36
Number of elderly	Number of elderly in the HH	.59	.77
Co-insurance variables			
Household shocks	Adverse general shocks the household (excluding health)	.06	.24
Health shock	Adverse health shock experienced by HHH or spouse	.54	.50
Borrowing money	Whether or not the HH is borrowing money	.11	.31
NELM variables			
Community infrastructure	Community infrastructure index, consisting of access to a school, a health centre, private medical care, phone, post, bus, bank, electricity, light, water, sewage.	.65	.34
Credit infrastructure	Credit possibility index that equals to one if possible to borrow money from bank, moneylender, or cooperative in community	.27	.45
Informal credit	Credit from family or friends is a source of borrowing in this community	.61	.49
Population	Population of the community	595620	478103
Lack of employment opportunities in community	Dummy variable	.23	.42

Urban/Rural	Dummy for whether the household lives in an urban or rural area (1 urban, 2 rural)	1.49	.50

Analysis 4: Testing for loan repayment (Moldova)

Variable name	**Variable description**	**Mean**	**Std. dev.**
Amount of remittances	Remittances received by the household over the last 12 months in US dollars	1154	2239
Migrant characteristics			
Age of migrant	Age of migrant at departure	34	10
Gender	Gender of migrant (dummy; base female)	.66	.47
Marital status	Marital status of migrant (dummy; base not married)	.62	.49
Duration of migration	Duration of migration in categories: less than 1 year, 1 to 5 years, >5 years	.61 .13 .26	.49 .33 .44
Country of migrant destination	Country dummies and region dummies (Italy, CIS, Europe)	.17 .64 .34	.38 .48 .47
Household characteristics			
Household size	Number of members of the household	2.9	1.3
Expenditure per capita	Monthly per capita expenditure in Lei in splines	10 38 500	113 189 407
Subjective wellbeing	Subjective wellbeing of the household in dummies: fully satisfied, rather satisfied, less satisfied and not satisfied	.05 .05 .55 .32	.23 .21 .50 .46
Other migrants in HH	Dummy for if there are other migrants in the HH	.48	.50
Loan repayment variables			
Education of migrant	Split into dummies for incomplete secondary, complete secondary, vocational and higher education	.12 .41 .28 .20	.31 .49 .45 .40
Education of household head	Split into dummies for incomplete secondary, complete secondary, vocational and higher education	.24 .36 .25 .15	.43 .48 .43 .36
Motivation to remit	Reasons the migrant remitted as dummy: debt	.21	.41 .
Cost of migration	Cost of migration in US dollars	679	1069
Returned borrowed money	Dummy returned money borrowed for migration: yes or no	.84	.37
Remittances sent to migrant	Dummy whether or not remittances were sent to the migrant	.04	.19

Analysis of Cointegration in Capital Markets of France, Germany and United Kingdom

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Abstract

In this paper, we assess whether there is cointegration among stock exchange markets of a bloc of major EU countries of France, Germany, and, United Kingdom. Besides, we probe the cointegration patterns between these countries' capital markets and the world capital market as well, proxy of which is the Morgan Stanley Capital International (MSCI) Index. The main rationale inducing us to focus on these countries is their joint membership in European Union inferring great financial integration among them. Additionally, their economic structures are of the same character, and their relatively high level of development makes them possess the heaviest volume stock exchange markets in the European Union.

We exploit monthly data of stock exchange for the period of January 1991 – September 2006, and daily data of stock exchange for the period of January, 1st 1991 – September 30th 2006. The methodology we use encompasses unit root tests and cointegration tests.

Our preliminary results indicate that there exists a long term relationship when we match the European countries with each other.

JEL Codes: C32, G15

Introduction

The aim of this study is assessing whether there is cointegration among stock exchange markets of a bloc of major EU countries of France, Germany, and United Kingdom for the time period from January 1991 to July 2006. Besides, cointegration patterns between these countries' capital markets and the world capital market are analysed as well.

Finance literature contains considerable number of studies that examine the degree of integration of stock markets around the world. These studies have proved that capital markets all over the world have become increasingly integrated and co-movements among major financial markets have been rising.

The main reason for this trend is a variety of policy changes that contribute to the liberalization and globalization of capital markets (Chou, Ng, Pi (1994)). According to Ripley (1978) and Bachman et al (1996), the interdependence among national stock markets may also be the result of some factors that provide indirect links between stock prices in different countries, too. Those factors include: similarity in income patterns, the formation of a currency area strengthening the relationship between domestic economic variables, the role of a dominant financial center within a multinational area facilitating within-area capital flows, a common technological trend assimilating concurrently into different economies, financial deregulations allowing investors to extend their portfolios internationally, and significant international trades in general and in capital goods inducing strong economic ties.

This research area has drawn great attention, and this is because of its result implications in the world of economics. The extent of international capital market integration has a big importance for investor's investment strategy and capital market efficiency. Let's talk on these in turn. Provided that the equity markets under consideration are integrated, then diversification benefits might be limited. This would be the result as an unfavorable movement in one market would reflect an unfavorable movement in other markets, too. So, investing at the same time on a group of cointegrated markets, will not hedge the risk of investing.

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Moreover, on the basis of available information, market efficiency is defined as the unpredictability of future price movements. The major implication of the idea that markets are efficient is that price movements do not follow any patterns or trends. This means that on the basis of available information it is not possible to predict future price movements. Such an unpredictable pattern of the price movement is called a 'random walk'. Testing a random walk model is the main methodology for testing the market efficiency. There are different forms of market efficiency based on the extent of information available. The most commonly observed and analyzed is the weak-form market efficiency (the information set includes only information on historical returns). Consequently, capital market integration may contradict weak-form market efficiency if one market's movements can be used to predict another market's movements.

To sum up, inspired by Ortiz (2006) on "Patterns of Cointegration in NAFTA Capital Markets", our paper undertakes a review of the issues surrounding capital markets' relationships and more specifically, the extent to which we may expect our selected international capital markets to be cointegrated. Section 2 reviews the available empirical evidence regarding the degree to which international stock exchange markets are cointegrated. We proceed in section 3 by stating the main methodology we exploited to find what is behind the enormous array of the data made use of. Section 4 includes our concrete empirical results obtained from unit root and cointegration tests. These results, then, lead us to make a final résumé and conclusion on the target of our research in section 5.

Literature Survey

The literature review develops a theoretical background for the study through a review of relevant theories. The literature review places the study in context by reviewing prior stock market integration studies in both global and regional contexts. Although there has been extensive research on equity market integration, there is no set agreement on this phenomenon. The studies of long-run relationships provide mixed results. Research results differ according to the methodology used, the model, the data, the sample, and the time period. Some studies have concluded that world equity markets are integrated, that the US market is the most influential stock market in the world, and that the Japanese market is the second most influential. On the other hand, some studies have reported no lead or lag relationships among international markets at all.

It would be proper to begin with the paper that was our source of inspiration, Ortiz (2006). This study tests financial integration among NAFTA capital markets, and between these markets and the world capital market. Results evidence a time-varying integration among NAFTA capital markets, and a mild segmentation and a time-varying integration between these markets and the world capital market.

As in this study we focus on analyzing the cointegration in capital markets of three major EU countries, in this literature review, we mostly concentrate on the studies that examine the patterns of cointegration on EU member countries. These studies generally find the evidence of stock market integration within the EU, reemphasizing the possibility of economic integration via policy coordination in explaining stock market interdependence.

Arshanapalli and Doukas (1993) uses unit root and cointegration analyses to examine relationships and interactions among the stock markets of New York, Japan, Paris, Frankfurt, and London, from January 1980 to May 1990. The authors conclude that there has been an increasing interdependence among these stock markets after the crash of 1987, except for Japanese stock market. The French, UK, and German markets are significantly affected by the US market. The Japanese market performance has no links at all with any market in the US, France, Germany, and UK.

Koutmos (1996) finds evidence that the stock markets of France, Germany, Italy, and the UK are integrated because they are affected not only by local news, but also by international news, especially unfavorable, stemming from other markets.

Friedman and Shachnurove (1997) also find that the larger markets of the EU comprising France, Germany, the Netherlands, and UK are highly related, but the smaller markets are more independent, implying larger benefits from short-run diversification by extending stock investment into those smaller countries. Moreover, the British stock market appears to be the leading market in the EU since it explains most of its own innovations and high proportions of the innovations in other markets.

Gallagher (1995), and Knif and Pynnonen (1999) find weak or no evidence of EU stock market integration. Gallagher (1995) suggests that Irish investors may increase long-run diversification benefits by extending their domestic stock portfolios to encompass the German and UK stock markets, because no evidence of cointegration is found between the Irish and German stock markets, or between the Irish and UK stock markets. Additionally, Knif and Pynnonen (1999) suggest that the Nordic countries appear to constitute separate region in Europe since they find no cointegration relationship between these markets and the other European stock

markets. However, their findings of no cointegration using three-year, daily data should not be interpreted as the lack of long-run stock market integration because cointegration is a long-run property and hence long time spans of data, rather than data frequency, are needed to appropriately test for existence of cointegration [Hakkio and Rush (1992)].

In contrast, evidence of stock market integration within the EU tends to be strong when a cointegration analysis is performed over an extended period of time. Such result is found in Serletis and King (1997), and Rangvid (2001).

Serletis and King (1997) find evidence of two common stochastic trends in ten EU stock markets using quarterly data from 1971 to 1992. They suggest that complete integration of, or a single shared common trend in EU stock markets is not observed potentially because of some existing differences in fiscal and monetary policies across EU countries. Using time-varying estimation, they also find evidence of an increase in convergence of stock prices over time, indicating that the linkages among the EU stock markets have been strengthening and the convergence has been an ongoing process.

Rangvid (2001) uses a recursive cointegration analysis to examine the degree of stock market integration among France, Germany, and the UK during the period from the first quarter of 1960 to the first quarter of 1999. They find that the number of cointegrating vectors increases from zero in the late 1960s to two as the estimation period gets expanded into the late 1990s. This suggests that the three major European stock markets have been increasingly integrated and driven by a fewer number of common market trends over time. Moreover, the integration appears to precipitate in the 1980s when capital restrictions are lifted throughout the EU area and increase throughout the 1990s when the moves toward the EU are more pronounced than those in previous decades because of the economic convergence criteria stipulated in the Maastricht Treaty (1992).

Similarly, Phengpis (2004) is an empirical analysis conducted upon stock price indices of five major EMU countries (France, Germany, Italy, the Netherlands, and Spain) , five non-EMU countires (Australia, Hong Kong, Japan, Singapore, and Switzerland), the US and UK for the period from January 1979 until June 2002. Unlike those of non-EMU countries, stock market price indices of the five EMU countries studied are cointegrated over the full sample period, over time, and even after controlling for the 1987 US stock market crash or the 1997 Asian financial crisis.

Finally turning back to our topic, our main concern would be to give answers to the following questions:

Which of the three major stock markets in the EU is the dominant market such that it is the source of common stochastic trends and may provide collective news and information that are relevant to all other EU stock markets?

Are there any long-run linkages and causal relationships between stock market integration among EU countries, and these countries and the world capital market (MSCI) as well?

Data and Methodology

Throughout this paper we make use of the monthly frequency of the data covering the period from January 1991 to July 2006 for France, Germany, and UK stock markets and the Morgan Stanley Capital International Index (MSCI). MSCI is used as a proxy for the world stock market index because it is built on more than 1500 stock prices from 23 stock markets around the world. Concerning our monthly series, in stead of using month-end closing values of stock markets as most papers have done up to now, we generate the monthly frequency of the data by taking the monthly average of the daily closing values of stock prices. We consider this originality a new idea in the context of better capturing the stock price movements throughout the month.

We use monthly series in this study, rather than daily series, because cointegration is a long-run property and hence long time spans of data, rather than high data frequency, is essential to appropriately test for the existence of cointegration [Hakkio and Rush (1992), Bailey and Stulz(1990)]. That is, the high number of observations as a result of a long time span (rather than as a result of high frequency of the data) grasps better the cointegration relation among capital market returns.

The FTSE 100 (UK), CAC 40 (FR), DAX 30 (GR) are used to represent the three EU markets respectively. Furthermore, in this analysis we transform our data into logarithms, that is into stock market returns. This transformation is necessary because the rate of returns is what all economic agents observe and are concerned about.

So, lnFR = monthly stock market returns for France.

lnGR = monthly stock market returns for Germany.

lnUK = monthly stock market returns for United Kingdom.

lnMSCI = monthly stock market index of the MSCI Index.

The cointegration analysis of our study covers an extended and relatively long period of time including the recent data of the last 15 years so as to allow common trends to be detected by cointegration analysis. Such a time period accentuates the potential influences of economic convergence on stock market integration, that appears to be reinforced by the dependence among EU countries as a result of Maastricht Treaty (1992), the 1990s initiantive of increasing policy coordination towards the formation of the EU and the ECB (European Central Bank)'s centralized monetary policy via the euro.

The standard classical estimation methods are based on the assumption that the mean and variances of the stochastic series are constant and time invariant. However, applications of unit roots have shown that a large number of economic series are non-stationary, that is, their means and variances change over time. This happens because time series data reflect a process that involves trend, cycle and seasonality. By removing these deterministic and/or stochastic patterns, the remaining data becomes stationary. The unit root tests determine the stationarity characteristics of the data. The ADF test of unit root is conducted within the context of three distinct models of generating processes of a series y as follows

$$\Delta y_t = \rho y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + u_t$$

Model (1) without any constant and trend.

$$\Delta y_t = \alpha + \rho y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + u_t$$

Model (2) with constant but no trend.

$$\Delta y_t = \alpha + \beta t + \rho y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta y_{t-i} + u_t$$

Model (3) with constant and trend.

The null hypothesis is: $H_0 : \rho = 0$, meaning that a unit root exits in y, that is, y is non-stationary. If a variable is stationary, that is it does not have unit roots, it is said to be integrated of order zero or I(0). When the non-stationarity problem is present in series data, the original data is differenced and retested. If a variable is not stationary in its level form, but stationary in its first differenced form, it is said to be integrated of order one or I(1). More generally, the series y_t will be integrated of order d, that is, $y_t \sim$ I(d), if it is stationary after differencing d times, so y_t contains d unit roots (Dickey and Fuller, 1981). Through this process, the order of the integrated process for each data series is established.

Only when our unit root tests indicate that all variables are integrated of the same order should we go further to examine whether the stock markets under study are cointegrated.

Earlier studies investigate market integration in two lines of research. The first and the oldest is the financial asset pricing perspective. According to this line, national markets are considered to be integrated if securities with the same risk characteristics are priced the same across borders, regardless where the securities are traded. The second line of research defines market integration from a statistical perspective and markets are considered to be integrated if national stock prices share a common long-run equilibrium relationship. All the papers that we took reference and talked about in our literature survey pursue this line of research, namely Arshanapalli and Doukas (1993), Koutmos (1996), Friedman and Shachmurove (1997), Gallagher (1995), and Knif and Pynnonen (1999), Serletis and King (1997), Rangvid (2001), Phengpis (2004). Our research adopts the later view and uses Johansen and Juselius (JJ) cointegration tests as the main methodology, too.

The basic idea behind cointegration is that if all the components of a vector time series process y_t have a unit root, or in other words, y_t is a multivariate I(1) process, it is said to be cointegrated when a linear combination of them is stationary, that is if the regression produces an I(0) error term. Johansen and Juselius (1990) proposed two types of hypothesis tests to help determine r, the number of cointegrating vectors. They are:

1. Trace test: The null hypothesis is that there are r or fewer cointegrating vectors in the system.

The statistic is: $-T \sum_{i=r+1}^{p} \ln(1-\hat{\lambda}_i)$. To determine the number of cointegrating vectors, r, we test the sequence of null hypothesis r=0, r≤1, r≤2,....., r≤(q-1). If r≤q is the first null accepted then we conclude that there are r=q cointegrating vectors.

2. Maximal eigenvalue test: The null hypothesis of the test is that the number of cointegrating vectors is r versus the alternative hypothesis that the number is r+1. The test statistic is $-T\ln(1-\hat{\lambda}_{r+1})$. To determine the number of cointegrating vectors, r, we test the sequence of null hypothesis r=0, r=1,....., r=p-1. If r=q is the first null accepted, then we conclude that there are r=q cointegrating vectors.

Cointegration regressions show the long-run, or equilibrium relationships between economic variables. Cointegration analysis will be conducted at both bivariate and multivariate levels in order to obtain more insight into the interrelationships among our markets of concern. Focusing only on bivariate or only on multivariate cointegration analysis might miss important information because it is possible that variables are not cointegrated at bivariate level but are cointegrated collectively, or vice versa.

Our aim in this study is to find only one cointegrating vector of the four-variate cointegrating regression among world stock market and the three selected EU countries. At the same time, we aim to find one cointegrating vector for the three-variate and bivariate cointegration regression equations among the EU countries as well. This implies that, in the long-run, there exists one equilibrium relationship between these variables throughout the time span under observation. In this instance, equilibrium refers to a situation where a shock may have a permanent effect on the levels of each of the processes, but any resulting disequilibrium will eventually die out completely.

This study employs an additional diagnostic technique proposed by Stock and Watson (1993), namely DOLS, to augment the robustness of the conventional JJ cointegration trace test. Dynamic Ordinary Least Squares provide efficient parameter estimators of the cointegrating relationships.

Finally, after determining the lag length in the VAR system, we then proceed to conduct the Granger test of causality. This will help us to see if the results gained from the cointegration tests are supported.

Empirical Analysis

This section presents the empirical results of this study. It is organized as follows: graphing the data all together, providing the correlation matrix, and evaluating the cointegration tests' results after firstly performing the ADF test for stationarity. Finally, Granger causality test results will be examined to see the causality between the four stock markets.

We refer to Graph-1 to get a visual idea of the basic characteristics of our time series. As it can be easily noted, the four time series show the same trend through the period under observation. We proceed with the correlation matrix included in Table-1. Pairwise correlation coefficients are remarkably high.

The traditional approach of testing market integration by referring to correlation coefficients cannot provide complete and enough information in this regard. To avoid this problem, this paper studies market integration by inspecting the long-run relationship among international stock market prices. In order to obtain a consistent regression equation, a compulsory condition is the data's stationarity. This can be tested by performing the ADF test. The outcomes are recorded in Table-2. First, we tested the null hypothesis of unit root for the level, and we failed to reject the null concluding that the level of the time series are non-stationary, that is they are not I(0). Then, we took the first differences and repeated the unit root test. This time, we succeeded in rejecting the null of unit root at all significance levels. Thus, the first differences of the logarithmic values of the price indices for France, Germany, UK, and MSCI came out to be stationary. They are all together integrated of order one, that is they are I(1).

Having all the series integrated of the same order, we can now test their cointegration relationships. The results we obtained are included in Table-3. According to Johansen and Juselius (1990) and Kasa (1992), in case of conflict between trace and the maximum eigenvalue tests, the former is superior. So, we refer to trace test to evaluate our results. We suceeded in getting one cointegrating vector from the following combinations:

lnMSCI, lnGR, lnFR, lnUK

lnMSCI, lnGR, lnFR

lnMSCI, lnGR, lnUK

lnGR, lnFR, lnUK

lnMSCI, lnGR

lnGR, lnUK

lnFR, lnUK

Thus, cointegration is present where there is a combination of non-stationary variables that is stationary, just like in our case. The finding of our study is that the four stock markets are cointegrated meaning that an equilibrium relationship between them exists in the long-run. Furthermore, a cointegration relationship was also obtained between the three major EU countries. But when looking at the cointegration relatonships in pairs, test results prove the existence of a long-run relationship except for Germany-France combination.

The results of the DOLS found in Table-4 give us statistically significant coefficients of cointegrating relationships if tested at 10%. Generally, their signs came out to be in accordance with the correlation coefficients.

Finally, the Granger causalities based on stock markets are analyzed to shed important light on the intertemporal relationships between the markets under study. Results of the causality tests show significant unilateral causal relationship from world stock market index to UK, from UK to France, and from UK to Germany; whereas there is no evidence of causality between France and Germany. Thus, Granger causality directions support the cointegration test results.

Conclusion

As stated also in our abstract, our preliminary results indicate that there should exist a long term relationship when we match the European countries with each other. The main rationale inducing us to focus on these countries is their joint membership in European Union inferring great financial integration among them. Additionally, their economic structures are of the same character, and their relatively high level of development makes them possess the heaviest volume stock exchange markets in the European Union.

But what did the empirical results of this study tell us about the degree of integration among the selected EU countries?

Firstly, as the correlation is a preliminary indication of market integration, referring to the correlation coefficients is a necessary but not sufficient step. As discussed a little before, returns among the stock markets show a high positive correlation.

After confirming that all four of our series were integrated of order one, I(1) by ADF unit root test, the data underwent the trace test of cointegration.

The results proved that one cointegrating vector is present in both multilateral and bilateral combinations. Stated simpler, the combinations of the integrated of order one (non-stationary) variables came out to be stationary. So, stock exchange markets are linked in the long-run, "in the sense that they tend not to drift apart over time" (Throop 1994, p. 11). All combinations, except for the France and Germany bilateral case, exhibit a long-run co-movement.

Stock Watson Dynamic OLS test of cointegration was used to support our JJ trace test results. What we got is that there is cointegration between the variables of interest, the coefficients are very good and the t-results are all statistically significant at 10 %.

This deduction is consistent with the preliminarily anticipated results stated in our abstract. Interestingly, the test results show that UK stock returns' movements explain and can also be explained by the variations in the other two countries' stock exchange returns, making in this way UK a leading indicator between these three EU countries. This is also supported by the generally unidirectional causality confirmed by the Granger causality test.

Ultimately, we concentrate in commenting on the implications of the findings of this research work.

We firstly discuss the effectiveness of international diversification benefits. Since this work involves a statistical view of market integration, an acceptance of the integration indicates that the international stock markets share a long-run equilibrium relationship. Namely, they do have a tendency to move together in the long-run. Therefore, international financial diversification benefits are limited among France, Germany and UK. However, as there is found no cointegration between France and Germany, investors can benefit by diversifying their investment portfolios among these two countries.

Last but not least, we discuss the market efficiency mentioned previously in the introduction.

The world stock index and the three major EU countries are cointegrated. This implies market inefficiency because the past information in one market can be used to help predict the price movements in another market. Consequently, the weak-form market efficiency is violated.

These findings are consistent with those of Arshanapalli and Doukas (1993), Koutmos (1996), Friedman and Shachnurove (1997), and Phengpis (2004).

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APPENDIX

Graph-1 Time series plot of the stock market indices

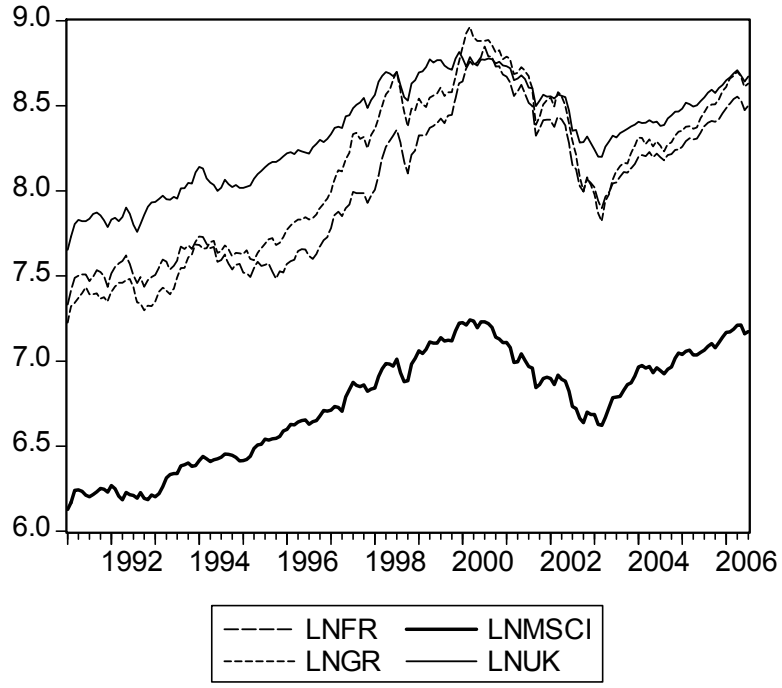

Table-1 Correlation matrix

Pairwise Correlation Matrix	lnFR	lnGR	lnMSCI	lnUK
lnFR	1.000000	0.968594	0.935903	0.927643
lnGR	0.968594	1.000000	0.972521	0.981103
lnMSCI	0.935903	0.972521	1.000000	0.973639
lnUK	0.927643	0.981103	0.973639	1.000000

Table-2 Augmented Dickey-Fuller (ADF) test

Variable	Case	Lags	Level	Case	Lags	Difference
lnMSCI	No Trend	1	-1.256	No Trend	0	-11.106*
lnFR	No Trend	1	-1.1282	No Trend	0	-10.561*
lnGR	No Trend	1	-1.3055	No Trend	0	-9.749*
lnUK	No Trend	1	-1.6487	No Trend	0	-11.0437*

The critical values for the case with no trend are -3.46 for 1%, -2.88 for 5% and -2.57 for 10% significance level.

* Reject null of unit root at 5% and 10% significance level. (i.e. time series is stationary)

Table-3 Johansen-Juselius cointegration test results

	Variables	Null	LAGS	TREND

				Max.E	Trace
1	lnMSCI lnGR	r =0 r≤1	1	30.2* 6.12	36.32* 6.12
2	lnUK lnGR	r =0 r≤1	1	25.96* 6.38	32.34* 6.38
3	lnUK lnFR	r =0 r≤1	1	13.35* 10.28	23.63* 10.28
4	lnMSCI lnGR lnFR	r =0 r≤1 r≤2	1	30.5* 13.75* 3.87	48.12* 17.62 3.87
5	lnMSCI lnGR lnUK	r =0 r≤1 r≤2	1	34.55* 14.23* 6.96	55.74* 21.19 6.96
6	lnUK lnFR lnGR	r =0 r≤1 r≤2	1	29.58* 14.59* 4.32	48.48* 18.90 4.32
7	lnMSCI lnGR lnFR lnUK	r =0 r≤1 r≤2 r≤3	1	36.81* 18.36* 15.42* 3.95	74.54* 37.73 19.37 3.95

* Significance referring to the following critical values:

The critical values for the case with trend for 10% significance level are:

	L-max Trace	L-max Trace	L-max Trace
r =0	19.88 58.96	16.13 39.08	12.39 22.95
r≤1	16.13 39.08	12.39 22.95	10.56 10.56
r≤2	12.39 22.95	10.56 10.56	
r≤3	10.56 10.56		

Table-4 Stock-Watson test results

		lnMSCI	lnGR	lnFR	lnUK	c
1	Coefficients Significance	1.0000	0.0937 0.0921	0.1856 0.0431	0.6263 0.0000	-0.7352 0.0444
		lnMSCI	lnFR	lnGR	c	
2	Coefficients Significance	1.0000	-0.0775 0.1540	0.7179 0.0000	1.5469 0.0000	
3		lnMSCI	lnGR	lnUK	c	

	Coefficients Significance	1.0000	0.3104 0.0000	0.5503 0.0000	-0.3616 0.2139	
4		lnGR	lnFR	lnUK	c	
	Coefficients Significance	1.0000	0.4919 0.0000	0.9307 0.0000	-3.6012 0.0000	
5		lnUK	lnGR	lnFR	c	
	Coefficients Significance	1.0000	0.8500 0.0000	-0.2735 0.0000	3.6436 0.0000	
6		lnFR	lnUK	lnGR	c	
	Coefficients Significance	1.0000	-0.8105 0.0000	1.3315 0.0000	3.9855 0.0000	
7		lnMSCI	lnGR	c		
	Coefficients Significance	1.0000	0.6539 0.0000	1.4440 0.0000		
8		lnGR	lnUK	c		
	Coefficients Significance	1.0000	1.5420 0.0000	-4.7554 0.0000		
9		lnFR	lnUK	c		
	Coefficients Significance	1.0000	1.2427 0.0000	-2.3466 0.0000		

The Effects of Capital Inflows on Growth and Other Macroeconomic Dynamics in Turkey after 2001 Crises

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Yıldız Technical University

Abstract

This study explores the direction of the causal relationship between the capital inflows and economic growth in Turkiye. The study's vision is to establish the effects of financial based growth over unemployment in Turkiye after 2001 crisis in case the financial resources could not be used effectively in production sectors and financial asset investments were preferred instead of productive resources. This choice can be stated as an unacceptable mistake for an underdeveloped country such as Turkiye as it prevents the growth to reduce unemployment rates. The vector auto regressive (VAR) context and vector error correction methodology (VECM) will be applied to investigate the effects of capital inflows over macroeconomics and their results after 2001 crisis as well.

Finally possible hazards of capital inflow volatility, in case the capital sources are not transferred to real sector at the right time, will be discussed.

INTRODUCTION

Growth and macroeconomic dynamics of Turkish Economy between 2001 and 2006 will be examined to understand the policy of the government. Recent studies cast doubts about the importance of capital inflows as a source of growth in developing countries.

Ragner Nurkse (1920) had focused on the destabilization of capital flows and had warned of the consequences based on international financial volatility. According to Mody and Murshid (2005) in the 1990s foreign capital induced less domestic investment than in the previous decades. As foreign direct investment (FDI) is a defining feature of globalization, one of the main goals of our paper is to investigate how FDI inflows affect growth in developing countries.

K. Ghose (2004) focused on manufacturing industries both because global restructuring of manufacturing industries is a central feature of globalization and because FDI inflows into developing countries in recent years have been mainly into manufacturing. In this paper we will examine the relationship between FDI, short term investments, long term investments, portfolio investments and GDP calculated by the production method based on the 1987 prices.

In the second part, the models and methodolgy used in the analysis will be introduced while data will be explained in the third part. In the fourth part empirical results will be discussed and finally these results will be evaluated. Also we will see that in Turkish economy different components of capital inflow react with growth differently. Impact of capital inflows over growth and domestic currency will be discussed based on macroeconomic policies.

METHODOLOGY

We will use Var models as such models have advantages to capture dynamic relationships among variables of interests which are so popular in emprical macroeconomics literature. Briefly the VAR metodology is as stated below:

$x_{it} \sim I(1)$ vs $I(0) \rightarrow ADF\ \ test$

$I(1) \rightarrow nonstationary\,;\ x_{it} \sim I(0)$

Test cointegration

Johansen Test

Engle-Granger Test

[90] The author has graduated from Yıldız Technical University Department of Economics.

If cointegrated → estimate Vector Error Correction Model

If not cointegrated → fit VAR to first differences

Estimation in the presence of Cointegration[91]

Engle and Granger (1987) have shown that corresponding to a pair of cointegrated variables, there exists an error correction model. This result is known as the Granger representation theorem. An ECM can be represented in the form:

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 \Delta(y_{t-1} - \beta x_{t-1}) + \varepsilon_t \quad (1)$$

After estimating equation 1, we identfy one variable as the dependent variable (Y) while identifying another one as independent (X). The information we are trying to obtain is about if X is expected to affect the conditional distribution of the future values of Y which is the notation known as **causality.** If X causes Y and Y causes X, there is a **feedback** which means that the two variables are **jointly determined.** But in many cases the direction of the causality is not so clear. It is important to note that the statement " Granger causes " does not imply that is the effect or the result of . Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

If there is no cointegrating relationship, we make the variables stationary by first differencing and test for non-causality in a VAR context. If there is cointegration than we test in VECM context with the stationary variables.

VAR Models

The notation of cointegration and causality are closely related to vector autoregressive models. They involve specifying several equations relating different independent variables to their own past values as well as those of other independent variables.

Below you will see an example of a VAR model with two endogenous variables and a second order autoregressive specification:

$$X_t = \alpha_0 + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \alpha_3 Y_{t-1} + \alpha_4 Y_{t-2} + u_t \quad (2)$$

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \beta_3 X_{t-1} + \beta_4 X_{t-2} + u_t$$

It should be noted that in each equation the current values, which is at time *t*, of the other independent variable's do not appear; only their past values do.

DATA

We used monthly data from the Turkish economy for the durations 1985.1-2006.12. and 2001.01-2006.12. We will focus on both periods seperately to understand the policies implemented after 2001 cirisis more clearly. All data were obtained from the Central Bank of the Republic of Turkey data delivery system, EVD. All series are I(0) and seasonal adjustments are made by the X12 filter.[92] For a few variables we benefitted from the correlograms and graphs to check seasonality and unit root test can be checked form Table1. The variables are as defined below:

Variable Name:	Explanation:
GDP1987ur(g) :	GDP calculated by the production method based on the 1987 prices.
REELEFEX:	Reel Effective ABD Dollar exchange rates calculated based on CPI (1997 as base year)
STCINF :	Other short term investments given in capital account division of the BOP sheet.
PORT:	Portfolio liabilities line in capital account division of the BOP Sheet.
FDI :	Foreign direct investment inflows.
NET ERRORS:	Net errors and omissions line in capital account division of the BOP sheet.
LTCINF:	Other long term investments given in capital account division of the BOP

[91] Ramanathan R, Introductory Econometrics with applications, 474-478

[92] The results of commonly used unit root tests are reported in the graphs and attachments section.

	sheet.
LM1:	Log of Real narrow money.
EMPLYMNT:	Percentage of employed labor.

EMPIRICAL RESULTS

The global financial system does not work well for developing countries. The money is flowing uphill from the poor to the rich. Some of these dollars from the developing to the developed countries go to pay their huge debts as well as buying bonds from the US and other strong currency countries. These bonds are highly liquid but they also earn very low interest rates and most of them are short-term US Treasury bills.

As Stiglitz mentions in his last book *Making Globalization Work*: *"We saw too that the huge volatility in the global economy -including interest rates and exchange rates- may quickly convert moderate debt in to an unbearable burden. While money should be flowing from the rich to the poor and risk from the poor to the rich, the global financial system is accomplishing neither.*[93]

Also Joseph E. Stiglitz mentioned in his book Globalization and Its Discontents that whether trade or capital market liberalization will improve growth is uncertain. Also growth models based on capital inflows will provide privileges for particular groups who are already wealthy.

One doubt about capital account liberalization is that if it provides yield net benefits, then these benefits should be measurable in empirical studies. It is obvious that the macroeconomic literature has had limited empirical success to prove that capital account liberalization has a positive effect on growth.

Unless it is not used properly to increase the productivity and reduce the unemployment to support the public welfare, capital inflows and hot money is a part of the problems rather than being a part of the solution. (Fukuyama F., 2004) Governments have to use the portfolio investments for industrialization and produce final products rather than buying bonds or various assets of developed countries.

We examined the relationships between capital inflow factors and growth and reel exchange rates in Turkey for both periods 1985.01–2006.12 and 2001.01–2006.12 to understand the macroeconomic policies more clearly.

Feedbacks between port, STCINF, LTCINF and GDP1987ur

Johansen suggests two test statistics to determine the cointegration rank which are trace statistics and λmax test (maximum eigenvalue test). After applying the Johansen test procedure to the data we can not find a cointegrating relationship between the pairs port and growth, STCINF and growth, ltcinf and growth.

As seen from Granger causality tests 1. table and table 2 there is no feedback between short term investments and growth at even 5% level. We can not reject the null hypothesis which states no cointegration between short term investments and growth in table 2. Also we can not reject the null hypothesis for both GDP1987ur_SA does not Granger Cause D1STCINF and D1 STCINF does not Granger Cause GDP1987ur_SA.

The situation is the same for portfolio investments and growth. There is no feedback at level 1% as you can see from Granger causality tests 2. table and table 2. There is no Granger causality for both variables between growth.

Moreover the response of growth (GDP1987ur) to short term investments is presented in figure 3.a. [94] growth increases for 7 months and then the effect stabilizes. Figure 3.a suggests that growth responds positively for a short time period when one standart deviation shock is given to short term investments. The evidence is statistically significant except for the fourth month.

However, figure 3.b suggests that growth responds positively for a short time period when one standart deviation shock is given to portfolio liabilities. The peak points occur in the second month. The response of growth (GDP1987ur) to port is presented in figure 3.b growth increases for 6 months and then the effect stabilizes.

The absence of long run feedback from long term investment to growth is surprising. See Granger causality tests 5. table and Table 2. Figure 4.b suggests that growth fluctuates when one standart deviation shock is given to long term investment. So it's obvious that there are lagged feedbacks effects for all the three situations.

[93] Stiglitz E. J, **Making Globalization Work**, p. 245–246

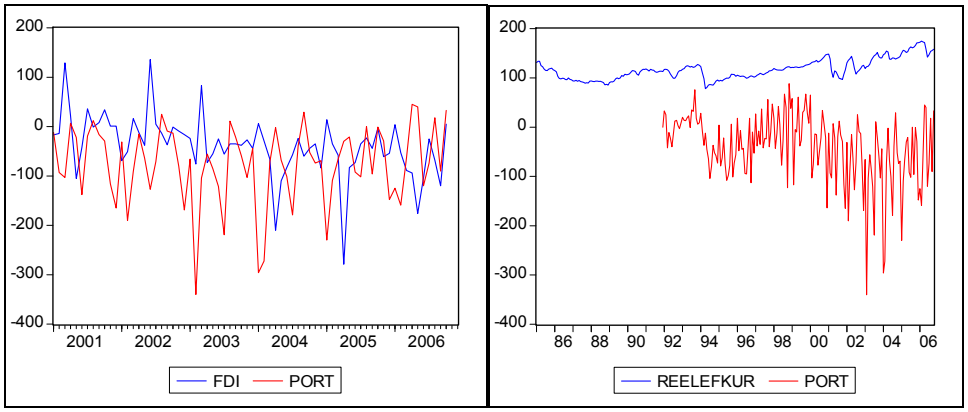
[94] All the models' lag structures are detected according to VAR Lag Order Selection Criteria one by one. The Akaike Information Criterion (AIC) is used to select appropriate lag order.

Another surprising result is that when we focus on data with same variables but between 2001.01 and 2006.12 as seen in Granger causality tests 7. table and Table 3, a one direction Granger Causality occurs from growth to portfolio investments. But rather than the presence of causality relation the direction of the relation is more interesting. We reject the null hypothesis which states that growth does not Granger Cause Portfolio investments strongly with a P-Value of 0.04. This can have such a meaning that Turkiye economy became an attractive investment are for foreign money after 2001 crisis by the macroeconomics policies.

FDI, Net Errors and GDP1987ur

The effect of globalization is an important factor for comparing the data with other developed countries as a crisis which can occur in those developed economies will absorb the money source from the economical system. This will make the system collapse and cause another crisis. This is just like constructing a building on a sandy field.

Considering all these factors which create uncertainty, we can realize how risky it is to build an economical system and growth model over financial assets without enough productivity increase. Another reason for considering about FDI is that only the developing countries are and have been net importers of FDI. If we focus on the graph below we can realize the FDI and portfolio investment import of Turkey clearly. FDI and portfolio investments have been behaved reversely especially after 2001.



Although there is not very strong evidence if we focus on table 2 and Granger causality tests 3. table we can discover that there is only one direction Granger Causality from FDI to growth. This weak causality points out very important situation. The foreign countries invest in our country, use our labor force and natural resources but do not let the profit to stay in our economy system. Furthermore when we look at the error correction output we can see that the coefficients of D1LG_SA(-1), D1LG_SA(-2), D1LG_SA(-3)→D1LG_SA are insignificant as well as the coefficients of D1FDI(-2), D1FDI(-3), D1LG_SA(-3), D1LG_SA(-4)→D1FDI.

About net errors and growth, there is only one direction causality from net errors to growth as we can see from Granger causality tests 6. table and Table 2. In fact this is not a surprising result for a developing country such as Turkey whose current account deficit increases day by day. Net errors are an important proxy to explore the deficits for understanding the effect of trade, capital in or out flows over growth.

REELEFEX and PORT

Table 2 and Granger causality tests 4. table suggest that there is one direction causality between reel effective ABD dollar exchange rates and portfolio investments from *port REELEFEX*. We can strongly reject the null hypothesis which states that *port* does not granger cause to *REELEFEX* with a P-value as 0.024. This causality means that by the portfolio investments and hot money movements, domestic currency may fluctuate if the macroeconomic fundamentals are not consistent especially in developing countries. As we can see from the graph below portfolio investments and Reel Effective ABD Dollar exchange rates move together.

Furthermore when we look at the error correction output we can see that the coefficients of second lag of *REELEFEX→port* are insignificant as well as the coefficients of first and second lags of *port→REELEFEX*.

Another interesting situation is that the same changes in the stock rates and exchange rates do not affect the economy with the same percentages.

EMPLYMNT, PORT, M1 and GDP1987ur

Finally we will construct a small artificial transmission system using the variables EMPLYMNT, port, m1 and GDP1987ur to see the effect of indirect injections to Turkish economy by portfolio investments over employment. Again the data period is 2001.01-2006.12.

Table 3 and Granger causality tests 8. table, state that there are no feedbacks within the variables EMPLYMNT, port, m1 and GDP1987ur in which there is only one direction causality between d1port and d1lm1. We can not reject the null hypothesis that EMPLYMNT does not Granger cause to LM1 at level %13 as well as LM1 does not granger cause port at level % 2. So it's obvious that portfolio investments granger cause to real narrow but both of them do not have a direct effect over employment and growth so these short term investments have to be converted to production before out flowing the system after the interest profits are obtained**.** Also growth seems to granger cause to portfolio investments at level %2.5 which can be paraphrased as growth increases the confidence of foreign capital investors.

CONCLUSION

As we discussed by using VAR models that short term investments, portfolio investments, long term investments and real narrow money do not have a direct effect on growth and employment percentages as well. So capital inflows can be the problem itself rather then being the solution if these resources can not be integrated with reel markets and can not be used to increase the productivity. But when we narrow the data period to 2001.01-12.2006 we see that a cointegration between portfolio investments and growth occur.

The effect of globalization is an important factor for considering about the effect of capital inflows over growth and unemployment as a crisis which can occur in those developed economies will absorb the money source from our economical system which will make the system collapse and cause another crisis. This is just like constructing a building on a sandy field.

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TABLE 1: AUGMENTED DICKEY- FULLER UNIT ROOT TESTS:1985.01-2006.12

	(I) For levels			(0) For first differences		
variable	**ADF**		**P-Value**	**ADF**		**P-Value**
GDP1987ur(g)	-3.45	*				
	(-5.62)		0			
REELEFEX	-2.87	**		-3.46	*	
	(-1.99)		0.28	(-10.50)		0
STCINF	-2.87	**		-3.46	*	
	(-1.69)		0.43	(-10.29)		0
PORT_YATIRIMI	-2.87	**		-3.46	*	
	(-1.183)		0.68	(-12.011)		0
FDI	-2.87	**		-3.46	*	
	(-0.31223)		0.91	(-10.67)		0
NET ERRORS	-3.46	*	0			
	(-14.95)					
LTCINF	-2.87	**		-3.46	*	
	(-1.12)		0.7	(-10.85)		0
LM1	-2.9	**		-3.53	*	
	(-1.18)		0.67	(-13.74)		0
EMPLYMNT	-2.9	**		-3.53	*	
	(-1.77)		0.38	(-8.63)		0

Notes: For both levels and first differences ADT tests iclude only an intercept term. ADF test statistics, given in parantheses, and associated probability values are coputed in Eviews 5.0
* indicates the rejection of the null unit root at 5% significane level while ** indicates the rejection of the null unit root at 1% significane level.

TABLE 2: UNRESTRICTED COINTEGRATION RANK TESTS: 1985.01-2006.01

	(I) Maximum Eigenvalue Statistics				Critical Values	
variables	**None**		**At most 1**		**0.05**	**0.01**
STCINF and GDP1987ur	24.56				25.87	
PORTFOYYATIRIMI and GDP1987ur	30.46					31.15
FDI and GDP1987	32.87	*				31.15
			3.77	*	16.55	
REELEFEX and PORT	32.87	*			31.15	
			10.59	*	16.55	
LTCINF and GDP1987ur	27.55					31.15
NET ERRORS and GDP1987	44.23	*			25.87	
			10.31	*	12.51	

Maximum Eigenvalue Statistics and ciritical values are calculated in Eviews 5. 0.
* indicates that null hypothesis is rejected at the stated significance level

TABLE 3: UNRESTRICTED COINTEGRATION RANK TESTS: 2001.01-2006.01

	(I) Maximum Eigenvalue Statistics								
variables									**Critical Value**
	None		**At most 1**		**At most 2**		**At most 3**		**0.05**
EMPLYMNT, PORT,	60.59	*							63.87
M1 and GDP1987ur			37.13	*					42.91
					19.79	*			25.87
							6.82	*	12.51
PORT and GDP1987ur	60.59	*							25.87
			21.22	*					12.51

Maximum Eigenvalue Statistics and ciritical values are calculated in Eviews 5. 0.

* indicates that null hypothesis is rejected at the stated significance level

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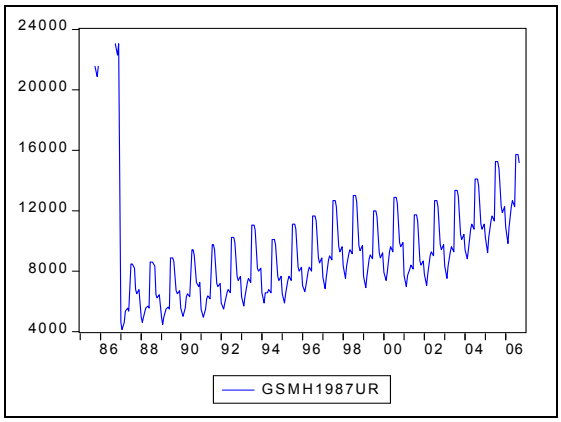

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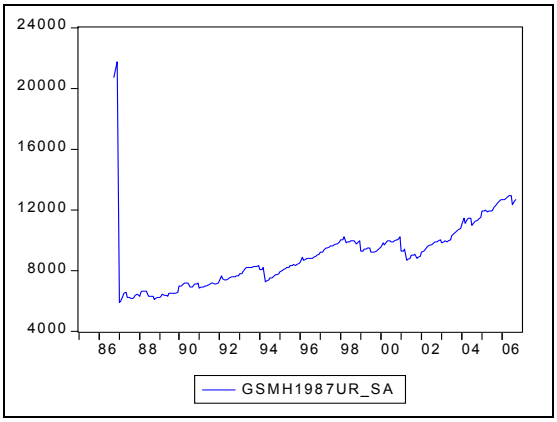

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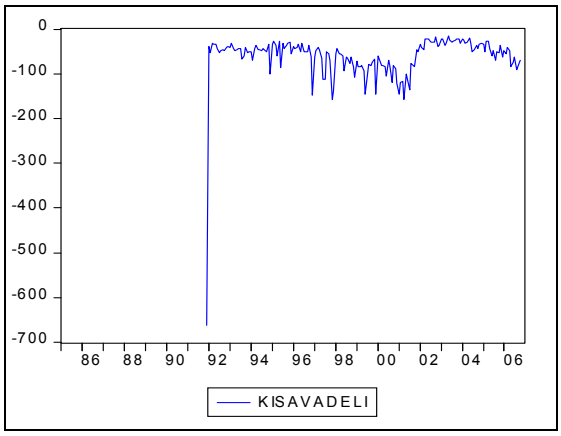

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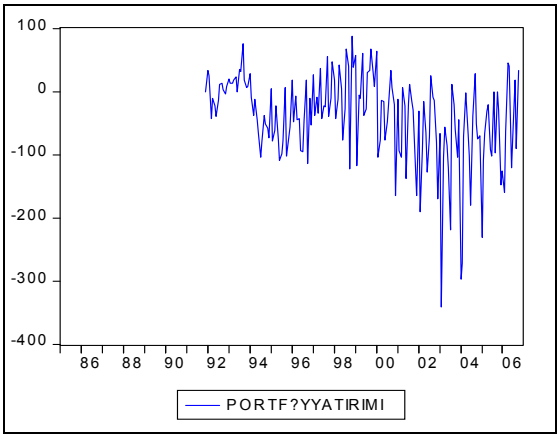

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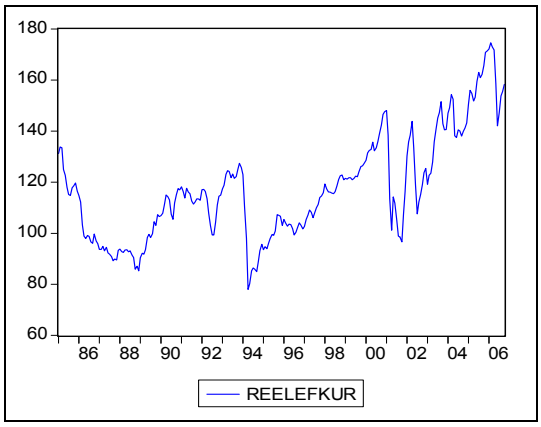
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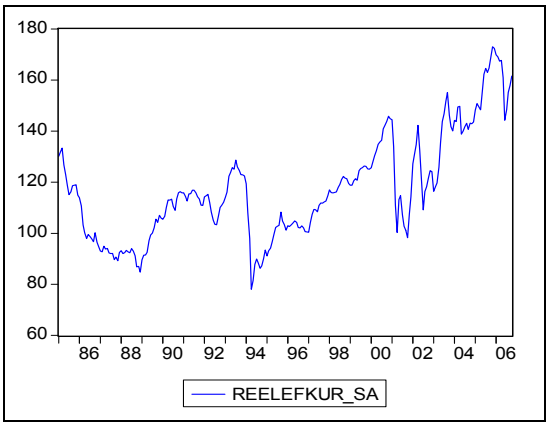
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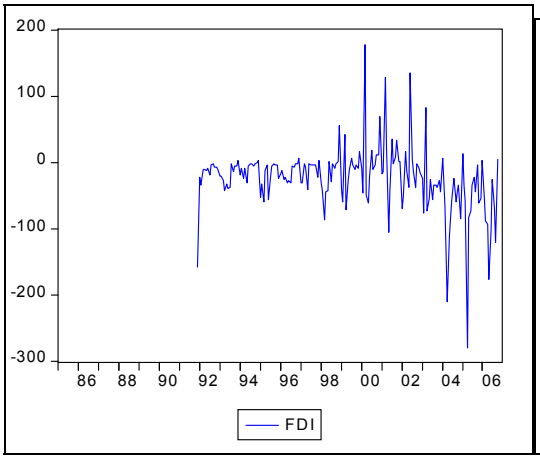
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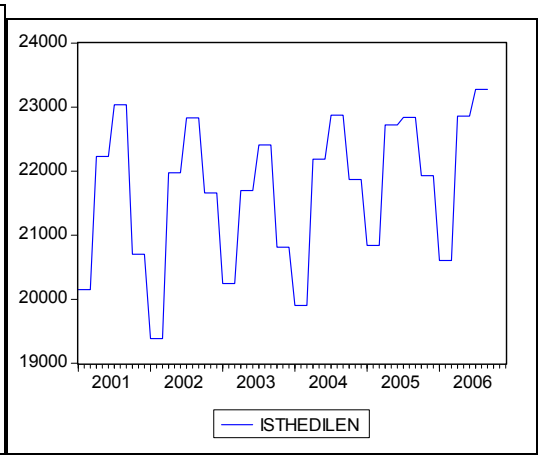
FDI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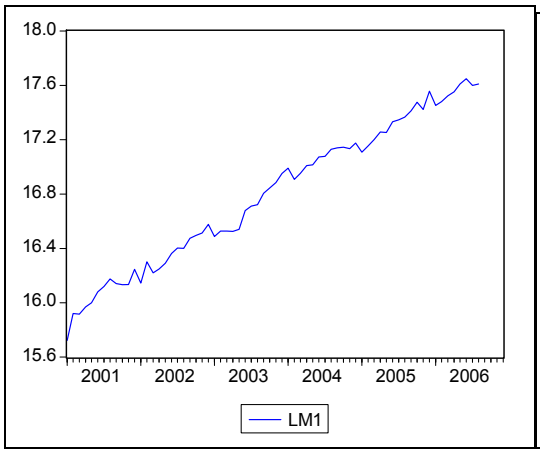
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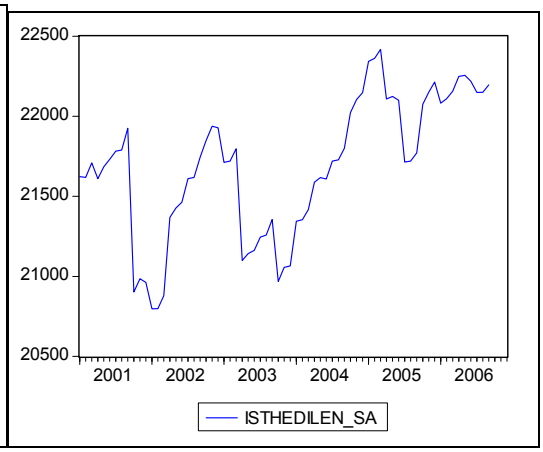
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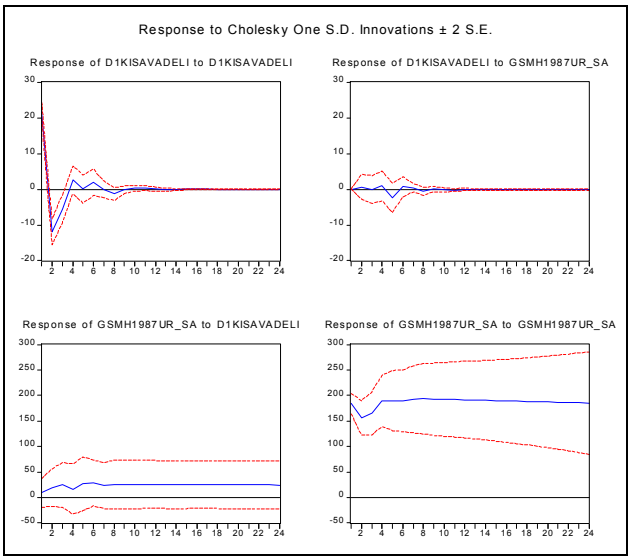
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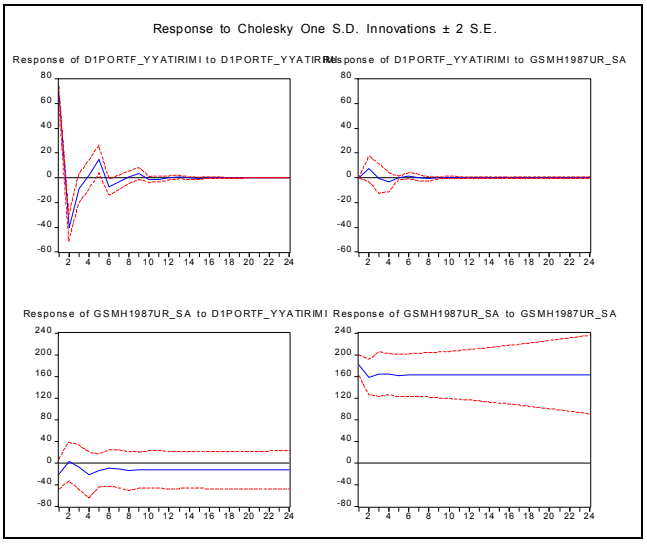
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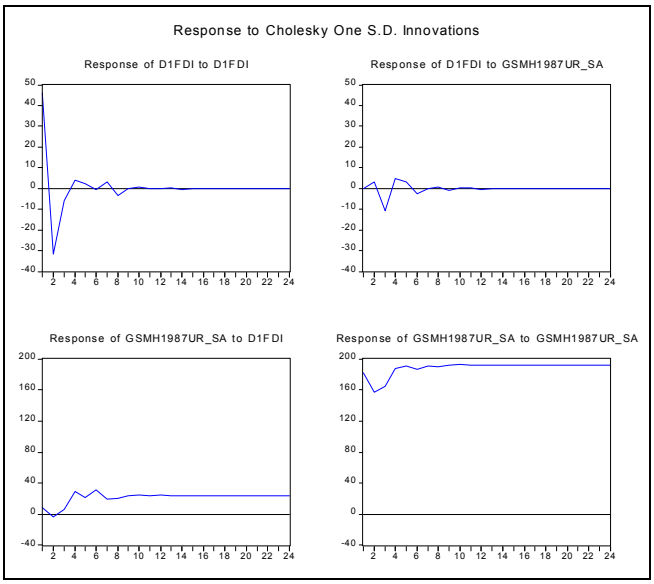
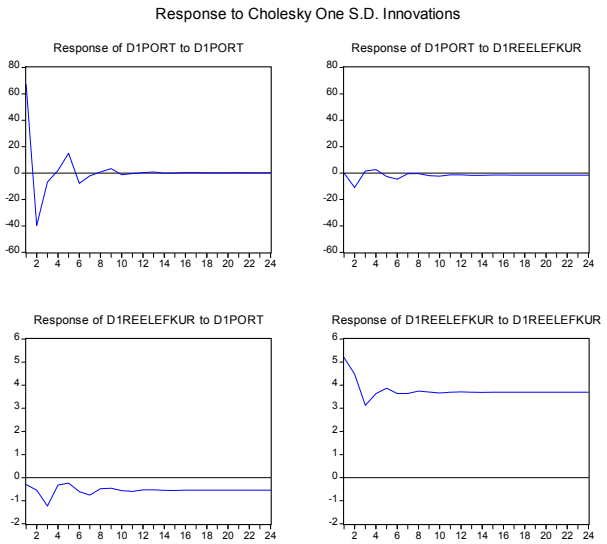
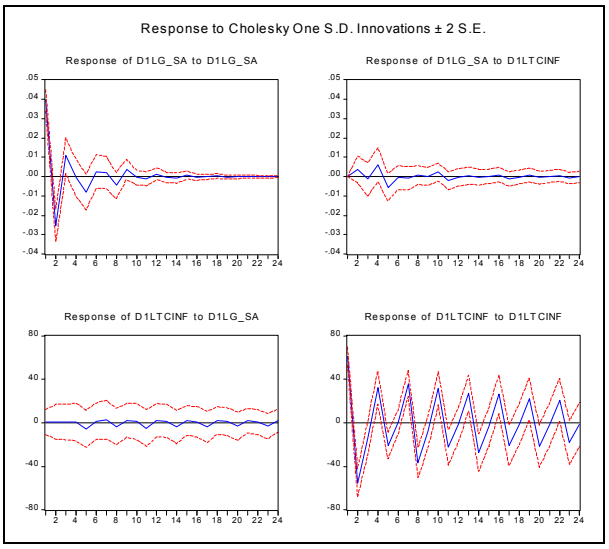
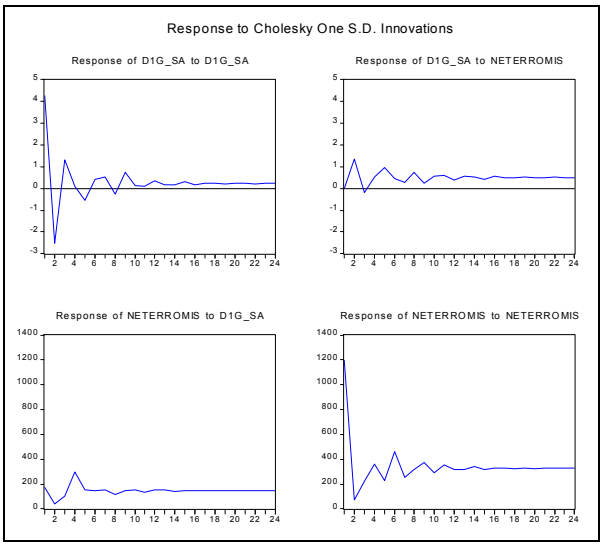
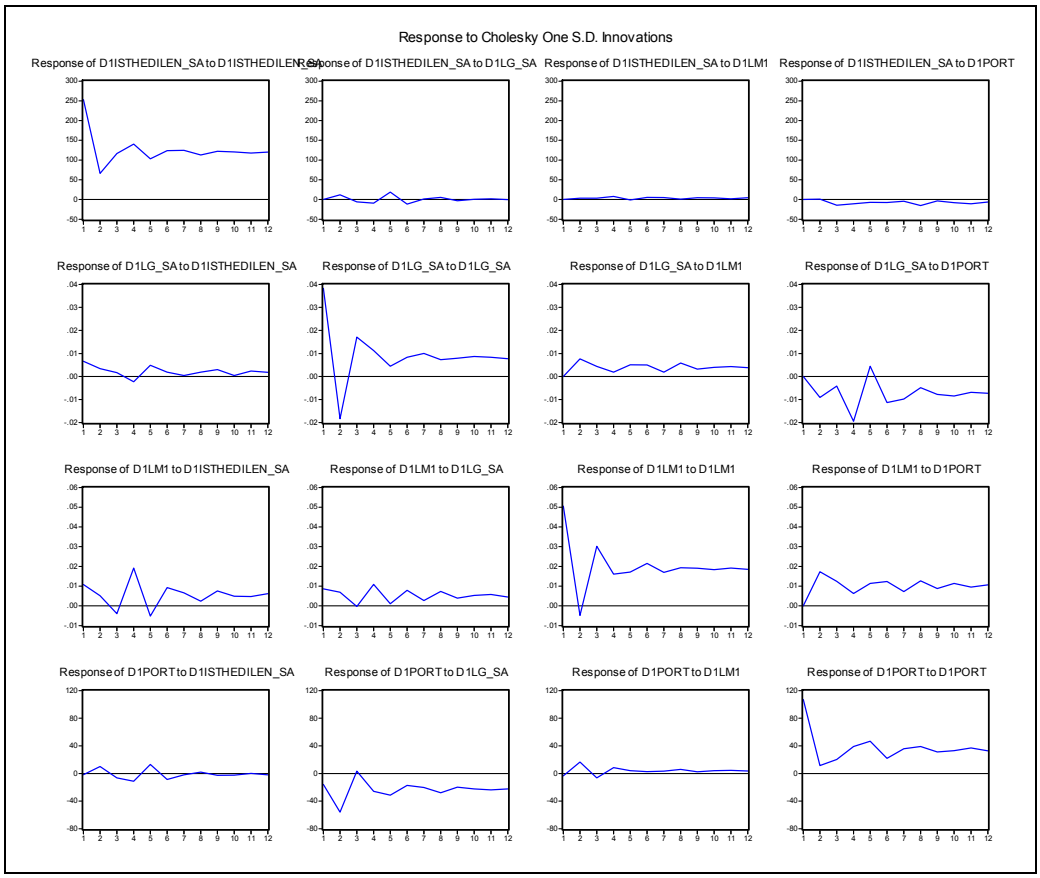
Response of GSMH1987UR_SA to GSMH1987UR_SA


Response to Cholesky One S.D. Innovations
Response of D1FDI to D1FDI
Response of D1FDI to GSMH1987UR_SA
Response of GSMH1987UR_SA to D1FDI
Response of GSMH1987UR_SA to GSMH1987UR_SA


Response to Cholesky One S.D. Innovations
Response of D1PORT to D1PORT
Response of D1PORT to D1REELEFKUR
Response of D1REELEFKUR to D1PORT
Response of D1REELEFKUR to D1REELEFKUR


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of D1LG_SA to D1LG_SA
Response of D1LG_SA to D1LTCINF
Response of D1LTCINF to D1LG_SA
Response of D1LTCINF to D1LTCINF


Response to Cholesky One S.D. Innovations
Response of D1G_SA to D1G_SA
Response of D1G_SA to NETERROMIS
Response of NETERROMIS to D1G_SA
Response of NETERROMIS to NETERROMIS



GRANGER CAUSALITY TESTS

1. Table

Pairwise Granger Causality Tests

Date: 12/31/06 Time: 16:39

Sample: 1985M01 2006M12

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
GDP1987UR_SA does not Granger Cause D1STCINF	173	0.58918	0.67093
D1STCINF does not Granger Cause GDP1987UR_SA		0.30857	0.87195

2. Table

Pairwise Granger Causality Tests

Date: 12/31/06 Time: 17:37

Sample: 1985M01 2006M12

Lags: 4

Null Hypothesis:	Obs	F-Statistic	Probability
GDP1987UR_SA does not Granger Cause D1PORTF_YYATIRIMI	173	0.62351	0.64638
D1PORTF_YYATIRIMI does not Granger Cause GDP1987UR_SA		0.90957	0.45981

3. Table

Pairwise Granger Causality Tests
Date: 01/01/07 Time: 18:45
Sample: 1985M01 2006M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
GDP1987UR_SA does not Granger Cause D1FDI	175	1.14325	0.32122
D1FDI does not Granger Cause GDP1987UR_SA		1.80367	0.16783

4. Table

Pairwise Granger Causality Tests
Date: 01/03/07 Time: 09:46
Sample: 1985M01 2006M10
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
D1REELEFEX does not Granger Cause D1PORT	176	0.25261	0.77706
D1PORT does not Granger Cause D1REELEFEX		4.50337	0.01242

5. Table

Pairwise Granger Causality Tests
Date: 01/02/07 Time: 14:12
Sample: 1985M01 2006M10
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
D1GDP1987ur_SA does not Granger Cause D1LTCINF	115	0.35056	0.70508
D1LTCINF does not Granger Cause D1GDP 1987ur_SA		0.62934	0.53485

6. Table

Pairwise Granger Causality Tests
Date: 01/02/07 Time: 16:56
Sample: 1985M01 2006M10
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
D1G_SA does not Granger Cause NETERROMIS	116	0.01350	0.90772
NETERROMIS does not Granger Cause D1G_SA		2.53288	0.11429

7. Table

Pairwise Granger Causality Tests
Date: 01/02/07 Time: 19:20
Sample: 2001M01 2006M12

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
D1G_SA does not Granger Cause D1PORT	67	3.31730	0.04279
D1PORT does not Granger Cause D1G_SA		0.26799	0.76580

8. Table

Pairwise Granger Causality Tests
Date: 01/05/07 Time: 23:36
Sample: 2001M01 2006M12
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
D1LG_SA does not Granger Cause D1EMPLYMNT_SA	66	0.88150	0.41937
D1EMPLYMNT_SA does not Granger Cause D1LG_SA		0.17844	0.83701
D1LM1 does not Granger Cause D1EMPLYMNT_SA	65	0.02652	0.97384
D1EMPLYMNT_SA does not Granger Cause D1LM1		2.07441	0.13455
D1PORT does not Granger Cause D1EMPLYMNT_SA	66	0.10305	0.90224
D1EMPLYMNT_SA does not Granger Cause D1PORT		0.54456	0.58289
D1LM1 does not Granger Cause D1LG_SA	65	0.18553	0.83114
D1LG_SA does not Granger Cause D1LM1		0.56190	0.57310
D1PORT does not Granger Cause D1LG_SA	67	0.22923	0.79582
D1LG_SA does not Granger Cause D1PORT		3.86310	0.02623
D1PORT does not Granger Cause D1LM1	65	4.18434	0.01990
D1LM1 does not Granger Cause D1PORT		0.63529	0.53331

FINANCIAL MARKETS

Interactions between BRICs and Turkey: Stock Exchange Markets and Convergence

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Abstract

This study investigates the stock exchange index movements of today's emerging markets commonly called as Brazil, Russia, India, and China (BRICs), and Turkey. It is proposed that the risk-return distance among international stock markets has been decreasing significantly over time, implying a mean-variance convergence. Hence, we try to show that the risk-return characteristics of our sample of five developing stock markets have converged significantly toward each other. We use two data series as monthly data for the period January 2001 – September 2006 and daily data for the period January 1st, 2001 – September 30th, 2006. First, we analyze the movements of stock exchange indices for each of these countries with sigma and beta convergence techniques. Then we employ ADF unit root tests and Zivot-Andrews structural break tests to determine whether convergence has been achieved. Our preliminary findings suggest that some form of convergence is achieved in the countries we consider. Our study supports the general belief that all these five emerging countries have been following similar paths recently due to their openness to the global shocks and capital flows.

*JEL Classificat*ions: C32, O57

Keywords: Convergence, stock exchange markets, stationarity

1. Introduction

In the absence of a more specific context, convergence denotes the approach toward a definite value, as time goes on; or to a definite point, a common view or opinion, or toward a fixed or equilibrium state. This approach in general is seen in the long-run relations, but it can be also seen for short-run ones. By its whole dimension, convergence is related with various types of sciences (mathematics, natural sciences, computing and technology, social sciences…etc.). But in this study we are interested with its economic side.

In the literature economic convergence refers to the phenomena in which lesser developed countries supposedly catch up to developed countries in terms of economic productivity and growth. This is also known as the catch-up effect or the theory of convergence. Theory states that poorer economies tend to grow faster than richer economies. Therefore, all economies will eventually converge in terms of per capita income.

This means that conceptually a poorer country's income will eventually catch up to a richer country's however it differs in the real life. In theory, new technologies and borrowing efficient institutions may allow the economies of emerging countries to grow faster than industrialized nations' economies or even surpass them, but the possibility of this happening has become debatable as developed nations become increasingly modernized at fast paces.

One of the reasons for this phenomenon of divergence is that poor countries often have little in the way of technology and are often inefficient. Since they do not have the access to capital to invest or own the proper resources to improve their processes, they are trapped in this low-efficiency pattern. If, however, they manage to attain some capital for investment the returns on this investment might be huge. This could be explained by the law of diminishing returns. A developed nation is so technologically advanced that the ROI (return on investment) of every unit of currency spent is dramatically lower than the ROI in an undeveloped nation because the poor nation is further behind in this diminishing returns path. This extra return allows poor countries to rapidly increase investment capital and raise efficiency until the law of diminishing returns kicks in and they are growing at the same pace as more advanced nations.

Productivity analysis among developed nations provides evidence of convergence as well. The differences in productivity techniques is what separates the leading developed nations from the following developed nations, but by a margin narrow enough to give the following nations an opportunity to catch-up.

While recently most leading developed countries have been experiencing a slowdown in productivity levels, following developed nations have been able to move into this gap by growing at faster rates and are in a course of convergence with the other developed nations.

This process of catch-up continues as long as the following nations have something to learn from the leading nations, and will only cease when the knowledge discrepancy between the leading and following nations becomes very small and eventually exhausted. However, this convergence does not necessarily suggest that leading developed countries like the United States are losing their advantage over them.

The literature survey which we have done showed also that the income convergence on region or country base is the most dedicated type of it. In this type of convergence the matter of the researches is the convergence of poor regions/countries to the rich ones.

If we look for the detailed explanation of this theory on the theoretical base, the fundamental preposition about this type convergence is done by the neoclassical school. A key feature of the neoclassical growth model asserts that, poor economies tend to grow faster than rich ones and consequently economies with similar tastes and technologies converge to the same steady state (Solow, 1956).

In line with the increasing importance in politics and economy policymaking, whether countries and regions converge in terms of per capita income or output has become one of the prominent issues in the literature starting with the seminal paper of Baumol (1986) and other papers of Barro and Sala-i Martin (1991).

Barro and Sala-i Martin's studies are the most cited contemporary studies on economic convergence. They tried to find evidence supporting convergence whether regions are converging towards their national steady state.

Also some other works by Dowrick and Nguyen (1989), Quah (1996), Martin and Sunley (1998), Butten (1998) provided several reviews to the body of convergence literature. As a robust indicator of the wealth, the income (especially income per capita), is the leading variable that should be investigated. But in our financial global world there are several indicators of the wealth in different structures. One of them is the return of the stock exchange in a country.

Because of the international capital flows are getting a crucial importance to determine the risk perception of a country to do some investments on it, the return that is gained from the first harbor of the international capital flows, from stock exchanges, is also getting a preference to determine the increase of the wealth in a country due to money investments at first stage.

Therefore our main questions are: How do these emerging markets interact between 2001 and 2006? Do they converge or diverge according to the relevant techniques? Does the convergence theory accord with the outgoing results? Are the structural characteristics of these series effective on these movements? We will investigate the answers of these questions for the leading transforming economies of the today's world with this study.

The rest of the paper is organized as follows: Section 2 gives a brief explanation about the sample data and the methodology towards testing sigma and beta convergence and testing the presence of the unit-root with or without structural break(s); the graphical and table type of empirical results are shown in Section 3. Section 4 is devoted to conclude the study with assessing all the results that are reached in Section 3.

2. Methodology

We separate this section into two groups. First group consists the testing of convergence with two different but related techniques, sigma, and beta convergence techniques and also accordance with these techniques it consists also the testing of the mean-variance convergence.

Second group employs the unit-root tests with and without structural break(s) and we use Zivot-Andrews structural break and ADF unit-root tests for this aim.

In general convergence hypothesis tests are classified into two categories: absolute and conditional convergence. Under these two categories we use beta and sigma convergence techniques.

2.1 Beta, Sigma and Mean-Variance Convergence

Without classifying them as absolute and conditional, in their basic definitions, we say that there is beta-convergence if poor countries tend to grow faster than rich ones and we say that there is sigma-convergence if the cross-sectional standard deviation of real GDP per head for a group of economy is falling over time.

These definitions show us these two techniques are mostly used for testing the income convergence between countries. But in this paper we use these techniques to test the stock exchange return convergence instead of income convergence between emerging markets.

As the second part of our first group methodology we also look for the mean-variance convergence considering the risk-return distances of the series.

We do this step first by calculating the risk-return distances among our sample data based on the Euclidean distance and finding that the distance thus computed has been decreasing significantly over time, implying a mean-variance convergence.

One of the most commonly used methods for measuring (dis)similarities in cluster analysis is the Euclidean distance.

Suppose that the number of characteristics for an observation is p and that each characteristic can be represented by a variable. Then, two observations can be represented by points in p-dimensions with coordinates ($x_1, x_2, \ldots, x_p$) and ($y_1, y_2, \ldots, y_p$) respectively.

The Euclidean distance between two observations, d_{xy}, is computed by the following equation:

$$d_{xy} = \sqrt{\sum_{i=1}^{p} (x_i - y_i)^2}$$

For each market, we compute the risk-return distance for each observation period. To compute this distance measure, however, we first need to compute the return distance and risk distance measures separately.

We measure the 'return distance' of a market from the cross-market average for N markets based on the absolute difference between the mean return for the market and the cross-market average return.

Specifically, the return distance for market i during the period t (DR_{it}) is computed as follows:

$$DR_{it} = \left| \overline{R}_{it} - \frac{1}{N} \sum_{i=1}^{N} \overline{R}_{it} \right|, \quad i = 1, \ldots, N; \; t = 1, \ldots, T,$$

and the risk distance for market i during the period t (DS_{it}) is thus computed as follows:

$$DS_{it} = \left| SD_{it} - \frac{1}{N} \sum_{i=1}^{N} SD_{it} \right|, \quad i = 1, \ldots, N; \; t = 1, \ldots, T$$

To be compatible with the Euclidean distance measure, the weights for each variables as follows:

$$W(DR) = \sqrt{\sum_{i=1}^{N} \sum_{t=1}^{T} DR_{it}^2 \Big/ \left(\sum_{i=1}^{N} \sum_{t=1}^{T} DR_{it}^2 + \sum_{i=1}^{N} \sum_{t=1}^{T} DS_{it}^2 \right)}$$

$$W(DS) = \sqrt{\sum_{i=1}^{N} \sum_{t=1}^{T} DS_{it}^2 \Big/ \left(\sum_{i=1}^{N} \sum_{t=1}^{T} DR_{it}^2 + \sum_{i=1}^{N} \sum_{t=1}^{T} DS_{it}^2 \right)}$$

where W(DR) is the weight for the return distance variable and W(DS) is the weight for the risk distance variable.

The risk-return distance (DRS_{it}) in such a way that each variable is normalized by its own weight:

$$DRS_{it} = \sqrt{AdjDR_{it}^2 + AdjDS_{it}^2} = \sqrt{(DR_{it} / W(DR))^2 + (DS_{it} / W(DS))^2}$$

$$i = 1, \ldots, N; \; t = 1, \ldots, T.$$

2.2. Unit Root Tests

The second group of this section consist the methodology of the unit-root tests with and without structural break(s). We use the augmented Dickey-Fuller and Zivot-Andrews tests to be acknowledged about the presence of non-stationarity in the series. We will explain them in terms of econometrics language one by one.

The first test that we used to investigate the presence of the unit root is ADF test, and it was derivate of the DF test. So first of all we should talk about the DF test.

Dickey and Fuller (1979, 1981) devised a procedure to formally test for non-stationarity. The key insight of their test is that testing for non-stationarity is equivalent to testing for the existence of a unit root. Thus the obvious test is the following which is based on the simple AR (1) model of the form:

$y_t = \Phi\, y_{t-1} + e_t$ (1.1)

What we need to examine here is whether Φ is equal to 1 (unity and hence 'unit root'). Obviously, the null hypothesis is $H_0 : \Phi = 1$, and the alternative hypothesis is $H_a : \Phi < 1$.

We can obtain a different (more convenient) version of the test by subtracting y_{t-1} from both sides of (1.1):

$y_t - y_{t-1} = \Phi\, y_{t-1} - y_{t-1} + e_t$

$\Delta y_{t-1} = (\Phi-1) y_{t-1} + e_t$

$\Delta y_{t-1} = \gamma\, y_{t-1} + e_t$ (1.2)

where of course $\gamma = (\Phi-1)$. Then, now the null hypothesis is $H_0 : \gamma = 0$ and the alternative hypothesis is $H_a : \gamma < 0$, where if $\gamma = 0$ then y_t follows a pure random-walk model.

Dickey and Fuller (1979) also proposed two alternative regression equations that can be used for testing for the presence of a unit root. The first contains a drift in the random-walk process as in the following equation:

$\Delta y_{t-1} = \alpha_0 + \gamma\, y_{t-1} + e_t$ (1.3)

This is an extremely important case, because such processes exhibit a definite trend in the series, which is often the case for macroeconomic variables.

The second case is to allow, apart from a drift, also a non-stochastic time trend in the model, so as to have:

$\Delta y_{t-1} = \alpha_0 + \alpha_2 t + \gamma\, y_{t-1} + e_t$ (1.4)

MacKinnon (1991) tabulated appropriate critical values for each of the three above models and these are presented below table.

Critical values for the DF test

Model	1%	5%	10%
$\Delta y_{t-1} = \gamma\, y_{t-1} + e_t$	-2,56	-1,94	-1,62
$\Delta y_{t-1} = \alpha_0 + \gamma\, y_{t-1} + e_t$	-3,43	-2,86	-2,57
$\Delta y_{t-1} = \alpha_0 + \alpha_2 t + \gamma\, y_{t-1} + e_t$	-3,96	-3,41	-3,13
Standard critical values	-2,33	-1,65	-1,28

Note: Critical values are taken from MacKinnon (1991).

In all cases the test concerns whether $\gamma = 0$. The DF-test statistic is the t statistic for the lagged dependent variable. If the DF statistical value is smaller than the critical value then we reject the null hypothesis of a unit root and conclude that y_t is a stationarity process.

But as the error term is unlikely to be white noise, Dickey and Fuller extended their test procedure suggesting an augmented version of the test which includes extra lagged terms of the dependent variable in order to eliminate autocorrelation. The lag length on these extra terms is either determined by the Akaike Information Criterion (AIC) or Schwartz Bayesian Criterion (SBC), or more usefully by the lag length necessary to whiten the residuals (i.e. after each case we check whether the residuals of the ADF regression are autocorrelated or not through LM tests and not DW test).

The three possible form of the ADF test are given by the following equations:

$\Delta y_t = \gamma\, y_{t-1} + \Sigma\, \beta_i\, \Delta y_{t-1} + e_t$ (1.5)

$\Delta y_t = \alpha_0 + \gamma\, y_{t-1} + \Sigma\, \beta_i\, \Delta y_{t-1} + e_t$ (1.6)

$\Delta y_t = \alpha_0 + \gamma\, y_{t-1} + \alpha_2 t + \Sigma\, \beta_i\, \Delta y_{t-1} + e_t$ (1.7)

The difference between the three regressions again concerns the presence of the deterministic elements α_0 and $\alpha_2 t$. The critical values for the ADF tests are the same as those given in Table 1.1 for the DF test.

Unless the econometrician knows the actual data-generating process, there is a question concerning whether it is most appropriate to estimate (1.5), (1.6), and (1.7). Doldado, Jenkinson and Sosvilla-Rivero (1990) suggest a procedure which starts from the estimation of the most general model given by (1.7) and then answering a set

of questions regarding the appropriateness of each model and moving to the next model. This procedure is not the subject of us in this paper but it needs to be stressed here that, although useful, this procedure is not designed to be applied in a mechanical fashion.

Plotting the data and observing the graph is sometimes very useful because it can clearly indicate the presence or not of deterministic regressors. However, the procedure we told about something is most sensible way to test for unit roots when the form of the data-generating process is unknown (Asteriou, 2005).

According to the proposed suggestions in Section 3 we put the plots and graphs of our sample data to indicate the presence or not of deterministic regressors and surely did the ADF test to our sample series.

The second test that we used to indicate the presence of the unit root is the Zivot-Andrews (1992) structural break test. Firstly we will explain the necessity of using the ZA test in our paper and then we will explain the ZA test in details.

In the econometrics literature it is argued that the conventional unit root tests can have little power when the true data generating process of a broken linear trend is stationary.

According to Perron (1989), failing to account for at least one time structural break in the trend function, may bias the usual unit root results towards their non-rejection of the null. In other words, tests such as the ADF test or the Phillips-Perron test may incorrectly indicate that there is a unit root in a series, whereas in actual fact this series can be stationary around a one-time structural break (Zivot and Andrews, 1992).

It should be noted, however, that Perron (1989) applied his procedure assuming or visually detecting a particular year as the starting point for the structural break. The assumption of a known break is subject to a criticism as one may choose a particular date which conforms with his or her results by resorting to pre-testing and data-mining. Furthermore, a particular event may have occurred in time t but its gradual effects would not eventuate until subsequent years. New studies now endogenise the time of structural breaks. These procedures involve the estimation of the break point in an iterative process. ZA propose a variation of Perron's test in which the time of break is estimated rather than assumed as an exogenous phenomenon. The null hypothesis in their method is that the variable under investigation contains a unit-root with a drift that excludes any structural break, while the alternative hypothesis is that the series is a trend stationary process with a one-time break in the trend variable occurring at an unknown point in time. In this methodology, they run a regression for every possible break date sequentially. By endogenously determining the time of structural breaks, ZA argue that the results of the unit root hypothesis previously suggested by earlier conventional tests such as the ADF test may be reversed.

In the rest of this section a brief description of the ZA approach is discussed. Their test is different from the usual unit root tests with respect to the treatment of the alternative hypothesis. The alternative hypothesis considered in the ZA method is more general and allows for shifts in the level or the growth rate of the series. In this methodology, TB (the time of break) is chosen to minimize the one-sided t-statistic of á=1 in equations (2.1) to (2.3) below or á2=1 in equation (1.7). In other words, a break point is selected which is the least favorable to the null hypothesis. The ZA model endogenises one structural break in a series (such as yt) as follows:

H_0: $y_t = \mu + y_{t-1} + e_t$ (2.1)

H_1:

Model A

$$y_t = \mu^A + \theta^A DU_t(T_b) + \beta^A t + \alpha^A y_{t-1} + \Sigma c_j^A \Delta y_{t-j} + e_t \quad (2.2)$$

Model B

$$y_t = \mu^B + \beta^B t + \gamma^B DT_t(T_b) + \alpha^B y_{t-1} + \Sigma c_j^B \Delta y_{t-j} + e_t \quad (2.3)$$

Model C

$$y_t = \mu^C + \theta^C DU_t(T_b) + \beta^C t + \gamma^C DT_t(T_b) + \alpha^C y_{t-1} + \Sigma c_j^C \Delta y_{t-j} + e_t \quad (2.4)$$

As can be seen, Model A allows for a one-time change in the intercept. Model B is used to test for stationarity of the series around a broken trend and finally Model C accommodates the possibility of a change in the intercept as well as a broken trend.

DUt is a sustained dummy variable capturing a shift in the intercept, and DTt is another dummy variable representing a shift in the trend occurring at time TB. The alternative hypothesis is that the series, yt, is I(0) with one structural break. TB is the break date, and DUt=1 if t > TB, and zero otherwise, DTt is equal to (t-TB) if (t > TB) and zero otherwise. The null is rejected if a coefficient is statistically significant.

More specifically, according to the ZA test TB is endogenously estimated by running the above three equations (models A, B and C) sequentially allowing for TB to be any year with the only exceptions being the first and last years. The optimal lag length is determined on the basis of the SBC and the most significant t ratio known as the general to specific approach (Zivot, E., and Andrews, D.W.K. (1992).

So we reviewed the theoretical explanations of the methodology that we used in our study, in the next section you will see the results of these techniques and tests that we mentioned throughout this section.

3. Empirical Results

In this section with our theoretical and methodological background we (i) compute the beta convergence coefficients and show the graphs of the standard deviations from mean of series for sigma convergence, (ii) compute the risk-return distance measures based on the formula developed in the previous section (iii) show the graphs of raw data and test the stationarity of them. Then in next section, conclusion, we will evaluate them from the convergence hypothesis point view.

Our sample period for 5 emerging markets spans January 2001 through September 2006. Our sample period starts in 2001 because the influence of the international capital flows in emerging markets is felt especially after from 2001, following the integration of capital markets intensively and also the period between 2001 and 2006 is relatively a stable interval.

The 5 emerging markets in our sample are: Brazil, Russia, India, China, and Turkey. There are the markets for which the data on stock market returns are available from their own web pages for the entire sample period. We employ daily and monthly stock market indices in conducting our analysis.

For our sample data we used the closing values of the Bovespa index, the RTS index, the BSE index, the SSE composite index, and IMKB National 100 index for Brazil, Russia, India, China, and Turkey, respectively.

While we were employing the daily data we have faced with the number of days problem due to different types and numbers of formal holidays. We solved this problem with determining a collective time table which includes at most number of days. In monthly data there is no problem like this.

At the same time these indices that we used in our relevant tests and techniques are converted into the logarithmic levels to be able to do computations on the same level.

3.1 Beta and Sigma Convergence Test Results

Table 1.1.a reports the beta sigma convergence coefficients of logged stock exchanges values for our 5 emerging countries for daily period during 2001–2006. This table also provides the t-statistics under each coefficient within brackets.

During our sample period, 2001-2006, we computed these coefficients and t-statistics with the ordinary least squares method (OLS) by using E-views software package. In our regressions the dependent variables are differenced individual country series with their one time lagged owns and the explanatory variables are their owns. Each regression contains the constant term also. The significance of the coefficients that we get from regressions of them shows the existence of beta convergence on condition to be negative.

Under these considerations Russia, India, China, and Turkey show beta convergence behaviors as the results of the relevant regression results. But Brazil differs with significance and sign of its coefficient and so this means that during our sample period it diverges from other countries according to the beta convergence technique.

But when we look to the beta convergence coefficients of our same sample data on monthly base (Table 1.1.b), we meet with different beta convergence results for countries. On the monthly base only India has a lack of beta convergence. But Brazil, Russia, China, and Turkey give significant and negative coefficients that point their beta convergence characteristics. Also from these two reported tables we see the duality of Brazil on daily and monthly periods. Our observations here suggest that as the average values of daily ones monthly data shows near movements with its one time lagged period, but the cause of high volatility on the daily movements they give insignificant coefficients us.

For our second and necessary condition of convergence we will analysis Graph 1.1.a and Graph 1.1.b for sigma convergence movements. As we mentioned from the previous section sigma convergence means that the dispersion of per-capita income reduces over time. But surely we investigate the stock exchange values in this study, so we look to the movements of the standard deviations to check the dispersion of them whether reduce or not.

In this framework as can be seen from Graph 1.1.a the standard deviations of each series from their means shows some random movements. But when we look to the trend paths and the end-points of these series, we extract two main solutions for each view. First of them trend paths of only Turkey and Russia are downward, others are upward. Secondly the end-points of Turkey-India and Russia-China intersect as pairs. From these two extractions we suggest the sigma convergence of Turkey-India and Russia-China pairs separately. Because the owners of downward series are the group leaders and the other ones (India for Turkey and China for Russia) are the followers. So as a conclusion except Brazil all series have sigma convergence also.

This conclusion can also be derived from withdrawals of the convergence hypothesis. According to this hypothesis beta convergence is a necessary but not a sufficient condition for sigma convergence. So the lack of beta convergence of Brazil is at the same time the cause of the lack of sigma convergence for it.

Also when we look to the graph of standard deviations of series for monthly period, Graph 1.1.b, we prove the withdrawals of convergence hypothesis by showing the divergence of India as in sigma one. Other countries all have a sigma convergence, as Russia the leader and the rest are follower.

3.2 Results of Risk-Return Distance Measures

Table 2.1.a shows cross-market average of the risk-return distance (DRS) measures of each country's logged stock exchange values for our sample daily period during 2001-2006. Table also provides separately the cross-market average return distance (DR) and risk distance (DS) measures and basic statistics of series. These all the return (DR), risk (DS), and risk-return distances (DRS) are computed for each series according to the Euclidean distance method as we mentioned in the methodology section.

As can be seen from table we see close risk-return distance measures for Brazil, Russia, and Turkey. But the risk-return distance measures of China and India are far away from others. So from here we can say the risk-return characteristics of Brazil, Russia, and Turkey converge to each other. We can examine the graphs of raw data for leader-follower relationship of our sample countries.

When we look to the Table 2.1.b for monthly period evolution of risk-return distances it can be easily seen that as in the daily ones Brazil, Russia, and Turkey continues their compactly quantitative convergence movements, and also China and India miss the convergence again.

These results differs from beta-sigma convergence ones. The fundamental causes of this difference come from the sensitivity of risk-return measures to the individual characteristics of countries. Especially their movements change according to the different risk perceptions of different global markets. The factors that effect these perceptions are the subject of a further study in this field.

3.3 Results of Unit Root Tests

Graph 2.1.a and Graph 2.1.b report the visual inspection of the raw stock exchange indices data for our five emerging economies during 2001-2006 for daily and monthly data. These graphs give some clues about the characteristics of series. We are interested here the stationarity side of these time series. The most dedicated type of violation to the assumptions of the classical regression model in time series is the unit root problem. So here we will investigate this problem for our series and then we will set the linkage of this investigation with the convergence theory.

In Graph 2.1.a we see the movements of series purely for daily period, and they show that Brazil diverge from other countries. But the other countries interestingly converges to its partner, as like in sigma convergence one Turkey seems the leader for India and Russia plays the same role for China.

But for monthly period as it is similar to the sigma convergence one India diverges from others but as a different point here Brazil and Turkey's paths almost intersect completely and Russia and China resume showing their convergence to each others.

When we assessed these graphs to get the signs about stationarity whether it exists or not in series. First looking to the graphs shows the non-stationarity of them but we look for further tests to make a precise inference about them.

First test that we applied to our sample data is ADF unit root test. For each choice of ADF test we used constant, constant and trend or none of them. As it is easily seen from Table 3.1.a we reached the stationarity of series with none option. Because of the coefficients in this option are significant at 5 and 10 percent levels. This means that the rejection of non-stationarity. For daily period all series satisfy this same condition and so they do not have a unit root.

But when we look to Table 3.1.b for the ADF test of the same series for monthly period we see the non-stationarity of Brazil, China, and Turkey series with none option again. But Russia and India series reject the null hypothesis of non-stationarity.

As we mentioned in methodology part we should investigate the existence of structural break(s) in non-stationary series to reveal that they are really non-stationary or not. For this aim we applied Zivot-Andrews (ZA) structural break test to our monthly data to test the existence of any structural break(s) in the sample data of Brazil, China, and Turkey.

In Table 4.1.a ZA test is applied to all the data for three main models of the test. And according to the Model B our non-stationary series that determined with ADF test includes a structural break date in a common day, 11 September 2001 and they are indeed non-stationary because of this break, so they are stationary also when we consider the structural break that they share.

4. Conclusion

In this section we will asses all the techniques and tests that we reported the results of them in the previous section and we will evaluate them under the convergence theory. Hence we will try to explain the extractions from these solutions.

First of all we should consolidate difference between the results that we hope to see according to our background in these subjects and the results that we found at the end of our study.

So in this framework we should remind our main questions that placed at the beginning of our study: How do these emerging markets interact between 2001 and 2006? Do they converge or diverge according to the relevant techniques? Does the convergence theory accord with the outgoing results? Are the structural characteristics of these series effective on these movements?

As an answer to our first question we can say that the interactions between our five sample countries (BRICs and Turkey) are not strong enough. We think that this needs to be a further study's subject. Because from our unreported observations we can say that however these countries are put into the same pool as emerging markets but they have very different structural characteristics specific to them.

For our second question we can answer it as they both converge and diverge depends on the technique that we used. But as a general seen fact in our study is that the convergence is satisfied especially with pairs. In this point we should emphasize the relationship between the countries that constitute the pairs as leader and follower. This point is also important that it would be the answer of third question also.

The convergence theory that it is based on this economic background can not be said accurately yes. Because of the outgoing results' showings differs depends on its relevant test and technique. On the other hand while they are giving meaningful results individually, it is hard to make inference with using all of them.

As the answer of our last question we can show the last tests' results that we applied to our sample in section three. It can be easily seen the structural break is crucial at this point.

From all these given theoretical, methodological, and empirical backgrounds finally we can say that there is a particular convergence between Brazil, Russia, India, China, and Turkey and this convergence will continue with the changing degree of global investors' risk appetite and perceptions effects on emerging markets.

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Tables

Table 1.1.a β-Convergence Coefficients of the Daily Period

Coefficients	Log-Brazil(-1)	Log-Russia(-1)	Log-India(-1)	Log-China(-1)	Log-Turkey(-1)
Log-Brazil	0.108904 (0.377770)				
Log-Russia		-1.143677* (-0.748830)			
Log-India			-1.029047* (-0.671132)		
Log-China				-1.004183* (-0.510413)	
Log-Turkey					-1.451392* (-0.675321)

Notes: * Denotes the significant coefficients and this means that β-convergence is satisfied for series which have negative coefficients.

Table 1.1.b β-Convergence Coefficients of the Monthly Period

Coefficients	Log-Brazil(-1)	Log-Russia(-1)	Log-India(-1)	Log-China(-1)	Log-Turkey(-1)
Log-Brazil	-0.162095* (-0.831457)				
Log-Russia		-1.223210* (-0.648412)			
Log-India			1.478914 (0.728372)		
Log-China				-1.220677* (-0.686568)	
Log-Turkey					-1.643913* (-0.840557)

Notes: See notes of Table 1.1.a for the explanations about signs and significance.

Table 2.1.a Risk-Return Distances for Daily Period

	Log-Brazil	Log-Russia	Log-India	Log-China	Log-Turkey
MEAN	4,271799312	2,707742283	3,698670111	3,17701856	4,229452825
STD DEV.	0,186194849	0,271135272	0,188852673	0,074922298	0,225486747
DR	3,548411989	1,98435496	2,975282787	2,453631237	3,506065501
DS	0,003123519	0,081816904	0,000465695	0,11439607	0,036168379
DRS	3,552115178	4,220091369	2,976076535	5,75652909	3,874125448

Notes: DR stands for return-distance, DS stands for risk-distance, and DRS stands for risk-return distance here. The evolution of the computations should be done comparatively.

Table 2.1.b Risk-Return Distances for Monthly Period

	Log-Brazil	Log-Russia	Log-India	Log-China	Log-Turkey
MEAN	4,274020055	2,709272618	3,700842996	3,173361155	4,235805642
STD DEV.	0,189140122	0,276155483	0,193266456	0,077709663	0,229381182
DR	3,550287956	1,985540519	2,977110897	2,449629057	3,512073543
DS	0,00399046	0,083024902	0,000135875	0,115420919	0,036250601
DRS	3,555713727	4,236398044	2,977850236	5,750304975	3,874302353

Notes: See notes of Table 2.1.b for the meanings of abbreviations.

Log-Russia	-0.575313	-2.572367	-3.147146*	1
Log-India	-2.305047	-0.565593	-2.208719*	4
Log-China	-1.019583	-2.951407	-3.301373*	0
Model: $\Delta y_t = \alpha_0 + \gamma\, y_{t-1} + \alpha_2\, t + \Sigma\, \beta_k\, \Delta y_{t-k} + e_t$; H_0: $\gamma = 0$; H_a: $\gamma > 0$				
Log-Turkey	-0.645375	-2.759468	-2.381061*	0
Unit-root tests at logarithmic levels				
Variables	Constant	Constant and Trend	None	k
Log-Brazil	-1.494511	-0.895084	-1.966229*	0

Table 3.1.a Augmented Dickey-Fuller Test Results for Daily Period

Notes: * Denotes significance at the 5% and 10% level and the rejection of the null hypothesis of non-stationarity. Critical values from Fuller (1976) are -2.88, -3.45, and -1.94 for the first, second, and third model, respectively. The optimal lag lengths k was chosen according to Schwarz Info Criterion (SIC).

Table 3.1.b Augmented Dickey-Fuller Test Results for Monthly Period

Notes: See notes of Table 3.1.b for the meanings of signs and about the confidence levels.

Model: $\Delta y_t = \alpha_0 + \gamma\, y_{t-1} + \alpha_2\, t + \Sigma\, \beta_k\, \Delta y_{t-k} + e_t$; H_0: $\gamma = 0$; H_a: $\gamma > 0$				
Unit-root tests at logarithmic levels				
Variables	Constant	Constant and Trend	None	k
Log-Brazil	0.031997	-2.973662	-1.104794	0
Log-Russia	-0.483326	-2.435907	-3.071823*	1
Log-India	1.009021	-2.890116	-2.907920*	4
Log-China	-1.935046	-1.079508	-0.395353	0
Log-Turkey	1.587464	-0.641186	-1.479626	0

Table 4.1.a Zivot-Andrews Structural Break Test Results for Monthly Period

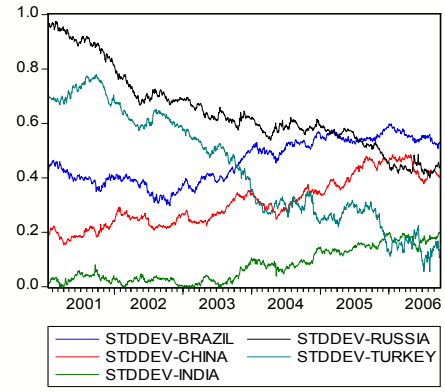
	ZA Model A		ZA Model B		ZA Model C	
	Intercept		Time Trend		Both	
	TB	t-statistic	TB	t-statistic	TB	t-statistic
Log-Brazil	2001.9	-4.3342	2001.9	-4.2545*	2001.9	-3.9513
Log-Russia	2001.9	-4.4561	2001.9	-4.0024	2001.9	-4.5461
Log-India	2001.9	-4.5127	2001.9	-4.0576	2001.9	-4.4621
Log-China	2001.9	-4.2721	2001.9	-4.3845*	2001.9	-4.4254
Log-Turkey	2001.9	-4.5678	2001.9	-4.1543*	2001.9	-3.6523
Model A Critical Values: 1% = -5.34, 5% = -4.80, 10% = -4.58						
Model B Critical Values: 1% = -4.93, 5% = -4.42, 10% = -4.11						
Model C Critical Values: 1% = -5.57, 5% = -5.08, 10% = -4.82						

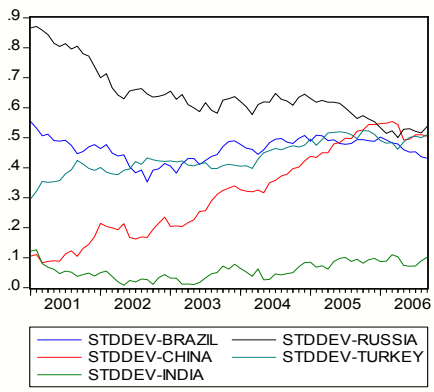
Notes: ** denotes the significance at 1% level and * denotes the significance at 5% level. The optimal lag lengths "k" is determined by Ben-David and Pappell (1994) method.

Graphs

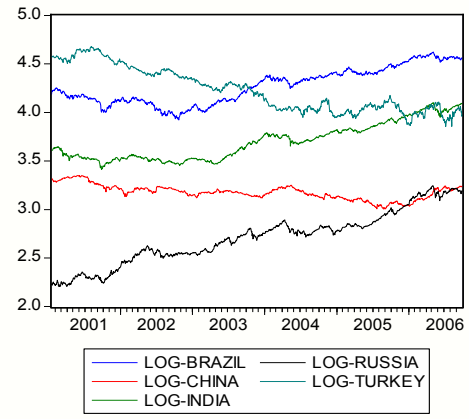
Graph 1.1.a Cross Sectional Standard Deviations of the Daily Indices from Mean

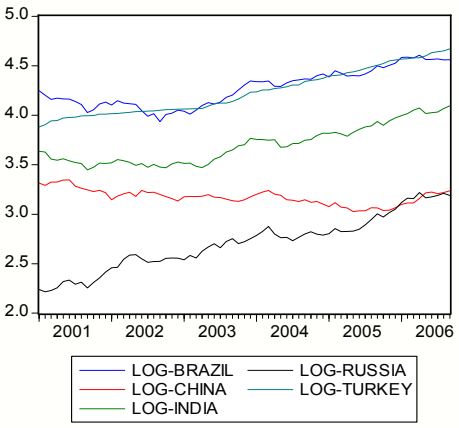
Graph 1.1.b Cross Sectional Standard Deviations of the Monthly Indices from Mean





Graph 2.1.a Graph of the Daily Period Graph 2.1.b Graph of the Monthly Period





Risk, Return and Volume in an Emerging Staock Market: The Istanbul Stock Exchange, 1998-2006

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ABSTRACT

The purpose of this paper is examining the popular financial relationship among risk-return- volume in the Istanbul Stock Exchange (ISE) with regarding the day of the week and 2001 financial crisis effects. This relation is examined by the daily data for the period of June 1, 1998 - November 10, 2006. In order to find this relation "The Generalized Autoregressive Conditional Heteroscedasticity-in-Mean (GARCH-M)" model is used. According to empirical results, positive relationship between risk and return, volume and return is found. It is empirically found that return granger causes volume; however the inverse causality cannot be found. Although there is a strong evidence of Friday positive effect on return in Turkish financial market, there is no evidence to support the Monday effect. 2001 financial crisis which is an important actor of the model has a negative and significant effect on return in the underlining period.

INTRODUCTION

There is substantial interest in how trading volume is related to price movements in the stock market. A recent stream of financial studies emphasizes the relevance of trading volumes for stock returns, namely that trading volumes should be regarded as critical information which influences both future prices and price volatility. On one hand, price movements and trading volumes can be jointly considered as aggregate market information. On the other hand, trading volumes have the specificity of reflecting the cumulative response of investors to "news", whereas price movements can only capture the impact of "news" on the average change in investors' expectations. Thus, trading volumes should be a critical complement in the process that generates stock returns and volatilities. If we assume that volume data are a good proxy for this stochastic information process, a strong positive correlation between trading volumes and return volatility should be observed (Clark 1973, Epps and Epps 1976).

Modeling risk and empirical tests of the relationship between risk and return are particularly important in emerging markets where volatility is inherently high and changing over time. In the models, volatility and related risk premiums are expressed in terms of asset covariance with the implied source of risk. The fact that assets with high expected risk must offer higher rates of return indicates that increases in the conditional variance should be associated with increases in the conditional mean.

The relatively small number of studies which have examined the causal and dynamic relationship between stock returns and trading volume for emerging markets have analyzed weekly or monthly data (see, Moosa and Al-Loughani (1995), Saatcioglu and Starks (1998), Basci et al. (1996), Gündüz and Hatemi-J (2005)). In contrast, our study uses daily data as we believe that they are more suitable to test a larger number of hypotheses which have been widely cited in support of a causal relationship between returns and trading volume. To ensure that the results are robust, we include dummy variables to capture the Monday and Friday effect and the Turkey Financial Crisis in 2001.

The main purpose of the paper is to search for the relationship between risk, return and volume in the ISE by applying an Autoregressive Conditional Heteroscedasticity (ARCH) specification. The main reason to use ARCH lies in the fact that a conditional stochastic process generates the return data with a changing variance. Therefore, it is naturally expected that ARCH is the right tool to approach to the problem since it takes the changing variances into consideration. . Risk – return relationship will be examined throughout the paper and the trading volume in the ISE will be tested. It is expected that in the equity market of the ISE return is positively related to both risk and volume. For estimation and testing the validity of the hypothesis a more parsimonious specification of ARCH which is Generalised ARCH in Mean (GARCH – M) specification will be used (Lamourex and Lastrapes, 1990).

There are specific advantages in using GARCH-M method in this paper. The Generalized Autoregressive Conditional Heteroscedastic in Mean (GARCH-M) model provides a convenient instrument to incorporate time-varying risk premium as the specification of the mean in the return. GARCH-M is a time series process,

which explicitly incorporates the risk-return relationship and the time-varying risk premium. While conventional time series models operate under the assumption of constant variance, the GARCH-M process allows the conditional variance to change over time as a function of past errors and of the lagged values of the conditional variance; still the unconditional variance remains constant (Bollersev, 1986). In more recent studies, researchers have found GARCH (1, 1)-M an appropriate model for financial data. Other GARCH specifications do not specialize in the relationship of risk and return; they rather specialize in finding the leverage effect. The only model that is appropriate for his relationship is GARCH-M modeling. We used this method because we think that the volatility has a significant effect on return.

GARCH-M modeling has been used, with two different results, in several US and UK studies to examine the relationship between risk and return. French, Schwert and Stambaugh (1987) found evidence that expected market risk premium is positively related to the predictable volatility of stock returns in the US market. In the UK market, Poon and Taylor (1992) also reported that estimates of risk using the relevant GARCH-M parameter are not statistically significant.

Effect of the calendar anomalies have been widely studied in finance literature. These studies have shown us that returns of stocks vary by the day of the week and this is known as the day of the week effect. The paper of Hakan Berument, Ali Inamlik and Halil Kıymaz shows that in Turkey there is a day effect on financial returns. Friday has the highest effect on return while Monday has the lowest return. When volatility of return is concerned, Monday has the highest volatility in Turkey. Because of the importance of the significant day effect, we also investigate this subject with regarding specific dates, namely Monday and Friday.

There are limited researches that are based on risk, return relationship in Turkey. No current paper has been found in Turkish case. Our first contribution will be investigating recent period. In addition we did not face any papers that concern the crisis effect on financial data. However, we think that 2001 crisis has a significant effect on Turkish financial market. The return data shows that there is a structural break during the crisis period. So adding the crisis dummy variable will make the model more reliable. Beside, we add the day of the week effect to the model; because, as earlier researches show there are significant effects of Monday and Friday on Turkish financial market. Finally, there are many papers that investigate risk and return relationship. However, very few papers treat volume as an effect on returns, including the trading volume is very important deciding criteria for risk and as a result for return.

LITERATURE REVIEW

Numerous studies have investigated the relationship between stock prices and trading volume. Karpoff (1987) provides a comprehensive review of theoretical and empirical work together with reasons for the importance of understanding this relationship. Karpoff attempts to provide a theory which directly links returns with trading volume. Karpoff's model ultimately leads to an asymmetric relationship between volume and price change. Empirical tests have generally supported the model (see also Jain and Joh [1988]). Researchers in this area have examined the volume-price/return relationship in a variety of contexts and by employing a range of analytical techniques.

The relationship between stock returns and trading volume has also been investigated (Epps (1975) and (1977)). More recent studies were interested in investigating the dynamic (causal) relationship between these two market variables (Smirlock and Starks (1988), Chordia and Swaminathan (2000), Chen et al. (2001)). Causality between stock prices and trading volume has also received a substantial amount of attention in the literature (Gallant et al. (1992), Campbell et al. (1993), Hiemstra and Jones (1994)).

In a recent study, Chordia and Swaminathan (2000) examine the interrelationship between trading volume and the predictability of short-term stock returns. They find that daily and weekly returns of high volume portfolios lead returns of low volume portfolios. The authors attribute these findings to the differences in the speed of price adjustment to information between the two types of stocks; stocks in low volume portfolios respond slowly to market-wide information while their high volume counterparts responding promptly to such information.

Chen et al. (2001) conduct a comprehensive study examining causal relation between stock returns, trading volume and volatility using daily data for nine major markets: New York, Tokyo, London, Paris, Toronto, Milan, Zurich, Amsterdam and Hong Kong. They document strong evidence for the argument that return causes volume; the reported F-statistics are significant for eight out of the nine markets investigated. However, they were able to uncover only limited evidence to suggest that volume causes returns; only four markets displayed such causality.

Some researchers have examined volume-price relationship in emerging markets. Moosa and Al-Loughani (1995) examine four Asian stock markets (Malaysia, Philippines, Singapore and Thailand) using monthly

aggregate data for the eight-year period ending 1993. They find strong evidence for causality running from volume to absolute price changes and from price changes to volume in all markets except the Philippines.

Basci et al. (1996), who used weekly price and volume data for 29 individual stocks traded on the Turkish stock market for the period from January 1988 to March 1999, found strong evidence of cointegration between the two variables.

Saatcioglu and Starks (1998) examine price-volume relation in six Latin American stock markets – Argentina, Brazil, Chile, Colombia, Mexico and Venezuela – using monthly data for the period from January 1986 to April 1995. They find evidence of volume causing returns in four markets (except Argentina and Chile) but not vice versa.

Lee and Rui (2000) analyze daily data on stock returns and trading volume of four Chinese market indices – Shanghai A, Shanghai B, Shenzhen A and Shenzhen B. They document a strong unidirectional causality running from return to volume in all four market indices examined; trading volume, however, is not useful in predicting future returns in the presence of current and past returns.

In a more recent study, Gündüz and Hatemi-J (2005) investigate Central and Eastern European markets: Budapest, Istanbul, Moscow, Prague and Warsaw. They used weekly data on price indices, trading volume and market turnover in their analyses. The authors report (i) bidirectional causality between price and volume/turnover in Hungary, (ii) bidirectional causality between price and volume in Poland and (iii) a unidirectional causality from price to volume/turnover in Russia and Turkey. However, no causality was found between price and volume/turnover in Czech Republic.

One of the particular studies by using cointegration analysis made on the ISE which took account of 166 weeks for the January 8, 1988 - March 29, 1991 period on 29 individual stocks supports the hypothesis of the positive relationship (Basci, Özyildirim and Aydogan, 1996). In this context, this paper is the first attempt that provides the reader with a larger range of time period and employs a different methodology (ARCH specification) to test the hypothesis and take the relationship arising from an information flow in the market proxied by volume in contribution to the already existing risk in the market. Volume is taken as a proxy for the information flow as suggested by Morgan (1976) since volume is associated with risk.

Salman, Ferhan provides empirical evidence for the risk-return-volume relationship in the Istanbul Stock Exchange (ISE) for the period of January 2, 1992 - May 29, 1998. The Generalized Autoregressive Conditional Heteroscedasticity-in-Mean (GARCH-M) specification reveals that daily return volatility is time-varying and highly persistent. The return is founded as positively associated with risk. Contemporary changes in volume have a positive effect on returns. The previous day's change in volume affects positively conditional volatility of returns.

Returns and how they are related with the days of the week is a popular study area in finance literature. Cross (1973), French (1980), Gibbons and Hess (1981), Keim and Stambaugh (1984), Lakonishok and Levi (1982) and Rogalski (1984) may be given as examples from the literature for the day of the week effect. An interesting result from these studies is that average returns on Monday are less than the other days of the week. Balaban (1995) reports that there is a days of the week effect for ISE. He states that Friday has the highest return for ISE for the period 1988-94.

MODEL

In order to estimate the relationship among risk, return and volume the following model has been established.

$$R_t = \varpi_0 + \varpi_1 V_t + \sum_{i=1}^{n} \vartheta_i R_{t-i} + \delta h_t + \varpi_3 mdum + \varpi_4 fdum + \varpi_5 dum01 + \varepsilon_t$$

$$h_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i}^2 + \lambda V_{t-1} + \nu_t \qquad \varepsilon_t \approx N(0, h_t)$$

From here;

$$R_t = \log(ISE_t / ISE_{t-1})$$

Return has calculated as log-first difference of ISE values in Turkey.

$$V_t = \log(V_t / V_{t-1})$$

Volume has calculated as log-first difference of trading volume in ISE.

dum= Dummy variable

mdum = Monday effect.

It is included to measure the Monday effect in financial data.

fdum= Friday effect

It is included to measure the Friday effect in financial data.

dum01= 2001 financial crisis in Turkey.

It is included to measure the effect of 2001 financial crisis in Turkey.

h_t is the estimated square root of variance taken to be a proxy for risk as suggested by

ARCH-M specification

δ : the risk premium.

The risk premium should be possitive and significant to show relationship beetwen return and risk.

V_{t-1} : first lag of volume

Risk is taken to be one of the determinants of the return in the financial markets. It is assumed that information set determines return in financial markets, so that, because volume is affected by both exogenous and endogenous shocks felt in the economy, it is taken as a proxy for information flow in the market and introduced as an explanatory variable in the equations. Since, information at time (t-1) is important, where volume is assumed to have a direct impact on risk. It is introduced in the variance equation with one period lag.

α_i that shows the ARCH effects, models the variance of the unexpected returns as a GARCH process depending on 'price news' (ε_i^2, the ARCH term capturing information about volatility observed in the previous period and measured as the lagged squared residual from the mean equation).

β_i that shows the GARCH effects, models the past expectations (the GARCH term capturing information about forecasted variance from the last period), and the rate of information arrivals (as proxied by the total volume of stocks traded).

ε_t is the stochastic process and assumed to be distributed normally conditional on the

information set ε_{t-1} given to the individual at time (t-1).

The unconditional variance of ε_t is given by $\text{var}(\varepsilon_t)=\dfrac{\alpha_0}{1-(\alpha+\beta)}$ when $\alpha+\beta<1$ must be satisfied for the model not to be explosive and to guarantee positive variances.

dum01 D = 1 during November 2000 and February 2001for financial crisis

D = 0 otherwise

mdum D=1 for Mondays in the period of beginning with 01.06.1998 till 10.11.2006

D=0 otherwise

fdum D=1 for Fridays in the period of beginning with 01.06.1998 till 10.11.2006

D=0 otherwise

DATA

Daily data that is used for the period of June 1, 1998 - November 10, 2006 employed as follows: ISE composite index (ISE-CI) is a value weighted index calculated according to closing prices of common shares and published by ISE is used to calculate return. Volume is taken as the total amount of operations done during the day in terms of New Turkish Lira units. The original data source of the variables is ISE obtained from the database of the Central Bank of the Republic of Turkey.

Theoretically the conditional skewness can be explained by the so-called volatility feedback effect (Campbell and Hentschel (1992)) that relies on volatility persistence and a positive intertemporal relation between expected return and conditional variance. This effect arises as follows. Because of persistence, a large piece of news increases not only present but also future volatility, which in turn increases the required rate of return on stock and, hence, lowers the stock price. This effect amplifies the impact of bad news but dampens the impact of good news, and therefore, large negative stock returns tend to occur more frequently than large positive ones when volatility is high. As a result, also the unconditional return distribution tends to be left-skewed. (Markku Lanne and Pentti Saikkonen)As it is the case in our paper (table below). The skewness is found as -0,003 for return. Also the Jarque-Bera support that the return is not distributed normally. In addition, there is an excess risk for return data which can be seen from kurtosis that is greater than 3.

	RETURN
Skewness	-0.002955
Kurtosis	7.724594
Jarque-Bera	1948.509
Probability	0.000000
Observation	2095

METHODOLOGY

AUGMENTED DICKEY-FULLER TEST (ADF)

The ADF test is applied for a time series as Y_t is based on t-statistic of coefficient in the following model.

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum_{i=1}^{p} \Psi_j \Delta Y_{t-i} + \varepsilon_t$$

In order to correct the autocorrelation effect in the error term (ε_t) lag1 of Y_t must be added to the model. The optimal lag interval that corrects autocorrelation is denoted by Akaike Information Criteria (AIC). The optimal lag can be found by using minimum AIC value. After the appropriate model is established the null hypothesis and alternative hypothesis can be constructed as follows,

$H_0 : \delta = 0$ (There is unit root)

$H_1 : \delta < 0$ (There is no unit root)

Rejecting H_o shows that series have unit root. In order to understand cointegration level, the first difference of the series must be determined. Then ADF test is applied in this stage, if H_o is rejected, the series' first difference are stationary I(1). If it is not rejected, the some procedure is applied for the second difference of series that shows the integrated order 2, I(2). ADF unit root test can cause deviated results when there are structural breaks in series.

GARCH-M

In finance, the return of a security may depend on its volatility. To model such a phenomenon, one may consider the Garch-M model, where "M" stands for Garch in the Mean. A simple Garch-M model can be written as

$$y_t = \beta_0 + \beta_1 x_{2t} + \ldots\ldots\ldots + \beta_k x_{kt} + \delta h_t + u_t \qquad u_t \approx N(0, h_t^2)$$

$$h_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \ldots\ldots\ldots\ldots + \alpha_q u_{t-q}^2 + \lambda_1 h_{t-1}^2 + \ldots\ldots\ldots\ldots\ldots + \lambda_p h_{t-p}^2$$

where β_0 and α_0 are constants. The parameter δ is called the risk premium parameter. A positive δ indicates that return is positively related to its volatility. Other specifications of risk premium have also been used in literature.

The formulation of Garch-M model in the equations above implies that there are serial correlations in the return series Y_t. These serial correlations are introduced by those in the volatility process (h_t^2). The existence of risk premium is, therefore, another reason that some historical stock returns have serial correlations.

GRANGER CAUSALITY

In order to understand the causality between variables, the Granger Causality is used. The test involves estimating the following regressions;

$$Y_t = \sum_{i=1}^{n} \alpha_i x_{t-i} + \sum_{j=1}^{n} \beta_j y_{t-j} + \varepsilon_{1t} \qquad (1)$$

$$X_t = \sum_{i=1}^{m} \phi_i \chi_{t-i} + \sum_{j=1}^{m} \sigma_j \chi_{t-j} + \varepsilon_{2t} \qquad (2)$$

Where it is assumed that the disturbances ε_{1t} 1t and ε_{2t} are uncorrelated.

Equation (1) shows that the current dependent variable is related to past values of itself as well as past values of independent variable and second equation postulates a similar behavior for independent variable (χ_t). Equation (1) The null hypothesis is $\Sigma\, \alpha_i = 0$ that is lagged χ_t values do not belong in the regression. To test this hypothesis, the Wald Test (F-test) is applied given;

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/n-k}$$

Where m is the number of lagged χ_t terms, k is the number of parameters estimated in the unrestricted regression.

If the computed F value exceeds critical F value as the chosen level of significance, the null hypothesis can be rejected. This is another way of saying that independent variable (χ_t) causes dependent variable (Y_t). The same procedure is applied for the second equation.

EMPIRICAL RESULTS

In order to find the unit roots Augmented Dickey Fuller Test is used. The null hypothesis is there is no unit root; the alternative hypothesis is that there is a unit root. The ADF results are as follows.

ADF	Return		Volume	
	c	c+t	c	c+t
Level	-9.4326 (15)**	-9.4307 (15)**	-11.5456 (24)**	-11.5443 (24)*

The values in parentheses show the optimal lags obtained according to Akaike Information Criteria (AIC).

** shows the rejection of null hypothesis at %5

According to unit root test results above;

Both return and volume are stationary in level. It means that there is no unit root in level.

When considering the Granger Causality results;

Pairwise Granger Causality Tests

Sample: 1 2096

Lags: 16

Null Hypothesis:	Obs	F-Statistic	Probability
VOLUME does not Granger Cause RETURN	2079	1.21007	0.25163
RETURN does not Granger Cause VOLUME		6.15851	1.5E-13

The lagged values of return and volume are chosen to be 16 according to the Akaike and Schwarz Criterion.

As it is seen from the table above; return granger causes volume. However the inverse causality cannot be found.

GARCH-M RESULTS

Mean equation	ϖ_0	V_t	R(-1)	mdum	fdum	dum01	Garch term
Coefficient	-0,0026	0,0235	0,0113	0,0017	0,0034	-0,0105	0,1230
Probability	0,09	0	0,5930	0,1425	0,0051	0	0,0734

Variance equation	α_0	ARCH(1)	GARCH(1)	V(-1)
Coefficient	6,47E-06	0,0855	0,9110	9,36E-05
Probability	0	0	0	0

From the regression, the R (-1) and mdum are insignificant. The risk premium is positive and significant at %10 significant level and the all other variables are significant even at %1 significance level.

CONCLUSION AND EVALUATION

The paper tested the validity of risk-return, volume-return and information return relationships by using a GARCH-M modeling of the estimation process. Volume is taken as a proxy for the information arrival to the market and is introduced both in the return and variance equations.

The estimated GARCH-M model is as follows

$$R_t = -0{,}003 + 0{,}0235V_t + 0{,}0113R_{t-1} + 0{,}1229h_t^2 + 0{,}0017mdum + 0{,}0034\,fdum - 0{,}0105dum01$$

$$h_t^2 = 0{,}00000647 + 0{,}0855\varepsilon_{t-1}^2 + 0{,}9105h_{t-1}^2 + 0{,}000936V_{t-1}$$

In order to evaluate risk premium, it should be positive and significant. The results indicate that this condition is hold. It is found that there is a positive risk premium relationship, which supports the empirical foundations of the earlier work on emerging markets. In other words, more returns require more risk. The increasing volatility (conditional variance) in market increases risk and eventually returns.

There is also positive relationship between volume and return. Return granger causes volume, however, volume does not granger causes return. At the same time, one lagged of volume data increases the volatility which in turn affects the return positively. According to risk and volume coefficient, it is observed that risk affects the return more than that of the volume does.

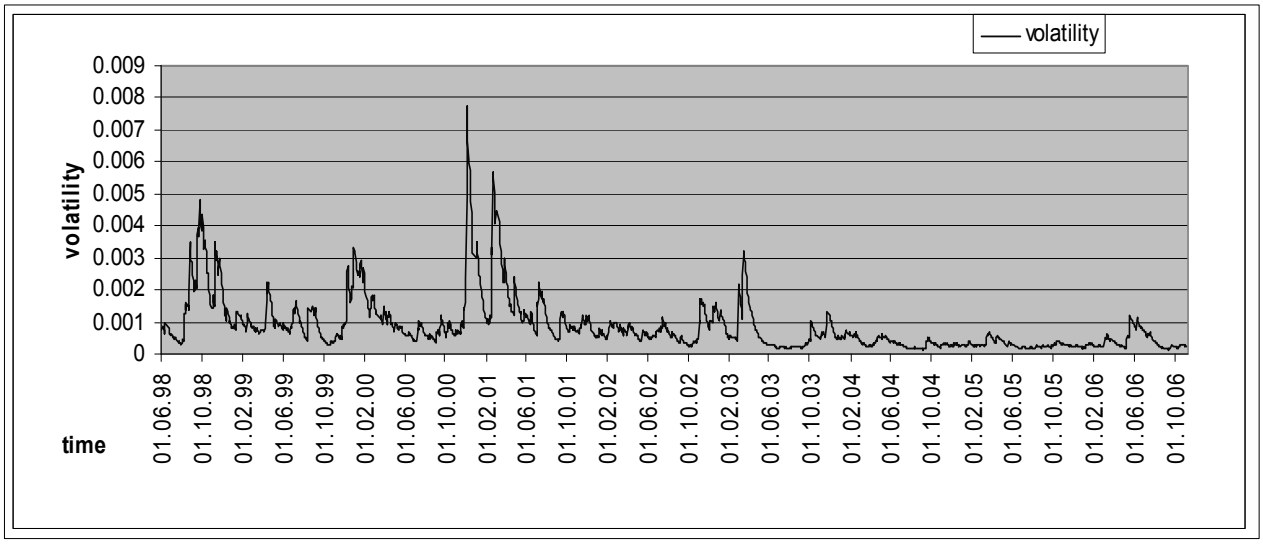
Return is not influenced by lagged values of itself. This condition is logical and expected, if R_{t-1} has a direct effect on R_t, the financial market would be open to speculation. As a result, this must not be occurred in an efficient market.

The results of day of the week effect imply that although there is no significant effect of Monday on financial returns, in contrast there is a significant effect of Friday. Previous researches also support the Friday

effect in Turkey. It can be thought in this way, the investors take the gain that are arised from transactions during the week and the investors do not want to take the risk in weekend when ISE closed.

The results show that 2001 financial crisis affects the return negatively and seriously. When this dummy variable is omitted from the model, the model becomes meaningless. This variable causes the structural break that is open in the table below. There is great jump in the volatility series between the period of November 2000 and February 2001, including. This structural break affects overall significance of model. As a result, crisis dummy has an important role on the estimation of risk-return model.

In the variance equation, both ARCH and GARCH terms are significant and the sum of them is less than 1 which implies a positive variance. The terms show that there is more GARCH effect than the ARCH effect on the volatility. This means that the current news do not have an important role on volatility, however the cumulative past news do have a very important role on volatility which in turn on return.



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CHALLENGING BOUNDARIES OF MEASUREMENT

How Accurate are the Measurements of Shadow Economy: A Review of Studies for Turkey

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Abstract

Shadow economy is still a "mystery" and it has tended to increase gradually both in developed and developing countries. Apart from its complex nature, shadow economy has many negative effects on the competition and public finances. So various policies have been implemented to reduce its size. Yet for the policies against shadow economy to be successful, its scope and causes should be accurately analysed. Various methods have been employed to measure the size of shadow economy. Those methods could be classified in two categories: Direct and indirect methods. Despite that the direct methods have the potential for more accurate results, the scale of economies do not allow a comprehensive measurement. That is why indirect methods have often been used. Based on those measurement methods, the size of the shadow economy seems to be 8-10 % in USA, 40-60 % in Mexico… Regarding its size in Turkey, there is a wide range from %26 to %184 as of 1985-2001 term. This paper is going to review the measurement methods of shadow economy, and discuss the empirical evidence for Turkey in more details.

JEL Classification: O17.

Keywords: Formal and Informal Sectors, Shadow Economy, Institutional Arrangements.

I.

GDP is an important indicator for the economic performance so it is required to be measured. While it is measured, there is always a handicap: GDP could not be measured "truly" because some parts of the economy are "grey, black, hidden, informal, irregular, unobserved, unrecorded, underground, subterranean or clandestine". In economics literature, these words are mostly used in nominating the shadow economy. Although it is hard to make a general definition of shadow economy, it could simply be explained as "economic activity that falls outside the purview of government accounting"[1]. Shadow economy, whether legal or illegal, appears in production, employment, and exchange (Schneider: March 2000). So it could be said that tremendous scope of shadow economy makes hard to explain its nature. However, defining shadow economy is important, otherwise policies that try to prevent shadow economic activities would be inefficient.

In addition to these explanations, generally there are two approaches which define shadow economy from different perspectives:

"The first considers shadow economic activity as simply *unrecorded* economic activity (the *definitional* approach), while the second defines the shadow economy in terms of behavioral characteristics-its economic activity therein (the *behavioral* approach). The former is descriptive while the latter provides underpinnings of a theoretical explanations for shadow economic activity. As a result the components included in these definitions are necessarily somewhat inconsistent" [2]

In fact, whether legal or illegal, the main incentive behind the shadow economic activities is to decrease transaction costs that frequently depend on institutional structures. So shadow economy is an interdisciplinary fact. For a period of time, there are psychological and micro-sociological studies that mention and try to analyse individual decision making process which results as shadow economic activities. As for the literature of economics, shadow economy has started to be considered with endogenous growth models, in other words, about the end of 1980s and 1990s (Feige: 1990).

In addition it could be said that, despite of lacking a formal definition, shadow economy is a reality for world economies, and it tends to increase gradually.

II.

[1] Fleming, Matthew, F., *et al, The Shadow Economy,* Journal of International Affairs, Spring 2000, p. 387.
[2] Fleming, Matthew, F., *et al, The Shadow Economy,* Journal of International Affairs, Spring 2000, p. 389.

In today's world, neither developing nor developed countries could prevent shadow economic activities and its increase. So policy-makers have started paying attention to the causes of the shadow economic activities. Unless real causes are determined, policies against shadow economy would be deprived of necessary means for solving this problem. Nevertheless shadow economy also limits policy-makers while real causes are investigated: Formal data on unemployment, labor force, income, and consumption would lose their accuracy and reliability in case of "large" shadow economy. Thus implementation of right policies against the shadow economy could not be possible.

At a glance, taxation (direct-indirect taxation or increase of tax burden) social transfers (like unemployment payments), excessive legal arrangements on formal economy, reducing working hour legally, early retirement, unemployment, decrease of reliance on public institutions, losing tax morale could be counted as the reasons of shadow economic activities most commonly (Schneider: March 2000).

In the first place, growing shadow economy could be an outcome of reaction of individuals who think they are overburdened by government (Schneider: March 2000). Obviously, tax is necessary to carry out public services. Yet, individuals' income level and consumption rates are greatly effective on taxation: An overtaxation that effects income level and consumption rates negatively would result as tax avoidance. But there would be individuals who go on paying tax. Thus, tax that is used for providing a fair income redistribution would become a means of transfer to individuals who participate in shadow economic activities. Subsequently, budget deficits arise and increase in time. Hence high tax rates – shadow economy paradox would occur (Pınar: 2002). As a result economy would become weaker.

Secondly, excessive legal arrangements on formal economy that include to reduce working hour and early retirement cause shadow economic activities by increasing transaction costs. Other side effect of similar implementations is unfair competition. Of course under unfair competition, market conditions would deteriorate.

As for social transfer like unemployment payments, it causes shadow economy mostly in developed countries. For many empirical evidence, social transfers like unemployment payments are incentive for unrecorded or informal employment.

Finally, when public institutions become less reliable and tax morale decreases, shadow economic activities tend to increase (Torgler and Schneider: 2007). Most important factors that effect public institutions' consideration and reliability are lack of rule of law, governments' arbitrary arrangements that effects social well-being negatively, lack of control and transparency in public administration and corruption. Although there is a strong relationship between tax morale and these factors, tax morale is also a cultural fact: Informal institutions also determine tax morale.

In conclusion, it could be said that shadow economy causes weakening of economy, therefore it has many negative effects on growth and welfare. Besides development level affects size and kinds of goods and services that matter to shadow economic activities. But it is claimed that shadow economic activities provide elasticity to economy and in some cases lower transaction costs.

III.

Another step against the shadow economy is to measure its size. But scale of shadow economic activities doesn't allow computing it correctly. Actually all the methods only try to estimate the size of shadow economy. But which result is more close to reality? In fact, accuracy and reliability of each method depends on the special characteristics of countries. For instance, while estimating the size of shadow economy by comparing expected tax revenue with collected tax revenue, this method would have different accuracy and reliability for where the tax revenues collected largely from indirect taxes and for where the tax revenues collected largely from direct taxes. Or direct methods as public surveys could not provide the expected result because of institutions.

Apart from these explanations, in theory, computing methods could be gathered in two main topics: Direct and indirect methods. Direct methods have the potential of more accurate results and consist of public surveys: Household, business, consumed time, tax, and other surveys. Even direct methods close to accuracy more than indirect methods, they are based on statistical data analyses. So for more accurate results, these methods need large population surveys and this increases costs. For this reason indirect methods are frequently preferred for computing. As for indirect methods, fiscal and mixed methods are mostly employed. Mixed methods based on inputs of production like electricity or cement.

Fiscal Methods[3]	
1.Tax Audit Discrepancy Method	2.Monetary Indicators Method
	Differences Between National Income and National Expenditure Approach.[4]
	Cash – Deposit Ratio Approach.[5]
	Econometric Approach.[6]

These methods are widely used in developed countries, rarely used in third world countries. Its reasons have been explained by Feige as below:

"In some cases the procedure can not be readily applied because of rudimentary and oft fragmentary nature of national accounting systems and the paucity of appropriate fiscal data." [7]

Differences Between National Income and National Expenditure Approach

Basic assumption of this approach is that individuals who participate shadow economic activities could hide their incomes from tax collector but it is not possible to hide their expenditures. In this way the difference between national income and expenditure would give the size of shadow economy. Yet, accordingly Thomas (1999),

"Unfortunately, there are number of problems with this approach. First, the assumption that the estimates of National Expenditure and National Income are constructed so that they are statistically independent is not generally true and the totals are a compromise with the same components being included in both. Second, while it is true that National Expenditure estiamtes often larger than those of National Income, this is not always the case. In Switzerland National Income tended to be larger than National Expenditure, implying a *negative* black economy."[8]

However, in Switzerland, in 1960, according to cash-deposit ratio approach, size of shadow economy is 1% of GDP and in 1995 6.7% of GDP (Schneider and Enste: 2000).

Cash – Deposit Ratio Approach

This method is the but off serious critiques because of its three "heroic" assumptions. Accordingly Thomas:

"… First, a year or (or quarter, depending on the available data!) must be identified which the black economy did not exist. Secondly, transactions in the black economy are carried out exclusively using cash. Finally, the velocity of cash is the same in both non-black and black economies. […] Of three heroic assumptions, the most questionable is the first. Was there ever a year in any society when hidden economic activities were not being undertaken?

[…] One must also question logical implications of the cash-only assumption. Given they have to hide their activities, can those working in the black economy launder money into savings in conventional interest bearing financial assets without attracting attention? […] However there is evidance against assumption that only cash is used in the black economy…"[9]

After these explanations, numbers on this table would become uncertain. Cash-only assumption would lower actual size of shadow economy.

Econometric Approach

Compared with other methods, econometric approach could provide more accurate information. On the other hand there is still lack of theoretical base in modelling: Variables that are excluded and included in econometric models could be inappropriate for economic theory.

[3] DPT Kayıtdışı Ekonomi Özel İhtisas Komisyonu Raporu, Ankara, 2001, p. 9.
[4] Thomas, Jim, *Quantifying The Black Economy: "Measurement Without Theory" Yet Again?*, The Economic Journal, June 1999, p. 382.
[5] Thomas, Jim, *Quantifying The Black Economy: "Measurement Without Theory" Yet Again?*, The Economic Journal, June 1999, p. 382-383.
[6] DPT Kayıtdışı Ekonomi Özel İhtisas Komisyonu Raporu, Ankara, 2001, p. 9.
[7] Feige, Edgar L., *Defining And Estimating Underground And Informal Economies: The New Institutional Approach*, World Development, July 1990.
[8] Thomas, Jim, *Quantifying The Black Economy: "Measurement Without Theory" Yet Again?*, The Economic Journal, June 1999, p. 382.

Country	Informal % GDP-1960	Informal % GDP-1995	% Change
Swiss	%2	%16	%14
Denmark	%4.5	%17.5	%13
Norvege	%1.5	%18	%16.5
Germany	%2	%13.2	%11.2
USA	%3.5	%9.5	%6
Austria	%0.5	%7	%6.5
Switzerland	%1	%6.7	%5.7

Source: Schneider, Friedrich and Dominik H Enste, *Shadow Economies: Size, Causes, and Consequences* Journal of Economic Literature, March 2000.

In sum, there are numerous methods to "compute" size of shadow economy. But these methods have shortcomings in explaining reality of shadow economy and they are sometimes far from theoretical background. Furthermore, these key questions on shadow economic activities have to be answered: What is done in informal field? Who is doing this and why, how, where? Isn't government really aware of shadow economic activities? Answers of these questions should not be surpassed by excessive empiricism. It is obvious, the first object of studies on shadow economy should not be "producing weird numbers" ; it is necessary that data should make easier providing right policies against the shadow economy.

IV.

Whether reliable or not, the empirical results differ incredibly in the literature of shadow economy. However, some of these estimates are still useful for policy-makers in framing policies against shadow economy.

While numbers are examined, it is seen that important part of the world faces tremendous impact of shadow economic activities. Besides there is not a universal relationship between development and shadow economy. For instance in Italy and Belgium, in 1990, 24 % of GDP is informal or unrecorded, in 1993 it rose by 6 % and size became 30 % of GDP. In other words it reached approximately one third of GDP. When it comes to Latin world; as for 1990-1993 term size of shadow economic activities rose by 20 % and reached 60 % of GDP. For former USSR countries; as for 1990-1993 term in Ukraine, it reached 43 % of GDP by increasing 15 % and for Russia it reached 27 % of GDP by increasing 7 %. As for new members of EU; in Bulgaria, in 1993, shadow economic activities reached 28 % of GDP and rose by 8 % compared to 1990. For Romania, in 1990, this ratio was equivalent to 9 % of GDP and in 1993 it rose by 7 % and became 16 % of GDP.

Regarding to Turkey, as shown in the table below, different methods give different results. However, as for 1970-1992 term, cash-deposit ratio approach and transaction capacity approach have given the same result.

When it comes to the size of the shadow economic activities in Turkey, there is a wide range that increase up to 184 % of GDP. Yet, according to the most recent study (Çetintaş and Vergil, 2003) which is used for estimating shadow economy's size by using econometric approach, as for 1972-2002 term, the informal economy in GDP changes in the range of 18 % - 30 %. For similar terms, when these estimates are compared with developed countries like UK, France and Holland where the size of shadow economy is approximately 13 % of GDP on average, the result would be against Turkey. Turkey has a serious informal economy problem that is required to be solved.

Source: Us, Vuslat (2004), *Kayıt dışı Ekonomi Tahmini Yöntem Önerisi: Türkiye Örneği*

<http://www.tek.org.tr/dosyalar/VUSLAT-US1-KAYITDISI.pdf > , access: 26th of December, 2006.

As it is explained above, causes of shadow economic activities in Turkey have a similarity with rest of the world. However some special characteristics of tax structure in Turkey causes extra informal activities. More specifically *lump-sum tax* on small businesses, is one of the main incentive for those businesses to hide their economic activities. In the implementation of this tax, tax authority determines a fix tax base. Such an

implementation undermine the real economic activities of those taxpayers who are sometimes overtaxed while the majority is undertaxed. The main reason for such an implementation is the inefficieny of Turkish tax administration.

Study	Method	Term	Informal Econ. in GDP %
Çetintaş and Vergil, 2003	Econometric	1972-2002	18-30
Öğünç and Yılmaz, 2000	Cash-Deposit Ratio	1960-98 1971-99	0-46 11-22
Ilgın, 2002	Cash-Deposit Ratio Tax Audity Discrepancy	1968-2001 1985-2001	31-84 26-184
Temel, Şimşek and Yazıcı, 1994	Tax Audit Discrepancy Cash-Deposit Ratio Transaction Capacity Econometric	1984-91 1970-92 1970-92 1975-92	8-45 0-26 0-26 6-20

V.

Up to now, definiton of shadow economy, its causes and estimation methods of shadow economy and their results have been mentioned. Apart from these theoretical explanations, in practice, it is impossible to eliminate shadow economic activities. Firstly, to eliminate shadow economic activities, there must not be transaction costs. Economies of scale and institutional transformation would be able to provide it in time. But for now, it is only possible to reduce shadow economy. In brief,

In the name of efficiency fair taxation should not be underestimated.

Public institutions should be controlled by civil society organization to increase their reliability.

Individuals should be educated: making individuals conscious of importance of tax payments; tax morale is parallel with citizenship conscious.

Individuals who participate in shadow economic activities should be punished and punishment should be deterrent.

Law codes that cause shadow economy should be regulated .

International cooperation is necessary to reduce the size of shadow economy.

However the most important means against the shadow economy is “institutions”: Institutions are both causes of shadow economy and remedies for this economic illness. Also it could be said that, there is a negative correlation between “macroeconomic stability, low inflation level, high income level” and “shadow economy”. When these two statements come together, it would be reached that development which means more than growth of GDP should be achieved to reduce the size of shadow economy and when the size of shadow economy is reduced, a difficulty in development process would be overcome.

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Informal Economy in Turkey

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ABSTRACT

Informal economy which has economical, administrative, social and psychological reasons has been saving its importance up to now. Furthermore, it has a very extremely complex structure in the economy life of world and also Turkey. It is a fundamental economical problem which is waiting its solution for both developed and developing countries. Despite the fact that a lot of solution suggestions are given, it is a structure that can not be removed. Firstly, we tried to explain the meanings of informal economy with the definitions of international organizations such as International Labor Organization. Secondly, you can see the various reasons of informal economy in Turkey and other countries. In addition, you can find the answer of why informal economy is getting higher and higher year by year. We support our work paper with empirical models. Then, the influences and also results of economicial and social life should be discussed. According to our opinion, it should be constructed the social consciousness and then certain economical, administrative, social and legal corrections should be done.

Keywords: Informal economy

1. INTRODUCTION

Although it was said that unregistered economy became a current issue with publishment of several articles were published at the end of 1970's and took an important role in daily life, first economic researches related to topics were started with the beginning of 1940's. However, unregistered economy started to setting the scientific attention with the article of Guttman published in 1977 so, unregistered Economy was not approved as an international fact until 1980's. The first international conference related to unregistered economy was held in Bielefeld, German in 1983, Although an agreement on general principle about the definitional problems was one of the basic aim of conference, participants did not reach a consortium and different definitions were used.[*]

The whole economic activities income which is not in officially registered and can not be inserted into GDP accounts with the statistical methods are known, denotes unrecorded economy. Unregistered economy is the economy which is not documented. When some people who are in a favour of unrecorded economy intend to avoid to expenses such as tax and social insurance deduction -which cause of extra cost- others economic activities′ basis is inconvenience for laws.

2. THE REASON OF UNRECORDED ECONOMY

The countries where unrecorded economy grows the most are the ones where the inflation is continuous, where the unfair and speculative income increases, the income is divided in an unfair way and where the economy remains uninspected.[*] In recent years, unrecorded economy has been increasing reasonable with the unstable inflation, unfair income shares with the economical activities that are not being inspected. The quality of economic activities such as agriculture too hard to difficult in registration. For these reason, it is estimated that unrecorded economy has an important role in which the use of material, based are on agriculture.

2.1. Financial Reasons

It is seen that the main one among the important reasons which leads to unrecorded economy is problems related to taxing. We can outline the reasons which lead to unregistered economy with 3 subtitles of unregistered economy by separating it in to three subtitles.

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[*] PROKHOROV, A.,"The World Unobserved economy: Defmition, Measurement, and Optimality Considerations", p.7, 2001, http://www.msu.edu/~prohorov/a.pdf
[*] DURA, Cihan, Kayıt Dışı Ekonomi Kavramı, Sebep ve Etkileri, Ölçülmesi, Mücadele Yolları ve Türk Ekonomisindeki Yeri, "Maliye Dergisi", N.124, p.6, 1997.

2.1.1. High Tax Rates

Tax is a legally obliged and a definite transfer of money from private sector to public sector in order to provide to public needs. Government makes this transfer on the basis of sovereign force.

There is a linear relation between the tax rates and unrecorded economy. In other words, the more the tax rates, the more the unrecordedness increases and the more the tax rates decrease the more the unrecordedness decrease. Therefore, unrecordedness is much more in developing countries than in developed countries.

The effect of tax rates an economic activity has been proved theoretically by many researches, but the most widely known among these is Arthur Laffers′ study is based on a relation between the tax rates and the tax income which is the most important basis of economics related to the demand. It is dictating in this analysis that the tax rate will decrease the tax income after a certain rate. When the tax rates exceed optimum, tax incomes begin to decrease, because people seek for the ways to earn money without having to work and pay taxes. Basically, when the tax rates begin to increase basically, there is no decrease in economic activities as it is stated with numbers. There is a motion from registered economy to unrecordedness only because of high tax rates. In this case the dimension of registered economy would be smaller.[*]

In order to diminish unrecorded less this is occurred because of the effect of high tax rates. Governments make the institution of exemption and exception, actually exemptions and exceptions decrease the unregistration to some extent, but they (exemption and exception) cause to breach of tax justice while decreasing the unregistration. Those who can not benefit from tax exceptions become disadvantageous against their rival who benefits from it, and they (can not benefit from tax exception) smuggle much more tax to transform disadvantage into advantage.

The tax rate in Turkey is not lower than in the countries of the European Union. However, it is certain that it (Turkey) is not a good point in terms of tax burden. When the countries of the European Union tent to decrease their tax rates, Turkey has to increase its tax rates according to the GDP, and so the solution of this is to enlarge the proportion of registered economy.[*] In the process of enrolling with the European Union, either tax rates must be degreased or must be collected from everyone without any discrimination. Tax is not being collected fairly from everyone causes to tax's being collected from taxpayer who is always works under registration, and this causes to loss of rivalry advantage for these taxpayers. Unregistration increases by the high tax rates and cause to unfair competition. Government has been bringing out the element of unfair competition whereas it must arrange and inspect the unfair competition. Whereas, it is necessary that taxes should be in a way that, and then tax evasion must be prevented so that tax revenue can be made effectively and tax justice can be provided.

2.1.2. Insufficiency of Service of Accounting and Consultancy

Accountants and Financial Consultants who provide connection between the taxpayer and tax management have important roles in preventing the loss of tax. Some job veterans restrict their tax by indicating their property value less or more by indicating their income and expense as it can be understated, by indicating their cost and expenses different than what they really are. Accountants and Financial Consultants who apply these kind of illegal activities, not only besmirch the respectuality of job both also defraud the honest taxpayer. Aggravated sanctions ought to be instituted for accountants and financial consultants who evade and ignore tax. The activity of job association should be provided and inspected by associations which are connected to the job veterans. We think that illegal activities will decrease if the inspection is carried out by both financial and job associations.

One of the most important problems related to this topic is the quality of those who execute this job. Different kinds of job employee who are not interested in tax and accounting and who were given the opportunity to make the job of Certified Public Financial Accountant which requires a characteristics of expertise come true, and finally the job of Certified Public Accountant have been in trouble because of this reasons. When the law of numbered 3568 was formed and after, some sector and job employee who guess how this job will be important in the future and try to go in the scope of this law.[*]

2.1.3.The Reasons that Proceed from Tax Inspection

[*] KILDİŞ, Yusuf; "Kayıtdışı Ekonomi", http://www.canaktan.org/ekonomi/kamu_maliyesi/maliye-genel/diger-yazilar/kildis-kayit-disi.pdf, p. 4-5.
[*] İstanbul Sanayi Odası, "Ekonomik İstikrar İçin Şeffaf Devlet Kayıtlı Ekonomi", Mart 2001, İstanbul, p.7
[*] AYDEMİR, Şinasi; "Türkiye'de Kayıtdışı Ekonomi", Maliye Hesap Uzmanları Derneği Yayını, İstanbul 1995, p.67.

Tax system, applied with process of getting money according to amount of added value created after the production should benefit to the source transfer that will be used in public services such as education, healt, justice in structure and security. However, it has been clearly that today's tax system can not carry out it. The most important reason tax mission not being carrying out successfully, a big part of tax revenue goes for debt's interest rates. This situation shows in turkey that the mission of the tax system which is known as the tax justice in Turkey can not be carried out. Firstly, sanctions ought to be aggravated directed towards the tax evasion and inspection system must be formed by dischargement of sanction by applier in order to carry out the main mission of tax and to form an infrastructure appropriate for it's definition. Tax free and tax peace must not take place in no matter the inspection system which will be formed. Tax free has not been only encouraging the tax evasion and payment but also punishment of honest citizen who pays his/her tax task out on time instead of paying after dead line.

Turkey will have opportunity to collect of tax much more 82% than the tax which is collecting today if the tax loss is prevented. That is, it is available to collect 34.8% of the GDP with the current rates. Increase of potential tax burden to 34.8% shows that tax rates are too high in Turkey. It is seen that tax rates are very high for employment where legal obligations are applied and that they have to suffer unfair competition in favour of the employers who works in unrecorded.[*]

Turkish tax laws are too complex and in a bad condition to bring understood by the law judgement, the decision of Council of Minister and general communicating. Repeated, temporary and flexible laws damage the clearness principle in taxing. Thus, tax laws must be rearranged. By the way, every kind of tax laws ought to be place in tax laws to easily watch by the tax payers and inspectors. In compatibility between the tax laws and Turkish Commercial Law and Capital Market Law must be removed. It necessary that tax law must be made compatible with new conditions in international relations. However, tax laws that are not understandable clearly and easily also important in punishing the tax payers who try to discharge their task duty and in decreasing their confidence towards the government after the inspection.

Tax payers′ incompatibility the main reasons of the administration failure and passiveness of control. Therefore the act of the tax evasion gets its source from the incompatibility of the tax and from the passiveness of control. The poorness of inspections and the sanctions, the strength of the tendency for taking risks and high tax rates are the necessary conditions for tax evasions but not enough. Besides these, has to be evasion-smuggling-opportunities. The elimination of these opportunities by the help of good and active tax administration or a tax control and the repairment of the deficiencies in tax laws would decrease the unrecordness-unregistered economy even if there is not an upsurge in inspection.[*]

2.2. Economicial Reasons

The economies having of high inflation, additional if increasing tax schedules are applied, tax burden taxes its place, as a reason of the increase in income proportions to a higher level proceeding even though the real incomes of the tax payers don't increase. This conditions leads to another in which the taxpayers take out some of their incomes priory registered flowingly to unregistered. Government collecting less tax finds a financial solution by getting into debt or by money emission with using a higher inflation and inequality in income distribution.

Companies which are in a favour of benefiting from investment exceptions of government display their existing tax assessments more or less than needed. As a result of this, government sometimes collects more or less tax than necessary. Applications such as investment exceptions causing an unfair competition should fastidiously be made and applied.

There is inequity in income distribution in the developing countries societies have unbalanced pyramid like shapes in low middle class and high lower and upper classes. This shape shows a property that is feeding the unrecordness. Because this shape leads to unrecordedness activities of the lower class members, marginal section (napkin seller, shoe shiner, street vendor….etc) and therefore unrecorded increases. Generally small family businesses are under less inspection catch more opportunity than large companies about unrecorded production.

To obtain equity in income distribution:

Getting the work strength into registration.

Preventing the population rise in a controlled way with population plan

[*] A.g.e. Ekonomik İstikrar İçin Şeffaf Devlet Kayıtlı Ekonomi, p.4

[*] BATIREL, Ömer Faruk; Vergi Kaçakçılığı ve Vergiye Gönüllü Uyum, "Vergi Dünyası", N.175, p.53.

Providing the establishments of new business in a way a stability employment policy and encouraging the existing business to increase the employment rates.

Providing the economic stability and stable growth are necessary.

3. MEASUREMENT METHODS OF UNRECORDED ECONOMY

Despite the fact that it is really hard to figure out the capacity of unrecorded economy, there are some predictions that can be done via various methods.

3.1. Direct Measurement Methods

In this method, the size of unrecorded economy is tried to estimate by survey application. in this method, it is possible to obtain a detailed data on unrecorded economy. Family member surveys, work space surveys, the use of time surveys, tax surveys and such others are used. In this surveys, people or companies are asked whether they are involved in unrecorded activities or how much of their activities are reflected in records. by the help of this reliable data is collected in order to calculate the limit of unrecorded economy. The survey questions should be prepared fastidiously, quite of people or companies should be picked enough and randomly to satisfy the reliability of the survey and the name of participants should not be on the surveys it shows close to real results. But since the unrecorded activities are against the legal procedures, people or companies tend to hide information on these activities and this harms the reliability of the method.[*]

3.2. Indirect Methods

In order to measure the unrecorded economy, indirect methods are used more intensively. These indirect methods are based on macro economic data analysis. GDP approach, employment approach tax inspection measurement approach and monetary approach are the four approaches to guess the unrecorded economy. Difference between the GDP which is found by expense methods and the number of GDP which are found by income method gives information about the size of unrecorded economy, However this method can not also give a reasonable result in term when savings tools such as foreign money and good are high in tendency of investment and the existent of transfer to abroad. The estimated which is calculated according to other approaches.

3.2.1. GDP Approach

Production, income and expense methods are three different ways to calculate GDP. No matter what is among these, GDP totals have to be equal. In economy, as a result of the unrecorded activities, calculated GDP numbers different when different methods are used. The number found with income method is the least. The difference between between the GDP number found with income method and the GDP number found with expense method gives data about the limit of unrecorded economy. Although, this approach does not give rational results during the periods in which the tendency of investment and foreign exchange or gold is high or during the existence of abroad transfer.[*]

3.2.2. Employment Approach

The approach helps to make estimation an unrecorded economy preceding examine the populations civil work power wish and the development of employment based on time changes. It is expected that the ratio of civil work power wish to population shows a similar development to that of the ratio of employment to population. The situation in which the ratio of civil work power wish to population stays a specific level whereas the ratio of employment to population decreases explains the increase of employment in unrecorded economy among total employment and as a matter of fact this is capable enough to give data on the size of unrecorded economy, according to official static; the difference between the number of people working and the number of people who are working under the social security foundations are a serious explanation of some percentage of employment which is created unrecorded.[*]

The most important deficiency of this approach though is that it does not consider the social developments during the period that the calculation is done and it excludes the people working in seconds jobs. Some amount of social developments increase the ratio of employment to population whereas some amount decrease the ratio

[*] TEMEL, A; ŞİMŞEK, A; YAZICI, K; "Kayıtdışı Ekonomi Tanımı Tespit Yöntemleri ve Türk Ekonomisindeki Büyüklüğü" DPT, Eylül 1994, Ankara, p.11-12.
[*] TEMEL etc., a.g.e., p.12
[*] KILDİŞ, Yusuf; a.g.e., p.15.

of civil work power to population and appear as if it diminishes the unrecorded economy, but effects the reliability of this approach in a negative way.[*]

3.2.3. The Tax Inspection Measurement Approach

In this approach the limit of unrecorded economy is estimated by examine the tax payments and determine the incomes that the tax payers do not declare. The lost of tax created by the unrecorded economy is theoretically seen as the difference between the hypothetical potential tax income that Is registered and the tax income that is collected. By this way, calculation methods are tried to be impared.[*]

The most important property of the contemporary tax systems are that the taxpayer's declare their taxable incomes to the tax administrations on their own. Sometimes, taxpayers declare their incomes lower than real deliberately or accidentally. In the tax inspections, the incomes declared by the tax payers are watched, and if there is a lack or shortage, then the difference of the taxable valve would be found. According to this approach the difference of the taxable valve is taken as the basis to find the large of untaxed economy, not the large of unrecorded economy.

Sometimes taxpayers declare their profiles less purposely or not in tax inspections, profit which taxpayers declare are inspected and difference of tax assessments are found if they are exist. According to this approach, not unrecorded economy, but the large of economy which is not taxed are determined by being considered the tax assessment which is found. The most important deficiency of this approach is estimating the large of economy which is not taxed instead of illegal economy.

The main deficiency of this approach is that the large of untaxed economy is determined instead of the large of unrecorded economy[*]

3.2.4. Monetary Approach

In this approach, it is tried to be estimated the size of unrecorded economy by being used the monetary statistic and by being started with fluctuations in money and capital market.

The most important hypothesis which is accepted by monetary approach is being made with cash the most of the payment which is made in unrecorded economy so that the inspections related to this matter is not made. Thus the improvements which will occur in unrecorded economy show themselves in monetary bigness, especially in stock of cash.[*]

Monetary approach are inspected into three groups; fixed rate (emission capacity), procedure capacity and econometric approaches.

3.2.4.1. Fixed Rate (Emission Capacity)

Fluctuations are observed in money market in order to determine the size of unrecorded economy and it is assumed that payment types such as cheques and voucher which payments are made an cash are used generally in unrecorded economic activity. It is assumed that in period when unrecorded economy there was not the rate of emission capacity to the deposits will stay fixed. It is envisaged that increasing of this rate will get the demand for the money raised, and in the end unrecorded economy will also increase. The biggest deficiency of this approach is to accept payment means is cash in unrecorded economic activity, and rapidly circulation of money will become same in recorded and unrecorded economy. However, payment on cheque and payment bill are extremely widespread in unrecorded uneconomy and the rapidity circulation of money also higher in unrecorded economy than recorded economy.

3.2.4.2. Procedure Capacity Approach

It is approach that the size of unrecorded economy is tried to be predicted by being benefited from the dubiety of the rate of procedure capacity to the national income and, by being used the equality of quantity theory of Fisher. This approach considers payment type such as cheque and payment bill beside cash, and this attitude provides more truth result for this approach than emission capacity, but the most important deficiency

[*] SARILI, Mustafa Ali; Türkiye'de Kayıtdışı Ekonominin Boyutları, Nedenleri, Etkileri ve Alınması Gereken Tedbirler, "Bankacılık Dergisi", N.41, 2002, p.37.
[*] ÖNDER, İzzettin, Kayıtdışı Ekonomi ve Vergileme, "İstanbul Üniversitesi Siyasal Bilgiler Fakültesi Dergisi", N.23-24, Ekim 2000-Mart 2001, İstanbul, p.4.
[*] SARILI, Mustafa Ali, a.g.m., p.36-37.
[*] DERDİYOK, Türkmen; Türkiye'nin Kayıtdışı Ekonomisinin Tahmini, "Türkiye İktisat Dergisi", TOBB Yayınları, N.14, Mayıs 1993, p.55.

of this approach is to assume the rapidity circulation of money is the same in recorded and unrecorded economy.

3.2.4.3. Econometric Approach

It is approach that dimension of unrecorded economy is tried to be predicted by being estimated the demand of cash of by an econometric equation. According to this approach, the most important reason of unrecorded economy is the high tax rates. This approach assume that payment means is cash in unrecorded economy, and the rapidity a circulation of money is the same in recorded and unrecorded economy. Demands of cash are calculated separately in situations which taxes are carried out or not, and the difference between these numbers facilitates the being involved the rapidity circulation of money in analysis the size of unrecorded economy is tried to be predicted.

4. DIMENSIONS OF UNRECORDED ECONOMY IN TÜRKİYE

Table 1. The Prediction of Unrecorded Economy in Türkiye

Researcher	Year	Method	Prediction
Altug	1992	Tax Approach	35
Derdiyok	1989	Tax Approach	46,94
Hakioglu	1989	Econometric	18
Ilgın	1998	Rate of cash	83,1
	1993	Rate of cash	54,3
	1992	Ekonometric	45,3 – 53,9
Kasnakoglu	1997	Rate of cash	30 – 61
	1997	Ekonometric	9 – 13
		Procedure Capacity	31
Koçoglu	1987	Analysis of Sensitively	19,6 – 26,5
Özsoylu	1990	Rate of cash	11,7
Temal, Şimsek Yazıcı	1991	Tax Approach	16,4 – 29,9
		Econometric	7,8
Yamak	1994	Ekonometric	10

Source: ÖİK "Kayıtdışı Ekonomi", 2001.

Many research were made in order to predict the dimensions of unrecorded economy, and different results were obtained because of being different of the definitions, methods and assumptions which were used in this approach. As it is seen on table, these predictions show that unrecorded economy is too high to be underestimated in our country.

Tanzi's cash Money demand equation was/is used to determine the size of Unregistrered Economy. The Money demand equation was/is like below,

$$M_t = \beta_0 ' Y_1^{\beta} VG_2^{\beta} F_3^{\beta} MF_4^{\beta}$$

M_t : Real Money amount in circulation

Y: Real national income per person

VG: Ratio of the tax income to GDP

F: Gross domestic product (by production) - implicit deflators (1987=100).

MF: Yearly -12 months- massed deposit interest rate

The equation after taking the logarithm of the variables($\beta 0' = e^{\beta 0}$),

$$LnM_t = \beta_0 + \beta_1 LnY + \beta_2 LnVG + \beta_3 LnF + \beta_4 LnMF$$

Table 2.

	Empirical proxies used	**Expected Sign**
Dependent variable	M_t : Real Money amount in circulation	
Independent **Variables**	Y: Real national income per person	+
	VG: Ratio of the tax income to GDP	+
	F: Gross domestic product (by production) - implicit deflators	-
	MF: Yearly -12 months- massed deposit interest rate	-

Real Money amount in circulation stands fort the dependent variable. Ratio of the tax income to GDP, implicit deflators and yearly -12 months- massed nominal deposit interest rate stand for the independent variables. The coefficients prospected for β_1 and β_2 are positive, the coefficients prospected for β_3 and β_4 are negative.

there are two hypothesis of our model;

The whole activities in unregistered economy are maintained with cash Money useage. This hypothesis naturally shows that the increase in unregistered economy will cause to an increase in Money demand.

The cirlulation pace of the Money in Unregistered Economy is the same with the circulation pace of the Money in Official Economy.

Our study refers to the period, 1988–2004. The data on the variables used in the study is maintained from the Turkish Statistics Institute(TÜİK) and State Planning Organization(SPO) Its possible for you to observe the data in added section of our study. We used the 5th version of the econometry programme, e-views in the study.

Table 3. Diagnostic Test Results

Dependent Variable: LOG(M_t)				
Method: Least Squares				
Date: 01/25/07 Time: 10:32				
Sample: 1988 2004				
Included observations: 17				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(MF)	-0.159901	0.098876	-1.617179	0.1318
LOG(F)	-1.044571	0.076704	-13.61822	0.0000
LOG(Y)	0.355305	0.347396	1.022768	0.3266
LOG(VG)	0.924122	0.011492	80.41636	0.0000
M_t	10.26841	4.896820	2.096954	0.0579
R-squared	0.999741	Mean dependent var		13.14779
Adjusted R-squared	0.999654	S.D. dependent var		3.062107

S.E. of regression	0.056928	Akaike info criterion	-2.654122
Sum squared resid	0.038890	Schwarz criterion	-2.409059
Log likelihood	27.56004	F-statistic	11569.98
Durbin-Watson stat	1.295292	Prob(F-statistic)	0.000000

LOG(M_t) = -0.1599006832*LOG(MF) - 1.044571246*LOG(F) + 0.3553052972*LOG(Y) + 0.9241216852*LOG(VG) + 10.26840579

The coefficients of interest rate and the price level are negative as prospected, the coefficients of National imcome per person and the tax income are positive but the value founded for the national income per person is not expressive. According to this, 1% increase in price level causes a 1,04% decrease in real Money amount whereas a 1% increase in interest rates causes a 0,16% decrease in real Money in circulation. Just like this, 1% increase in National income per person causes to a 0,35% increase in price level and the 1% increase in tax income causes to a 0,92% increase in pricel level. Excluding the coefficient of National imcome per person real income, whole coefficients of the variables are meaningful and expressing. If we take a look at the F statistical variable this can be found reasonable. The value R^2 is clearly high and this shows its propriety to the data.

Table 4. Currency Demand Method

	Money in circulation	**Money in the calculated circulation**	**Unregistered Economy**
1988	8,50442652668465	8,61360247595991	0,10917594927526
1989	9,11086309847994	9,11361691025255	0,00275381177261
1990	9,87663674432488	9,85510169075524	-0,02153505356964
1991	10,29543711068140	10,30792310031710	0,01248598963570
1992	10,76769963410340	10,72499113589580	-0,04270849820760
1993	11,23574276345320	11,18555967612170	-0,05018308733150
1994	11,46429055618820	11,43876157021490	-0,02552898597330
1995	12,28385320082850	12,17292589283390	-0,11092730799460
1996	12,91362885464490	12,91659566406900	0,00296680942410
1997	13,50640575726180	13,51548963443680	0,00908387717500
1998	14,12422570005280	14,18693935398970	0,06271365393690
1999	15,03829554276770	15,08317885018110	0,04488330741340
2000	15,67291868890130	15,68035068471550	0,00743199581420
2001	15,91259257038520	15,94447999663390	0,03188742624870
2002	16,56489697190220	16,53887159841120	-0,02602537349100
2003	17,58652055056940	17,60813440571340	0,02161385514400
2004	18,65401106749820	18,62592269822620	-0,02808836927200

When we look at the projection of the Unregistered Economy in Turkey during 1988–2004, its shows obvious fluctuations. Our study shows that the size of Unregistered Economy has gotten to an important increasing potential eventhough the study stands for a limited estimate. Despite the current positive influences of the Unregistered Economy, the procedures of getting the unregistered activities into registration programatically, has an ultimate importance and significance for the Economy of Turkey which otherwise would have erruptive influences on the social and economical structure.

5. UNRECORDED ECONOMY'S EFFECTS, BENEFİTS AND PATRİMENTS ON TÜRKİYE

5.1.Positive Effects of Unrecorded Economy

Unrecorded economy has occurred in different ways in other countries except Turkey. Unrecorded economy generally is perceived as negative but its positive results are not ignored.

In a research which was made on Belgium a positive connection was found between the development of unrecorded economy and development of recorded economy, and it is come to result that under various assumption there are positive stimulus of a widening financial politics.[*] The results in another study which were made in German and Austria has been showing that more than to 66 percentage of earnings which were obtained from unrecorded economy are spent directly for recorded economy, and it lead to breaking out for recorded economy. Thus, these expenses' positive effects on economic growth and tax incomes (specially indirect tax income) must be taken into account for consumption expenses.[*]

These are the positive effects of unrecorded economy;

It (unrecorded economy) has a positive effects on property level of person and their economic life.

Unrecorded economy gives an opportunity for fund aggregation so, it is though that it contributes to the employment.

Unrecorded economy will provide rivalry advantage in market since it will decrease the cost of companies. Thanks to this advantage, foreign trade balance will follow trend of development in a positive way.

In recorded economy, when taxes are transferred to the government, they are evaluated as a investment fund in unrecorded economy.

In this way, economic growth will have a positive effect on national income thanks to the increase of fundamental capital of companies.

5.2. Negative Effects of Unrecorded Economy

The detriments of unrecorded economy are much more than its benefits. These detriments cause to both the deviation of statictics data and the distordion of economy politics. Being devialed of statictics data cause to be calcuated some data by startingwith GDP missing and wrongly. As a reult of this.meaningful and appropriate Money and financial politics can not be developed.

Unrecorded economy cause to a decrease in tax revenue by damaging the social security and tax floor, and in this way it lead to bigger budget deficit, and both in direct taxes,it can cause to much more increase,in the end this situation can occur a vicious circle like upward taxing always growing unrecorded economy.

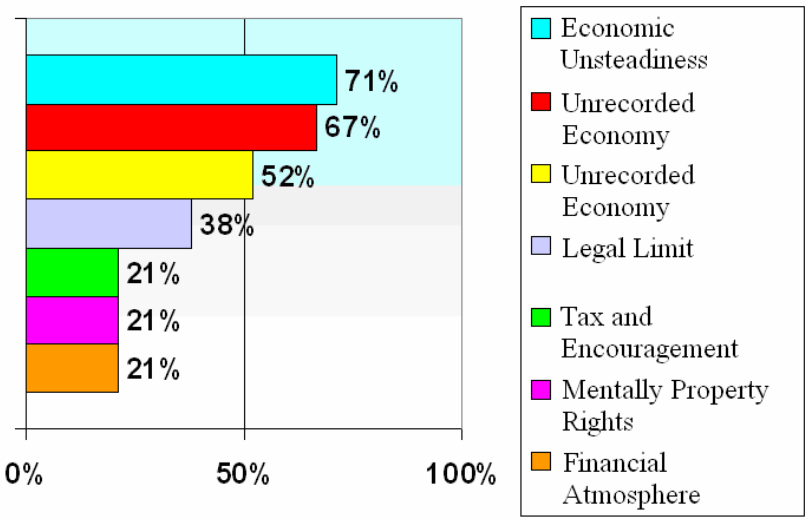
Unrecorded economy can impair also the financial position of social security.The firms which are active in unrecorded economy can limit the social transfer whichis provided by goverment since they (firms)income of government.Decreasing social security cause to social and paritical disguied by making life standarts of group who are low income more difficult.

In Türkiye, only percentage of 3-4 of taxpayers are ins pected and it can not be said that the tax inspections which are made is not effective.The company which is in the unrecorded economy can determire more rivaliyer price than recorded company as long as they are not rubbed since they will getr id of legal liability.In this way free,competition converd into unfair competetion.

Graph 1.The obstacle infront of the Foreign Investment in Türkiye

[*] ADAM, M.C., GINSBURGH, V.; "European Economic Review", The Effects of Irregular Markets on Macroeconomic Policy: Some Estimates for Belgium, S. 29 (1), 1985, p.15-33.

[*] FREY, B.S.,SCHENEIDER, F., "International Encyclopedia of Social and Behavioral Science", Informal and Underground Economy, Bd. 12 Economics, Amsterdam, Elsevier Science Publishing Company, 2000, p.8-9.



Source: Yased, "Barometre Basın Toplantısı", 13 Eylül 2006, p.18, http://www.yased.org.tr/page.asp?pageID=1214&keyword=barometre&CatID=-1&ContentID=2418.

As it is seen on graphe, unrecorded economy constitutes the most second important obstacle after the economic unsteadiness not entering the foreign capital in Türkiye. Unrecorded economy has to be gotten in registiration in order to be provided the macroeconomic stability and be made permanent.

6. CONCLUSION

Türkiye is the country which the pass of black Money is the most dense because it provides the shortest transportation between the Asia and Europe. It is posible that this problem may be solved a concious society and safety measures. In this sense, Türkiye should collaborate with international platforms.

About the struggle for black money, which are called "where did you find the laws" in puclic, and which pruple paid have to be documented. Which production factor they get it (money), and the laws can be formed about this matter. Firstly, it can be thought that the black Money in Türkiye can pass to abroad because of the this kind applications and also it can be thought fund getting out which will occur may damage the country's economy, but it is not as it is thought. Head economist of IMF who is one of the professors in chicago University have come to result in his study, which investigate the connections between the developing countries foreign capital and their development that except the diract investment, fund entrances and exists affect the country economy in a negative way.[*] However, legally it is not possible to ask the source of payment of people. Because thiskind of questions were banned by the law of the number of 4783 which was printed in Formal Newspaper by date of 9th January 2003, Law items, which give opportunity to ask these questions are put out force.[*]

As it is known, Türkiye have been having public deficcit for years. The most appropriate way to finance these deficit is being met the public expenditure with tax and being raised the productivity of tax. Although Türkiye has a tax potential that will pay the public expenditure, it have not raised the tax income and it prefer to finance the public expenditure by dept because of the appnications and engaging politics, at the result of this, majority of government saurce are used topay the interest of these dept, it is that unrecorded aconomy in our country have extend togreat number of people.Being gotten the unrecorded economy registered in period can cause to social breaking out in lang term and much more decrease in tax income. In this sense, paint of departure of politics applications, which are related to being prevented of unrecorded economy ought to become being prevented the unfair conpetition and being provided the social justice besides being increased the tax income. Long term politics must be pursued by stability because of the breaking out which will occur in struggle for anrecorded economy.

Turkish banking system will put Basel-2 standards into practice in 2008. By this new application, company will take credit note from foundations of credit grading. Banks will pass the application of freely fluctuation interest_bearing credit according to the companies' risk grade. Companies which have good credit note will good at rivalry with low interest but foundations which have bad credit note will not success to rival.Companies will compete each other in order to raise their credit note and get recorded. In spite of all

[*] CANSEN, Ege; "Hürriyet Gazetesi", 06.09.2006, p.8. http://hurarsiv.hurriyet.com.tr/goster/haber.aspx?id=5036130&yazarid=17.
[*] KIZILOT, Ş., "Hürriyet Gazetesi", 1.10.2006, http://www.hurriyet.com.tr/yazarlar/5178656.asp?yazarid=82&gid=61.

these development, it is not possible to a bolish the unrecorded economy if we consider that Türkiye has a restricted structure.

Application of recuttionin tax income ought to be put into proctice by indicating expenditure taxpayer's all expense, including the expense which they made for the sector of education, health…etc. In this way, both service sector which is not in register is recorded and tax is distributed fairly.Thanks to this application, goverment will raise it's tax income without bedring a cost.

To solve the problem of unrecordless, firstly it aught to be diagnosis by making rightly the determination. Early years in Republic Government ignored the unrecordedless for years in order to increase the productivity. While buying product or service, our saciety is predilection for bargaining of VAT so as to use effectively their restricted budget. Also our companies tendto emplay fugitive warker and demonstrate low their endorsement in order to increase their advantage of rivalry, and government is also aware of all these happens. As goverment arrange it budget and collaect the nacessary tax,it declare its tax rates more than what is usual, so honest taxpayer who pay his/her tax is damged. After a period time, she/he becomes predilection for the unrecordless because she/he understand that it is not possible torival by not evading tax. In this case, goverment make a new orrangement in tax rates,and these happens reach a deadlock. The tax rate which government detemine and predilection of unrecordedless affects to each others as rings of chain. In deadlock pf unrecordedless, government accuse the citizen, citizen accuse the government, so problem can not be solved never. To solve this problem, citizen and government must collaborate to each others. In this sense, government must become foremost.

And it must institute a method which firstly government will carry out its necessary responsibility and then society will carry out its duty. This method's process must be as it is stated below.

1. Process of creating confidence of government for society

Our society have lost confidence to government because of being difference the tax laws and its instituon presenting difference the tax laws with each new government tax reduction, exempt reconculation unlowfulness in public and bribe. To provide the necessary confidence atmosphere government firstly must research the reason which cause to distrustfulness, and then it must improve alternative solutions. Finally, it must institute one of them immediately and stablely by choosing the solution way which is the most appropriate. In this sense it is necessary that government must …

2. Process of decreasing the Tax Control's procedure at reasonable Level

Procedure must be decrease at reasonable in tax control and it must be provided that citizen do fast and easy operation by being faciliated the operation of tax control. In this sense, some arrangements must be made the laws and institution. It must be assimilated that tax control focus on taxpayer. It must be provided that tax control operate like private sector by making analysises and evaluations such as performances evaluation,effectiveness and activity as private sector made.

3. Process of being Developed of Infrastructure of Tax Information Technology

Time is one of the most important source of scarce in our era. Tax controls have gone on the infrastructure of information operation so that tax payers carry out their tax duties, but existent system is slow and insufficient. Tax control must improve its info technology and technique infrastructure. If taxpayer's make their operation fast, the cost of process will decrease besides its easiness. In this sense, the institution of e-government must be accelerated.

4. Process of being Provided of tax justice by tax rates which can be paid

Tax politics can be prepared as if they realize the tax justice by tax rates which can be paid. In this sense,being prevented the unfair competition aimed.

5. Process of being become concious the society about tax

Public associations which is interested in tax must present education seminar for public about their right and duties. The line of "Hello Finance"must be operated very well in order to provide the autocontrol mechanism. Because it is benefitted from this auto control mechanism in order to prevent the smuggled taxes. Thanks to this autocontrol mechanism, unfair competition can be prevented and society can check to each other. About the struggle for tax fugutive different kinds of compaign must be arranged by being benefitted from the media types such as television, radio, printed publication and internet. Arranged compeign must aim at becoming concious of society so as to prevent smuggled taxes, and while doing this, it must be benefitted from the nongovernmental organisation,declarations of famous persons who are beloved by society, and serman and fetwa which is given by Department of Religious Affairs.

APPENDIX

Table 5. Data

	Y	F	MF	M	VG
1988	1420577	69,3	83,9	4936,572417	0,186509091
1989	1393590	75,5	58,83	9053,105242	0,333998272
1990	1487082	58,3	59,35	19470,1294	0,543195918
1991	1471998	58,8	72,7	29597,26125	0,932317519
1992	1530808	63,7	74,24	47462,71024	1,583903705
1993	1623613	67,8	74,76	75791,60121	2,736014411
1994	1507540	106,5	95,56	95252,88261	6,436209972
1995	1587953	87,2	92,32	216177,0876	11,07748463
1996	1670657	77,8	93,77	405805,3356	21,42433393
1997	1802677	81,5	96,56	734103,8314	42,13294362
1998	1829754	75,7	95,5	1361674,432	79,47909933
1999	1719567	55,6	46,73	3396634,148	133,7805253
2000	1760856	49,9	45,64	6407108,845	223,1155737
2001	1601407	54,8	62,5	8142375,862	361,6127726
2002	1703562	44,1	48,19	15633036,73	502,7460727
2003	1774594	22,5	28,59	43423900,51	671,9212226
2004	1904088	9,9	22,06	126279854,3	739,3318365

M: Money amount in circulation

Y: Real national income per person

VG: Ratio of the tax income to GDP

F: Gross domestic product (by production) - implicit deflators (1987=100).

MF: Yearly -12 months- massed deposit interest rate

Source: SPO, TCMB.

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POVERTY AND INCOME STUDIES

Trade Liberalization and Income Distribution: A CGE Model for Jordan*

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Abstract

The Association Agreement between Jordan and the EU entered into force in 2002. It provides a gradual reduction of import duties on EU products over a period of twelve years. In this paper we investigate the economic implications of induced trade liberalization on aggregate economic performance as well as effects on welfare and income distribution of heterogeneous households. This is done by introducing heterogeneous households into a standard neoclassical dynamic computable general equilibrium model. Thereby individual households' tax rate, wage rate, initial endowment of assets, transfers from government and abroad, as well as individual preferences, are calibrated by data from a household survey.

JEL classification: C68, F11, I32, D31

Keywords: Dynamic CGE, Heterogeneous households, Trade liberalization, Jordan

1. Introduction

The Association Agreement (AA) between Jordan and the European Union (EU) was signed in 1997 and is part of a larger program, the Euro-Mediterranean Partnership that involves through a network of bilateral relations the EU and countries in the Middle East and North Africa (MENA) region. The AA between Jordan and the EU replaced the 1997 Cooperation Agreement, and entered into force in May 2002. It reduces and eliminates, over a 12-year period, custom duties and charges on importing most EU industrial products to Jordan. Duties on EU agricultural and food products are only partially eliminated.

Trade liberalization in the form of a preferential trade agreement with the EU is expected to provide benefits for Jordan in terms of lower import prices of investment and consumption goods that bring about higher consumer welfare. However, trade liberalization reduces government revenue due to reduced import tariff duties. Therefore, a possible resulting drop in government transfers could make results ambiguous, particularly for households which rely heavily on transfers. In addition, low income households can probably not exploit the benefits of increased incentives for investment and will therefore have problems utilizing the full potential of trade liberalization. Moreover, special attention should be given to poverty in Jordan, since this is a potentially important determinant in the Middle-East conflict.

In our model we asses the question of how trade liberalization affects heterogeneous households in a dynamic neoclassical Computable General Equilibrium (CGE) framework. More specifically, the model at hand builds on previous work done by Feraboli et al. (2003), who implement a dynamic CGE model characterized by the assumption of one representative consumer as used by Ramsey, Cass and Koopmans (see Ramsey, 1928, Cass, 1965 and Koopmans, 1965). We augment their dynamic CGE model by introducing heterogeneous households. In detail, we disaggregate households into six different groups ranked by their disposable income. Within each group a representative consumer maximizes the sum of discounted utility according to his or her own budget constraint. Household groups' individual tax rate, wage rate, initial endowment of assets, transfers from government and abroad, as well as preferences concerning the consumption basket are calibrated by data from a household survey. Moreover, different households' time preferences are also calibrated from survey data.

The model is implemented by means of the mathematical software Gauss and by employing the relaxation algorithm proposed by Trimborn et al. (2007). This allows for simulation exercises regardless of the dimension

* For useful comments and suggestions we would like to thank Beatriz Gaitan Soto and Bernd Lucke.

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of the state space. Our simulation results indicate changes in per-capita level of welfare in Jordan between -0.03% and 0.19%, providing evidence that trade liberalization has indeed a different impact across heterogeneous households. More precisely, low income households gain even slightly more from trade liberalization in terms of welfare, since they can overcome losses in transfers by an increasing wage income due to aggregate capital accumulation. However, income inequality increases, since high income households can exploit the benefits of increased incentives for investment. This results in higher capital income and, therefore, a widening income gap. Remarkably, the behaviour of aggregate variables is qualitatively consistent with previous work done by Feraboli et al. (2003)[1].

In the context of General Equilibrium modelling several studies have been conducted to assess aspects of income distribution and poverty (see Reimer, 2002, and Winters et al., 2004, for a survey). We build on the strand of the literature, which embeds the disaggregated household groups within the CGE model (e.g. Bourguignon et al., 1992, Gibson, 2002)[2]. This approach guarantees that the model is internally consistent, i.e. behavioural changes at the household level can transmit back into the macroeconomic solution. Moreover, these models exhibit additional channels, which can potentially influence income distribution, e.g. inflation, human capital accumulation, or labour market distortions. We extend the existing studies by relaxing the assumption of an exogenous saving rate. To our knowledge, this study is the first approach analysing income distribution in a dynamic General Equilibrium framework with utility maximizing agents as used by Ramsey, Cass and Koopmans (see Ramsey, 1928, Cass, 1965 and Koopmans, 1965). On the other hand, theoretical contributions analyse the effects of implementing heterogeneous consumers into a neoclassical framework (see e.g. Chatterjee, 1994 or Caselli and Ventura, 2000). By imposing restrictions on the utility maximizing agents it is guaranteed that the sum of all households behave as if it were a single household. This is of analytical convenience, since it is possible to analyse a model with one representative consumer in a first step and calculate the effects on heterogeneous households in a second step. However, the restrictions on the utility maximizing agents imposed by this strand of the literature are not fulfilled in our model and would be neglected by the available survey data. Therefore, in our approach the behaviour of disaggregated variables influences aggregate variables.

This paper is structured as follows: In Section 2, we describe the EU-Jordan Association Agreement, in Section 3, we explain the model briefly, in Section 4, we present the calibration process and explain the numerical solution method, in Section 5, we analyse and discuss the simulations, and in Section 6 we draw the main conclusions.

2. The EU-Jordan Association agreement

The relations between Jordan and the European Union are governed by the Euro-Mediterranean Partnership, which is implemented through the EU-Jordan Association Agreement and the regional dimension of the Barcelona Process. The EU-Jordan Association Agreement is part of the bilateral track of the Euro-Mediterranean Partnership. The aims of the Agreement are to provide a framework for the political dialogue, to establish progressive liberalization of trade in goods, services, and capital, to improve living and employment conditions, to promote regional cooperation and economic and political stability, and to foster the development of economic and social relations between the parties. The final aim is the creation of a free trade area between the EU and Jordan over a period of 12 years, in conformity with the provisions of the General Agreement on Tariffs and Trade (GATT).

The Euro-Mediterranean Partnership was launched at the 1995 Barcelona Conference between the European Union and its 12 original Mediterranean Partners[3]. This Partnership governs the policy of the EU towards the Mediterranean region. It comprises two complementary tracks, the bilateral agenda and the regional agenda. The framework for the bilateral agenda is the Association Agreement. The regional agenda is implemented through a number of regional working groups on a range of policy issues including trade, customs cooperation, and industrial cooperation.

The EU-Jordan Association Agreement was signed in 1997 and entered into force at the beginning of 2002. This agreement provides the gradual reduction of import duties on imports of EU industrial and agricultural

[1] Previous work by Hosoe (2001) on Jordan's trade liberalization implements a static model with one representative household. Simulation results suggest average welfare gains of 0.44%.

[2] Other studies of this strand are e.g. Löfgren (1999), Decaluwé et al. (1999), Cogneau and Robilliard (2000), Cockburn (2001), and Harrison et al. (2002).

[3] The 12 original partners are: Israel, Morocco, Algeria, Tunisia, Egypt, Jordan, the Palestinian Authority, Lebanon, Syria, Turkey, Cyprus and Malta. Two of them, Cyprus and Malta, joined the EU in 2004. Libya has observer status since 1999.

products into Jordan over a period of twelve years. Table 1 shows the pre-AA import duty rates and the tariff reduction schedule of the Association Agreement for the eight good sectors[4].

The establishment and the promotion of cross-border cooperation with the Mediterranean Partners will also be an important element of future regional integration. Jordan is already at the core of the main integration process in the region. It is a member of the Mediterranean Arab Free Trade Area, the so-called "Agadir" agreement, which was signed in May of 2001 with Egypt, Morocco, and Tunisia. Jordan has also signed bilateral FTAs with several countries in the MENA regions, and is a member of the Great Arab Free Trade Area (GAFTA), with 13 other countries, which are members of the Arab League. After joining the World Trade Organization (WTO) in April 2000, Jordan signed FTAs with the United States in October 2000, and with the European Free Trade Association (EFTA) in June 2001 in an effort to more trade liberalization.

	Agricult	Mining	Food	Textile	Paper	Chemic	Minerals	Others
Pre-Agreement rates	17,0%	9,4%	29,2%	14,1%	13,2%	2,8%	12,2%	12,2%
Entry into force of the AA	17,0%	5,6%	29,2%	8,5%	7,9%	1,7%	7,3%	7,3%
One year after	17,0%	5,0%	29,2%	7,5%	7,0%	1,5%	6,5%	6,5%
Two years after	17,0%	4,4%	29,2%	6,6%	6,2%	1,3%	5,7%	5,7%
Three years after	17,0%	3,8%	29,2%	5,7%	5,3%	1,1%	4,9%	4,9%
Four years after	15,3%	2,8%	26,3%	4,2%	4,0%	0,8%	3,7%	3,7%
Five years after	13,6%	2,5%	23,4%	3,8%	3,5%	0,8%	3,3%	3,3%
Six years after	11,9%	2,2%	20,4%	3,3%	3,1%	0,7%	2,9%	2,9%
Seven years after	10,2%	1,9%	17,5%	2,8%	2,6%	0,6%	2,4%	2,4%
Eight years after	8,5%	1,6%	14,6%	2,4%	2,2%	0,5%	2,0%	2,0%
Nine years after	8,5%	1,3%	14,6%	1,9%	1,8%	0,4%	1,6%	1,6%
Ten years after	8,5%	0,9%	14,6%	1,4%	1,3%	0,3%	1,2%	1,2%
11 years after	8,5%	0,6%	14,6%	0,9%	0,9%	0,2%	0,8%	0,8%
12 years after	8,5%	0,0%	14,6%	0,0%	0,0%	0,0%	0,0%	0,0%

Table 1. Tariff schedule reduction of the AA.

Trade liberalization in the form of the Association Agreement with the EU is expected to provide benefits for Jordan in terms of lower consumption and investment prices, that bring about a rise in welfare. Investment demand plays a key role in the process of trade liberalization, and is potentially important to the dynamic behaviour of output over the long-run. Since lower investment prices create incentives for investment, the capital stock is expected to rise over the long-run. On the other hand, trade liberalization has an unpleasant effect for the Jordanian government. There is a clear loss in government revenue, due to foregone import tariff duties. Such an impact is likely to be particularly strong for Jordan, where government revenue relies heavily on custom duties[5].

The policy implications for Jordan suggest, therefore, that the government should accompany the trade liberalization process with appropriate economic measures in order to counteract the adverse effects on government revenue due to the reduction in custom duties. Such measures should involve a reform and modernization of the tax system and broadening of the tax base as well as a reduction in government expenditure (see Lucke 2001). In recent years, the government has undertaken a reform of the tax system. As measures of fiscal reform, the Jordanian government has replaced the General Sales Tax (GST), introduced in 1994, with a sales tax in 2000, which is similar to a Value-Added Tax (VAT). The government has also undertaken an income tax reform in 2001.

However, trade liberalization had not started before 2002 and the expected significant drop in government revenues will likely force government expenditure to decrease. This potential decrease in government

[4] The sectors are Agriculture, Mining, Food, Textiles, Papers, Chemicals, Minerals, and Others.
[5] Import duties from EU trade in Jordan in the period 1994-96 averaged 12% of total tax revenue and 2% of GDP, total import duties averaged more than one-third of total tax revenue and about 6% of GDP (Abed, 1998).

expenditure could comprise a reduction of government consumption and will probably include a reduction of government transfer payments. Since the poorest households rely heavily on these transfer payments, it is likely that trade liberalization will affect different households asymmetrically.

3. The model

We model the Jordanian economy as a dynamic small open economy, building on the model of Feraboli et al. (2003). For each of six different household groups, a representative consumer maximizes discounted intertemporal utility subject to a budget constraint. In the domestic economy there are nine production sectors, eight of which are producing goods and one produces services. Aggregate private consumption, government consumption, and aggregate investment are Cobb-Douglas composites of nine different sectoral outputs, which, in turn, are Armington (1969) composites of domestically produced and imported goods. Firms produce nine different commodities using a Leontief production technology between sectoral goods and a value-added factor, which is a CES composite of capital and different kinds of labour. Total output can be sold domestically or exported according to a CET specification. The Government raises taxes and collects import tariffs. Government revenues are spent for a fixed amount of government consumption as well as for transfers to households.

The domestic economy accepts the world price as given in international markets. Perfect competition and full employment are assumed in all sectors. Production factors are perfectly mobile across sectors.

In the following, we focus on the main mathematical equations.

Households

The problem of each representative infinitely-lived household, *i*, is to maximize discounted intertemporal utility

$$\max \int_o^\infty u(C_i) e^{-\rho_i t} dt \qquad i = 1,...,6$$

subject to

$$\dot{K}_i = I_i - \delta K_i = \frac{YD_i - P^C C_i}{P^I} - \delta K_i$$

$$K_i(0) = K_{i,0}$$

where C_i, YD_i, K_i are consumption, disposable income, and capital of household *i*, respectively. Each representative household discounts future utility with discount rate ρ_i, which is specific to each household group.

Disposable income of each household group is given by

$$YD_i = (1 - \tau_i)\{w_i L_i + rK_i + GT_i + FT_i\}$$

whereby w_i, L_i, K_i, GT_i and FT_i denote the individual wage rate, labour endowment, and capital endowment of household *i*, as well as government and foreign transfers to household *i*, respectively. The interest rate *r* is identical for each household since capital is a homogenous good. Each household pays a different income tax τ_i depending on its household group.

Firms

Sectoral output in the domestic economy is determined by a two-stage production process, which exhibits at the top tier a Leontief (or fixed-proportions) specification between intermediate input and value-added output. Each representative firm producing commodity j generates total output according to the following production technology

$$Q_j = \min\left\{\frac{VA_j}{a_{VA,j}}, \frac{q_{1,j}}{a_{1,j}}, ..., \frac{q_{9,j}}{a_{9,j}}\right\} \qquad j = 1,...,9$$

where Q_j and VA_j are sectoral output and value-added output, respectively. $q_{k,j}$ is intermediate input produced by sector *k* and used in the production of activity *j*. Leontief coefficients are denoted by $a_{VA,j}$ and $a_{k,j}$.

At the second tier, intermediate input $q_{k,j}$ is a Cobb-Douglas composite of domestic and foreign intermediate consumption goods.

Value-added production is determined by a technology characterized by a constant elasticity of substitution between the primary inputs, capital (KD_j) and six different types of labour $LD_{i,j}$, pertaining to each household group i

$$VA_j = A_j \left[\sum_{i=1}^{6} \alpha_{i,j} LD_{i,j}^{\frac{\sigma_j - 1}{\sigma_j}} + \left(1 - \sum_{i=1}^{6} \alpha_{i,j} \right) KD_j^{\frac{\sigma_j - 1}{\sigma_j}} \right]^{\frac{\sigma_j}{\sigma_j - 1}}$$

$$\alpha_{i,j} > 0, 0 < \sum_{i=1}^{6} \alpha_{i,j} < 1, \sigma_j > 0, \sigma_j \neq 1$$

where A_j is the time-invariant technological parameter, $\alpha_{i,j}$ is the share of labour of household i, and σ_j denotes the constant elasticity of substitution between primary inputs. At the value-added production stage, firms minimize production costs subject to the above technology constraint.

Government

The government consumes an exogenous amount of goods, raises taxes and tariffs, and provides transfers to consumers. We assume the government to run a balanced budget. Although at first sight the assumption might look unrealistic, it is actually appropriate and roughly consistent with government fiscal balance data for Jordan provided by the IMF[6]

Government consumption is determined by a CES Armington specification between domestically-produced goods and imports. Government revenue is generated from the Value-Added Tax, that applies with different rates to domestic and imported goods (VAT^D and VAT^M) the income tax (TY) and import duties (TM) which apply with different rates to the EU and the rest of the world, and exogenous and fixed foreign grants, (FRG). The expenditure is given by an aggregate transfer to households (TR) and an aggregate fixed consumption of goods and services ($\overline{G}$).

The government budget is, therefore, given by

$$VAT^D + VAT^M + TY + TM + FRG = TR + \overline{G}$$

Market clearing

The equilibrium in the factors markets requires for each type of labour, aggregate endowment of labour to be equal to aggregate labour demand and aggregate capital stock to be equal to aggregate demand for capital

$$L_i = \sum_{j=1}^{9} LD_{i,j} \qquad i = 1,...,6$$

$$\sum_{i=1}^{6} K_i = \sum_{j=1}^{9} KS_j$$

where L_i and K_i are, respectively, labour and capital supplied by household i.

The equilibrium condition on the domestic goods markets is

$$X_j = \sum_{k=1}^{9} q_{k,j} + C_j + I_j + G_j \qquad j = 1,...,9$$

where I_j and G_j are investment demand and government consumption, respectively.

The equilibrium in the balance of payments is given by

$$\sum_{j=1}^{9} PWM_j M_j = \sum_{j=1}^{9} PWE_j E_j + \sum_{i=1}^{6} FT_i + FGR$$

where M_j and E_j are, respectively, imports and exports of sector j, PWM_j and PWE_j are the exogenous world prices of, respectively, imports and exports of sector j, and FGR are foreign grants donated to the Jordanian government.

[6] The IMF reported Jordan's government fiscal balance in percent of GDP to equal -4.9 in 2002, -1.0 in 2003 and -1.7 in 2004 (see IMF, 2006).

Theoretical properties of long-run equilibria

The model does not exhibit a single steady state, but a continuum of stationary equilibria (i.e. a centre manifold of stationary equilibria)[7]. This characteristic of the model stems from linear dependency of Keynes-Ramsey rules of heterogeneous households at each stationary point. Nonetheless, adjustment dynamics are unique, and the specific stationary point to which the economy converges in the long run depends on the initial conditions[8]. More specifically, the individual initial endowment of capital determines to which particular equilibrium the economy converges. Each stationary equilibrium is characterized by varying disaggregated and aggregated variables. Individual initial endowment of assets, then, influence the behaviour of aggregate variables in the long run.

This is, by no means, naturally given. Chatterjee (1994) as well as Caselli and Ventura (2000) investigate in a neoclassical framework under which conditions the sum of all households behave as if it were a single household. They state restrictions for the utility function of heterogeneous households to hold. If they hold, aggregate variables would not vary along the continuum of stationary equilibria. This is of analytical convenience, since then it is possible to analyse a model with one representative consumer in a first step and calculate the effects on heterogeneous households in a second step. However, these restrictions on the utility functions are not fulfilled in the model at hand since individual households' discount rates differ. This causes aggregate variables to vary along the curve of stationary equilibria, which captures the transmission of behavioural changes on the household level into the macroeconomic solution.

4. Calibration procedure and numerical solution technique

The calibration procedure is based on the Social Accounting Matrix (SAM) for Jordan constructed for the year 2002[9]. The model's parameters are calibrated such that the SAM represents a solution of the model where all variables are stationary except asset accumulation of individual households. The reason for this is that the fractions of savings and assets are not the same across households, and, therefore, the assumption of a stationary individual capital accumulation would violate the SAM.

Household survey data allows disaggregation into six different groups of households. Each group differs with respect to labour income, capital income, transfers from government and from abroad, income-tax payments, and savings, as well as total consumption and the composition of total consumption. Within the calibration process, these differences result in varying exogenous variables for each group of households as well as diverse parameters. We want to emphasize that, according to Jordan's tax system, there is no distinction between labour and capital income taxation. Households are taxed with a progressive, general income tax, resulting in different net interest rates. Therefore, each household faces different incentives for saving. We calibrate time preference rates so that they exactly offset this effect in the long-run[10]. In addition, individual households' preferences are reflected in different consumption baskets, which each household consumes in the benchmark year.

Elasticities of substitution are obtained from the existing literature (see Devarajan et al., 1999, Devarajan and Go, 1998, and Lucke, 2001). The domestic interest rate is set to 10%. Once these parameters have been fixed, the remaining parameters are calibrated from the SAM.

The model is programmed in Gauss and solved with the relaxation procedure as proposed by Trimborn et al. (2007). Since the model exhibits a continuum of stationary equilibria (i.e. a centre manifold), we explicitly utilize the fact that this numerical procedure does not require information regarding an achieved stationary equilibrium in advance. The particular stationary equilibrium is determined within the iteration process. Moreover, the relaxation procedure can simulate transitional dynamics on multidimensional stable manifolds. This means that an increase in the dimension of the model, especially in the state space, does not cause any conceptual problems.

5. Simulations

[7] For details on the concept of centre manifolds see, for instance, Tu (1994). To our knowledge, the first growth model which exhibits this characteristic is the Lucas (1988) model.

[8] This is supported by the eigenvalues of the linearised system as well as simulation exercises. For details on transitional dynamics around a centre manifold of stationary equilibria see Hirsch et al. (1977) or Trimborn (2006).

[9] The SAM was constructed by Feraboli and Kolev. We thank the latter for very helpful research assistance.

[10] Precisely this means that all households' consumption grows with the same rate in the long-run since otherwise some would vanish asymptotically (see Becker and Tsyganov, 2002).

As illustrated in Section 2, the economic effects of the EU-Jordan Association Agreement can be summarized by a gradual reduction of tariff rates on EU imports in Jordan according the schedule shown in Table 1. Since the data available for the calibration procedure represents the Jordan economy of the year 2002, this is our benchmark year. In our simulation, tariff rates are gradually reduced in the subsequent years. Since the government revenue is expected to decrease drastically, we must account for counteracting fiscal measures imposed by the government. In our baseline scenario, this will be a reduction of government transfers to households. Precisely, this means that total transfers from the government, granted to households, are endogenous, whereas the share each household receives is fixed. This assumption guarantees that the reduction of distortionary tariffs is not accompanied by distorionary side-effects as additional taxation. In a second scenario we investigate how an additional ten-percent increase in all VAT rates affects the economy.

According to our simulation results, trade liberalization affects the aggregate economy through decreasing prices of imported goods. This causes the prices of investment goods, as well as consumption goods, to decrease since investment goods are Armington composites of foreign and domestically produced goods. Incentives for investment increase, which in turn leads to faster capital accumulation and hence a higher steady state value of aggregate capital. Therefore, output will increase in the long-run. The loss in government revenue due to import duty reduction is partially offset in the long-run by the expansion in the tax base. Since transfers to households are endogenous, there is a resulting immediate drop in transfers which can only be partially offset in the long-run. However, aggregate income and consumption increase and converge to higher steady state values in the long-run.

We rank heterogeneous households by their income in 2002, i.e. household group one earns the lowest income and household group six the highest[11]. This brings about an almost monotonous ranking in labour income, capital income and, reversely, transfers received. Also, the share of capital income (transfers) on total income is almost monotonously increasing (decreasing) while the share of labour income on total income is hump-shaped (See Figure 1)[12]. The impact on welfare of individual households might be in principle ambiguous. On the one hand, lower domestic prices increase consumption and, hence, households' welfare. In addition, an increasing interest rate and capital stock in the long-run yield higher capital and labour income. On the other hand, a reduction in government revenue due to diminishing import duty rates forces the government to cut transfers to households. This will negatively affect the disposable income of households, which must reduce consumption, ceteris paribus. Such an impact on welfare is, therefore, negative. Our simulations indicate an increase in welfare for most household groups, and welfare gains of the poor households are slightly higher than gains of the rich households. However, trade liberalization is not pareto improving since some households (group five) are even worse off. Figure 2 represents welfare changes of both scenarios. The blue line summarizes the impact on welfare for each household group and its absolute size in the baseline scenario, whereas the green line refers to the second scenario.

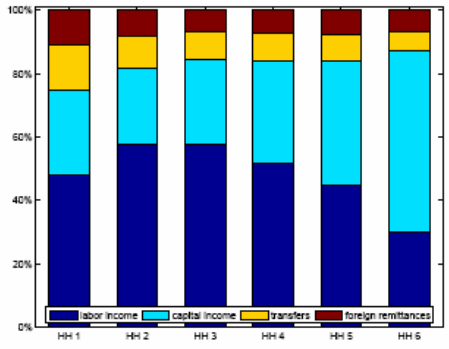

Figure 1. Income composition of households

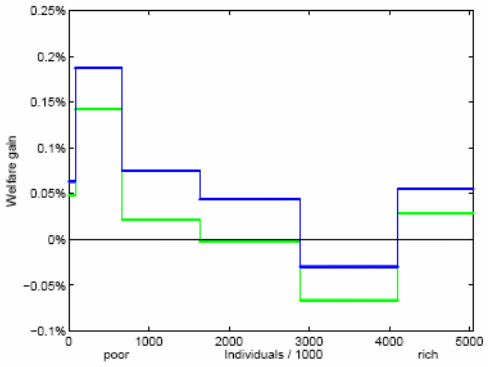

Figure 2. Welfare effects of both simulations

Since welfare gains are roughly higher for poor households, one may expect inequality to decrease. However, the opposite is the case. We measure inequality with the Gini index of income (see Gini, 1912), which increases immediately with trade liberalization and over time, which is measured in years (see Figure 3, (i))[13]. The reason for this can be seen in Figure 3 (ii), which indicates that the initial response of income to trade liberalization is positive for household groups 3, 4, 5, and 6 and negative for household groups 1 and 2. In

[11] For convenience we will denote household group one the poorest and household group six the richest household.
[12] The share of capital income on total income of the poorest household group is unexpectedly high. We suspect that households misreported self-employment labour income as capital income. However, richer household groups earn considerably higher capital income per capita. Therefore, we expect that results are not affected substantially.
[13] An alternative measure of inequality, Theils entropy of income (see Theil, 1967), yields qualitatively the same result.

addition, income increases more drastically over time, the richer the household group is[14]. That means, the gap in income increases over time, as well. The reason for this is that households rely differently on various kinds of income. First, transfers are cut immediately when trade liberalization starts and are even decreasing in the subsequent years because the tax base and, therefore, government revenue increase sluggishly. This affects poor households relatively severely. Secondly, since the aggregate capital stock grows, wage income increases over time. Poor households benefit slightly more from this because of the progressive tax system. Due to the fact that a large part of their income is labour income, poor households can offset the negative effect of reduced transfers after some periods. Finally, households own different amounts of capital. Higher incentives for investments condense in a higher interest rate. Therefore, capital income for the four richest groups of households is increasing instantaneously and over time, due to capital accumulation. This capital accumulation can be seen in Figure 3 (iii). Poor households use their already tiny amount of assets to smooth consumption, since they have to overcome temporary losses in income (see Figure 3 (iv)). Therefore, poor households even deaccumulate capital, and this deaccumulation is insignificant for the economy as a whole.

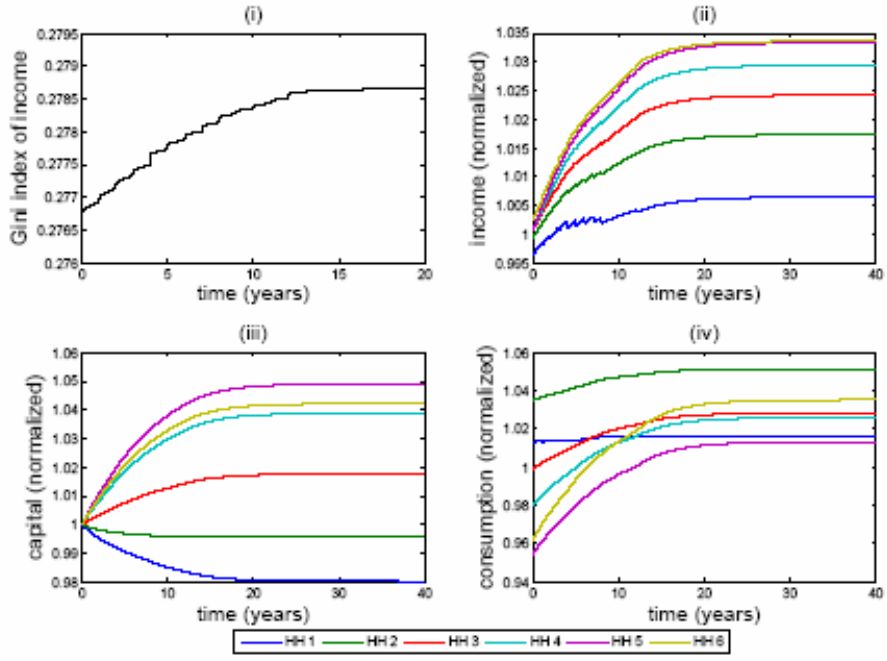

Figure 3. Effects of AA on heterogeneous households (baseline simulation)

In the second scenario we assume the government to undertake the additional fiscal measure of a 10% increase of all VAT rates to overcome losses in revenues[15]. This 10% increase has two effects on the economy. On the one hand, prices of consumption goods and investment goods rise, affecting welfare negatively and additionally resulting in diminishing incentives for investment. On the other hand, government revenue increases and, hence, transfers to households. Therefore, we expect poor households to benefit more in relation to rich households from this additional fiscal measure.

Simulation results indicate that the effect of trade liberalization dominates the rise in VAT rates. Aggregate variables behave qualitatively the same. However, welfare gains are reduced for every group of households, and for one household group (group four), the welfare gain turns into a loss. This is illustrated in Figure 2 where the green line indicates welfare changes of the second scenario. Although transfers remain even higher than in the benchmark year, every households' welfare is lower compared to the previous simulation. The reason is that the rise in the VAT rates has a negative impact on investment and, therefore, reduces the aggregate accumulation of capital compared to the baseline scenario. This determines steady-state values for private consumption and capital which are below the steady-state levels in the previous simulation.

To summarize, poor households gain even more from trade liberalization in terms of welfare, because they can overcome losses in transfers through their increasing wage income. However, inequality among the household groups increases, since richer households can exploit incentives for investment and, therefore,

[14] Whereas time is continuous, the import tariff reduction takes place at specific points in time. Therefore, government transfers to households drop sharply at the beginning of each year and recover smoothly during the remainder of the year. Hence, the income flow follows a discontinuous path.
[15] However, total government transfers to households remain the endogenous variable to balance the government's budget.

accumulate capital over time. A widening income gap follows from the resulting higher capital income. An additional 10% increase in VAT rates compensates for losses in government revenue such that the level of transfers can be sustained. However, this increase results in either less welfare gains or even welfare losses for every group of households.

6. Conclusions

We have investigated the economic effects of the Association Agreement between Jordan and the European Union which entered into force in 2002. By introducing heterogeneous households into an otherwise standard neoclassical dynamic CGE model, we assessed the question of how trade liberalization affects different households. Thereby, individual households' tax rate, wage rate, initial endowment of assets, transfers from the government and abroad, as well as individual preferences, were calibrated by data from a household survey. Our findings confirmed the previous analysis by Feraboli et al. (2003) on the aggregate level. In particular, trade liberalization lowers prices for investment and consumption goods and, therefore, spurs capital accumulation. Government transfers decrease due to foregone import duties. Our simulations support the fact that effects are diverse among individual households, since one household group even lost welfare. Therefore, we can conclude that trade liberalization alone is not pareto improving for Jordan. In addition, we found effects to be contrarian concerning welfare and income distribution. While on the one hand welfare gains are slightly higher for low income households, on the other hand the gap in income will increase, especially in the long-run. The results are driven by the fact that low income households can overcompensate losses in transfers by an increasing labour income. However, rich households' capital income increases much more in the long-run due to exploitation of investment incentives.

Overall, introducing heterogeneous households into a dynamic CGE model yields interesting insights about welfare and the dynamic behaviour of income distribution across households. Since distributional aspects are of great importance we hope that this analysis will offer additional theoretical insights, as well as fruitful policy implications.

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Impacts of Poverty on Land Conservation Investment: A Case of Mardi Watershed Nepal

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Abstract

The paper examines the impact of poverty on the probability and the level of land conservation investment by individual farm household. In order to capture the notion of resource poverty, the total household income is predicted by using OLS estimation. The predicted household income is used as the instrument for poverty while estimating impact of poverty on the probability and the level of land conservation investment. Household characteristics and resource availability - for instance value of asset, occupation of the household head affects the land conservation investment. The results of the analysis show that resource endowments of the households and the type of income source also affect the investment on land conservation by the household. Poverty is found to affect the level of conservation investment. Therefore, policies targeted to enhance the investment on land conservation and land use sustainability in developing countries should, therefore, not only consider the bio-physical issues, but also the household characteristics, socio-economic structure, institutional set up and resource base of the household. The results show that the composition of total household income matters much in the level of land conservation investment as the households with higher share of remittance income are found to invest less on land conservation.

1. Introduction

The relationship between land degradation and poverty is still a question. Is poverty good or bad for land degradation? The question has remained unanswered for a long time. Understanding the relationship between poverty and land degradation is of high importance, especially in developing countries where majority of the poor are engaged in agriculture. On the one hand, poverty may lead to low level of land conservation investment that causes land degradation and on the other; land degradation may aggravate poverty by increasing threat to the livelihood of the rural households. The impacts may go both directions and reinforce each other. Land degradation is thus one of the sources of poverty trap (Barbier and Lopez, 1999) in many developing countries.

As agriculture is the mainstay of the Nepalese economy, land degradation can have serious environmental as well as economic consequences. The probability of soil erosion increases as high population pressure has led to increased cultivation in marginal land and on steep slopes as the per capita agricultural land has declined from 0.16 ha in 1980 to 0.13 ha in 1999 (MOPE, 2001). Cultivation on the steep slope, low level of soil conservation investment and inappropriate agricultural practices lead to land degradation and decrease in productivity. Declining productivity not only threatens the household food security but also the agricultural sustainability. Under this situation, land conservation investment by the individual household is a major issue.

While dealing with the factors that determine the land conservation investment, one should not only consider the biophysical factors but also several other factors such as socio-economic factors, institutional factors, land management aspects, and the market structure. Biophysical factors like plot characteristics and the soil characteristics influence the land conservation investment. In addition, usage of the land has much to do with soil erosion. A study in Nepal (MOPE, 2001) states that soil loss from well-managed paddy terraces is about 5-10 tonnes/ha/year whereas it is 20-200 tonnes/ha/year from poorly managed sloping terraces. Increasing intensification and continuous cultivation on sloping lands without supplementary use of soil amendments and conservation practices posit a serious threat to sustainable land use (Shiferaw and Holden, 1999).

Existence of poverty and inequality in the distribution of income and resources influence the land conservation investment through the resource use decisions of poor households. It is widely believed that poverty limits poor people's options and induces them to deplete resources faster (Holden and Shiferaw, 2002). Hence the poor may aggravate the process of environmental degradation (Ekbom and Bojo, 1999). Poor people may have short time horizons and this may worsen environmental degradation. Poverty often results in myopic production and consumption decisions, and precludes long-term investments in natural capital (Holden et al., 1998; Prakash, 1997). Pagiola (1995) however, shows that under certain conditions, poor farmers may have

more incentives to adapt sustainable practices than other farmers, as future disutility of degrading the resource is potentially unbounded.

In understanding the Nepalese rural economy, transaction costs and imperfect information need to be considered. When transaction costs and imperfect information are important, the separability of equity and efficiency does not hold. Under market imperfections, efficiency in resource allocation crucially becomes dependent on the ownership structures and property relations (Bardhan, 1989). The presence or absence of market imperfections has significant efficiency and other policy implications (Holden et al. 2001). Poverty affects the participation of the poor to several markets (Ray, 1998) and this change in access has repercussions for the entire economy. In this context, market imperfections influence the soil conservation investment of the individual household.

In Nepal, the lack of detailed knowledge on the economics of land degradation and incentives for land conservation remains a problem in designing policies to ensure a sustainable land use. Much of the studies done so far considered only biophysical variables in explaining the problems of soil erosion and declining farm productivity. When markets are imperfect, socio-economic variables affect land use decisions and cannot be ignored in designing appropriate policies. Land conservation investment may depend on several factors, some of them can be specific to a particular village, household, or plot characteristics. For instance, labor and credit market imperfections can affect an individual household's decision to invest on land conservation differently. Thus, the analysis of the impact of poverty on land conservation investment requires the approach, which is different from the traditional neo-classical approach.

Clear understanding of the effects of poverty on land conservation investment helps us to design policies that enhance land conservation investment and land productivity. Some studies (Holden, 1997; Shiferaw and Holden, 1997; Holden, Shiferaw, and Pender, 2001/2002) have shown that policies can play a great role in enhancing soil conservation or some policy distortions can even cause land degradation.

This paper therefore, makes an effort to find out how poverty affects the probability and the level of land conservation investment. Moreover, it also investigates the various determinants of land conservation investment such as biophysical, institutional and socio-economic including the composition of household income.

2. Existing Dilemmas on Land Conservation Investment

The controversies over the factors affecting the land conservation investment by rural household are accustomed among the researchers. Several research come up with different arguments- some are close but others are not. However, clear identification of the factors is crucial for designing the policies, which promote incentive to invest on soil conservation.

One of the common assertions among the economists following property rights school is that insecurity of tenure leads to the suboptimal investment incentives. The indigenous land rights in the third world are, therefore, the source of inefficiency in resource allocation. Inefficiencies are thought to arise because indigenous land rights are ambiguous, are communal, and are afforded insufficient protection in legislatures- resulting in tenure insecurity which in turn leads to inferior investment incentives, undersupply of credit, and constraints on efficiency –enhancing market exchanges (Dorner, 1972; Johnson, 1972; World Bank, 1974; cited in Sjaastad and Bromley, 1997). The property rights school hence suggested tenure security as the panacea. The secure property rights alone, however, cannot solve the problem of inadequate investment on land conservation.

Some studies (Bassett, 1993; Platteau, 1996) have challenged the argument put forth by the property rights school. These studies point out that the indigenous land rights are often neither communal nor ambiguous, but are flexible enough to cope with increasing land scarcity and to permit a gradual, autonomous individualization of rights. A study by Sjaastad and Bromley (1997) states: *Permanent use is one way to establish claims to land. A method that is perhaps even more powerful is to invest in land. To the extent that the investment represents a visible commitment to the long-term productivity of the land, continued use of the land is implied, and the common assertion that tenure security is necessary to promote investment may- in many cases- be reserved. ……Thus, although insecurity of tenure is a disincentive to invest, it is- paradoxically- often also an incentive because investment will itself increase security.* Hence indigenous tenure may provide equal or higher investment incentives than private rights, and may promote modes of rights appropriation that are productive rather than wasteful (ibid).

On policy standpoint, property rights school supports the government action in land administration issues, basically on converting land into private holding, while in contrast, the indigenous land rights considers state intervention in land matters as harmful.

Some consider that poverty and liquidity constraints, rather than tenure security, tend to increase rates of time preference and may thereby reduce incentives for investment and sustainable management of natural resources (Holden et. al., 1998; Holden and Shiferaw, 2002). Poverty is associated with low levels of on-farm investment even in the presence of ownership rights (Faruqee and Carey, 1997). Under market imperfections, production and consumption decisions are inseparable which, in turn, implies that household's production and investment decisions are not dictated by profit considerations alone but consumption choices as well. In such settings, household's asset endowments play a crucial role in influencing the decision and level of conservation investments made (de Janvry et. al., 1991; Holden et. al., 2001). For instance, labor rich households are expected to invest relatively more than labor poor households. Similarly, farm household with larger farm or other assets holding may invest relatively more on land conservation than asset poor households. However, under certain conditions (severe poverty), poor families may have more incentives to adapt sustainable practices than other farmers because future disutility of degrading the resource is potentially unbounded (Pagiola, 1995, cited in Holden and Binswanger, 1998).

Empirical studies on land conservation investment however, show the mixed results. Some studies support tenure security as an important variable influencing investment on land (Feder et.al., 1988; Alemu 1999) while some other studies show that tenure security in the form of land titling alone or insecurity from redistribution might bear a weak or an unclear link to conservation investment or improvements in productivity (Holden and Yohannes, 2000; Brasselle et. al., 2002). These results inclined researchers to argue that basic use rights are apparently sufficient to induce farmers to make land-specific investments (Brasselle et. al., 2002), and indigenous tenure systems are flexible enough to adjust to internal developments (Platteau, 1995), and are able to provide rather long term entitlements to users (Brasselle et. al., 2002). The commonsense logic associating higher land security and higher incentives to invest requires more scrutiny (Brasselle et. al., 2002). While these arguments should not be entirely discounted, there are reasons to believe that the situations in settings where state ownership of land prevails could be different. Land tenure arrangements can therefore be uncertain to guarantee security to the user (Admassie, 2000, cited in Hagos, 2003). Hagos (2003) highlights on the importance of public led conservation programs for stimulating private investment on land conservation. The study (Hagos, 2003) also focuses on the policy measures that emphasize on the provision of technologies that reduce household risk and poverty to enable sustainable investment on land conservation by the household. A recent study (Antle et.al. 2003) focuses on the endogeneity of land titling and farm investments. This endogeneity may bias the estimated effect of property rights on farm investments.

Overall, several explanations are put forth on why investment on land conservation is not adequate. Lack of private property and tenure security (Feder et.al., 1988; Alemu, 1999), poverty and high discount rates (Holden et.al., 1998; Holden and Shiferaw, 2002), long payback periods of conservation structures, and low short-term returns to household income (Shiferaw and Holden, 1998; Shiferaw and Holden, 2001), differences in transaction costs among communities, agro-ecological factors and factor market imperfections (Pender and Kerr, 1988), labor shortages and credit market imperfections which may encourage households to under invest and mine their natural resource base (Binswanger and Rozenzweig, 1986; Holden and Binswanger, 1998) are some of the major factors determining investment on land conservation by rural households.

3. Theoretical Model and Hypotheses

The theoretical framework of the study is designed based on the existence and functioning of the markets in the study area. Recent studies show that factor market imperfections are common in the study area. Though land sales market exists, it is very thin (Aryal, 2002) and a household does not often sale land unless it faces severe economic problems. Similarly, there are imperfections in credit market (Debela, 2001) and the labor market (Sesabo, 2001; Thapa, 2003). As market imperfections are common in the study area, the imperfect information theory is appropriate in analyzing the factors that determine the land conservation investment by the individual household. In this respect, the concept in the model is similar to the model developed by Pender and Kerr (1988), Clay et al (1998) and Hagos (2003).

In this context, market imperfections imply missing markets, partly missing markets (rationing, seasonality), thin markets (imperfect competition) and interlinked markets (Holden and Binswanger, 1998; Sadoulet and Janvry, 1995). In a rural setting, many markets fail because the costs of using it for a transaction are too high relative to the benefits that market transactions yield. Transaction costs include not only the transportation costs but also the consequences of imperfect and asymmetrical information that lead to adverse selection and moral hazards (Sadoulet and Janvry, 1995). Market imperfections may prevail due to several factors such as high transaction cost, shallow local markets and price risks.

When market imperfections are pervasive, resource poverty can have significant effect on the investment in land conservation. If markets are perfect, distribution of resources does not matter for the efficiency. It means

under perfect markets, land conservation investment is unaffected by the farmers' endowment of labor, savings or other productive assets (Pender and Kerr, 1998). If labor and capital markets are perfectly functioning, an initial difference in these assets is irrelevant for conservation investment, since they do not affect the costs and benefits of investment.

As land conservation investment yield benefits in future, households' utility function increases with an increase in present value of future income (Y) and under market imperfections, the utility function also includes the household characteristics (H^z). Therefore, following Hagos (2003) the household's utility function can be expressed as:

$$\underset{I_i}{Maximise} \quad U\left[E(Y_t); H_t^z\right]$$

Subject to

$$(1)\ E(Y_t)=\sum_{t=1}^{T}\delta^t(H_t^z)(pq_t\,A_t-cI_i(L_e)\,I_{it});\quad where\ cI'(L_e)<0$$

$$(2)\ q_t=q(s_t,z_t);\quad where\quad q'(s_t)>0$$

$$(3)\ s_t=s_0\left(1-er\left(\Gamma,\sum I_{it}\right)\right);\ where\ s'(s_t)>0,\ s'(er)<0,\ and\ er'(\Gamma)>0$$

The equation (1) shows the present value of future income (Y_t) at the end of planning horizon. It is therefore the difference between the discounted annual crop revenues and the unit cost of land conservation investment over the planning horizon. The discount factor (δ) is determined by the household characteristics and household asset holding. The model is based on the assumptions that the unit cost of conservation decreases with increase in level of work experiences (L_e), yield is the increasing function of the current soil depth (s_t), soil depth (s) increases linearly with initial soil depth and decreases with soil erosion (er) and soil erosion increases with the factors governing the soil propensity to erode (Γ). Soil erosion is assumed to decrease concavely with the cumulative land conservation investments by the household. Yield depends not only on the current soil depth but also on the other conditioning factors (z_t) such as soil fertility, weather and pest controls. As this study uses the cross sectional data, distance from farm to the nearest market is assumed to capture the variability in prices. Thus, the expected crop revenue is the product of crop price (p), yield (q) and the land area (A). The utility function gives the following Hamiltonian when the equations (1), (2) and (3) are substituted:

$$(4)\ H=U\left(E\left\{\sum_t\delta^t(H^z)\,pq_t\left(s_0\left[1-er\left(\Gamma,\sum_t I_{it}\right)\right],z_t\right)A_t-cI_i(L_e)\,I_i\right\};H^z\right)$$

The differentiation of equation (4) with respect to the I_i helps us to identify the factors influencing the land conservation investment by the farm household given the market imperfections.

$$(5)\ \frac{\partial H}{\partial I_i}=\frac{\partial U}{\partial Y}\frac{\partial Y}{\partial q}\frac{\partial q}{\partial s}\frac{\partial s}{\partial er}\frac{\partial er}{\partial I_i}A+\frac{\partial U}{\partial H^z}\frac{\partial H^z}{\partial s}\frac{\partial s}{\partial H^z}-\sum_{t=1}^{T}\delta^t(w)\,cI_i=0;\ where\ w=wealth$$

The equation (5) indicates that optimal land conservation investment occurs when the marginal utility of cumulative addition in the yield is equal to the marginal cumulative discounted cost of the land conservation investment required to obtain the added yield. Under market imperfections, household characteristics and the wealth including asset holdings affects this marginal condition. In addition, not only the income but also the composition of income affects the investment in land conservation. Based on this theoretical framework and other empirical studies (Feder et al., 1992; Clay et al., 1998; Clay et al., 2002; Hagos, 2003), we can use following model for the estimation of land conservation investment.

$$(6)\ I_i=f(Pc,Ms,w,tenr,H^z,Percep,Inc,Compinc)$$

The equation (6) indicates that investment in land conservation is influenced by several factors like plot characteristics (Pc), market structure (Ms), wealth (w), land tenure (tenr), household characteristics (H^z), farmers perception (Percep) regarding the plot (i.e. whether the farmer perceives that a plot requires the conservation and whether it is beneficial to invest on that specific plot), total household income (Inc) and the composition of total household income (Compinc).

Hypotheses

The main research question now is how poverty affects the probability and the level of land conservation investment. In order to find out the determinants of land conservation investment, following hypotheses are put forth.

H1: The relationship between poverty and investment in land conservation investment is non-linear, preferably bell-shaped.

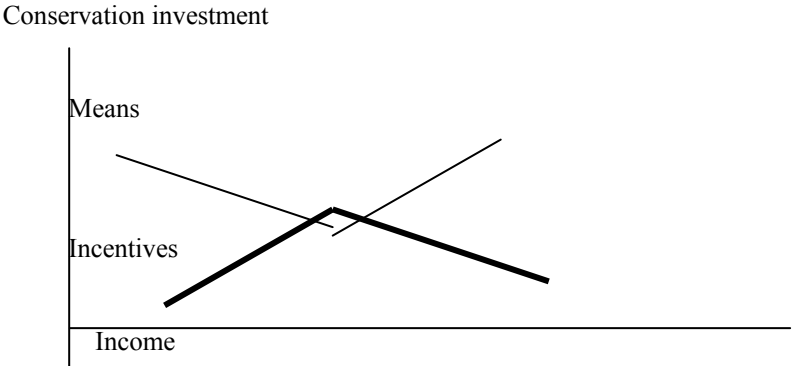

Fig 1: Relation between land conservation investment and household income

It means very poor households invest less on land conservation because they lack resources to invest, while very rich households also invest less on land conservation, as they lack incentives because the share of the agricultural income is relatively small in their total household income. The middle-income groups invest more on the land conservation. This nonlinearity may be explained by existing market imperfections. For instance, liquidity constraints limit the investment of poor households, while the labor market imperfections (high supervision costs) limit investments of wealthy households. High opportunity cost of labor of rich households limit their investment in land conservation. Relatively low expected return to labor in conservation can be one of the reasons that dampen incentives to invest in land conservation.

H2: Household with a larger labor endowment invests more on land conservation investment. It is mainly due to the fact that land conservation investment like maintaining terraces; managing waterways during heavy rainfall periods require immediate labor. Under labor market imperfections, the endowment of labor in the household affects the labor intensive conservation investment in land.

H3: Own-operated plots are expected to be more likely to be conserved compared to rented-in plot. It is mainly due to the land market imperfections and the short-term land rental contract. It may be due to the fact that most of the land rental contracts in the study area are informal.

H 4: Conservation investment is likely to be lower in case of distant plots compared to plots close to homestead. It may be due to high transaction costs.

H5: Poverty reduces the household's willingness to pay and ability to invest on land conservation. Poverty increases the rate of time preferences and this lead to lower investment in land conservation as the benefit of land conservation investment is usually expected in the long run.

H6: Credit constrained household invest less on the land conservation investment. It is mainly due to the credit market imperfections.

H7: Households with high remittance income may invest more on land conservation as increased remittance income softens the liquidity constraints. However, it may go other way round as these households on the one hand lack labor for conservation investment and on the other they depend less on farm income and hence, have lower incentives.

4. Econometric Specification of the Model

The econometric specification of the model consists of two major parts. First, we have to find out the good instrument for poverty in order to estimate its impact on the probability and level of land conservation investment. Once we have the good instrument, we can use it for testing the nonlinear effect of poverty on land conservation investment. So, the econometric model consists three parts as follows:

Instrument for poverty measurement

The household income is assumed to reflect the welfare level of the household i.e. whether the household is poor or not. The household income however, depends on the resource base of the household such as size of land holding, labor unit available in the household, education status of the household head, caste and off farm income opportunities. In order to capture the idea of resource poverty, we used the predicted income level as an instrument for poverty. For this we use simple OLS regression model.

$$(7)\ y_i = x_i\beta + \varepsilon_i$$

In equation (7) y represents the total income of individual household and x is the vector of independent variables. The predicted income obtained from equation (7) is used as the instrument for poverty. In order to test for nonlinear effect of poverty on land conservation investment, we consider predicted income and the square of the predicted income as independent variables in the econometric models used for the estimation of probability and the level of conservation investment.

Probability of having land conservation investment

For estimating the probability of land conservation investment, we use binary choice probit model at the plot level data. Consider that the amount of conservation investment on the plot by a household i as:

$$(8)\ y_1 = x_1\beta_1 + u_1$$

In equation (8), y_1 is the amount of conservation investment per hectare and x_1 is the vector of independent variables. Under this situation, whether a household decides to invest in land conservation or not, is given by the following participation equation:

$$(9)\ y_2 = 1[(x\alpha_2 + v_2) > 0]$$

This implies that y_1 is observed only when $y_2 = 1$. For estimation purpose, we assume both u_1 and v_2 are independent of x with mean zero implying that x is exogenous and v_2 is normally distributed with zero mean and unit variance. Hence the standard probit model is given by:

$$(10)\ y_p^* = x_p\beta + \varepsilon_p$$

where,

$$y_p = \begin{cases} 1 & if\ \ y_p^* = 1 \\ 0 & otherwise \end{cases}$$

In equation (10) subscript p denotes for the plot level observation.

Estimation of land conservation investment

We use Tobit model (censored regression model) in order to estimate the level of conservation investment. According to Tobit model, a latent variable y_p^* is given by

$$(11)\ y_p^* = x_p\beta + \varepsilon_p \quad where\ \varepsilon_p \sim iid(0, \sigma_\varepsilon^2)$$

where,

$$y_p = \begin{cases} 0 & if\ \ y_p^* \le 0 \\ y_p^* & if\ \ y_p^* > 0 \end{cases}$$

Therefore, the probability that there is no land conservation investment on a plot is given by:

$$(12)\ P(y_p = 0) = 1 - \Phi\left(\frac{x\beta}{\sigma}\right)$$

The equation (12) represents the probit model and the required density function for the positive value of y_p is given by:

$$(13)\quad f(y_p / x, y_p > 0) = \left[\Phi\left(\frac{x\beta}{\sigma}\right)\right]^{-1} \frac{1}{\sigma}\phi\left(\frac{y - x\beta}{\sigma}\right)$$

In equation (13) Φ is the standard normal cumulative distribution function while ϕ is the standard normal probability density function. This equation represents a truncated regression for positive values of the continuous decision of the level of investment given that $y_p^* > 0$. When we assume that same variables affect both conservation adoption decision on a plot and level of conservation investment on it, we often use the Tobit model. It is therefore, a variable that increases the probability of a plot being conserved also affect the level of conservation investment positively and vice versa. The log-likelihood function for the Tobit model is given by:

$$(14)\quad \ln L = \sum_0 \ln\left[1 - \Phi\left(\frac{x\beta}{\sigma}\right)\right] + \sum_+ \ln\left[\frac{1}{\sigma}\phi\left(\frac{y - x\beta}{\sigma}\right)\right]$$

In the equation (14) the first part in left hand side represents the summation over the zero observations in the sample, which implies that the equation contains the probabilities of non-conservation decision. The second part in the left hand side of the equation represents the summation over positive observation and it is similar to a classical regression for the positive values of y.

5. Study Area and Data

A cross-sectional household survey was conducted in 2003 in Mardi watershed, the middle hill belt of the Western Development Region of Nepal. Three Village Development Committees (VDCs), namely Lwang Ghalel, Rivan and Lahachok in Mardi watershed were selected as the field area for the study. This watershed is located between 28° 19′ to 28° 29′ N and 83° 50′ to 83° 56′ E in the Western Development Region of Nepal which covers the area of about 144 sq km. The elevation varies from 915m to 5590m above the mean sea level. The topography is highly dissected and contains varying slopes ranging from flat at valleys to 80°. Total sample size under study is 498 households and these households have 1154 plots. However, we consider only the plots under own cultivation and rent-in as we do not have enough information about the conservation investment in rented-out plots. So the number of total plots under study is 991.

Agriculture is the main occupation in this watershed and is practiced from valley bottom to the hilltop, with variety of cropping systems and management practices (Giridhari and Thapa, 2001). Income from remittances also plays a vital role in the economy of this area (Gurung, 1999; Sesabo, 2001). The use of land under agriculture is increasing in the area. Agricultural land occupied 55.4 per cent of the total land in 1978, whereas it had accounted for 46 per cent in 1957 (Thapa and Weber, 1990). The major crops in this area are paddy, maize, millet and wheat.

In this watershed land can be divided into three classes: low land Khet; upland Khet and the upland Bari. A narrow stretch of river valley constitutes the low land Khet, upland Khet is located on hill slopes and the Bari land is found in the ridges and on hill slopes ranging from 1200 m to 2200 m altitude (Thapa and Weber, 1990). The structure of terraces and the type of crop grown varies in these land types. As there is high variation in the slope and other properties of land, the vulnerability to soil erosion is also different. The variation in the average soil loss ranges from 1.3 to 34.4 Mg ha^{-1} annually (Awasthi, 2004). Soil loss in the Khet land is lower in compared to other land uses. Bari land experienced an erosion rate, which is 2 to 3 times higher than tolerable soil loss rate of 10-11 Mg ha^{-1} in the mountain environment (ibid, 2004).

In this watershed, an outward-sloping terrace in the Bari land is one of the reasons for higher soil erosion. Awasthi (2004) found that the outward slope ranged from 2 to 9 per cent and most of the terraces are not aligned along the contour; hence possess lateral slopes up to 16 per cent. Bari lands are also vulnerable to erosion during ploughing and hollowing of maize, because it requires digging at least twice during early or pre-monsoon season (Awasthi, 2004). The high soil loss from Bari land in Mardi watershed is the combined effect of terrace slope, tillage practice, soil type, ploughing and hollowing, high intensity of rainfall, and farmers' management practice (Mulder 1978; Gardner and Gerrad 2003; Awasthi, 2004).

Bari land occupies larger area than degraded forest and grazing land (Awasthi et al., 2002). Bari land is the major resource upon which the poor farmers are particularly dependent. In order to minimize soil loss and to keep soil productivity, farmers need to seek for best management options applicable to this agro-ecological region. Therefore, to invest on soil conservation is not only the environmental concern but also the socio-economic concern having a long-term impact.

Land conservation investment in the study area is mainly labor intensive. It is because this area lies in the highest rainfall region of Nepal. It is reported that the average annual amount of rainfall on the ridge is about

4700 mm, while it is 4000 mm on plains. Therefore, managing the water during the heavy rainfall is one of the major works needed to control the raiser falling and land slide. In addition, of the total agricultural land in this Watershed, 31.1 per cent have slope gradients of more than 30 degree, 47.6 per cent have slope gradients of 5-30 degree, and 21.3 per cent have slope gradient of less than 5 degree (Thapa and Weber, 1995).

The Khet lands on the ridges are much less vulnerable to accelerated erosion due to their inward sloping; narrow spaces bench-terracing required regulating water (Thapa et.al, 1992). However, uplands are vulnerable to erosion as the terraces are outward sloped. Outward sloping is essential for avoiding water logging of dry crops and preventing land slipping due to accumulation and penetration of water. Upland terraces are relatively wide spaced. This wide spaced outward sloping terrace not only reduces time and labor requirement for their construction and maintenance in comparison to inward sloping and closely spaced terraces, but also makes it easier for ploughing. Widely spaced terraces, however have relatively steeper slope gradients and are vulnerable to soil erosion (ibid).

In order to prevent soil erosion and to conserve the land, various measures such as structural, biological and soil fertility management are applied in this watershed. Structural measures consist of building and maintaining of terrace, bunds and waterways; gully control activities; landslide repair and prevention activities; check dams. Biological measures include ally cropping; bamboo plantation in Gullies; establishment of vegetation for landslide control and mulching, while soil fertility management comprises the application of organic and chemical fertilizers; farm yard manure, compost, green manure, overall application of NPK, and Goth system.

Despite preventive efforts, land degradation continues partly because of lack of adequate investment in farm management and partly due to their steady emphasis on practicing arable agriculture.

Land conservation investment therefore includes all forms of expenditures that are meant to reduce soil erosion. This paper considers labor spent on construction and maintenance of conservation structures such as terraces, check dam, planting trees on land slides areas, planting of grasses. The costs of both family and hired labor are considered in calculating total labor costs. Therefore, the total cost of conservation in the given plot is the sum of labor as well as material costs of conservation.

6. Results and Discussion

This section is divided into two parts. The first part consists of the simple graphical analysis of the relation between the land conservation investment and the total income of the household by quintile group while the other part deals with the econometric analysis.

6.1 Distribution of land conservation investment and the total income

The total sample size of the study is 498 households. These households are divided into 5 groups on the basis of total income in ascending order. The total investment on land conservation (LC) is summed up accordingly. Each group consists of 20 per cent of the sample households. Average total household income and the average investment on land conservation are calculated in order to present their relation graphically. The table 1 and the figure 2 clearly depict that the increase in household income initially increase the investment on land conservation sharply, but it declines after a certain level of income is reached.

Table 1: Average land conservation investment and average total income of the household

Quintile Group	Average income of the household (in NRs.)	Average investment on land conservation (in NRs.)
Bottom 20 %	7047.5	572.5313
20-40 %	16397.5	1093.938
40-60 %	27546.88	2202.375
60-80%	52035.47	1569.406
Top 20 %	96592.66	1086.75

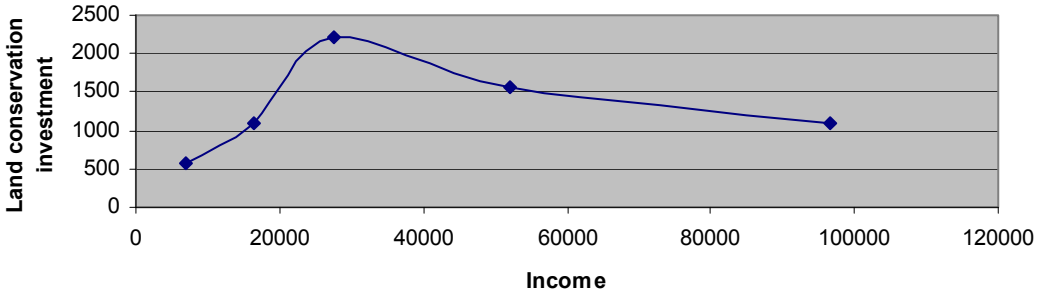

Figure 2: Relation Between Income of the Household and the Investment on land conservation

6.2 Econometric Models

In the econometric analysis, first of all we estimate the total household income by using Ordinary Least Square method. This is done to find out the instrument for poverty. It is assumed that the predicted income will be the instrument for poverty as it includes most of the variables that affects the total household income. The regression results are given in the table 2 below.

Table 2: Estimation of total household income as an instrument for poverty

Total household (HH) income	VT	**Coef.**	**Std. Err**	**t**	**P>|t|**
Value of asset	C	1.504813	.027910	53.92	**0.000**
Value of land	C	-.003708	.00087	-4.25	**0.000**
Total livestock unit	C	-218.678	224.319	-0.97	0.330
HH head sex (Female)--base 'male'	D	3786.631	1528.6	2.48	**0.013**
HH Education (Literate)-- base 'illiterate'	D	1102.489	1266.99	0.87	0.384
Caste (Chhetri)--base 'Brahmin'	D	8371.804	1938.63	4.32	**0.000**
Caste (Newar)	D	-14422.56	8784.33	-1.64	0.101
Caste (Gurung)	D	4683.788	1579.7	2.96	**0.003**
Caste (Lower)	D	1132.295	1613.95	0.70	0.483
Occupation of head (off-farm)-- base 'farm'	D	-3999.821	4266.67	-0.94	0.349
Occupation of head (both)	D	9987.626	4493.70	2.22	**0.026**
Village (Rivan)-- base 'Lahachok'	D	-16722.93	1692.88	-9.88	**0.000**
Village (Lwang Ghalel)	D	-13506.95	1375.28	-9.82	**0.000**
Number of migrated members	C	12381.44	919.306	13.47	**0.000**
Standard labor unit	C	1644.621	391.43	4.20	**0.000**
Constant		11519.54	1991.93	5.78	**0.000**

R-square = 0.6922; VT= variable type (C= Continuous, D=Dummy)

The table 2 shows that the value of asset, the sex of the household head, caste (chhetri), caste (Gurung), occupation of head (both), number of migrated members and the standard labor unit available in the household have positive and significant effect on the total household income. Most of these variables have signs as per our expectation. In the study area, female-headed households are found to have wealthier as male members are outside and engaged in the remittance earning.

Social variables like caste also have important association with the income of the household. It is basically due to the higher involvement of some caste groups in the remittance earning jobs than other caste groups. In the study area, Gurung caste is found to have more involvement in remittance earning jobs outside the country. This may be the main reason why they have higher income than Brahmins (a base caste dummy).

Occupation is another variable influencing the household income. The results show that household heads with both farm and off-farm income earns more than the household with farm income only. As remittance is one of the major sources of income in this area, the number of migrated member has positive influence in the household income. Similarly, the labor unit available in the household is found to have positive impact on household income.

We have included village dummies in order to capture the locational effect on the household income. We have considered three villages namely Lahachok, Rivan and Lwang Ghalel. Village Lahachok lies nearer to the local city centre than the remaining villages. As per our expectation, the household nearer to the local city centre has more income. These households have higher access to market and also to off-farm income earning opportunities.

Some variables, however, have the sign, which is not as our expectation a priori. The value of land is found to have negative impact on the household income, which is quite surprising.

6.2.1 Probability of conservation investment

In order to know the probability of land conservation investment, we have carried out the probit model. In this case, dependent variable is a categorical and thus it tells us whether a plot is having conservation investment or not. Therefore, most of the variables that are supposed to affect the land conservation investment at plot level are included in the model. As per the theoretical model built on section 3 of this paper, not only the biophysical characteristics of the plot (such as slope, land type, soil type, soil depth, distance to plot) but also the variables related to household characteristics (such as labor available in the household, number of migrated member, caste) are included in the estimation of the model.

For capturing the effect of poverty on the land conservation investment, we use the predicted income of the household by using the model stated in table 2. The predicted income and square of the predicted income per unit of land are used as variables in the probit model on the assumption that it will indicate the non-linear relation between the investment per unit of land and the total household income per unit of land. The result of the estimated probit model is given in table 3.

Table 3: Probability of land conservation investment at plot level (Probit model)

Land conservation investment (Yes/No)	**VT**	**Coef.**	**Std. Err.**	**z**	**P>z**
Area of plot (in hectare)	C	.8879413	.5444667	1.63	0.103
Credit constraint (yes) - - base ‘no constraint’	D	.1290498	.1707356	0.76	0.450
Share of remittance income in total income	C	-.5733513	.4577045	-1.25	0.210
Share of nonfarm income in total income	C	-.216656	.3737686	-0.58	0.562
Distance to plot (in minute)	C	-.3848114	.0637761	-6.03	**0.000**
Standard labor unit	C	.3428726	.1860108	1.84	**0.065**
Standard consumer unit	C	-.2645674	.1467006	-1.80	**0.071**
Number of migrated member	C	-.2006532	.1900068	-1.06	0.291
Total livestock unit	C	-.0187135	.031366	-0.60	0.551
Caste (Chhetri)- - base ‘Brahmin’	D	.0051281	.260583	0.02	0.984
Caste (Newar)	D	-.1763986	.254614	-0.69	0.488
Caste (Gurung)	D	-.5811496	.2168469	-2.68	**0.007**
Caste (Lower)	D	.9327427	.9106939	1.02	0.306
HH head education (literate)- - base ‘illiterate’	D	.0557719	.1917124	0.29	0.771
HH head sex (female)—base ‘male’	D	-.0143287	.2417592	-0.06	0.953
Predicted HH income per unit land	C	-9.52e-08	4.01e-07	-	0.812

				0.24	
Square of predicted HH income per unit land	C	2.25e-12	2.74e-12	0.82	0.413
Cultivation type (shared in plot)—base 'own plot'	D	-.6608317	.1818755	-3.63	**0.000**
Village (Rivan)- - base 'Lahachok'	D	1.115568	.3538526	3.15	**0.002**
Village (Lwang Ghalel)	D	.7469215	.2178902	3.43	**0.001**
Land type (upland Khet) - - base 'Low land Khet'	D	1.447992	1.119915	1.29	0.196
Land type (upland Bari)	D	2.168782	1.12762	1.92	**0.054**
Soil (Sandy) - - base 'black'	D	-.6483721	.3793218	-1.71	**0.087**
Soil (Red)	D	-1.472949	.3760174	-3.92	**0.000**
Soil (Domat)	D	.2122792	.5335839	0.40	0.691
Soil (Gray)	D	-.9320466	.3870325	-2.41	**0.016**
Soil depth (medium)- - base 'Shallow'	D	-.2810106	.2487671	-1.13	0.259
Soil depth (deep)	D	.3216913	.2372732	1.36	0.175
Slope (Foot hill)—base 'flat'	D	.7531859	.2817377	2.67	**0.008**
Slope (Mid hill)	D	.155549	1.103591	0.14	0.888
Slope (Steep hill)	D	-.1130137	1.123297	-0.10	0.920
Land quality (medium)- - base 'poor'	D	-.3984113	.3731812	-1.07	0.286
Land quality (Good)	D	-1.042584	.3551599	-2.94	**0.003**
Constant		1.681564	.5175663	3.25	**0.001**

From table 3, it is clear that access to credit does not influence the probability of land conservation investment implying that credit constraints do not limit the probability of land conservation investment. Similarly none of the variables related to income and its composition such as predicted HH income per unit land, square of predicted income per unit land, share of remittance income in total income and share of nonfarm income in total income are found to affect the probability of land conservation investment significantly. It may imply that poverty may not significantly influence the probability or participation decision of the household in the land conservation investment. This result does not support the hypothesis that poverty affects the probability of land conservation investment.

Some of the households' characteristics variables are found to significantly affect the decision to invest in land conservation. Standard labor unit, standard consumer unit and the caste (Gurung) are found to have significant influence on the probability of land conservation investment. Standard labor unit and standard consumer unit are significant at 10 per cent level of significance whereas caste (Gurung) is highly significant. Results show that increase in labor endowment with the household increases the probability of land conservation, whereas increase in consumer unit decreases it. This is an expected outcome given the labor market imperfection in the study area. This result supports that hypothesis that households with higher labor endowments have higher probability to invest on land conservation. The higher involvement of Gurung households in remittance earning activities may be the reason why they have lower probability of land conservation investment while comparing with Brahmin households.

Distance to plot is found to be significantly negative. It supports the hypothesis that conservation investment is likely to be lower in case of distant plots compared to the plots closer to homestead. Similarly, the rented in plots are found to have lower probability of being conserved. This is as per our hypothesis that farmers are unwilling to invest in conservation of those plots in which they have less security. Given the short period of land rental contract, it is not unusual.

Village dummies are found to have significant positive effects on the land conservation investment. The village Lahachok (Base category) is nearer to market and thus we assumed that it might have higher probability to invest on land conservation. However, it is not supported by the result. This means higher access to market

may not guarantee the higher probability of conservation and it may be due to the higher access to off-farm opportunities.

Many plot and soil characteristics variables are significantly affecting the investment on land conservation. Upland Bari has higher probability of conservation than low land Khet. Not only this, the plots with sandy or red soil have lower probability of conservation compared to plots with black soil. This is mainly due to the fact that farmers consider these soils as less productive and hence conserving those plots does not yield them more income.

6.2.2 Level of conservation investment

Tobit model is estimated for finding out the determinants of the level of conservation investment. All the independent variables included in the probit model (table 3) are included in Tobit model. Table 4 lists the results of the Tobit model.

Table 4: Level of land conservation investment at plot level

Conservation investment per unit land	VT	Coef.	Std. Err	t	P>|t|
Area of plot (in hectare)	C	248.8683	248.557	1.00	0.317
Credit constraint (yes) - - base 'no constraint'	D	-271.4127	133	-2.04	**0.042**
Share of remittance income in total income	C	-965.232	404.766	-2.38	**0.017**
Share of nonfarm income in total income	C	271.5787	269.723	1.01	0.314
Distance to plot (in minute)	C	-940.1864	65.0606	-14.45	**0.000**
Standard labor unit	C	70.77023	144.548	0.49	0.625
Standard consumer unit	C	-121.4777	114.234	-1.06	0.288
Number of migrated member	C	-320.6767	150.938	-2.12	**0.034**
Total livestock unit	C	-11.2468	25.4473	-0.44	0.659
Caste (Chhetri)- - base 'Brahmin'	D	-211.8425	219.381	-0.97	0.334
Caste (Newar)	D	2784.843	990.529	2.81	**0.005**
Caste (Gurung)	D	-595.2831	184.524	-3.23	**0.001**
Caste (Lower)	D	710.8253	185.754	3.83	**0.000**
HH education (literate)- - base 'illiterate'	D	-108.0391	144.743	-0.75	0.456
HH head sex (female)—base 'male'	D	-403.4871	175.730	-2.30	**0.022**
Predicted HH income per unit land	C	.0070747	.000233	30.33	**0.000**
Square of predicted HH income per unit land	C	-2.35e-08	1.56e-09	-15.07	**0.000**
Cultivation (shared in plot)—base 'own plot'	D	-375.7661	166.423	-2.26	**0.024**
Village (Rivan)- - base 'Lahachok'	D	1060.515	202.806	5.23	**0.000**
Village (Lwang Ghalel)	D	781.7246	162.116	4.82	**0.000**
Land type (upland Khet) - - base 'Low Khet'	D	1057.442	515.001	2.05	**0.040**
Land type (upland Bari)	D	1132.324	473.644	2.39	**0.017**
Soil (Sandy) - - base 'black'	D	-395.8417	236.783	-1.67	**0.095**
Soil (Red)	D	-710.6866	290.697	-2.44	**0.015**
Soil (Domat)	D	-73.79594	335.463	-0.22	0.826
Soil (Gray)	D	-225.505	249.903	-0.90	0.367
Soil depth (medium)- - base 'Shallow'	D	27.44986	188.414	0.15	0.884
Soil depth (deep)	D	10.14131	153.213	0.07	0.947
Slope (Foot hill)—base 'flat'	D	889.1794	252.535	3.52	**0.000**
Slope (Mid hill)	D	1330.957	509.748	2.61	**0.009**
Slope (Steep hill)	D	2844.489	489.85	5.81	**0.000**
Land quality (medium)- - base 'poor'	D	-157.8041	248.308	-0.64	0.525

Land quality (Good)	D	-233.8001	223.308	-1.05	0.295
Constant		29.00209	357.699	0.08	0.935

The result in table 4 shows that credit constraint has significant negative effects on the level of conservation investment by individual household. This resembles to our hypothesis that credit constrained households invest less on the land conservation investment given credit market imperfections. Similarly share of remittance income is found to influence negatively to the land conservation investment. Households having higher remittance income lack enough family labor to invest on land conservation. Given that there are labor market imperfections and high cost of supervision, increase in remittance earning reduces the level of land conservation investment of individual household. This hypothesis is also supported by the result that number of migrated member has significant negative impact on the land conservation investment.

Poverty affects the level of land conservation investment nonlinearly and it is highly significant. The variables predicted income per unit land and the square of predicted income per unit land are highly significant and have signs as per expectation. It implies that the very poor household invests less in land conservation and thus when income increases initially the investment on conservation increases, but it decreases when households gets richer. This result may be influenced by the composition of income in the study area as most of the household with high income have higher share of remittance income in their total income. It may be due to the fact that household becomes less dependent on farm income as the share of remittance increases in total household income.

Caste is another social variable having significant influence on the level of land conservation investment. Caste dummies for Newar, Gurung and lower castes are highly significant. However, only Gurung has the expected sign. Likewise, as per our a priori expectation, female-headed households are found to have lower level of conservation investment. Most of the female-headed households have some migrated male members and thus it reduces the availability of household labor leading to lower conservation investment.

Rented in plots are found to have significantly lower conservation investment as compared to own cultivated plots. This supports our hypothesis that given the insecurity of investment, the rented in plots are expected to have lower level of conservation investment. Short term land rental contracts and the existence of informal contracts can be some of the reasons for this.

Regarding plot characteristics, conservation investment is found to be lower in case of distant plots compared to the plots nearer to homestead. It may be due to supervision as well as other transportation costs. Village dummies which represent locational differences and market access are found to have significant impact on land conservation investment by farmers. The results show that land conservation investment is higher in relatively remote villages (Rivan and Lwang Ghalel) than in Lahachok, which is nearer to the district market centre. It may be the fact that the household labor is more used for off-farm activities.

All slope dummies and land type dummies are found to have significant influence on the level of land conservation investment. In comparison to low land Khet, both upland Khet and Upland Bari have higher level of land conservation investment. Given the geographical nature of the area, this is a reality. As upland Khet and upland Bari are terraced lands and they lie in the range of mid hill to steep hill, they require more labor to maintain the terraces and regulate water. Land conservation investment is lower on those plots having sandy soils and red soils in comparison to the plots with black soil. This is mainly due to the expectation of increase in yield after the conservation investment. Farmers invest more on the plots which have higher yield potential after the conservation. All slope dummies for are found to have significant positive impact on the land conservation investment. The results in the table 4 indicates that the higher the slope the higher the level of land conservation investment. This seems quite plausible given the terrace farming system in the study area.

7. Conclusion

The probability to invest on land conservation and the level of land conservation investment by an individual household are influenced by several factors. The analysis reveals that a variable that increases (decreases) the probability to invest on land conservation may or may not increase (decrease) the level of conservation investment.

Variables like poverty, credit constraint and the share of income are found to have significant effect on the level of conservation investment, but not on the probability of investment. Poverty affects the land conservation investment negatively and it is supported by the significant positive coefficient of predicted income variable in the Tobit model. It means higher the income higher the level of conservation investment. However, the significant negative coefficient of square of predicted income in Tobit model implies that conservation investment decreases with the increase in income at the higher level. This sustains the hypothesis that very poor households invest less on land conservation as they lack means to invest i.e. investment poverty, whereas the

very rich households also invests less on land conservation as they lack incentives. The lack of incentives in case of richer households may be due to their less dependence on farm income or the labor market imperfections leading to high supervision costs.

Similar effect is found in case of credit access. Credit constraint is found to have no significant effect on the decision whether to invest or not. However, credit constraint lowers the level of investment on conservation significantly. Composition of income of the household affects only the level of land conservation investment, but not the probability to invest. Social variables like caste are also found to have important implication in determining the probability and the level of land conservation investment.

Some variables are found to affect both probability and level of land conservation investment in similar ways. Distant plots and rented-in plots are found to have lower probability and level of land conservation investment. Many soil and plot characteristics variables significantly affect the probability and level of conservation investment. Overall, under the market imperfections, not only the plot characteristics but also the household characteristics, household endowments and the composition of income influence the probability and level of land conservation investment by individual farm households. Therefore, the policy targeted to enhance the investment on land conservation and land use sustainability in developing countries should not only consider the bio-physical issues, but also the household characteristics, socio-economic structure, institutional set up and resource base of the household.

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Asymmetric Volatility in Istanbul Stock Exchange "Sectoral Analysis"

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Abstract

The purpose of this paper is examining leverage effect for Istanbul stock exchange indices. Recent studies suggest that a negative shock to stock prices will generate more volatility than a positive shock of equal magnitude. This paper uses daily data from the Istanbul Stock Exchange to illustrate the nature of stock market volatility. In order to estimate volatility, we employ econometric models of GARCH, EGARCH and TGARCH (GJR-GARCH). The empirical results indicate leverage effect for ISE100, technology, industry, service and finance indices.

Keywords: GARCH, EGARCH, TGARCH (GJR-GARCH), leverage effect, asymmetric volatility

1. Introduction

Over the past 20 years, volatility models and their forecasts have been the focus of both academic researchers and practitioners. This is chiefly because volatility is used as a measurement of risk. Also it is important due to asset pricing, portfolio allocation or market risk measurement. According to Hongyu and Zhichao (2006) modeling volatility in financial markets is important because it sheds further light on the data generating process of the returns.

Volatility also has a great effect on the macro-economy. High volatility beyond a certain threshold will increase the risk of investor losses and raise concerns about the stability of the market and the wider economy (Yu, 2002). For example, Cote's (1994) survey of exchange rate volatility and trade found that volatility tends to reduce the level of trade, although the quantity of the effect is not particularly sizable. Bernanke and Gertler (1999) discussed the implications of the volatility of financial markets for monetary policy.

Modeling financial time series is not an easy task because they possess some special characteristics (see Ruey S. Tasy (2002)). They often exhibit volatility clustering (i.e. large

changes tend to be followed by large changes and small changes by small changes), often exhibit leptokurtosis (i.e., the distribution of their returns is fat tailed) and often show leverage effect (i.e. changes in stock prices tend to be negatively correlated with changes in volatility which implies volatility is higher after negative shocks than after positive shocks of the same magnitude). In order to capture the first two characteristics of financial time series, Engle (1982) propose to model time-varying conditional variance with the Auto-Regressive Conditional Heteroskedasticity (ARCH) processes that use past disturbances to model the variance of the series. Early empirical evidence shows that high ARCH order has to be selected in order to catch the dynamic of the conditional variance. The Generalized ARCH (GARCH) model of Bollerslev (1986) is an answer to this issue. It is based on an infinite ARCH specification and it allows reducing the number of estimated parameters from ∞ to only 2. Both models allow taking the first two characteristics into account, but their distributions are symmetric and therefore fail to model the third stylized fact, namely the "leverage effect". To solve this problem, many nonlinear extensions of the GARCH model have been proposed. Among the most widely spread are the Exponential GARCH (EGARCH) of Nelson (1991), the so-called GJR of Glosten, Jagannathan, and Runkle (1993).

The purpose of this paper is to evaluate the performance of GJR model on Istanbul Stock Exchange with ISE100 (National 100), service, finance, industry and technology indices for the period between 2000 and 2006

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years. We investigate the ability of asymmetric GARCH models to forecast volatility of ISE indices and try to express the importance of GJR model while interpreting the financial data.

The rest of the paper is organized as follows: Section 2 reviews on literature; Section 3 explains Univariate models of conditional volatility; Section 4 describes the data and methodology; Section 5 interprets the results and finally Section 6 makes a general conclusion.

2. Literature Survey

There are many studies on volatility analyzing in finance literature. These studies mainly analyze the volatility of stock market returns. For example using daily returns from 1992 to 2002, Peremaratne and Bala (2003) investigate volatility co-movement between Singapore stock market and the markets of US, UK, Hong Kong and Japan. The empirical results indicated that there is a high degree of volatility co-movement between Singapore stock market and that of Hong Kong, US, Japan and UK (in that order). And their study evinces that it is plausible for volatility to spill over from the smaller market to the dominant market.

Shamiri and Hassan studied on Asian stock indices (KLCI and STI) using daily data over a 14 years period. The estimation results show that the forecasting performance of asymmetric GARCH models (GJR-GARCH and EGARCH), especially when fat-tailed asymmetric densities are taken into account in the conditional volatility, is better than symmetric GARCH.

Aydemir (1998) made a contribution to the finance literature with his study on modeling volatility in stock markets of developing countries relative to developed countries.

Yavan and Aybar (1998) analyzed the structure of volatility in ISE returns for the period between 1986 and 1996 using daily indices. In this study they conclude that the short run volatility is extremely higher than the long run volatility.

In Turkey, Balaban (1999) had studied on forecasting volatility. He analyzed volatility with seventeen different volatility models using monthly stock market data.

Another study was made by Mazıbaş (2004). He modeled asymmetric price movements in ISE composite index using symmetric and asymmetric ARCH models.

Duran and Şahin (2006) investigated the existence of volatility spillover and its direction between ISE, service, finance, industry and technology indices in daily data from July 2000 to April 2004 and according to the results obtained from the VAR model, they found volatility spillover between ISE indices.

3. Univariate Models of Conditional Volatility

GARCH: The GARCH (1, 1) model by Bollerslev (1986) is based on the assumption that forecasts of time varying variance depend on the lagged variance of the asset. An unexpected increase or decrease in returns at time *t* will generate an increase in the expected variability in the next period. The basic and most widespread model GARCH (1, 1) can be expressed as:

$$y_t = \mu + \phi y_{t-1} + u_t \quad , \quad u_t \sim N(0, \sigma_t^2)$$
$$\sigma_t^2 = \omega + \alpha u_{t-1}^2 + \beta \sigma_{t-1}^2$$

where $\omega > 0, \alpha \geq 0, \beta \geq 0$. The GARCH (1, 1) is weakly stationary if, $\alpha + \beta < 1$, ω is the mean, u_{t-1}^2 is the news about volatility from the previous period (the ARCH term), and σ_{t-1}^2 the conditional variance is the last period forecast variance (the GARCH term) and must be nonnegative.

The basic GARCH is symmetric and does not capture the asymmetry effect that is inherent in most stock markets return data also known as the "leverage effect". In the context of financial time series analysis the asymmetry effect refers to the characteristic of times series on asset prices that 'bad news' tends to increase volatility more than 'good news' (see Black, 1976 and Nelson, 1991). The Exponential GARCH (EGARCH) model and the Threshold GARCH (TGARCH) model proposed by Nelson (1991) and Glosten, Jagannathan and Runkle (1993) respectively are specifically designed to capture the asymmetry shock to the conditional variance.

EGARCH: In the EGARCH model the natural logarithm of the conditional variance is allowed to vary over time as a function of the lagged error terms rather than lagged squared errors. The EGARCH (1,1) model can be written as:

$$y_t = \mu + \phi y_{t-1} + u_t \quad , \quad u_t \sim N(0, \sigma_t^2)$$

$$\log(\sigma_t^2) = \omega + \beta \log(\sigma_{t-1}^2) + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right]$$

The exponential nature of the EGARCH ensures that the conditional variance is always positive even if the parameter values are negative, thus there is no need for parameter restrictions to impose nonnegativity, γcaptures the asymmetric effect.

TGARCH: The TGARCH modifies the original GARCH specification using a dummy variable. The TGARCH model is based on the assumption that unexpected changes in the market returns have different effects on the conditional variance of the returns. Good news goes with an unforeseen increase and hence will contribute to the variance through the coefficient β instead of an unexpected decrease which is presented as a bad news and contributes to the variance with the coefficient $\alpha . \gamma$. We require $\alpha . \gamma \geq 0$ and $\alpha \geq 0$ for non-negativity. If $\gamma > 0$ the leverage effect exists and news impact is asymmetric if $\gamma \neq 0$. The GJR model is written as;

$$y_t = \mu + \phi y_{t-1} + u_t \quad , \quad u_t \sim N(0, \sigma_t^2)$$

$$\sigma_t^2 = \omega + \alpha u_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma u_{t-1}^2 I_{t-1}$$

Where $I_{t-1} = 1$ if $u_{t-1} < 0$

=0 otherwise

4. Data and Methodology

4.1. Data description

We study on the Istanbul Stock Exchange with ISE100 (National 100), service, finance, industry and technology indices capture the period between 2000 and 2006 years. The daily data obtained from the electronic data distributor of Central Bank (EVDS). Our data start from the year 2000 because technology index is available for Istanbul Stock Exchange (ISE) after this date. The ISE returns (r_t) at time t are defined in natural logarithm of the ISE indices (p) that is, $r_t = \ln(p_t / p_{t-1})$. Using the Augmented Dickey-Fuller (ADF) unit root test, we cannot reject the hypotheses of unit roots in the stock return process. Existence of unit roots in series denotes non-stationary. So the same tests are applied to the first differences of the series and the results reject the unit root hypotheses with a confidence level of more than 99%. The table below reports the unit root test results:

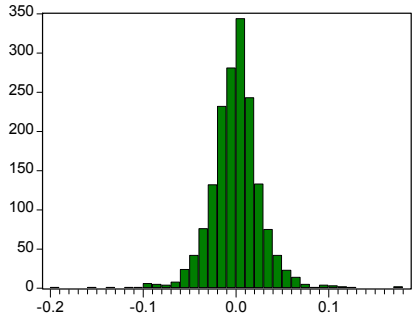
Table: Unit Root Test

	Level			Difference		
	model	Maximum lag	level	model	Maximum lag	level
İse100	(c,0)	24	0.1933(0.97)*	(0,0)	24	-39.475(0.00)**
industrial	(c,0)	24	0.2625(0.98)*	(0,0)	24	-43.456(0.0001)**
financial	(c,0)	24	0.3717(0.98)*	(0,0)	24	-39.432(0.00)**
technology	(c,0)	23	-2.074(0.25)*	(0,0)	23	-26.079(0.00)**
service	(c,0)	24	0.1667(0.97)*	(0,0)	24	-38.772(0.00)**

Note: (c,0) indicates that when testing for the unit root, there is a constant but no trend in the regression model. The p-values are indicated in the parentheses. * indicates insignificance in all levels. ** indicates significance in all levels.

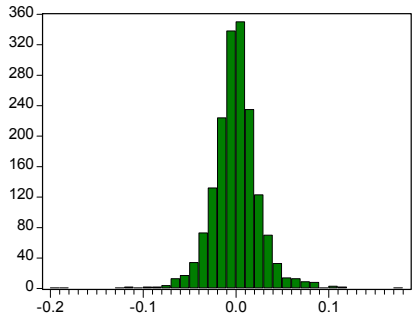
Descriptive Statistics of ISE100 (National 100), Services, Financial, Industrial and Technology returns Series

TABLE-1: ISE100



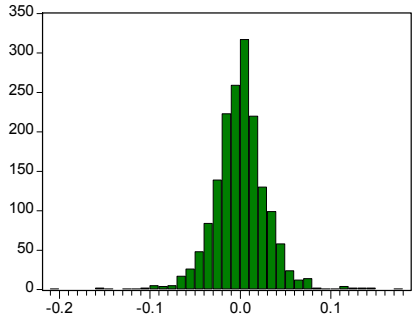
Series: ise100	
Sample 1 1708	
Observations 1707	
Mean	0.000482
Median	0.001228
Maximum	0.177736
Minimum	-0.199785
Std. Dev.	0.027535
Skewness	-0.021565
Kurtosis	8.714001
Jarque-Bera	2322.350
Probability	0.000000

TABLE-2: Service



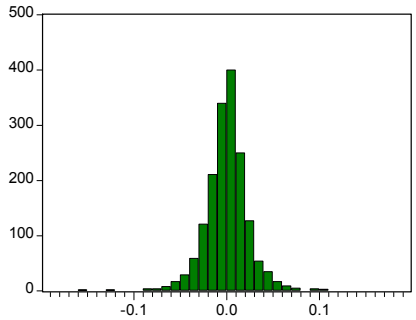
Series: Service	
Sample 1 1708	
Observations 1707	
Mean	0.000272
Median	0.000139
Maximum	0.173280
Minimum	-0.192560
Std. Dev.	0.026148
Skewness	-0.164678
Kurtosis	9.229166
Jarque-Bera	2767.544
Probability	0.000000

TABLE-3: Finance



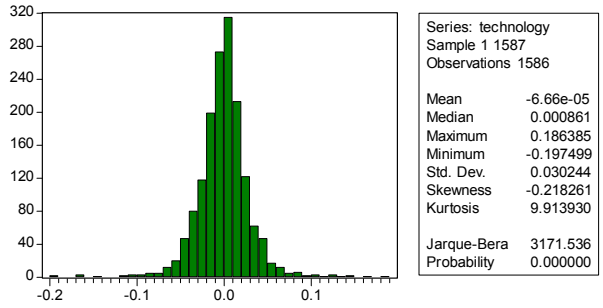
Series: financial	
Sample 1 1708	
Observations 1707	
Mean	0.000585
Median	0.001052
Maximum	0.174552
Minimum	-0.208422
Std. Dev.	0.030170
Skewness	-0.055363
Kurtosis	7.764038
Jarque-Bera	1615.129
Probability	0.000000

TABLE-4: Industry



Series: industry	
Sample 1 1708	
Observations 1707	
Mean	0.000711
Median	0.001232
Maximum	0.180446
Minimum	-0.180142
Std. Dev.	0.024940
Skewness	-0.181541
Kurtosis	11.28570
Jarque-Bera	4892.311
Probability	0.000000

TABLE-5:Technology



Generally the indices have a large difference between their maximum and minimum returns. The standard deviations are also high indicating high levels of fluctuations of the ISE daily returns. There is also evidence of negative skewness, which means that the left tail is particularly extreme. ISE's returns are leptokurtic or fat-tailed, given their large kurtosis statistics in tables above. The values of kurtosis exceed the normal value of 3.

4.2. Methodology

The GARCH (1,1), EGARCH(1,1), TGARCH(1,1) models are estimated for the ISE returns series using a combination of information criteria such as minimum Akaike information criteria (AIC) and the maximum Log-likelihood (LL) values and ARCH-LM test to choose the volatility model that best models the conditional variance of the ISE. We estimated the models using EViews 5.0 program.

5. RESULTS

5.1 Model Estimation

The results of estimation and statistical verification of the GARCH (1,1), TGARCH(1,1) and EGARCH(1,1) models are shown in tables of Estimated Volatility Models below. The ARCH (α) and GARCH (β) terms are positive and the summation of the coefficients ($\alpha + \beta$) are very close to 1, indicating that volatility shocks are quite persistent. All of the parameters estimated in GARCH models in the tables show that the coefficients of the conditional variance equation, αand β, are significant at all levels (1%, 5% and 10%) implying a strong support for the ARCH and GARCH effects. The sum of the ARCH (α) and the GARCH (β) estimates are quite close to unity, which is an indication of a covariance stationary model with a high degree of persistence; and long memory in the conditional variance. In the GARCH (1, 1) model for Ise100, $\alpha + \beta = 0.9918$is also an estimation of the rate at which the response function decays on daily basis. Since the rate is high, the response function to shocks is likely to die slowly. In other words, if there is a new shock it will have implication on returns for a longer period. In such markets old information is more important than recent information and that the information decays very slowly. For the EGARCH model the persistence in volatility is very long and explosive suggestive of an integrated process. This is consistent with Alagidede and Panagiotidis (2006). The asymmetric (leverage) effect is captured by the parameter estimate is positive and significant in the TGARCH. The asymmetry term is positive and significantly different from zero in the EGARCH model, so it is suggesting leverage effect. As a result, both EGARCH and TGARCH models support that all indices, we study on, have leverage effect.

Overall, using the minimum AIC and maximum LL values as model selection criteria for the GARCH models, the preferred model is the TGARCH model except industrial index. For this index under the same assumption, the preferred model is EGARCH.

Estimated Volatility Models

Note: The p-values are indicated in the parentheses. We check for all levels of significance (1%, 5% and 10%). P- values are strictly near zero so we can infer that they are significant for all levels. * denotes statistical significance at all levels.

Ise100			
Variance equation	GARCH	TGARCH	EGARCH
ω	7.92E-06(0.0002)*	8.61E-06(0.00)*	-0.3244(0.00)*
α	0.092(0.00)*	0.0647(0.00)*	0.2077(0.00)*
β	0.8998(0.00)*	0.9004(0.00)*	0.9779(0.00)*
γ		0.0491(0.0005)*	-0.0388(0.00)*
AIC	-4.6209	-4.6246	-4.6167
LL	3948.022	3952.158	3945.414
$\alpha+\beta$	0.9918	0.9651	1.1856

Finance			
Variance equation	GARCH	TGARCH	EGARCH
ω	2.26E-05(0.00)*	2.25E-05(0.00)*	-0.4979(0.00)*
α	0.1222(0.00)*	0.0730(0.00)*	0.2462(0.00)*
β	0.8581(0.00)*	0.8619(0.00)*	0.9567(0.00)*
γ		0.0819(0.00)*	-0.0555(0.00)*
AIC	-4.3672	-4.3757	-4.3657
LL	3731.468	3739.703	3731.137
$\alpha+\beta$	0.9803	0.9349	1.2029

Industry			
Variance equation	GARCH	TGARCH	EGARCH
ω	2.11E-05(0.00)*	2.20E-05(0.00)*	-0.6811(0.00)*
α	0.1607(0.00)*	0.1204(0.00)*	0.3257(0.00)*
β	0.8151(0.00)*	0.8111(0.00)*	0.9427(0.00)*
γ		0.0838(0.0010)*	-0.0593(0.00)*
AIC	-4.8453	-4.8491	-4.8516
LL	4139.542	4143.719	4145.855
$\alpha+\beta$	0.9758	0.9315	1.2684

Technology			
Variance equation	GARCH	TGARCH	EGARCH
ω	4.01E-05(0.00)*	4.54E-05(0.00)*	-0.7471(0.00)*
α	0.1229(0.00)*	0.0765(0.00)*	0.2601(0.00)*
β	0.8340(0.00)*	0.0827(0.00)*	0.9232(0.00)*
γ		0.0870(0.00)*	-0.0737(0.00)*
AIC	-4.4021	-4.4095	-4.4015
$\alpha+\beta$	0.9569	0.1595	1.1833

Service			
Variance equation	GARCH	TGARCH	EGARCH
ω	6.38E-06(0.0002)*	6.54E-06(0.00)*	-0.2852(0.00)*
α	0.0975(0.00)*	0.0529(0.00)*	0.1868(0.00)*
β	0.8962(0.00)*	0.9059(0.00)*	0.9813(0.00)*
γ		0.0649(0.00)*	-0.0507(0.00)*
AIC	-4.7544	-4.7615	-4.7569
LL	4061.887	4068.995	4065.097
$\alpha+\beta$	0.9937	0.9588	1.1681

6. CONCLUSION

The volatility of the ISE100 (National 100), service, finance, industry and technology returns have been modeled for forecasting using a nonlinear symmetric GARCH(1,1) model, and two nonlinear asymmetric models TGARCH(1,1) and EGARCH(1,1). We found that the ISE100 (National 100), service, finance, industry and technology returns exhibit the stylized characteristics such as volatility clustering, leptokurtosis and asymmetry effects.

The parameter estimates of the GARCH models (α and β) suggest a high degree persistent in the conditional volatility of stock returns on the Istanbul Stock Exchange. In the light of this study, we can infer that the most appropriate model for ISE100 (National 100), service, finance, and technology indices is TGARCH. Besides this, EGARCH model has a better performance on interpreting the volatility and leverage effect of industry index between the period of 2000 and 2006 years than TGARCH.

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MACRO DYNAMICS

An Experimental Study of Real Estate Market Efficiency

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ABSTRACT

Real estate markets are generally considered to be less efficient than financial markets. We attempt to explain the causes of these inefficiencies by attributing them to unique characteristics of the real estate markets. We consider asset market trading in an experimental environment where all investors receive the same dividend from a known probability distribution. We specifically examine the impact of transaction costs, short selling restrictions and divisibility of assets on the market efficiency. We find that short selling restrictions prevent traders from reducing prices, contribute to prolonged bubbles, and hence leading to inefficient markets. Transaction costs do not exacerbate the inefficiency of the market. Conversely, they reduce the occurrence and magnitude of bubbles and cause prices to track fundamentals more closely. Introducing transaction costs also lowers trading volume. Relaxing the short selling constraint increases the trading volume, reduces prices, increases the occurrence of "bust cycles", but does not result in prices tracking the fundamentals. Introducing a more divisible asset reduces the magnitude of bust cycles and improves the overall efficiency of the market.

Keywords: market efficiency, bubbles, experimental economics

I. Introduction

A central idea in asset valuation theory is that the value of an asset is equal to the discounted present value of its rationally expected cash flows. An asset market is said to be efficient if prices closely follow fundamental values. Furthermore, if the market is efficient, in equilibrium, prices should change only when new information that affects market participants' expectations about the cash flows becomes available. On the other hand, if asset prices persistently deviate from their fundamental values, "bubbles" may form in the market. The existence of bubbles can result in misallocation of capital and resources, affect investment decisions, and have considerable economic impact. Therefore, it is important to understand the causes of bubble formation and examine ways to reduce or eliminate bubbles. This is especially important for the real estate markets, where vast amounts of capital are invested. When we consider the fact that approximately half of all the wealth in the world is real estate[2], it becomes obvious that the existence of a bubble in the real estate market may have large implications for the overall economy. Examples include the savings and loan crisis of the 1980s, the Asian financial crisis of 1997, and the current mortgage crisis. Thus, it is important that we better understand the factors which may contribute to the formation of bubbles in the real estate market.

Real estate has several important attributes that differentiate it from financial assets. Real estate is heterogeneous, indivisible and has unique location. In addition, the real estate markets are characterized by high transaction costs, lack of short selling opportunities, high cost of obtaining information, illiquidity, and high government regulation. All of these attributes affect the efficiency of the market to varying degrees. For

[1] We thank the Insurance and Real Estate Department and the Institute for Real Estate Studies at Pennsylvania State University for providing funds for this research. This research was supported in part by a Dissertation Research Award from the Smeal College of Business.

[2] Based on a 1991 estimate by Ibbotson Association.

example, difficulty of obtaining information makes it harder for relatively uninformed investors to take advantage of profit opportunities. Therefore, we would expect that investors who have access to higher-quality information to use their advantage to earn above normal returns. Since above normal returns indicate market inefficiency, the costly nature of information in the real estate market may lead to inefficient outcomes.

The inability of investors to short sell real assets may make the real estate market less efficient than when short selling is present. In the financial markets, when a well-informed, rational investor believes that a particular asset is currently overpriced, the investor can short sell that asset and make a profit. Short selling an asset can bring its price closer to its fundamental value more quickly and thus enhance the overall efficiency of the market.

In this paper, we focus on three attributes of real estate: transaction costs, short selling restrictions and divisibility of assets. When short selling is not allowed, the market is characterized by a high volume of trade and the emergence of large and prolonged bubbles. Overall, the market is inefficient. Imposing transaction costs on this market has two effects. First, as can be expected, the volume of trade decreases dramatically. Second, contrary to our initial hypothesis, occurrence and magnitude of bubbles is reduced dramatically. In other words, the market is more efficient in the presence of transaction costs. Contrary to our expectations, when short selling is allowed, the prices fail to closely track fundamental values. Introducing short selling has the effect of reducing overall price levels and significantly increasing the volume of trade. Introducing a more divisible asset reduces the magnitude of bubbles is reduced and increases the overall efficiency of the market.

Over the years, a vast theoretical, empirical and experimental literature on market efficiency has developed. Any list of the articles on this topic would be incomplete at best. Theoretical work gives us a framework of how to think about the efficiency of markets. Seminal theoretical articles on the issue include Hayek (1945), Muth (1961), Lucas (1972) and Grossman (1976). Empirical research tests whether the real world data confirm the theoretical predictions. However empirical studies have a critical weakness: the most important variable, the fundamental value of the asset, is unobservable. Consequently, results of empirical studies are inconclusive. Another disadvantage of field data is that many potentially important variables cannot be manipulated. In such cases, experimental methodology is often useful. In experimental studies, we can structure markets in such a way that the fundamental values of the assets are known with certainty. Furthermore, we can control for traders' expectations of future cash flows, news available to them, as well as short-selling restrictions. Therefore, we are able to directly test the informational and allocational efficiencies[3] of the market.

In this paper, we offer an experimental analysis of the informational efficiency of real estate markets. The rest of the paper is organized as follows: Section II reviews the relevant literature and states our hypotheses. Section III presents a detailed description of the different experimental treatments[4] in this study. Section IV present the data and reports the results. Section V concludes and points out future directions.

II. Background

Review of the relevant experimental literature

Since Smith's seminal article in 1962, there has been an explosion in the quality and quantity of research in the area which has become known as "experimental economics". A significant portion of this literature deals with the informational and allocational efficiencies of experimental asset markets. Typically data collected in experiments are compared with the predictions of the rational expectations theory (Muth, 1961 and Lucas, 1972). This theory assumes that individuals take all available information into account in forming expectations and act upon those expectations. For example, Plott and Sunder (1982) test the rational expectations theory by conducting a simple double oral auction experiment where some of the traders, called "insiders", have more access to information than others. They find that initially prices are far from efficient levels predicted by rational expectations theory. In Plott and Sunder (1982), prices eventually start to converge to efficient levels, highlighting the importance of traders' experience in achieving price convergence. In Forsythe et al. (1982) prices converge to efficient levels after three or four periods, when near-100% efficiency is reached. The speed with which prices converge to equilibrium levels increases when futures are introduced into the market.

[3] The literature distinguishes between the informational, allocational and production efficiencies of a market. Informational efficiency is achieved when observed prices reflect fundamental asset values and prices immediately adjust to new information. Allocational efficiency refers to whether or not assets are held by individuals who value them the most. Production efficiency refers to the optimal use of resources in the production process.

[4] In an experiment, a treatment refers to a design with a particular combination of factors. An additional treatment usually changes one factor while holding all others constant. Any differences between treatments are likely to be caused by the factor that was tested.

A related stream of experimental research deals with the occurrence and causes of the so-called "bubbles". The existence of pricing bubbles, defined as asset prices being persistently higher than their fundamental values[5], was first studied in a laboratory environment by Smith et al. (1988). This study considers spot asset trading in an environment where all investors receive the same dividend from a known probability distribution at the end of each trading period. Bubbles are observed in 14 of the 22 sessions conducted. In most of the experiments, bubbles are followed by crashes, which are characterized by asset prices falling sharply to or below their fundamental values. Considering the fact that the market environment is extremely simple, it is rather surprising that bubbles would form in these experiments. However, Smith et al. (1988) results have been replicated in numerous later studies, including King et al. (1993), Van Boening et al. (1993), Porter and Smith (1995), Fisher (1998), Noussair, Robin, and Ruffieux (2001), Lei et al. (2001), Porter and Smith (2003), and Haruvy and Noussair (2006). All of these studies feature an experimental design which features an asset with a finite lifetime, typically 15 or 30 periods. The asset pays dividend every period and apart from a possible fixed terminal value this dividend is the only source of value. The important characteristic of these markets is that all the traders receive identical dividends and the dividend structure is common knowledge. The common pattern is that of a price bubble, a sustained occurrence of high transaction volumes at prices significantly higher than the fundamental value, followed by a crash to prices near or below fundamental values toward the end of the asset's life.

In particular, Porter and Smith (1995) test whether bubbles are formed because of dividend risk aversion in a market with uncertain dividends. That is, when there is uncertainty about dividends, do people use the market for insurance, which leads to arbitrage buying and rising prices? Their results show that the market is not more efficient when the dividends are certain. The occurrence and magnitude of bubbles is not significantly lower in the treatment with certain dividends compared to the treatment with uncertain dividends. Likewise, Noussair, Robin, and Ruffieux (2001) construct a market where the fundamental value of the asset is constant throughout its lifetime. The market is inefficient in the sense that keeping the value of the asset constant fails to eliminate price bubbles. Lei et al. (2001) consider an asset market where speculation is not allowed[6]. The common theme of "boom" and "bust" cycles is observed. The results suggest that the divergence of prices from fundamentals is not caused by the lack of common knowledge of rationality, which may lead to speculation. Rather, the market is inefficient because traders exhibit behavior which can be characterized as irrational.

In this study, we conduct experiments to test the effects of three attributes on market efficiency. In particular, we incorporate into the experimental design three attributes of real estate markets: transaction costs, short selling restrictions and (in)divisibility of the asset. We first consider the baseline experimental treatment where the nature of the asset and the double auction trading mechanism are characteristic of financial markets. We then consider the other experimental treatments, each capturing some of the important features of the real estate markets.

Each design is intended to measure the effect of an institutional change on the efficiency of the market. Here, efficiency is measured by the degree to which prices track fundamentals and occurrence of bubbles and crashes, as well as other quantitative measures.

The first treatment has the most restrictive market conditions and we hypothesize that this market design results in the least efficient outcome. In the first treatment, called TC (abbreviation for transaction costs), there is a 10% transaction cost to the sellers, and short selling is not allowed. Among the five treatments, TC most closely resembles the real estate markets. The second treatment, NSS (no short sales) is exactly the same as TC, except there are no transaction costs. The third treatment, CR100 (cash reserve 100%) relaxes the short selling restriction. Traders can short sell as many units as they wish, as long as they meet a cash reserve requirement. The next two treatments are designed to measure the effect of the divisibility of the asset on market efficiency. Divisibility is captured by increasing the number of assets and decreasing the dividend amounts, i.e. reducing the amount needed to invest in the asset. In the MA (multiple assets) treatment, there are four times as many assets, which provide one fourth of the dividends in each state of the world. Finally, the fifth treatment, NSS-MA (no short sales and multiple assets) is similar to MA, except short selling is not allowed. While the MA treatment measures the combined effect of short selling and divisibility, the NSS-MA treatment is designed to measure only the effect of divisibility. Summary information about the five treatments is provided in Table I.

Research Hypotheses

[5] This is the definition of bubbles we will be using throughout the paper.
[6] Traders are randomly assigned to either "Buyer" or "Seller" types, so each trader can either sell assets or buy them, but cannot do both.

Our initial conjecture is that the market will be least efficient in the first treatment and most efficient in the fourth treatment, where short selling is not allowed and the seller pays a 10% commission on every trade. Here we state our initial hypotheses.

Hypothesis 1: In the presence of transaction costs, the difference between prices and fundamentals is larger when compared to the "zero transaction costs" treatment.

The rationale for this hypothesis is that higher transaction costs make it more difficult for trades to react to new information or to the divergence between the current price and the fundamental value of the asset. The second and third hypotheses test the conventional wisdom: the availability of short selling reduces the occurrences of bubble formation. Miller (1977), for example, argues that the cause of asset market bubbles is a constraint on the ability of traders to speculate on future downward movements of prices. Following this line of thought, we make two hypotheses, one strong and the other weaker.

Hypothesis 2: In the presence of short selling, prices track fundamental values.

The second, weaker conjecture states that relaxing short selling restrictions does not necessarily lead to prices tracking the fundamentals. The restrictions simply increases the supply of assets, thereby reducing their equilibrium price. This leads us to the next hypothesis:

Hypothesis 3: In general, short selling reduces price levels.

The last attribute of the real estate market considered in our experiments is the lumpiness or (in)divisibility of the asset. The standard microeconomic theory requires that for the competitive equilibrium, we need the goods to be (infinitely) divisible. In the real world, not many goods meet this requirement. The indivisibility of assets is, perhaps, most pronounced in the real estate markets. This follows from the fact that even the smallest investment, whether it is a piece of land, a residential or a commercial property, requires a significant capital outlay. For all practical purposes, it is impossible to break a single real estate investment into smaller units. Shares of real estate investment trusts (REITs), which are public or private companies which invest in real estate, are a notable exception. Directly-held real estate, however, is relatively indivisible compared to financial assets. The fourth hypothesis states that this indivisibility of real assets reduces the efficiency of the market.

Hypothesis 4: Prices track fundamentals more closely in a market with divisible assets than in a similar market with lumpy assets.

III. Experimental Design and Procedures

A. General Structure

The experimental sessions are conducted at the Pennsylvania State University. The subjects are undergraduate and graduate students enrolled at the three respective universities. Subjects were not allowed to participate in more than one session. Each session lasts about 90 minutes. Subjects receive US$5 dollars for participation, in addition to the money they earn based on their performance in experiments. Actual earnings ranged from US$6.81 to US$41.21, and average earning was US$19.59.

Our sessions are complimentary to those of Haruvy and Noussair. For that reason, we review their design here and relate it to ours. Table I shows the summary information about the five treatments considered in this paper. The NSS and CR100 treatments are conducted by Haruvy and Noussair (2006). The TC, MA, and NSS-MA treatments are conducted by us at Penn State.

The parametric structure of the experiments is based on "Market 4" in Smith et al. (1988). There are 15 trading periods in each session. At the end of each trading period, the asset (which is called "share" in the experiment) pays a dividend that is determined by an independent four-point distribution. A roll of a four-sided die determines which one of the dividends will be paid per share for that period. The four possible values of dividends are 0, 8, 28 and 60 francs (the experimental currency), for the TC, NSS, and CR100 treatments and 0, 2, 7, and 15 francs for the MA and NSS-MA treatments. The expected dividend stream per period is 24 francs for the TC, NSS, CR100 treatments and 6 francs for the MA and NSS-MA treatments. In this experiment, dividends are the only source of value for the share, so the fundamental value of the share is equal to the expected future dividend stream. Thus, the fundamental value of the share in any period t equals $24*(16-t)$ francs for the TC, NSS, CR100 treatments and $6*(16-t)$ francs for the MA and NSS-MA treatments.

This particular market structure is chosen for several reasons. First, this is a very simple market that makes sharp predictions about the price levels. Calculating the fundamental values of the shares in each period is straightforward. Therefore, should bubbles and crashes occur, we can readily observe them. Second, we only

need to consider the informational efficiency here. We need not worry about the allocational or production efficiency. In our experiment, all traders have identical preferences expressed by the dividend structure, so theory does not make any predictions about allocational efficiency. Likewise, there is no production, so we cannot speak of production efficiency. Therefore, we will say that the market is efficient if it is informationally efficient, i.e. if prices are equal or close to fundamental values. Third, this particular design is known in most trials to produce bubbles, whose existence seems to be relatively robust to many changes in the market organization. This allows us to analyze the occurrence of bubbles with institutional changes, such as introducing transaction costs, relaxing short selling restrictions, and increasing the aggregate supply. Fourth, using the same parameters allows us to directly compare our results to those of previous studies, including Smith et al. (1988) and Haruvy and Noussair (2006) and make sharper predictions about the impact of transaction costs, short selling and the divisibility of the asset.

In each session, subjects participate in a market for an asset which has a 15-period life. We use a fictitious currency called "francs" during experiments. At the end of each session, the traders' money balances in francs are converted to US dollars. The subjects are paid in dollars. The conversion rate is 100 francs = 1 US dollar. In the TC, NSS, and CR100 treatments, each share provides dividends of 0, 8, 28, and 60 francs with equal likelihood. Since the dividends are the same to all traders, traders have identical preferences. Traders only differ with respect to their endowments. There are three trader types and three subjects of each type (total of nine subjects) in each session. In the first three treatments, Type I traders have an endowment of 225 francs and 3 units of shares; Type II traders have 585 francs and 2 units; and Type III traders have 945 francs and 1 share. In the MA treatment, each share provides dividends of 0, 2, 7, and 15 francs, each with equal likelihood. Type I traders are endowed with 225 francs and 12 units of shares; Type II traders have 585 francs and 8 units; and Type III traders have 945 francs and 4 units. These parameters are chosen to make sure that the expected earnings from all four treatments are identical. The expected earning for all trader types is US$18.05 in all four treatments. The experimental design parameters are summarized in Table II.

We use the z-Tree software developed by Fischbacher (2007) to create an electronic continuous double auction market that is similar to the market environment created by Smith (1962).

Timing of the Sessions

Before conducting the sessions, we made sure that the subjects who had signed up to participate in the experiments had not participated in similar experiments before. This is important because prior experience has been repeatedly shown to affect the subjects' strategies in experimental asset markets. Upon arrival, the subjects receive written instructions explaining how the electronic auction market works, and how the subjects' earnings are calculated[7]. Then the experimenter reads the instructions aloud and goes through an exercise of making offers and bids, as well as buying and selling shares. The subjects are thus trained in the z-Tree interface. After the instructions are read and the experimenter answers all the questions the subjects may have, the subjects participate in three training periods, where they practice buying and selling shares. The earnings or losses during the training period do not count towards final earnings.

After the training period, the subjects participate in a market consisting of 15 four-minute periods. The subjects receive their initial endowments in francs and shares. These endowments differ depending on the trader type. In each session, there are 3 subjects of each type, for a total of 9 traders. During the four-minute trading period, subjects are free to buy and sell their shares, as long as they follow the rules. For example, in the NSS treatment, subjects are not allowed to short sell their shares. If a subject has no shares, but tries to sell a share, the computer does not allow it. The subjects' money balance, as well as their inventory of shares carries over from one period to the next, up to the last period (15th period). After the last dividend payout in period 15, the shares are worthless.
The money earned or lost in the 15 periods is converted into US dollars and the subjects are paid in US dollars at the end of the session. A subject's earnings in a session are equal to the initial money endowment plus dividends earned from shares held minus dividends paid on shares sold short (for CR100 and MA treatments) plus money earned from the sales of shares minus the money spent to buy shares.

IV. Results

We begin our analysis of the data with a visual inspection. Figures I – III present the median prices and trading volumes for each session for the five experimental treatments. Figure I shows the data from the TC and NSS treatments and highlights the main differences between the two treatments.

[7] Instructions for the TC treatment are provided in Appendix I. A screenshot of the main trading period is shown in Appendix II.

The left panels of Figure I indicate that bubbles occur in all five sessions of the TC and NSS treatments. Bubbles occur more frequently in the NSS treatment, in which the median price exceeds the fundamental value in 23 of the 30 periods (77%). In the TC treatment, the median price is higher than the fundamental value in 30 out of 45 periods (67%). In terms of volume, the number of trades is clearly higher in the NSS treatment.

Figure II shows the median price and volume information for the CR100 and MA treatments. In the CR100 treatment, the median price is lower than the fundamental value in 37 periods out of 45 (82%). Prices are lower than fundamental values in 19 of 45 periods (42%) of the MA treatment. More importantly, as the lower left panel of Figure II clearly indicates, prices are significantly closer to fundamentals in the MA treatment. The trading volume is higher in the CR100 treatment, which is somewhat surprising. This may be explained by lower dividend earnings per share in the MA treatment.

Figure III shows the median price and volume information for the NSS-MA treatment. Prices are lower than fundamental values in 23 of 45 periods (51%). Overall, the pattern of median trading prices is similar to that of the MA treatment. The first session of NSS-MA seems to be an exception, where the magnitude of the bubble is large.

From the left panel of Figure I, we can see that the NSS treatment is more inefficient than the TC session – the magnitude of the bubble is much larger in the NSS treatment. In supporting our results, we consider the effect of institutional changes on transaction prices at specific points in time. In our experiments, the natural measure of time is a trading period. We use the median transaction price[8] over all prices in a given period. We do not use other measures, such as the last transaction price or prices in the last few periods, because there is a very large variation in observed prices within a period. This is especially true for initial periods of all sessions.

The quantitative measures of quantitative analysis of efficiency are shown in Table III. We start the quantitative examination by defining two main measures of differences between median prices and fundamental values. These measures, *"Total dispersion"* and *"Average bias"*, are shown in the last two columns of Table III. *Total dispersion* is the sum (over 15 periods) of the absolute deviations of median period price from fundamental values. In equation form: $Total\ dispersion=\sum_t |MedianP_t - f_t|$, where $MedianP_t$ denotes the median transaction price in period t and f_t denotes the fundamental value in period t. A low *Total dispersion* means that asset prices closely correspond to fundamental values. A high *Total dispersion* means that prices diverge from fundamentals.

The other main measure of differences between median prices and fundamental values is the *Average bias*, which is the average over 15 periods of the deviation of median period price from fundamental value in the period. That is: $Average\ bias=\sum_t(MedianP_t - f_t)/15$, where $MedianP_t$ and f_t are the median transaction price and fundamental value in period t, respectively. If *Average bias* is close to 0, this means that on average prices are close to fundamentals. A large positive (negative) *Average bias* indicates that prices are on average much higher (lower) than fundamentals. *Average bias* is a measure of whether mean prices deviate from fundamentals, while *Total dispersion* is a measure of variability. It is possible for *Average bias* to be very low (if both positive and negative bubbles occur) but for *Total dispersion* to be high. Therefore, *Total dispersion* and *Average bias* together provide us with a much better understanding of the market than either measure by itself.

In addition to *Total dispersion* and *Average bias*, we use five other measures of trading volume and divergence of observed prices from fundamentals: *Amplitude, Normalized deviation, Turnover, Boom duration, and Bust duration. Amplitude* is the difference between the ratio of the highest deviation of average prices from fundamental value and the ratio of the lowest deviation of average prices from fundamental value. That is: $Amplitude=max_t\{(P_t - ft)/f_t\} - min_t\{(P_t -ft)/f_t\}$, where P_t and f_t are the average transaction price and the fundamental value, respectively. *Normalized deviation* is the deviation of all transaction prices, normalized by the total number of shares available. In equation form: $Normalized\ deviation=\sum_t\sum_i|P_{it} - f_t|/(100*TSU)$, where P_{it} is the price of the i^{th} transaction in period t, and *TSU* is the total stock of units that traders hold. *Turnover* is a measure of trading volume, which shows the trading volume in a session expressed in terms of total inventory of shares available. The formula is: $Turnover=(\sum_t q_t)/(TSU)$, where q_t is the quantity of units of the asset exchanged in period t and *TSU* is the total stock of shares that traders hold. *Boom duration* is the greatest number consecutive periods during which the median prices exceed fundamentals within a session. *Bust duration* is the greatest number of consecutive periods during which the median prices are below fundamentals within a session. Notice that *Boom duration* and *Bust duration* in a session need not add up to fifteen.

Result 1: In the presence of transaction costs, the difference between prices and fundamentals is smaller compared to the "zero transaction costs" treatment. In other words, the TC treatment is *not* less efficient than the NSS treatment. In fact, the TC treatment is more efficient.

[8] The results do not change significantly if we use mean trading prices instead of median prices.

Support for Result 1: Table III shows that the *Average Bias* is much lower in the TC treatment than in the NSS treatment. When averaged over all sessions, the *Average bias* is -2.42 for the TC treatment, compared to 42.8 for the NSS treatment. The *Total Dispersion* measure indicates that the variability of median prices from fundamentals is also lower in the TC treatment (1081 vs. 1320 in NSS). In addition, both *Amplitude* and *Normalized Deviation* measures are smaller in TC. As seen in the bottom left panel of Figure I, with zero transaction costs, very large bubbles form when short selling is not allowed. In the NSS treatment, the *Boom duration* (greatest number of consecutive periods that median transaction prices are above fundamental values) averages 11.5 periods.

While we also observe a bubble in the TC treatment, its magnitude is much smaller. This fact is somewhat surprising and contrary to our hypothesis. We conjecture that this is due to the low volume of trade. The significant difference between trading volumes is measured by the *Turnover* variable, which is shown in the fifth column of Table III. *Turnover* in NSS (12.20) is more than twice that of TC (4.81). Since traders must pay a 10% commission on every share they sell, they trade less actively. This significant transaction cost discourages less sophisticated or "naïve" traders, from participating in the market. Only the traders who are relatively sophisticated and can reasonably expect to make a profit from a trade participate.

The result that the TC treatment is more efficient is further supported by statistical tests. Table IV reports the results of Wilcoxon tests for comparing the means of the median prices in the five treatments and fundamental values over all 15 periods[9]. The reported values are normal approximations and the two-sided p-values are shown in parentheses. The null hypothesis is that the means of the median prices in the TC treatment and fundamental values are equal. The alternative hypothesis is that the samples compared have different means. As shown in Panel A of Table IV, we fail to reject the null hypothesis. The statistic is 0.18 and the p-value is 0.859. Therefore, the means of median prices in the TC treatment are not statistically different from the fundamental values.

Result 2: Under short selling, prices do not track fundamental values. Prices under the CR100 treatment are below fundamental values.

Support for Result 2: This result is strikingly clear from the top left panel of Figure II. Prices are lower than fundamental values in of 37 of 45 periods. In addition, Table II shows that under the CR100 treatment, the *Average Bias* is negative (-77.1). This would be extremely unlikely if the prices are equally likely to be above and below fundamental values. The CR100 treatment is also characterized by very active trading, as measured by the *Turnover* measure. Since median prices are significantly lower than fundamental values in all but 2 periods under CR100, we do not find support for Hypothesis 2.

Result 2 is also supported by the Wilcoxon tests. When we compare the means of median prices in the CR100 treatment and fundamental values for all 15 periods, we safely reject the null hypothesis at the 1% significance level. The statistic is 3.52 and the p-value is 0.000. When only the last 10 periods are considered, we reject the null hypothesis at the 10% level.

On the other hand, under short selling, prices do not track fundamentals. Rather, they are systematically lower compared to when short selling is not allowed. Indeed, when we look at the data, we find support for our Hypothesis 3.

Result 3: Prices are lower when short selling is allowed.

Support for Result 3: Under CR100 treatment, median transaction prices are significantly lower than in the NSS treatment. *Average Bias* is -77.1 in CR100. In other words, on average, the median prices are lower than fundamental values by 77 francs. This is a huge difference, considering the fact that fundamental values vary between 34 and 360 francs. In contrast, *Average Bias* is 42.8 in the NSS treatment. In addition, we can observe the bust and boom cycles. In the CR100 treatment, the *Bust cycles* (greatest number of consecutive periods that median transaction prices are below fundamental values) average almost 13 periods, in contrast to 3 periods in the NSS treatment. Prices only approach fundamental levels in the last 2-3 periods.

The hypothesis that the prices are lower in the CR100 treatment is confirmed by the tests as well. The null hypothesis that the median prices of NSS and CR100 treatments are equal is rejected at the 1% significance level, both when all 15 periods or the last 10 periods are considered. From Table IV, the statistics (p-values) are 4.90 (0.000) and 3.69 (0.000) for all 15 and last 10 periods, respectively.

[9] As Figures I-III reveal, there is considerable fluctuation in prices in the first few periods of all sessions. Therefore, it may argued that there is some learning occurring in the first few periods and one should only analyze the median transaction prices of the last 10 periods. With this in mind, we conduct the Wilcoxon tests comparing the median prices in all five treatments with the median prices of all other treatments and fundamental values over the last 10 periods. The results of these Wilcoxon tests are reported in Panel B of Table IV. When only the last 10 periods are considered, the overall results are largely consistent with the case when all 15 periods are considered.

Thus, we find that when short selling is allowed, prices are below fundamental values. One reason for this may be that short selling simply increases the supply of shares available. Assuming that demand for these types of assets is downward-sloping, increasing the supply would reduce the prices.

Next, we consider the MA treatment, which features a larger number of assets. This last treatment is introduced to test the effect of the "lumpiness" of real assets on the efficiency of the market.

Result 4: When short selling is allowed, prices track fundamentals more closely in a market with divisible assets than in a market with lumpy assets.

Support for Result 4: By any measure of market efficiency considered in this paper, MA performs significantly better than CR100. As can be seen from the left panels of Figure II, median transaction prices tend to follow fundamental values quite closely under the MA treatment. Neither *Boom cycles* (6 periods on average) nor *Bust cycles* (3.7 periods) are very long. *Average Bias* for MA is only -2.38, compared to -77.1 for CR100. Likewise, *Total Dispersion* (195 vs. 1,261.5), *Normalized Deviation* (0.8 vs. 26.91), *Amplitude* (0.91 vs. 1.92) all compare favorably against the CR100 treatment. Overall, the data supports our hypothesis that when assets are divisible, the market tends to be more efficient, with prices tracking fundamentals more closely.

Statistically, when we compare the median prices in the MA treatment to fundamental values, we fail to reject the null hypothesis that the means are equal. The statistic is 0.54 (0.19) and the p-value is 0.588 (0.847) when all 15 (last 10) periods are considered.

Finally, we consider the NSS-MA treatment. We have seen that the market is significantly more efficient when short selling is allowed *and* when the goods are divisible (in the MA treatment). However, the difference between the NSS and MA treatments is due to two factors: short selling and divisibility of the asset. Therefore, we cannot be certain which one of these factors is responsible for differences between the two treatments. The fifth treatment, NSS-MA, where the asset is divisible but short selling is not allowed, was designed to test the effect of divisibility only. In other words, the difference between NSS and CR100 is due to short selling; the difference between NSS and NSS-MA is due to divisibility. Data from NSS-MA yields the following result:

Result 5: Prices track fundamentals more closely in a market with divisible assets even when short selling is not allowed.

Support for Result 5: Compared to the NSS treatment, the NSS-MA treatment results in significantly more efficient prices. The *Average Bias* is only -0.91 (lowest among all treatments) compared to 42.8 for NSS. Likewise, *Total Dispersion* is only 218.7 compared to 1,320 for NSS. Statistically, the median transaction prices in the NSS-MA treatment are different from median prices in the NSS treatment (the statistic is 2.12, p-value is 0.034). Furthermore, median prices in NSS-MA are not statistically different from fundamental values (the statistic is 0.19, p-value is 0.85). Therefore, the market with divisible assets is efficient even when short selling is not allowed.

V. Conclusions and Future Directions

This paper incorporates some of the fundamental characteristics of the real estate market into the experimental spot markets which are designed to test for the efficiency of a market for a financial asset. The purpose is to measure how different institutional changes affect the efficiency of this experimental auction market. The changes in question are transaction costs, short selling restrictions and the divisibility of assets. Data from a total of 14 experimental sessions provide a number of interesting answers. First, introducing transaction costs to a market with short selling restrictions does not increase the occurrence and magnitude of price bubbles. On the contrary, prices are closer to fundamentals in the market with transaction costs than in the market with zero transaction costs. This implies that the reduction in transaction costs due to improvements in information technology might be contributing to overvaluation in markets. Second, relaxing the short selling constraint does not bring market prices near fundamental values. Third, allowing short selling merely reduces average transaction prices and drives them significantly below fundamentals, leading to negative bubbles. This result is consistent with previous studies' findings. Fourth, when assets are more divisible, prices seem to track fundamentals more closely. This may partially explain why real estate markets, where assets are extremely bulky, are less efficient than financial markets. Fifth, when short selling is not allowed, but the assets are more divisible, prices are close to fundamental values.

We do not claim that all of the potential sources of inefficiencies in real estate markets have been explained here. Our hope is that this paper is a good first step in examining the unique features using a relatively novel methodology. Experimental research into the efficiency of real estate markets can be further developed in several ways. First, we need to consider additional characteristics which make real estate unique. The most

important of these include the heterogeneity of assets, costliness of obtaining information, and illiquidity. We plan to design and conduct additional experiments incorporating these features, contingent on the availability of research funding. Second, this study yields interesting results which can be analyzed empirically, using field data. For example, two implications from the TC treatment are that in presence of transaction costs, a) prices are less volatile and b) the prices follow the fundamental values more closely. Both of these hypotheses are empirically testable. We plan to continue analyzing the effect of transaction prices in an empirical study. In particular we plan to compare transaction costs associated with buying and selling real estate across metropolitan statistical areas (MSAs) and test whether these costs affect the volatility of real estate prices.

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Table I

Information about the sessions

Three sessions for each of the TC, MA, and NSS-MA treatments were conducted. All of these nine sessions were conducted at Penn State from between January and September of 2007. Data from the NSS and CR100 treatments are adopted from Haruvy and Noussair (2006). They conducted two sessions of the NSS treatment and three sessions of the CR100 treatment at Emory and University of Texas at Dallas.

Session	Treatment	Experimenter	Conditions
1	TC	Ikromov	No short sales permitted, sellers charged a 10% commission, endowments of Types I, II, III are 1, 2, and 3 shares, respectively.
2	TC	Ikromov	No short sales permitted, sellers charged a 10% commission, endowments of Types I, II, III are 1, 2, and 3 shares, respectively.
3	TC	Ikromov	No short sales permitted, sellers charged a 10% commission, endowments of Types I, II, III are 1, 2, and 3 shares, respectively
4	NSS	Haruvy&Noussair	No short sales permitted, endowments of Types I, II, III are 1, 2, and 3 shares, respectively.
5	NSS	Haruvy&Noussair	No short sales permitted, endowments of Types I, II, III are 1, 2, and 3 shares, respectively.
6	CR100	Haruvy&Noussair	Cash balance ≥ 24*(16-t)*(net short position) , endowments of Types I, II, III are 1, 2, and 3 shares, respectively.
7	CR100	Haruvy&Noussair	Cash balance ≥ 24*(16-t)*(net short position) , endowments of Types I, II, III are 1, 2, and 3 shares, respectively.
8	CR100	Haruvy&Noussair	Cash balance ≥ 24*(16-t)*(net short position) , endowments of Types I, II, III are 1, 2, and 3 shares, respectively.
9	MA	Ikromov	Cash balance ≥ 6*(16-t)*(net short position), endowments of Types I, II, III are 4, 8, and 12 units, respectively.
10	MA	Ikromov	Cash balance ≥ 6*(16-t)*(net short position), endowments of Types I, II, III are 4, 8, and 12 units, respectively.
11	MA	Ikromov	Cash balance ≥ 6*(16-t)*(net short position), endowments of Types I, II, III are 4, 8, and 12 units, respectively.
12	NSS-MA	Ikromov	No short sales, cash balance ≥ 6*(16-t)*(net short position), endowments of Types I, II, III are 4, 8, and 12 units, respectively.
13	NSS-MA	Ikromov	No short sales, cash balance ≥ 6*(16-t)*(net short position), endowments of Types I, II, III are 4, 8, and 12 units, respectively.
14	NSS-MA	Ikromov	No short sales, cash balance ≥ 6*(16-t)*(net short position), endowments of Types I, II, III are 4, 8, and 12 units, respectively.

Table II

Experimental design parameters

The initial endowments and the dividend structure are identical in the TC, NSS, and CR100 treatments. In these three treatments, Type I traders receive 225 francs and 3 units of share; Type II traders receive 585 francs and 2 units; and Type III traders receive 945 francs and 1 unit of share. Each share yields a dividend of 0, 8, 24, 0r 60 francs with equal likelihood in each period. The expected dividend per period is 24 francs. The fundamental value of a share in the first period is 360 francs and decreases by the expected dividend each period. In the MA and NSS-MA treatments, Type I traders receive 225 francs and 12 units of share; Type II traders receive 585 francs and 8 units; and Type III traders receive 945 francs and 4 units of share. Each share yields a dividend of 0, 2, 7, 0r 15 francs with equal likelihood in each period. The expected dividend per period is 6 francs. The fundamental value of a share in the first period is 90 francs and decreases by the expected dividend each period.

Treatment	Endowment (francs; units of shares)			Dividend, francs (p=1/4)	Expected dividend per period, francs	Intrinsic (dividend) value per share in Period 1, francs
	Type I	Type II	Type III			
TC	(225;3)	(585;2)	(945;1)	(0, 8, 28, 60)	24	360

NSS	(225;3)	(585;2)	(945;1)	(0, 8, 28, 60)	24	360
CR100	(225;3)	(585;2)	(945;1)	(0, 8, 28, 60)	24	360
MA	(225;12)	(585;8)	(945;4)	(0, 2, 7, 15)	6	90
NSS-MA	(225;12)	(585;8)	(945;4)	(0, 2, 7, 15)	6	90

Table III

Observed Values of Bubble Measures

This table reports the observed values of various measures of the magnitude of bubbles in each of the 4 treatments. *Amplitude*=$max_t\{(P_t - ft)/f_t\} - min_t\{(P_t - ft)/f_t\}$, where P_t and f_t are the average transaction price and the fundamental value, respectively. *Normalized deviation*=$\sum_t\sum_i|P_{it} - f_t|/(100*TSU)$, where P_{it} is the price of the i^{th} transaction in period t, and *TSU* is the total stock of units that traders hold. *Turnover*=$(\sum_t q_t)/(TSU)$, where q_t is the quantity of units of the asset exchanged in period t. The boom and bust durations are the greatest number of consecutive periods that median transaction prices are above and below fundamental values, respectively. *Total dispersion*=$\sum_t |MedianP_t - f_t|$, where $MedianP_t$ denotes the median transaction price in period t. *Average Bias*=$\sum_t(MedianP_t - f_t)/15$.

Session number	Treatment	Amplitude	Norm. deviation	Turnover	Boom duration	Bust duration	Total dispersion	Average bias
1	TC (1)	1.39	6.07	5.72	10	5	861	-5.6
2	TC (2)	1.53	3.31	1.89	12	1	841	9.4
3	TC (3)	2.42	11.09	6.83	7	6	1541	-11.1
	Avg TC	1.78	6.82	4.81	9.67	4	1081.0	-2.42
4	NSS (1)	1.98	3.46	8.39	12	3	533	23.8
5	NSS (2)	3.25	25.50	16	11	3	2,107	61.8
	Avg NSS	2.61	14.48	12.20	11.5	3	1,320	42.8
6	CR100 (1)	3.84	57.77	41.33	2	13	1,855	-114.2
7	CR100 (2)	1.25	13.60	18.11	4	10	925	-50.4
8	CR100 (3)	0.66	9.36	11.89	1	14	1,004.5	-66.8
	Avg CR100	1.92	26.91	23.77	2.3	12.7	1,261.5	-77.1
9	MA (1)	0.98	0.58	2.5	2	7	252.5	-14.30
10	MA (2)	0.36	0.49	4.93	5	1	89.5	-4.9
11	MA(3)	1.40	1.33	8.78	11	3	243	12.07
	Avg MA	0.91	0.8	5.40	6	3.7	195	-2.38
12	NSS-MA(1)	2.91	3.77	16.94	10	3	273	16.1
13	NSS-MA(2)	1.56	0.77	9.43	6	4	110.5	-0.63
14	NSS-MA(3)	1.46	1.46	5.69	0	15	272.5	-18.17
	Avg NSS-MA	1.65	1.99	10.69	5.3	7.3	218.67	-0.91

Table IV. Statistical significance of the Wilcoxon tests

This table reports the results from the Wilcoxon tests comparing the sample means of median transaction prices in the five treatments compared to fundamental values and median prices in other treatments.

The null hypothesis is that the means of the two groups are equal. Panel A is compiled by comparing means of median transaction prices in all 15 periods. Panel B is compiled by comparing means of the last 10 periods.

p-values are shown in parantheses.

* indicates significance at the 10% level

** indicates significance at the 5% level

*** indicates significance at the 1% level

Panel A: Wilcoxon test results - All 15 periods

Null hypothesis: The difference of means of median prices in two samples = 0

	FundP	TC	NSS	CR100	MA	NSS-MA
FundP	-					
TC	0.18					
	(0.859)	-				
NSS	-1.88	-2.17**				
	(0.060)*	(0.029)	-			
CR100	3.52***	4.53***	4.90***			
	(0.000)	(0.000)	(0.000)	-		
MA	0.54	0.46	2.15**	-2.88***		
	(0.588)	(0.643)	(0.032)	(0.004)	-	
NSS-MA	0.190	0.49	2.12**	-3.657***	-0.367	
	(0.850)	(0.623)	(0.034)	(0.000)	(0.714)	-

* Median prices for the MA and NSS-MA treatments are multiplied by 4.

Panel B: Wilcoxon test results – Last 10 periods

Null hypothesis: The difference of means of median prices in two samples = 0

	FundP	TC	NSS	CR100	MA	NSS-MA
FundP	-					
TC	-2.43**					
	(0.015)	-				
NSS	-3.08***	-1.27				
	(0.002)	(0.205)	-			
CR100	1.78*	3.56***	3.69***			
	(0.094)	(0.000)	(0.000)	-		
MA	-0.19	1.79*	2.77**	-1.23		
	(0.847)	(0.074)	(0.018)	(0.220)	-	
NSS-MA	-0.92	0.68	2.06**	-1.82*	-0.36	
	(0.355)	(0.496)	(0.039)	(0.069)	(0.717)	-

* Median prices for the MA and NSS-MA treatments are multiplied by 4.

Figure I. Time series of median transaction prices and volumes over time, TC and NSS treatments. The panels on the left show median transaction prices for periods 1 through 15. In period 10 of the TC treatment, there was no trade. For that period, the median price is taken as the average of median prices in periods 9 and 11. In the TC treatment, no short selling is allowed, and sellers are charged a transaction cost of 10% of the selling price on every transaction. In the NSS treatment, there is no transaction cost, but short selling is not allowed. The dotted line is the fundamental value, which is equal to the expected value of the dividend stream of one unit of share. The panels on the right show transaction volume in terms of the number of shares bought and sold.

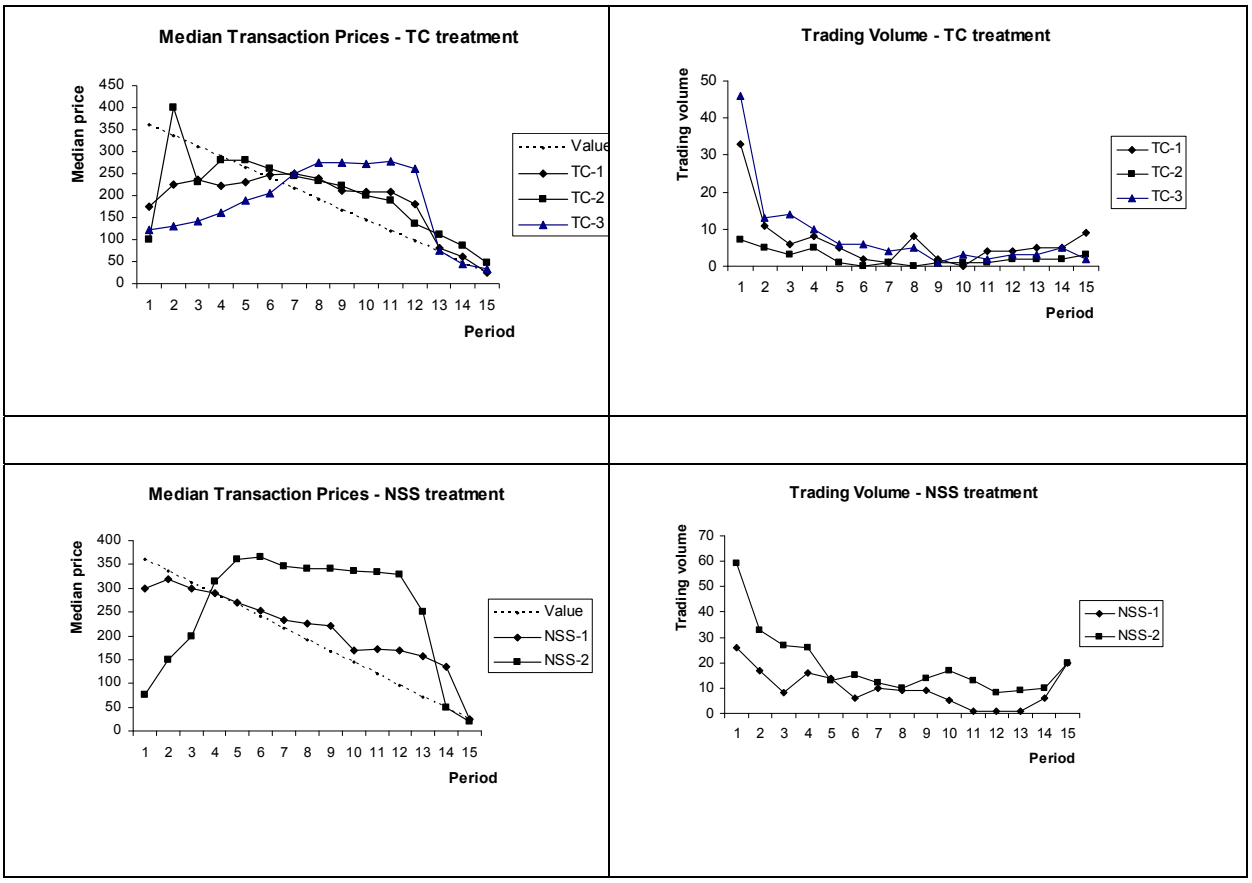
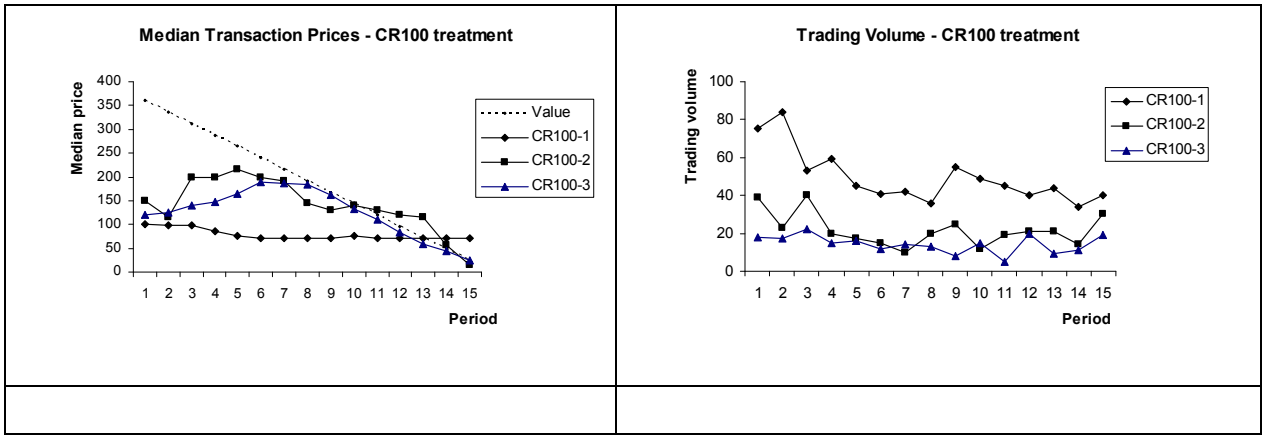


Figure II. Time series of median transaction prices and volumes over time, CR100 and MA treatments. The panels on the left show median transaction prices for periods 1 through 15. The dotted line is the fundamental value, which is equal to the expected value of the dividend stream of one unit of share. In the CR100 treatment, traders can short sell shares, but must keep cash balance greater than or equal to the expected dividend value of their short positions. In the MA treatment, the number of assets available is four times that in other treatments and the dividends are one-fourth of dividends in the TCC, NSS and CR100 treatments. The panels on the right show transaction volume in terms of the number of shares bought and sold.



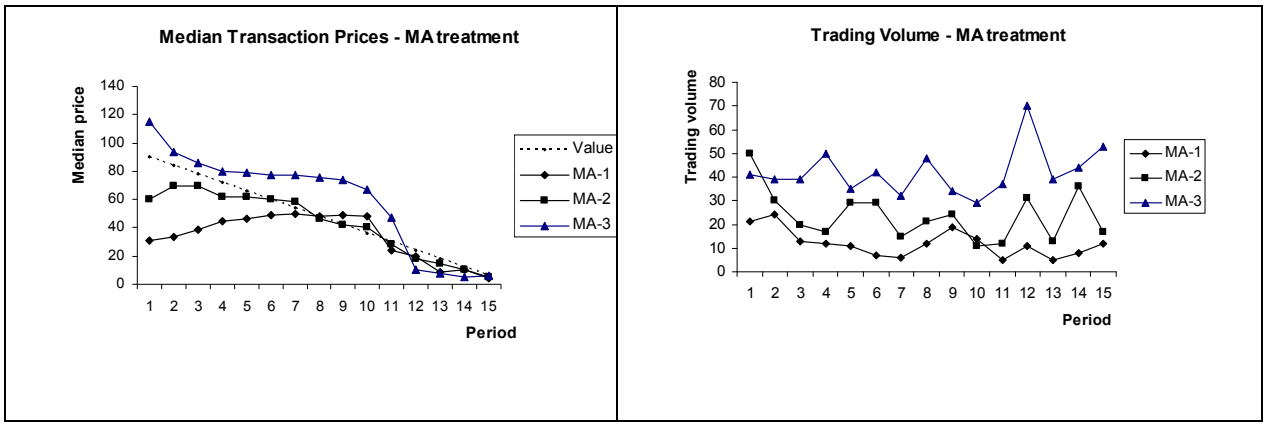
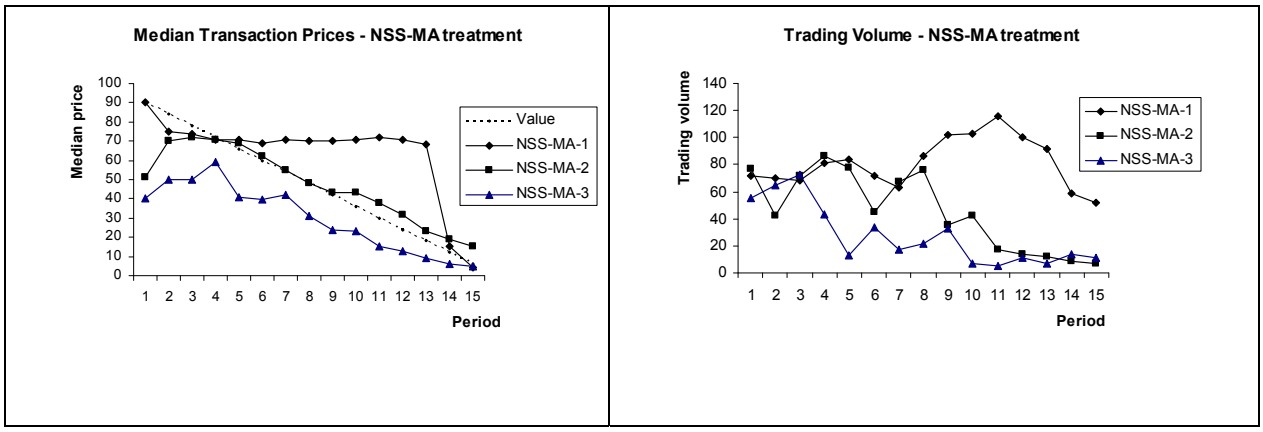


Figure III. Time series of median transaction prices and volumes over time, the NSS-MA treatment. The panels on the left show median transaction prices for periods 1 through 15. The dotted line is the fundamental value, which is equal to the expected value of the dividend stream of one unit of share. In this treatment, there is no transaction cost, but short selling is not allowed. The number of assets available is four times that in other treatments and the dividends are one-fourth of dividends in the TCC, NSS and CR100 treatments. That is, the starting balance of francs and shares available to Trader types I, II, and III are (225, 12), (585, 8), and (945, 4), respectively. The panels on the right show transaction volume in terms of the number of shares bought and sold.



Appendix I

Instructions for the Transaction Costs Treatment

Instructions for Treatment 1 (TC)

1. General Instructions

This is an experiment in the economics of market decision making. These instructions explain how the decisions you make determine your earnings from this session. The experiment will consist of a sequence of trading periods in which you will have the opportunity to buy and sell in a market. The currency used in the market is francs. All trading will be in terms of francs. The cash payment to you at the end of the experiment will be in dollars. The conversion rate is 100 francs to 1 dollar. In addition to any profits you earn in the market, you will also receive an additional $5 (equivalent to 500 francs) for your participation today.

2. How to use the computerized market

The goods that can be bought and sold in the market are called Shares. On the left-most column of your computer screen, in top left corner, you can see the Money you have available to buy Shares and in the middle of the column, you see the number of Shares you currently have.

If you would like to offer to sell a share, use the text area entitled “Enter ask price” in the second column. In that text area you can enter the price at which you are offering to sell a share, and then select “Submit Ask Price”. Please do so now.

You will notice that nine numbers, one submitted by each participant, now appear in the third column from the left, entitled "Ask Price". The lowest ask price will always be on the bottom of that list and will be highlighted. If you press "Buy", the button at the bottom of this column, you will buy one share for the lowest current ask price. You can also highlight one of the other prices if you wish to buy at a price other than the lowest.

Please purchase a share now by highlighting a price and selecting "Buy". Since each of you had put a share for sale and attempted to buy a share, if all were successful, you all have the same number of shares you started out with. This is because you bought one share and sold one share.

When you buy a share, your Money decreases by the purchase price. When you sell a share, your Money increases by 90% of the sales price (this will be explained later).

You may make an offer to purchase a unit by selecting "Submit bid price."

Please do so now. Type a number in the text area "Enter bid price." Then press the red button labeled "Submit Bid Price".

You can sell to the person who submitted an offer if you highlight the offer, and select "Sell". Please do so now for one of the offers.

3. Specific Instructions for this experiment

The experiment will consist of 15 four-minute trading periods. In each period, there will be a market in which you may buy and sell shares. Shares are assets with a life of 15 periods, and your inventory of shares carries over from one trading period to the next. You may receive dividends for each share in your inventory at the end of each of the 15 trading periods.

At the end of each trading period, including period 15, the experimenter will roll a four-sided die to determine the dividend for the period. Each period, each share you hold at the end of the period:

earns you a dividend of 0 francs if the die reads 1
earns you a dividend of 8 francs if the die reads 2
earns you a dividend of 28 francs if the die reads 3
earns you a dividend of 60 francs if the die reads 4

Each of the four numbers on the die is equally likely. The average dividend in each period is 24. The dividend is added to your cash balance automatically.

After the dividend is paid at the end of period 15, there will be no further earnings possible from shares.

4. Selling more shares than you own

In this market, you cannot sell more shares than you own. That is, you may not own a negative number of shares.

5. Commissions

In this market, when you SELL a share, you pay 10 percent of the selling price as "sales commission". For example, if A sells one share to B for 60 francs, then B pays A 60 francs, but A only receives 54 francs (60 – 60*10% = 54). You may think of this as the experimenter acting as a broker who charges sellers (but not buyers) a 10 percent commission. Thus, when you sell a share, 10% of the selling price is automatically deducted from your Money.

6. Average Holding Value Table

You can use your AVERAGE HOLDING VALUE TABLE to help you make decisions. There are 5 columns in the table. The first column, labeled Ending Period, indicates the last trading period of the experiment. The second column, labeled Current Period, indicates the period during which the average holding value is being calculated. The third column gives the number of holding periods from the period in the second column until the end of the experiment. The fourth column, labeled Average Dividend per Period, gives the average amount that the dividend will be in each period for each unit held in your inventory. The fifth column, labeled Average Holding Value Per Unit of Inventory, gives the average value for each unit held in your inventory from now until the end of the experiment. That is, for each unit you hold in your inventory for the remainder of the experiment, you will earn on average the amount listed in column 5.

Suppose for example that there are 7 periods remaining. Since the dividend on a Share has a 25% chance of being 0, a 25% chance of being 8, a 25% chance of being 28 and a 25% chance of being 60 in any period, the

dividend is on average 24 per period for each Share. If you hold a Share for 7 periods, the total dividend for the Share over the 7 periods is on average 7*24 = 168.

Therefore, the total value of holding a Share over the 7 periods is on average 168.

AVERAGE HOLDING VALUE TABLE

Ending Period	Current Period	Number of Holding Periods	x	Average Dividend Per Period	=	Average Holding Value Per Share in Inventory
15	1	15		24		360
15	2	14		24		336
15	3	13		24		312
15	4	12		24		288
15	5	11		24		264
15	6	10		24		240
15	7	9		24		216
15	8	8		24		192
15	9	7		24		168
15	10	6		24		144
15	11	5		24		120
15	12	4		24		96
15	13	3		24		72
15	14	2		24		48
15	15	1		24		24

7. Your Earnings

Your earnings for the experiment will equal the amount of cash that you have at the end of period 15, after the last dividend has been paid, plus the $5 you receive for participating. The amount of cash you will have is equal to:

The money you have at the beginning of the experiment

+ dividends you receive for the shares you own

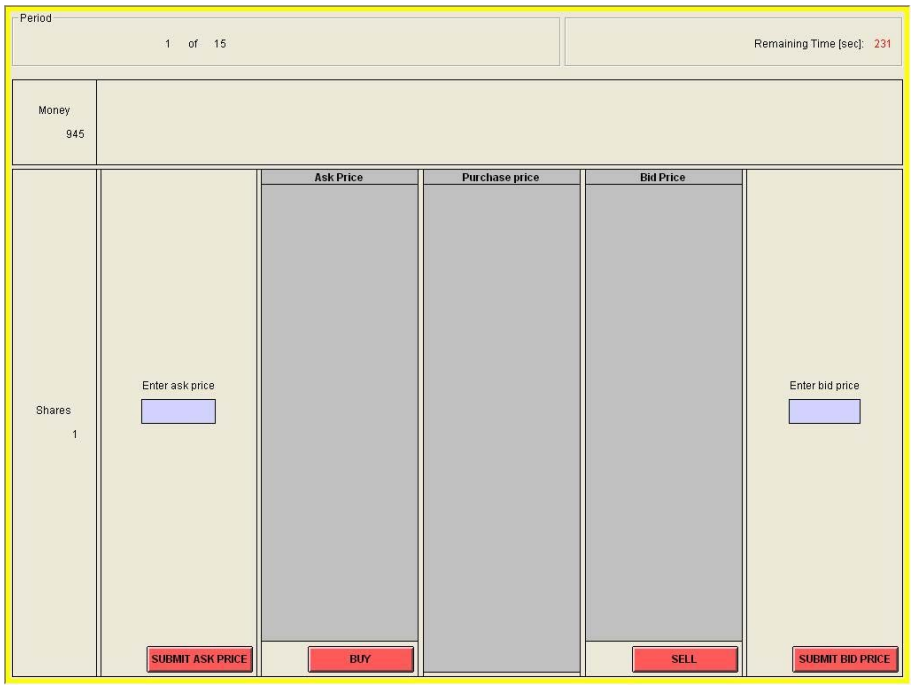
+ money received from sales of shares

- money spent on purchases of shares

You will now play in a practice period. Your actions in the practice period do not count toward your earnings and do not influence your position later in the experiment. The goal of the practice period is only to master the use of the interface. Please be sure that you have successfully submitted bid prices and ask prices. Also be sure that you have accepted both bid and ask prices. While you are selling a share, notice the 10% difference between your selling price and the money you actually receive. It is important that you do not talk or in any way try to communicate with other people during the experiment. If you violate the rules, you will be asked to leave the experiment. You are free to ask questions, by raising your hand, at any time during the experiment.

Appendix II

A Screenshot of the Main Trading Period


Period
1 of 15
Remaining Time [sec]: 231
Money
945
Shares
1
Enter ask price
Ask Price
Purchase price
Bid Price
Enter bid price
SUBMIT ASK PRICE
BUY
SELL
SUBMIT BID PRICE

MICRO MODELLING

Modelling Spatial Variations in Consumer Demand with Geographic Weighted Regression

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Abstract

This paper investigates the spatial pattern of fresh fish demand in the Philippines using a model that allows demand elasticities to vary across the country and by taking into account the spatial dependence of the data. To enhance visualization and interpretation, province (location)-specific demand elasticities are mapped using geographic information system's data and modeling tools. The results reveal distinct spatial fresh fish demand structures, which justify location-specific policy interventions. The paper concludes by providing summary conclusions and directions for further research.

1. Introduction

A number of economic processes like consumer demand have spatial aspects and are governed by unobserved influences that manifest in space. This paper provides insights on the importance of incorporating spatial dimension in fresh fish demand analysis using data from the Philippines. Specifically, the objective of the paper is to investigate the spatial structural differences in fresh fish demand using a spatial econometric framework that allows demand elasticities to vary across the country and by taking into account the spatial dependence of the data. To enhance visualization and interpretation, province (location)-specific demand elasticities are mapped using geographic information system's (GIS) data and modeling tools.

The analysis is based on the hypothesis that consumption structure varies across locations and that neighboring locales are more influential in the consumption behavior of a particular area than distant ones. The intuition behind this hypothesis is that regions in close proximity to one another may exhibit similar consumption pattern due to inherent common spatial influences such as climate, resources, regional market influences, production similarities, socio-demographic and economic structure, etc[1].

The next section (Section 2) presents the methodology which includes the conceptual and theoretical framework, the empirical models and the data used followed by the discussion of the results in Section 3. The paper concludes by providing concluding remarks and directions for further research.

2. Methodology

2.1. Conceptual Theoretical Framework

Marketing science literature indicates that geographic differences in consumption are due to two main factors or landscapes, namely: (i) behavioral or "psychological" landscapes, which can be fleshed-out into economic- and non-economic (socio-demographics, historical, religious, cultural, etc.) factors, and (ii) "physical landscapes", which include climate, topography, natural resources, etc (Figure 1)[2].

In a parallel literature, the consumer demand theory postulates that the economic-related landscape is the most important determinant of demand (Salvatore 2003). Specifically, the most direct influence on demand is exercised by the price of the commodity itself (i.e. own-price factor), price of substitute products (relative or cross-price factor, i.e. the price of fresh fish relative to substitute products, e.g. meat, processed fish, etc.) and disposable income. Similarly, it is postulated that to gain a more complete explanation of consumer demand, non-economic determinants that include a whole range of factors, such as traditions (religion), family size (population structure), actual availability of the commodity (supply), must also be included.

---

[1] Studies that support empirically the existence of regional variation/spatial association in consumption behavior, consumer lifestyle, values, and attitude are provided in Hawkins et al. (1981), Kahle (1986), Gentry et al. (1988) and Parker and Tavassoli (2000). Empirical support from international segmentation research studies is provided by Ter Hofstede et al. (2002) and Steenkamp (2001).

[2] Factors associated with the physical landscape directly influence the usage situations that consumers face. These, in turn, influence consumption patterns through "homeostatic influences" outlined in Parker (1995) and Parker and Tavassoli (2000). Factors associated with the "psychological" or behavioral landscape can affect consumer values, motivations, and preferences, which, in turn, determine consumer lifestyles and consumption patterns.

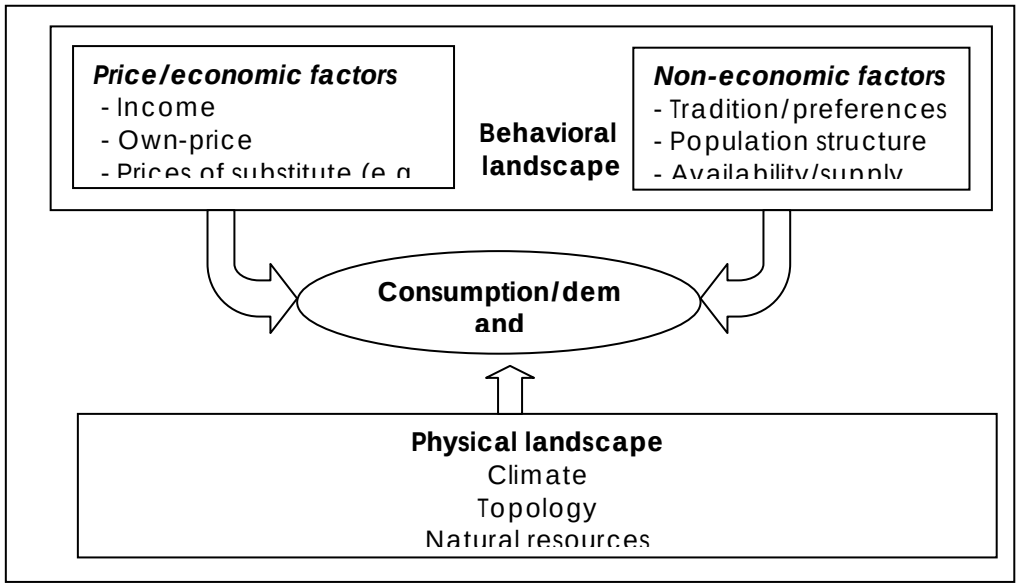

Figure 1. Geographic, demographic and socio-economic influences in consumer behavior

Denoting y as the amount of fresh fish demanded, and x as a vector of determinants consisting of economic variables such as income (I), prices (P) and non-economic and/or physical variables (Z) so that $x = \{I, P, Z\}$, the conceptual framework (Figure 1) can be translated into an econometric model:

$$y = x\beta + \varepsilon \quad (1)$$

where β is a vector of the parameters to be estimated and ε is the random error term that is $N(0,\sigma^2)$.

Equation 1 resembles an aggregated fresh fish demand model which assumes that consumption behavior is homogenous across the country. To allow for spatial behavioral changes in demand, location-specific aggregate fresh fish demand functions that account for the spatial dependence in the data are estimated using a Geographic Weighted Regression (GWR) framework (Fotheringham et al. 2002)[3]. The GWR aggregate fresh fish demand model takes the form:

$$y_i = W_i x_i \beta_i + \varepsilon_i \quad (2)$$

where y and x are as defined earlier. W represents a spatial weight matrix with (n x n) elements w_{ij} that define the neighborhood structure of the locations (observations). Specifically, W is expressed as relative weights of locations that are assumed to decrease or decay at an empirically determined rate as their distance from the focal location i increases. Simply put, the spatial heterogeneity is operationalized by this weighting scheme (W) so that locations closer to the focal point will have more weight. In particular, the weighting scheme is defined by an exponential distance-based decay function as follows[4]:

$$w_{ij} = e^{\left(-d_{ij}^2/\theta\right)} \quad (3)$$

where d_{ij} is the Euclidean distance between locations i and j that are derived from the longitude-latitude coordinates of the centroid for each location (in this case province). The optimal bandwidth, θ, is the distance decay parameter and is determined using the least-squares cross-validation procedure suggested by Cleveland

[3] The GWR model has been applied in agriculture and environmental analysis (Nelson and Leclerc 2001), spatial dimension of poverty-determinant relationships (Benson et al. 2005; Kam et al. 2005) and in regional income convergence (Eckey et al. 2007).

[4] The exponential distance-decay function is the most commonly used in the literature. Other approaches include the tri-cube function and Gaussian function. For more information, please refer to LeSage (1999).

(1979). Cross-validation basically relies on a scoring function taking the form shown in (equation 4) to determine the optimal value for θ :

$$\sum_{i=1}^{n}\left(y_i-\hat{y}_{\neq i}(\theta)\right)^2 \qquad (4)$$

where $\hat{y}_{\neq}(\theta)$ represents the fitted value of y with the observations from the focal location i omitted from the calibration process (for simplicity the *Ln* notation was omitted). A value of θ that minimizes this score function is used as the bandwidth for calculating the weight matrix (Fotheringham et al. 2002).

2.2. Empirical model

In light of the conceptual and theoretical framework presented above, the empirical global aggregate fresh fish demand function is specified using a Cobb-Douglas (double log) specification of the form:

$$\begin{aligned} Ln(y_i) &= \alpha+\delta Ln(I_i)+\sum_{j=1}^{k(=4)}\gamma_j Ln(P_{ij})+\sum_{j=1}^{l(=5)}\xi_j Ln(Z_{ij})+\varepsilon \\ &= \alpha+\sum_{j=1}^{10}\beta_j Ln(x_{ij})+\varepsilon_i\ , \end{aligned} \qquad (5)$$

where *Ln* refers to the natural logarithm, y_i is the average per capita total annual fresh fish consumption in the i^{th} province, I is the average per capita annual income, P is the vector of prices (i.e. prices of fresh fish and substitutes) and Z is a vector of non-economic and physical variables, the α, β, δ, $\gamma$and ξ are the corresponding parameters of the model to be estimated. Specifically, β is a function of δ, γ, ξ while ε_i is a vector of error terms assumed to be $N(0,\sigma^2)$. The list of the variables used in the model is presented in Table 1, with their corresponding symbols and descriptions.

Table 1. List of variables used in the analysis

Variables		Parameters/elasticities	
Symbol	Description	Symbol	Description
Y	Per capita fresh fish consumption (kg/yr)		
I	Per capita income (PhP/yr)	δ	Income elasticity
P_1	Price of fresh fish (PhP/kg)	γ_1	Own-price elasticity
P_2	Price of processed fish (PhP/kg)	γ_2	Cross-price elasticity
P_3	Price of meat (PhP/kg)	γ_3	Cross-price elasticity
P_4	Price of cereals (PhP/kg)	γ_4	Cross-price elasticity
Z_1	Per capita fish supply from aquaculture (kg/yr)	ξ_1	
Z_2	[a] Per capita fish supply from municipal fisheries (kg/yr)	ξ_2	
Z_3	[b] Per capita fish supply from commercial fisheries (kg/yr)	ξ_3	
Z_4	[c] Provincial poverty threshold (PhP)	ξ_4	
Z_5	Household size (number)	ξ_5	

Notes: 1 US$ = PhP 40.55

[a] "Commercial fisheries" refer to the catch/harvest of operations beyond 15 kilometers from the shore using boats weighing more than 3 gross tonnes (BAS 2002)

[b] "Municipal fisheries" refer to the catch/harvest of operations within 15 kilometers from the shore using boats weighing less than 3 gross tonnes (BAS 2002).

[c] It should be noted that by definition, "poverty threshold" is an economic variable. However, since it is not normally used as a consumption-determinant variable, it is included under non-economic variables (Z) in this paper.

By virtue of logarithmic transformation (i.e., Cobb-Douglas specification), the parameter estimates of the demand model can be interpreted as elasticities[5]. In particular, δ is the income elasticity of demand, which measures the percentage change in fresh fish demand (Δy) relative to a one per cent change in the income (I), *ceteris paribus* (Henderson and Quandt 1980); γ_i is the own-price elasticity of demand that measures the percentage change in the fresh fish demand (Δy) relative to a one per cent change in its price (P_1), $\gamma_2 - \gamma_4$ are cross-price elasticities that measure the percentage change in fresh fish demand relative to a one per cent change in the price of other commodities; $\xi_1 - \xi_3$ measures the effect of supply from different sources, ξ_4 measures the effect of an increase in the overall cost of basic needs to fish consumption, and ξ_5 measures the effect of the household size[6].

The sign of δ is expected to be positive for commodities that are characterized as normal goods (i.e. demand increases as income increases)[7]. On the contrary, the direction of γ_1 is expected to be negative (i.e., the demand for fresh fish decreases when its own-price increases)[8]. The relationship between fresh fish and another commodity j is reflected in the direction (sign) of the cross-price parameters (γ_j). A positive cross-price coefficient means that the goods are substitutes while a negative cross-price coefficient suggests that the goods are complements.

2.3. Sources of Data and Software Used

The main source of data was the Family Income and Expenditure Survey (FIES) for the year 2000, which was collected by the National Statistics Office. The price data were generated from the Consumer Price Index Survey (CPIS) of the same year, which was only available at the provincial level[9]. Fish production data were extracted from the Bureau of Agricultural Statistics (BAS 2002). The province-specific poverty lines were collected from the National Statistical Coordination Board (NSCB) website (http://www.nscb.gov.ph/psgc).

Analyses were also conducted separately for low-income (poor) and high-income (non-poor) households where low-income households were defined as those households whose basic needs expenditures were lower than the provincial poverty line, while the high-income households are defined as those whose expenditures were higher than the poverty line. The location-specific demand functions were estimated with GWR software (Charlton et al. 2003), using an exponential decay function weighting scheme, W.

3. Results and discussion

3.1 Descriptive analysis and spatial pattern

An average Filipino consumes around 33 kg of fish annually which is slightly higher than the Asian average of 27 kg/cap/yr. Fresh fish represents around 59% (19 kg/cap/yr) of the total fish consumption and the remaining 49% are in processed form, e.g., canned, dried, smoked or salted (Table 2). Comparing the consumption across household types, on the average high-income households consumed more than twice (24 kg/cap/yr) that of the low-income households (11 kg/cap/yr). However, the share of fish in the total animal protein expenditure (which includes meat, poultry and fish) is relatively higher among the low-income households (64% vs. 49%). This reflects the strong dependence of poor households on fish as a source of animal protein.

Table 2. Descriptive summary, Philippines, 2000

[5] The theory of demand also postulates that demand functions are homogenous of degree zero in prices and income (i.e. if prices and income increase at the same proportion, then there should be no change in demand). However, we were not able to impose the restriction in the local estimates (i.e., GWR), thus all estimates reported in this paper are from unrestricted models. A comparison of the restricted and unrestricted global estimates however showed only minor differences in magnitude and no difference in the directions (signs).

[6] On the one hand, it could be argued that there will be multicollinearity among the independent variables (e.g. between income and poverty threshold, and between supply and own-price of fresh fish etc.), a diagnostic test using the variance inflation factor (VIF) on the global parameters showed no severe multicollinearity problem in the data set. The maximum VIF value found was only 2 which is statistically acceptable. On the other hand, it could be argued that with the presence of supply variables in a demand model one has to consider endogeneity issue.

[7] A negative income elasticity of demand denotes that the corresponding commodity is an inferior one, which in general is highly unlikely in the case of fresh fish in the Philippines.

[8] This inverse quantity-price relationship is called the *Law of Demand*. In the case where the relationship is directly proportional (i.e. positive), the commodity is said to be a *giffin* commodity. When the magnitude is high (i.e. $\gamma_1 > 1$), the commodity is said to be elastic (i.e., a slight increase in price results in an abrupt change in the quantity demanded). Otherwise, it is inelastic.

[9] Note that the FIES contain fish/food expenditures on monetary terms, hence the corresponding quantities were generated by dividing fish expenditure with the provincial-specific prices from the CPIS.

Items (samples: as % of the total)	Household type: Low-income (poor) (33 %)	High-income (non-poor) (67 %)	All (100%)
Variables used in the fresh fish demand function			
Annual per capita fresh fish consumption (kg)	10.83	24.43	19.48
Annual per capita income (PhP)	9,578	36,751	27,405
Price of fresh fish (PhP/kg)	59.37	62.85	61.68
Price of processed fish (PhP/kg)	28.37	29.52	29.28
Price of meat (PhP/kg)	94.46	98.95	96.20
Price of cereals (PhP/kg)	14.09	18.52	16.01
Annual per capita fish supply from aquaculture (kg)	14.54	14.54	14.54
Annual per capita fish supply from municipal fisheries (kg)	12.49	12.49	12.49
Annual per capita fish supply from commercial fisheries (kg)	12.50	12.50	12.50
Provincial poverty threshold (PhP)	11,679	11,679	11,679
Household size (number)	6.22	4.55	5.04

1 US$ = PhP 40.55

The spatial distribution of fresh fish consumption by province across the country is shown in Figure 2. The figure shows that households from the coastal provinces of central Philippines (i.e., Visayas region) consumed a larger amount of fresh fish than those from land-locked or inland provinces located in the northern (Luzon) and southern (Mindanao) portions of the country. These regional differences in consumption could be due to differences in the availability of fish supply, which in turn is mainly attributed to access in fishing grounds or aquaculture opportunities of fish farmers.

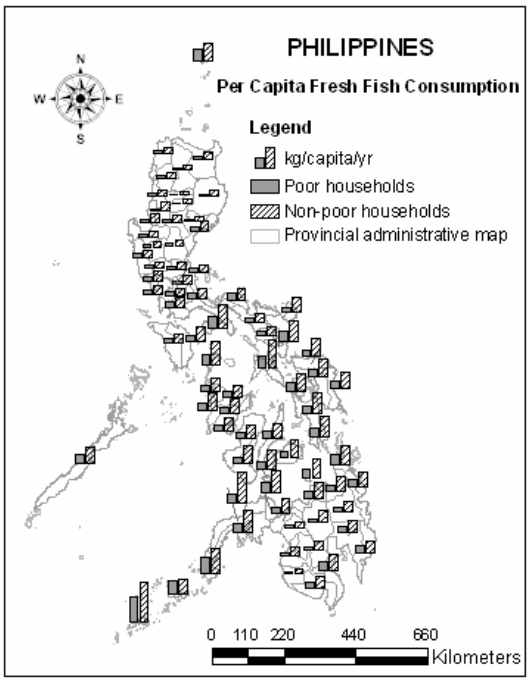

Figure 2. Spatial pattern of annual per capita fresh fish consumption by household type (kg/capita/year), Philippines, 2000

3.2 Global elasticity estimates

The global elasticities of demand are presented in Table 3. In general, the estimated elasticities suggest that fresh fish is a necessity and a normal commodity for both types of households since the income elasticities (δwere found to be positive and less than unity. Further, the results reveal that the low-income households are more sensitive to price-changes and to changes in the cost of basic needs (represented by the poverty threshold variable). The results also suggest that the low-income households appeared to be more dependent on fish from municipal waters (γ_4= 0.09) than the high-income households (γ_4= 0.05). This could be explained by the high concentration of poor households in the coastal areas. On the other hand, because of the export orientation of most commercial fisheries, fish supply coming from this sector are hardly intended for domestic consumption. Similarly, since aquaculture supply is still low (about 40%) compared to the total supply from fisheries (both from municipal and commercial fishery), the effect of this sector on fresh fish demand is still minimal. More reliable supply from expansion of the aquaculture sector suggests promising prospects.

Table 3. Global elasticities of fresh fish demand by household type, Philippines, 2000.

Variable description		Low-income		High-income		All	
Constant		1.21		4.57	***	4.18	**
Ln(per capita income)	δ	0.46		0.47	***	0.59	***
Ln(price of fresh fish)	γ_1	-0.90	***	-0.85	***	-0.91	***
Ln(price of processed fish)	γ_2	0.02		0.06		0.07	
Ln(price of meat)	γ_3	0.83	**	0.89	***	0.98	***
Ln(price of cereals)	γ_4	0.26		0.01		0.08	
Ln(per capita fish supply from aquaculture)	ξ_1	0.001		0.01		0.02	
Ln(per capita fish supply from municipal capture)	ξ_2	0.09	***	0.05	***	0.05	***
Ln(per capita fish supply from commercial fisheries)	ξ_3	-0.001		-0.02		-0.01	
Ln(poverty threshold)	ξ_4	-0.57		-0.77	***	-0.79	***
Ln(household size)	ξ_5	0.56		-0.04		-0.68	
Adj. R^2		0.72		0.75		0.75	

*- significant at $\alpha = 0.10$ ** - significant at $\alpha = 0.05$ *** - significant at $\alpha = 0.01$.

3.3 Local elasticity estimates

The results of the local estimates of the fresh fish demand function estimated using GWR framework are summarized in Table 5. Specifically, the table presents the minimum and maximum values of the estimated demand elasticities and the number of significant local elasticities as a percentage of the total observation (provinces). Also, the compatibility of the signs of the local elasticities with respect to the global estimates were evaluated and presented in the table. Results show that the local elasticities vary from negative to positive, flanking the global estimates. This is a clear indication that there are spatial structural changes in fresh fish demand which is location-specific. In particular, the global income elasticity of demand indicates that, on average, fresh fish is a normal commodity ($\delta > 0$), while the local estimates indicate that 11-32 per cent of the total number of provinces consider fresh fish as an inferior commodity ($\delta < 0$). The maximum income elasticity greater than unity ($\delta > 1.0$) also suggests that there are provinces where fresh fish is a luxury commodity. In the same manner, the absolute minimum local own-price elasticity greater than unity ($|(\gamma_1| > 1.0$) suggest that there are areas where fresh fish is highly price-elastic. A formal test on the significance variability of the local elasticities was also conducted using Monte Carlo simulation (Fotheringham et al. 2002). The results indicate that there are significant spatial variations in the local income elasticities and in supply elasticities from municipal fisheries. These support the earlier results that geographical variation in fresh fish demand exists.

The map of local income-elasticity of demand for combined households is depicted in Figure 3. The results suggest that fresh fish is a luxury commodity in the Northern provinces ($\delta > 1$), which are characterized by low supply and consumption of fresh fish. On the contrary, in the Bicol region (southern Luzon), fresh fish is found to be an inferior commodity ($\delta < 0$). A close examination of the data reveals that consumers in these provinces are more dependent to aquaculture supply (i.e., highest ξ_1) and are characterized by a negative response to municipal fisheries (ξ_2).

Table 4. Minimum and maximum local elasticities in relation to the global estimates, Philippines, 2000

	Low-income household					High-income household					All				
	Global	Local				Global	Local				Global	Local			
		Min	Max	Same sign[a] (%)	Signi-ficant[b] (%)		Min	Max	Same sign[a] (%)	Signi-ficant[b] (%)		Min	Max	Same sign[a] (%)	Signi-ficant[b] (%)
Intercept	1.21	-1.78	8.75			4.57	3.64	5.87			4.18	-3.80	26.44		
Income	0.46	-1.17	1.53	68	36	0.47	0.34	0.50	89	59	0.59	-1.45	1.67	89	59
Fresh fish price	-0.90	-1.11	-0.44	100	88	-0.85	-1.07	-0.66	100	70	-0.91	-1.58	0.15	96	70
Processed fish price	0.02	-0.19	0.30	62	0	0.06	0.03	0.10	100	76	0.07	-0.20	0.41	59	1
Meat price	0.83	-0.46	2.61	76	13	0.89	0.81	1.00	100	80	0.98	-2.77	2.42	78	18
Cereals price	0.26	-0.84	1.11	58	11	0.01	-0.06	0.20	93	56	0.08	-0.81	0.88	29	4
Aquaculture supply	0.00	-0.06	0.05	66	0	0.01	-0.01	0.02	86	22	0.02	-0.06	0.16	86	22
Municipal fisheries supply	0.09	0.02	0.10	100	76	0.01	0.04	0.05	100	43	0.05	-0.21	0.17	93	43
Commercial fisheries supply	0.00	-0.05	0.05	57	0	-0.02	-0.02	-0.01	100	22	-0.01	-0.10	0.07	71	22
Poverty threshold	-0.57	-2.01	1.26	75	12	-0.77	-0.86	-0.53	100	57	-0.79	-1.67	1.08	86	57
Household size	0.56	-2.99	1.23	38	9	-0.04	-0.37	0.10	100	20	-0.68	-3.29	1.65	92	20
R^2	0.72	0.62	0.95			0.75	0.79	0.90			0.75	0.73	0.98		

[a] Cases of same sign as global (%)

[b] Cases for which b_i is significant (%)

** Significant at α=0.05

*** Significant at α=0.01

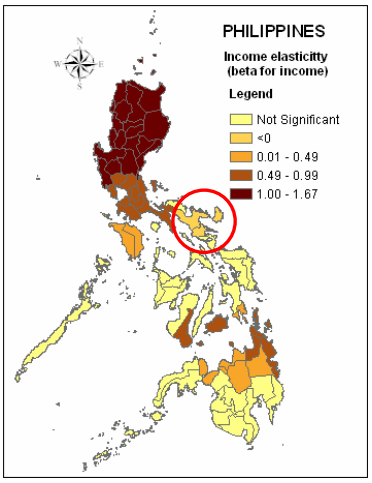

Figure 3. Distribution of

The map of the own-price elasticity is presented in Figure 4. The map shows two clusters (groups) of provinces where fresh fish is elastic ($|(\gamma 1 | > 1.0)$. The first cluster is among the provinces of central Luzon and the extending provinces in the north, while the second cluster is among the provinces in southern Mindanao. Both groups are in the neighborhood of province(s) that are primary producers of milkfish and tilapia. These are the provinces of Bulacan and Pangasinan in Luzon and the province of South Cotabato in Mindanao.

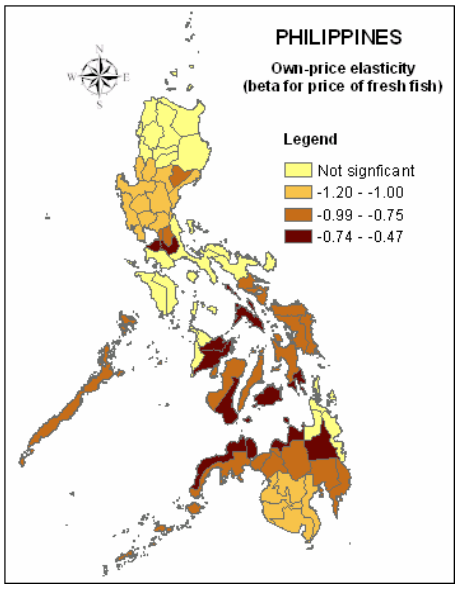

Figure 4. Distribution of Own-Price Elasticity.

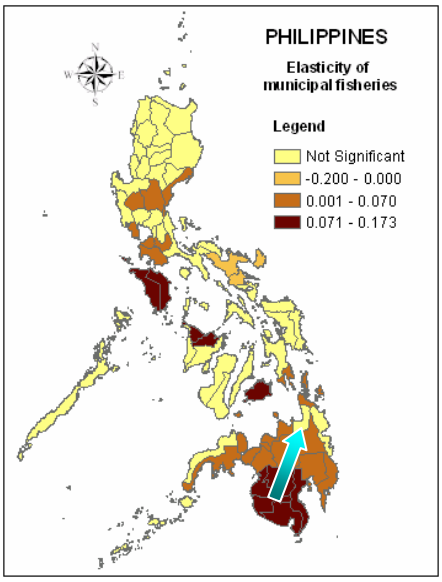

Figure 5. Distribution of Supply Elasticity from Municipal Fisheries.

Figure 5 mapped the local elasticities of municipal fisheries. A spillover effects on fish demand in southern Philippines (Mindanao) was observed. Supply elasticities of municipal fisheries highest in South Cotabato and its adjacent provinces as well as in some other coastal provinces. This could be due to the fact that South Cotabato is a primary producer of marine fish as it has the largest fish-landing site in the country. As distance from South Cotabato increases, the supply elasticities for marine fisheries decreased.

4. Summary, conclusion and Recommendation

This paper presents an investigation of the spatial pattern of fresh fish demand in the Philippines. A fresh fish demand model is estimated using GRW that allows demand elasticities to vary across the country taking into account the spatial dependence of the data. To enhance visualization and interpretation, province (location)-specific demand elasticities are mapped using GIS data and modeling tools.

Results showed that fresh fish consumption varies geographically across the country. Specifically, households from the coastal provinces basically located in central Philippines (Visayan region) consumed higher amount of fresh fish than households from the land-locked areas in the northern (Luzon) and southern (Mindanao) regions. These spatial differences in consumption could be due to the differences in resource endowments or access to fishing grounds, i.e. the physical landscape. As different fish species are produced in different environments, it is also expected that fish consumption and production by species will vary geographically.

The results from the GWR analysis revealed clusters of provinces with distinct consumption patterns. Fresh fish was found to be a luxury commodity in the Northern Luzon where fish supply is low. In the neighborhood of primary producers of fish (e.g., milkfish and tilapia), fresh fish is found to be elastic- a slight increase in the price will result in an abrupt decrease in the quantity demanded. In the coastal provinces of the Bicol region, fish is found to be an inferior commodity. Households in these areas have high response for aquaculture supply (i.e., high ξ_1) and are characterized by a negative response to municipal fisheries (i.e., $\xi_2 < 0$). One distinct spatial consumption pattern is the spillover effects of marine fisheries on fish demand in southern Philippines (i.e., Mindanao). It was found that provinces near the coastal areas of South Cotabato, which is a primary producer of marine fish, have a higher elasticity on fish from municipal waters. As their distance from South Cotabato increases, the supply elasticities for marine fisheries decreased.

As demonstrated in the paper, GWR has a strong potential in establishing regional differences in fresh fish demand in an aggregate framework. However, it has been argued that fish is heterogenous commodity (Westlund et al. 1995; Smith et al. 1998; Dey 2000). Thus, a system of demand equations (see for example Dey 2000; Kumar et al. 2006; Garcia et al. 2006) extended to account spatial hetogeneity and dependence remains a topic for further study. The current framework however can be similarly useful in evaluating geographic impacts of economic policies, technology and infrastructure development not only in the fisheries sector but for other sectors as well. Taking into account these geographical factors has important implications for policy formulation, e.g., social safety nets, say, in the form of food subsidies, can be more effective if it is possible to use region-specific behavioral parameters to locate those communities that are most vulnerable to food

insecurity. Their implied effects on consumption linkages, could be an additional tool for targeting the areas with scarce capital and resource endowment.

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