AN EMPIRICAL ANALYSIS OF THE RELATIONSHIP BETWEEN FINANCIAL DEEPENING AND ECONOMIC GROWTH: THE CASE OF TURKEY

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ABSTRACT

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This study aims to investigate the direction of the relationship between financial deepening and economic growth after the completion of financial liberalization in Turkey. In order to do this, an unbalanced panel data set of 49 OECD and emerging countries for 1953-2005 period is examined with Granger causality and panel data estimation techniques. In the light of panel data analysis results, quarterly Turkish time series data for 1987-2006 period is examined by using Granger causality, cointegration and Vector Error Correction Model (VECM) procedures. Although the unbalanced panel data analysis reveals a relationship that is from financial deepening to economic growth, country specific Granger causality analysis employed with the panel data gives the opposite relationship for Turkey. Moreover, it is observed that quarterly time series data analysis mainly gives a relationship that is from economic growth to financial deepening.

Keywords: Financial Deepening, Economic Growth, Granger Causality, Vector Error Correction Model, Panel Data.

ÖZ

FİNANSAL DERİNLİK İLE EKONOMİK BÜYÜME ARASINDAKİ İLİŞKİ ÜZERİNE AMPİRİK BİR ÇALIŞMA: TÜRKİYE ÖRNEĞİ

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Çalışma, Türkiye'de finansal liberalizasyon sürecinin tamamlanmasının ardından finansal derinlik ve ekonomik büyüme arasındaki ilişkinin yönünü araştırmayı amaçlamaktadır. Bunun için OECD ve gelişmekte olan ülkelerden oluşan 49 ülkenin 1953-2005 dönemindeki dengeli olmayan panel verileri, Granger nedensellik ve panel veri tahmin yöntemleri ile incelenmektedir. Panel veri analizinin sonuçları ışığında, Granger nedenselliği, eşbütünleşme ve Vektör Hata Düzeltme Modeli prosedürleri kullanılarak Türkiye'ye ait 1987-2006 dönemi 3 aylık zaman serisi verisi incelenmiştir. Dengeli olmayan panel veri analizinin finansal derinlikten ekonomik büyümeye doğru bir ilişki göstermesine rağmen, yine panel veri üzerinde ülkeye özel yapılan Granger nedensellik testi Türkiye için tam ters bir ilişkiyi ortaya çıkarmaktadır. Ayrıca 3 aylık zaman serisi verilerinin analizi ile de genel olarak ilişkinin ekonomik büyümeden finansal derinliğe doğru olduğu gözlenmektedir.

Anahtar Kelimeler: Finansal Derinlik, Ekonomik Büyüme, Granger Nedenselliği, Vektör Hata Düzeltme Modeli, Panel Veri.

To My Family

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CHAPTER 1

INTRODUCTION

This thesis aims to find a relationship between financial deepening and economic growth for Turkey using both panel data of 49 OECD and emerging market countries containing Turkey and time series quarterly data of Turkey from 1987Q1 to 2006Q4. The relationship between financial deepening and economic growth has attracted significant attention in the economics literature. Since understanding the link between financial sector and economic growth has important regulatory implications, interest on this relationship is increased.

Economic growth is increase in value of goods and services produced in an economy. Since the emergence of growth theory, many researchers tried to answer the questions why countries grow, how long-run growth rate could be achieved and what are the causes behind the steady state growth rate. Some theorists focus on the effect of financial sector effectiveness on economic growth. This leads to emergence of the concept of financial deepening which can be defined as the development in quality, quantity and efficiency of financial sector.

In the literature, there are many theoretical and empirical studies on the relationship between financial deepening and economic growth. Theoretical studies evolve in accordance with the evolution of economic growth literature and the theories on economic growth. Firstly, financial liberalization approach is introduced and with this approach it is claimed that money increases economic growth process. On the other hand, opponents of this approach introduced financial repression concept that money has a role of decreasing economic growth process of an economy. With emergence of endogenous growth models, studies examine the link between financial sector and economic growth from a

different perspective. These studies analyze the relationship between financial deepening and economic growth, according to properties of the financial sector's functions. Financial sector serve the functions of information producing, capital allocation, investment monitoring, easing the trading, diversification and management of risk, mobilization and pooling of savings and easing the exchange of goods and services (Levine, 2004).

Attention on the link between financial sector and real sector leads to differing ideas on the relationship. Some authors claim that direction of causality is from financial deepening to economic growth while opponents argue that the relationship is from economic growth to financial deepening. This bi-directional relationship was first introduced by Patrick (1966) and used in many of the empirical studies.

Based on the theoretical models, many empirical studies are carried out. These studies can be classified into three different categories. Cross-country studies, such as King and Levine (1993a) and Calderon and Liu (2002) use panel and cross-section data in the investigation of the relationship. In firm or industry-level studies panel and cross-section data is used and in Demirgüç-Kunt and Maksimovic (1998) this methodology is used. The last category is country specific approach which is used in the studies by Kularatne (2001) and Waqabaca (2004) and time series data is used in these studies. Besides these studies, there are some others examining Turkish data. Among them some of the researches use time series annual data while some of them use pooled data.

Since we try to find the link between financial deepening and economic growth, there should be some proxies measuring each one of them. The growing body of literature gives us many different economic growth and financial deepening proxies. Natural logarithm of real Gross Domestic Product (GDP), annual growth rate of real Gross Domestic Product (GDP), per capita Gross Domestic Product (GDP), growth of real Gross Domestic Product (GDP) per capita and

per capita Gross National Product (GNP) are some of the measures used as proxy for economic growth. Moreover, there are many different proxies which could be categorized into three different classes. The first category consists of measures such as natural logarithm of private credit, private sector credit as a ratio of GDP and share of private sector credit to domestic credit. On the other hand, broad money (M2) to GDP ratio and financial savings to GDP ratio are some other proxies that belong to the money market. The last category has the following proxies which are from stock market: volume of transactions to GDP share and ratio of total capitalization to GDP.

In the literature, cross-country studies investigate the relationship between financial deepening and economic growth with the panel data technique. On the other hand, in most of the time series studies the relationship is examined by Granger causality test in a Vector Autoregression (VAR) and Vector Error Correction (VEC) context. Therefore, we use both of the methodologies in the analysis of this relationship.

This study mainly investigates the relationship for Turkey. Therefore, cross-country analysis of 49 countries for 1953-2005 period is employed to find a general view of the direction of finance growth relationship. After this, time series quarterly data from 1987Q1 to 2006Q4 is used in country-specific analysis. The contribution of this thesis will be that it employs quarterly time series data. Moreover, the period it covers has the property of more intense financial sector activities. After 1980 financial liberalization was officially begun. Until 1987 many reforms were made and after 1987 financial deepening and financial sector activities started to increase.

This study is outlined as follows: Chapter 1 gives a brief introduction to the study. In Chapter 2, historical evolution of financial sector in world and in Turkey is provided. Chapter 3 explains the theoretical framework of the relationship between financial deepening and economic growth. In Chapter 4,

empirical studies, related with financial deepening and economic growth, are presented. While Chapter 5 provides world panel data analysis, Chapter 6 is devoted to the analysis of Turkish time series data. Finally, Chapter 7 concludes the study.

CHAPTER 2

FINANCIAL EVOLUTION OF WORLD AND TURKEY

This chapter first provides an overview of the conditions that have significant effects on world financial structure along with some world economic indicators. Next, it presents developments in the Turkish financial sector for 1980-2006 period.

2.1. World Financial Structure[1]

Economic conditions reveal changes over time and countries adopt their financial systems according to the new environment. One important phenomenon that causes changes in financial markets is the economic globalization all around the world. Mishkin defines economic globalization as "the opening up of economies to flows of goods, services, capital, and businesses from other nations that integrate their markets with those abroad" (2006, p.1). The level of globalization may change according to each country. It is this level of globalization in one country that determines the effect of other countries' economic conditions on a single country's economy. Thus, financial market of each country is affected from this interrelationship. Mishkin also defines financial globalization as "movement of capital and financial firms across borders" (2006, p.2). In the following paragraphs of this section, the history of world economic globalization in the perspective of financial markets is briefly mentioned.

The process of globalization can be traced far back to the 1870s. In that period international trade and capital flows across countries started to increase. Although increase in the rate of international trade and capital flows across

[1] This part is adopted from Mishkin (2006).

countries declined with the advents of World War I and World War II, the financial globalization started to increase again, after 1945. Between the period of World War I and World War II, Great Depression started in the United States in 1929 and affected almost all countries in the world.

Table 2.1 World Trade to GDP Ratios

	World Total Exports/GDP	**World Total Imports/GDP**	**World Trade Balance/GDP**
1980	16.48%	16.59%	-0.11%
1981	16.46%	16.24%	0.22%
1982	15.24%	15.51%	-0.27%
1983	14.30%	14.65%	-0.36%
1984	14.50%	15.19%	-0.69%
1985	14.22%	14.84%	-0.62%
1986	13.04%	13.65%	-0.61%
1987	13.44%	13.94%	-0.50%
1988	13.74%	14.28%	-0.54%
1989	14.24%	14.72%	-0.48%
1990	14.55%	14.98%	-0.43%
1991	14.21%	14.71%	-0.50%
1992	15.02%	15.52%	-0.50%
1993	14.66%	14.99%	-0.33%
1994	15.57%	15.89%	-0.33%
1995	16.74%	17.08%	-0.34%
1996	17.09%	17.52%	-0.43%
1997	18.39%	18.74%	-0.35%
1998	18.27%	18.67%	-0.41%
1999	18.23%	18.73%	-0.50%
2000	20.02%	20.66%	-0.64%
2001	19.43%	20.07%	-0.65%
2002	19.59%	20.03%	-0.44%
2003	20.27%	20.76%	-0.49%
2004	21.88%	22.54%	-0.66%
2005	23.16%	23.71%	-0.55%
2006	24.81%	25.27%	-0.46%

Sources: International Financial Statistics of IMF
and http://www.econstats.com/weo/V019.htm

After World War II, to be able to promote economic activities across countries, International Monetary Fund (IMF) and International Bank for Reconstruction and Development, known as World Bank, were established. Besides these foundations, in 1947, General Agreement on Tariffs and Trade (GATT) was enacted. These institutions helped increase in international economic activities and world trade grew at a rate of 11% annually on average, since 1973. With this growing rate, world trade has come to 42% of world GDP in 2000s, while capital flows have come to 21% of world GDP. Table 2.1 shows world trade to world GDP ratios between 1980 and 2006. These ratios may be regarded as proxies for economic globalization. Although both shares of exports and imports in world GDP decreased after 1982, ratio of exports and imports to GDP started to increase after 1987.

Table 2.2 Global Capital Flows

	Gross Global Capital Flows*	**Gross Global Capital Flows / World GDP**
1995	1,540	5.50%
1996	1,880	6.40%
1997	2,470	8.70%
1998	1,820	6.20%
1999	3,000	10.00%
2000	4,000	13.60%
2001	2,590	9.00%
2002	2,210	7.10%
2003	3,060	9.40%
2004	5,000	13.00%
2005	6,170	15.00%

* billion dollars (rounded)
Source: IMF, International Financial Statistics

Mishkin emphasizes that northern rich countries were involved in financial globalization more than emerging markets and poor countries for the purpose of risk diversification. Although there is a rise in capital inflows to emerging

markets during the last few years, capital flows mainly occur among rich countries. Table 2.2 shows global capital flows and the ratio of global capital to world GDP for 1995-2005 period. Global capital flows gives an idea about world financial globalization. It can be interfered from Table 2.2 that capital flows reveal a fluctuating pattern. In 1990s and early 2000s, some emerging countries experienced severe financial crisis: 1994-1995 Mexico crisis, 1997-1998 South Korea (or Asia) crisis, 1998 Russia crisis, 1999 Ecuador crisis, 2001 Turkey crisis and 2001-2002 Argentina crisis. During the crisis period, it is observed that capital flows to world GDP ratios declined.

2.2. Turkish Financial Structure

2.2.1. Pre-1989 Period

Although this study takes into account the period after completion of financial liberalization (post-1989), it is worth mentioning briefly the process of financial liberalization and financial deepening in Turkey between 1923 and 1970. Özçam (1999, p.2) mentions that during the first years of the Republic of Turkey, financial system was developed into a liberal view with the help of developments in banking sector. After 1930s, financial system was under control of state and in 1950s, liberalism was again the issue but it could not be implemented (Özçam, 1999, p.2). After this period, five year development plans were prepared under control of state. During 1970s, the number of private sector companies was increasing and this led to a rise in primary and secondary market activities. In spite of this development, financial system showed a bank based structure until 1980s.

Ekinci (1996), Esen (2000) and Özatay and Sak (2002) are among the studies that try to explain the financial evolution of post-1970 Turkey. All these studies

examine the financial liberalization period in three sub-periods. The first sub-period consists of the period between 1970 and 1979. The second sub-period is the reform period of the 1980s and the last part is post-1989 period. The first sub-period is treated as the pre-reform period. The second sub-period is the reform period and the last sub-period is the post-implementation of the reform period.

Table 2.3 Some Macroeconomic Indicators

	1972-1980	1981-1988	1989-1999	2000-2006
Real growth rate of GDP (%)	3.7	4.8	3.0	5.3
PSBR/GNP	6.5	4.0	9.7	7.4
Inflation Rate (CPI)	39.0	38.1	87.0	33.8
Imports/GNP	11.5	13.7	20.2	30.6
Exports/GNP	4.8	9.3	13.4	19.8
Foreign Trade/GNP	-6.7	-4.4	-6.8	-10.8
Private Sector Credit/GNP *			57.8	66.9

Sources: 1972-1999 period is adopted from Voyvoda and Yeldan (2001)
2000-2006 period is calculated with the data from EDDS of CBRT.
* Whole period ratio is calculated with the data from EDDS of CBRT.

Esen summarizes that, during 1970s, Turkey had a development strategy based on "industrialization drive, inward looking import substitution strategy and high degree of protectionism" (2000, p.7). Due to negative shocks to the world economy together with the internal shocks, during 1970s, Turkish economy and financial system were severely affected. Therefore, most of the macroeconomic indicators were adversely changed. As it is presented in Table 2.3, with low level of exports and high level of imports of raw materials and investment goods, Turkey experienced insufficiency in foreign exchange which restricted investment and growth. Besides these properties, current account deficit, which was mainly financed by short-term borrowing, was rising between 1975 and 1977 and credits of foreign lenders stopped.

In pre-1980 period financial sector had some important features. Since 1940s, there was control on the interest rates. Government's development strategy was based on import substitution and the main instrument was directed credit loans. Moreover, the capital account was controlled by the government and existence of entry barriers to banking sector was limiting competition (Denizer, 2000, p.2). In this period, the system showed a financial repression with fixed real interest and exchange rates, high tax burden on financial earnings, high liquidity and reserve ratios and preferential credit allocations (Balkan and Yeldan, 2002; Günçavdı and Küçükçiftçi, 2005). Furthermore, lack of capital market made corporations rely on banking credits to finance their operations. Fiscal deficits were financed by Central Bank through monetization (Balkan and Yeldan, 2002, p.2). With negative real interest rates created by low and fixed interest rates and high inflation, households avoided from depositing their savings to banking sector (Günçavdı and Küçükçiftçi, 2005). Overall, the 1970-1980 period showed a bank based structure together with low level of exports, high level of imports of raw materials and a financial repression.

After the economic crisis of 1979-1980, a change in the industrialization strategy, from import substitution towards outward orientation occurred (Günçavdı and Küçükçiftçi, 2005). Ekinci (1996) evaluates this liberalization process in two phases: domestic financial liberalization and external financial liberalization. Similarly, Esen (2000) characterizes the 1980-1983 period with "stabilization, deregulation of industrial product markets, and deregulation of financial markets through an interest rate reform" and the 1984-1989 period as the period of "trade liberalization and partial capital account liberalization".

In 1980s, world economy has entered to a fast process of change whose important properties were elimination of barriers in the capital flows and change in the composition of fund transfers (Gençay, 2005). In Turkey, a development policy based on market orientation and export based production is adopted with flexible exchange rates, positive real interest rate policy and regulations toward

liberalization and deepening of financial markets (Alp-Yiğit, 2005). Aim of the January 1980 structural adjustment program was to find solutions to internal and external disequilibrium problems of Turkey and to decrease the strictness of economic restrictions created by this disequilibrium (Günçavdı and Küçükçiftçi, 2005). Moreover, "stabilization with export-led recovery and liberalization of the Turkish economy" was the broader objective of this structural adjustment program and decreasing inflation rate with current account deficit were initial issues of the program (Esen, 2000, p.8).

One of the reforms made as part of the liberalization process was to free up deposit and credit interest rates in 1980. In the 1979-1981 period, individual brokers, called "Bankers", appeared in the financial system and they collected savings of households in exchange of high return promises (Özçam, 1999). Since bankers could not able to invest in high profit projects, they could not meet their obligations and Turkey experienced a significant financial crisis (Özçam, 1999). This crisis ended the market determination of interest rates and authority was given to Central Bank of Republic of Turkey in 1982 (Esen, 2000).

Other reform attempts in the post-1980 period may be summarized as follows: In 1981, capital market rules were introduced (Özçam, 1999). Foundation of commercial banks was eased, competition was encouraged which provided effectiveness in banking sector and required reserve ratio was decreased (Gençay, 2005). With the permission to use new financial instruments, Certificates of Deposits (CDs) emerged as one new instrument in 1981 (Esen, 2000; Gençay, 2005). Moreover, restrictions on foreign exchange transactions were removed in 1983 (Gençay, 2005). Tax on the profits of financial market transactions were decreased step by step (Gençay, 2005). Furthermore, Capital Markets Board (CMB) was established in 1982 and domestic banks started to open branches in foreign countries in 1983 (Alp-Yiğit, 2005).

In 1984, external capital movements were partially deregulated. On December 29, 1983, Decree No. 28 was introduced. This decree contained abolition of import lists, adopting a negative list approach and decreasing tariffs. Current account transactions were deregulated and non-residents and residents were permitted to open foreign exchange deposits in domestic banks (Ekinci, 1996; Esen, 2000; Alp-Yiğit, 2005). Moreover, foreign banks were permitted to open branches in Turkey (Esen, 2000). With declaration of Banking Law in 1985, banks were required to keep provision for a minimum capital base, ownership of banks were deregulated, procedures to report non-performing loans were set, and bank's uniform accounting and reporting principles were introduced (Ekinci, 1996; Alp-Yiğit, 2005). Besides these regulations, Central Bank opened a bank supervision unit in 1986 (Ekinci, 1996). Domestic borrowing process of government also began in this period. An interbank money market was established in 1986 and by this way, Central Bank and domestic banks started following their liquidity position better (Günçavdı and Küçükçiftçi, 2005). Istanbul Stock Exchange (ISE) was established in 1986 and Central Bank started open market operations (OMO) in 1987 (Alp-Yiğit, 2005; Günçavdı and Küçükçiftçi, 2005). In 1987, deregulation in interest rates was made which led to rise in interest rates. During this period, inflation was rising and deposit rates were not increasing that fast. This made foreign exchange deposits more advantageous and deposit rates were increased by intervention of Central Bank of Republic of Turkey (Esen, 2000). In 1987, banks were permitted to determine their interest rates subject to the ceilings given by Central Bank (Ekinci, 1996). Furthermore, Central Bank foreign exchange and effective markets were introduced in 1988 (Alp-Yiğit, 2005; Gençay, 2005). Gold market was introduced in 1989 (Gençay, 2005).

After Decree No. 28, Decree No. 30 was enacted. In this decree, Turkish currency value protection rules were set. Moreover, Decree No. 32 was introduced in 1989. It can be said that Decree No. 30 liberalized foreign investments by a significant level and Decree No. 32 completed the process of

liberalization (Özçam, 1999). With the introduction of Decree No. 32, all restrictions on capital movements were removed (Ekinci, 1996). Moreover, non-residents were allowed to buy and sell domestic real and financial assets and could take the profit to their countries, residents were permitted to buy and sell foreign exchange and foreign securities and domestic banks were allowed to loan money to foreign trade companies (Günçavdı and Küçükçiftçi, 2005). Moreover, TL became a convertible currency in April, 1990 (Ekinci, 1996).

Table 2.4 gives the ratio of financial assets to GDP during the 1970-2006.[2] By examining this ratio, we can get an idea about the effectiveness of the reforms made during 1980-1990 period. Financial assets presented in the table include domestic and foreign exchange deposits, government and private securities. Domestic and foreign exchange deposits are calculated by using deposits with deposit money banks. Securities are calculated by using deposit money banks' and investment and development banks' securities at fair value and securities available for sale. Looking at the table, it can be easily interpreted that Turkish financial system is dominated by the banks as financial intermediaries. Although banking intermediaries' proportion declined to 60 percent of the overall financial assets in the reform period, it is still the dominant intermediary in the Turkish financial sector. Moreover, the ratio of foreign exchange deposits shows volatility throughout the whole period. It has a zero proportion in the overall deposits in the first sub-period. It increases to 12 and 47 percent of total deposits in the second and third sub-periods, respectively. Besides these features, securities have an increasing trend during the period. However, this increase only comes from the rise in government securities and this situation can be interpreted as the government running into some fiscal difficulties (Özatay and Sak, 2002).

[2] 1970-1999 data is adopted from Özatay and Sak (2002) and 2000-2006 period data is based on calculations with the data obtained from electronic data distribution system (EDDS) of Central Bank of Republic of Turkey (CBRT).

For 2000-2006 period, increase in both domestic and foreign exchange deposits receives attention at the first glance. Moreover, percentage increase in foreign exchange deposits is higher than the percentage increase in domestic deposits. These rises cause an overall increase in bank deposits from 30.8% during 1990s to 40.4% during 2000s. Furthermore, there is a decline in total securities mostly coming from the decrease in private securities. However, total financial assets to GDP ratio has increased to 56.8% in 2000s, which was 51.4% in 1990s.

Before 1980, there were no foreign exchange deposits as it is represented in Table 2.4. With the process of financial openness, households were allowed to open foreign exchange deposits in banks. Therefore, share of foreign exchange deposits in total bank deposits increases during 1980-2006 period. Moreover, ratio of total financial assets to GDP is increasing throughout the period. This may be interpreted as deepening of financial system.

Table 2.4 Financial Assets to GDP Ratios, 1970-2006

Financial Assets to GDP Ratios, 1970-2006 (period averages)				
	1970-1979	1980-1989	1990-1999	2000-2006
Bank deposits	19.3	24.9	30.8	40.4
TL deposits	19.3	21.9	16.3	19.4
FX deposits		3.0	14.5	20.9
Securities	5.4	7.0	20.6	16.5
Government	4.2	4.8	16.3	16.0
Private	1.2	2.2	4.3	0.4
Total financial assets outstanding	24.7	31.9	51.4	56.8

Source: 1970-1999 period is adopted from Özatay and Sak (2002, p.8) and 2000-2006 period is calculated from EDDS of CBRT.

2.2.2. Post-1989 Period

Ekinci (1996) emphasizes that anti-inflationary policies were adopted at the end of 1988. Moreover, Central Bank was restricting credits to the commercial banks and a monetary program was announced by Central Bank in 1990. Fiscal deficits were mainly financed by domestic borrowing during this period.

After financial liberalization period, in 1990s, inflation rate continued increasing which is 87 on average for 1989-1999 period (see Table 2.3). In addition, growth rates were fluctuating and capital movements were fragile. These resulted in a decrease at the reliability of TL and a rise in currency substitution (Alp-Yiğit, 2005). For post-1989, public sector borrowing requirement as a share of GNP has increased as it is presented in Table 2.3. Moreover, government's domestic borrowing relied implicitly on short-term external borrowing because short-term nature of external borrowing affected the maturity of government debt instruments. For this reason, government had to borrow on shorter maturities and increased its burden of interest payments (Ekinci, 1996). Foreign creditors withdrew from the system when speculative financing came to a certain point and this process caused the 1994 crisis in Turkey (Ekinci, 1996). In order to eliminate adverse effects of 1994 financial crisis, interventions and precautions that help to decrease in interest rates and uncertainty towards strong markets started to rise. Therefore, treasury could borrow for longer periods, all deposits were taken under control of government and legal constraints were put to the short positions (Alp-Yiğit, 2005).

Political instability and Russian crisis in 1998 broke the financial balance, which was achieved to some extent until then. Interest rates increased rapidly and financial system had entered to an instable environment once again (Alp-Yiğit, 2005). In order to stabilize the economy, a Stand-by Agreement was signed with IMF and it was in effect in January, 2000. With this agreement, inflation with consumers' price would be 25% by the end of 2000, 12% by the end of 2001 and

7% by the end of 2002. Real interest rates would decrease to acceptable levels, economic growth potential would increase and fair and effective distribution of resources would be provided (Alp-Yiğit, 2005). Moreover, Central Bank announced money and exchange rate policy for 2000 to prevent inflation and provide sustainability. As it is presented in Table 2.3, during 1990s, inflation rate increased rapidly. In order to decrease inflation rate, an inflation reduction program was introduced involving increase in primary surplus with tight fiscal policy and application of revenue policy which is in a harmony with inflation target (Alp-Yiğit, 2005).

One of the financial deepening measures is share of private sector credit in GNP. Examination of the path of this ratio may give us an idea about how economic conditions could affect financial sector. Table 2.3 shows that private sector credit to GDP ratio has an increasing trend during the period.

Due to increases in short-term interest rates, Turkey experienced a financial crisis in November, 2000. After this crisis, political distress led to a severe financial crisis in February, 2001. Alp-Yiğit (2005)[3] stresses that there are some reasons for turning inflation reduction program into a crisis such as fragile structure of banking sector, pressure on Central Bank to follow passive monetary policy, existence of no sufficient credibility of the program and existence of no sufficient revenue policy. Moreover, higher real inflation rate than expected, very valuable TL, current account deficit being higher than the critical level, no capital availability in financial sector, short positions of banks, real sector and government, duty loss of government banks and its pressure on money market, maturity mismatches, increase in exchange and interest rate risk of financial sector and disappearance of confident environment were the reasons behind 2000 and 2001 financial crisis. These two crises made Turkey to apply floating exchange rate regime and inflation rate rose.

[3] See also Alper (2001), Keyder (2001), Cizre and Yeldan (2005), Akyürek (2006), Ekinci and Ertürk (2007).

To sum up, Turkey entered post-1989 period with the following economic features: applying an anti-inflationary program, restricting credits to commercial banks and financing fiscal deficits with domestic borrowing. Moreover, inflation rate was high, growth rates were fluctuating and domestic borrowing relied on short-term borrowing. In 1994, Turkey experienced a financial crisis. With some policies, decrease in interest rates was provided. Moreover, borrowing period has risen and all deposits were taken under control of government. In 1998, some financial difficulties were experienced and inflation started to increase again. In 2000, a Stand-by Agreement was signed with IMF. With this agreement, reduction in real interest and inflation rates would be satisfied and growth rate would be brought to higher levels. However, Turkey experienced two financial crises in November 2000 and February 2001. After these crises Turkey started to apply floating exchange rate regime.

CHAPTER 3

THEORETICAL RELATIONSHIP BETWEEN FINANCE AND GROWTH

The relationship between finance and growth is explained by different theoretical models. In this chapter, financial sector and its functions are explained. Moreover, a brief definition of financial deepening is given. Then, theoretical relationship between finance and growth is presented.

3.1. Financial Sector and Financial Deepening

Financial sector can be defined as the mechanism that transfers resources from some economic agents, spending less than their income and saving the remaining, to the others willing to spend more than their income (Özcan, 2007, p.5). The most important theoretical reason for the emergence of financial sector is the existence of some agents saving more than their income and some others willing to spend more than their income.

Financial development means emergence and development of institutions, instruments and markets and increase in the effectiveness of financial system functions which support investment and growth process (Özcan, 2007, p.33). According to the above discussion, it can be stated that financial deepening can be briefly defined as the development in quality, quantity and efficiency of financial sector which "is a complex of markets for financial assets and financial services" (Shaw, 1973, p.3). Moreover, it is a term used to describe the development and expansion of financial institutions such as banks, stock markets, and financial intermediaries relative to the size of the whole economy.

It refers to the increased provision of financial services with a wider choice of services equipped to all levels of society.

Levine (2004) summarizes that emergence of financial institutions, intermediaries and contracts are caused by costs associated with transactions and information gathering. Different legal and tax systems of every country lead to the creation of different financial institutions, intermediaries and contracts. While financial markets emerge to fix market frictions, they affect resource allocation. Even though they are not able to eliminate all market frictions, financial institutions, intermediaries and contracts can decrease effects of the costs associated with transactions and information gathering. Therefore, financial functions can be more successfully provided which result in financial development. These financial functions can affect saving and investment decisions; thus, they can make contribution to the economic growth. Levine classifies functions of the financial sector as follows: "produce information ex ante about possible investments and allocate capital, monitor investments and exert corporate governance after providing finance, facilitate the trading, diversification, and management of risk, mobilize and pool savings and ease the exchange of goods and services" (2004, p.5).

- *Production of information ex ante about possible investments and allocation of capital:* Financial intermediaries may help to decrease costs associated with acquiring and processing information. With the help of less costly information, investment opportunities may be evaluated better and investors may invest in more successful projects. This means that more efficient resource allocation may be provided. Moreover, financial intermediaries may also increase the rate of technological innovation by providing information to new entrepreneurs with successfully new innovations and projects.

- *Monitoring investments and exerting corporate governance after providing finance:* Financial intermediaries have a function of investment monitoring. If investors concretely know the use of their capital in the firm, they can influence and guide managers to maximize the firm value which means high return for the capital provider. Moreover, financial arrangements which enhance corporate governance may provide capital moving to more profitable investments.

- *Facilitating the trading, diversification, and management of risk:* Financial contracts, markets and intermediaries produce information on possible investments. With the help of this feature trading, hedging and pooling of risk may become easier for the investors. In order to manage the risk, type of the risk should be determined. Risk amelioration can be analyzed in three different categories: cross-sectional risk diversification, intertemporal risk sharing, and liquidity risk. Cross-sectional risk diversification provides investors to be able to get higher expected returns with the help of portfolios. Intertemporal risk sharing allocates risk among generations and provides investors to avoid from higher risks. Investors face uncertainties while they are converting assets into a medium of exchange. This situation brings about liquidity risk.

- *Mobilizing and pooling savings:* Mobilization of savings involves collecting savings from different individuals and lending these savings to the ones who need them. However, this is not an easy and cheap process. Moreover, financial intermediaries should make savers feel comfortable about the position of their savings which is also a difficult work for the financial institutions.

- *Easing the exchange of goods and services:* Financial intermediaries make the exchange of goods and services become easier. If an investor

wants to make short-term investments, financial intermediaries provide the opportunity of quick buy and sell options of a security.

3.2. Theoretical Relationship between Finance and Growth

Theoretical studies that focus on the relationship between finance and growth can be traced as far back as to Bagehot (1873), Schumpeter (1911 [1912]) and Hicks (1969) (Waqabaca, 2004, p 3). Although there are no certain results on the direction of causality between financial deepening and economic growth, existence of this relationship is accepted in the literature (Calderon and Liu, 2002). In order to detect the link between finance and growth, two general facts that are explained by Levine (2004) are worth stressing here. The first one is that long-run economic growth cannot be explained wholly by physical capital accumulation. Thus, some theories describing the effect of financial development on resource allocation decisions are needed. Moreover, the theories should show how the financial development fosters productivity. The second fact is the existence of two general ambiguities between economic growth and financial arrangements. These ambiguities come from higher returns and lower risk. Higher expected returns decrease households' tendency to consume today rather than tomorrow. This increases saving rate but depending on dominance of income and substitution effects, higher returns ambiguously affect saving rates. Similarly, saving rates are ambiguously affected from lower risk.

There are different models that explain the channels relating financial system and economic growth. As emphasized by Levine (2004), theoretical models are based on the features of financial sector which can be classified as: producing information and allocating capital, monitoring firms, risk management, pooling of savings and easing exchange. Since 1960s, there are theoretical studies which focus on this relationship from different perspectives. Some studies focus on the contribution of financial sector on economic growth and conclude that financial

institutions contribute to economic growth by providing resources for the investments. As another category of research, we can say that there is a new trend depending on the emergence of endogenous growth literature. After the emergence of endogenous growth models, the relationship between financial system and economic growth could be better explained – as opposed to neo-classical models such as Solow growth model. The most important factor is that in Solow growth model, change in saving rate does not affect long-run (steady-state) growth rate. There is no way to affect long-run growth rate through savings. On the other hand, it is possible to change growth rate with savings rate by different channels in endogenous growth model. Tsuru (2000, pp.6-7) proposes the simple "AK" model in his study to be able to understand the relationship between financial system and economic growth.

Tsuru (2000, p.7) expresses the following steady-state growth rate equation assuming that a certain portion (ϕ) of saving is used for investment, with g, A, s and δ being steady state growth rate, productivity of capital, saving rate and depreciation rate, respectively:

$$g = A\phi s - \delta \tag{3.1}$$

From this equation it can be interpreted that financial deepening can effect economic growth through change in saving rate (s), efficiency of financial systems (ϕ) and productivity of capital (A). In the following part of this section, explanation how each of these channels can affect economic growth is given.

3.2.1. Saving Rate

Tsuru mentions four ways that financial development can affect saving rates: "idiosyncratic risks, rate-of-return risks, interest rates and liquidity constraints"

(2000, p.8). A decrease in idiosyncratic risks provided by insurance and finance markets can decrease savings rate of households and thus growth rate may decrease. Besides this, decline in rate-of-return risks provided by portfolio diversification may have ambiguous results on savings rate due to rate of risk-aversion of households. This leads to ambiguous effect on economic growth. When these two risks that Tsuru (2000) mentions are considered, the effects of savings rate on economic growth may differ.

Levine (2004) summarizes that risk management feature of financial system can have an effect on growth by changing resource allocation and saving rates. By diversifying the risk, financial sector serves profitable investments with higher expected returns. Moreover, risk may be shared across generations by investing in long-run investments. By this way, economy can get the advantage of this long time interval. On the other hand, if investors make long-term investments, which are illiquid, they lose control over their savings for a long time period. This can be explained as being the link between liquidity risk and economic growth. If financial sector can serve easy conversion to investors, this can enhance long-term investments and growth. All of the risks related with investments should be efficiently managed. When this is provided by financial sector, investors may be willing to invest more. This results in increase in saving rates and which will promote economic growth. In their study, Bencivenga and Smith (1991) show the role of financial markets on decreasing liquidity risk of investor. Similar to the discussion of Levine (2004), Saint-Paul (1992) claims that financial sector helps investors to decrease the risk of investments by forming diversified portfolios. This leads to productivity and growth in the economy.

Tsuru (2000) also emphasizes that financial development may increase interest rates paid to households by decrease in financial repression. In this situation, change in savings rate may differ depending on the dominance of income and substitution effects. Moreover, he mentions that decreasing liquidity constraints

of households will decrease savings rate of households who are saving for the next generations. All of these effects reveal that the net effect of financial sector on savings rate is ambiguous.

3.2.2. Efficiency of Financial Systems

Tsuru (2000) mentions that efficiency of financial systems means transferring savings to investments in a more efficient way. In this transformation all savings could not be turned into investments due to the costs associated with services of financial system. Although these costs are inevitable, they can be higher than the value that had to be. These costs are rents for the financial sector. If these rents are invested in low return projects by the financial sector, economic growth rate will be negatively affected.

Levine (2004) stresses that with the information creation function; financial sector contribute to the economic growth. Moreover, easing of medium of exchange function of financial sector leads to involvement of short-term savings into the financial markets and allocate them to profitable projects. This may be regarded as an example of efficiency in turning savings into investments. Similar to the discussion of Levine (2004), Hermes and Lensink (1996) relate financial deepening and economic growth with the functions and services that financial markets provide. Financial markets ensure the working of an efficient system of payments. It can be said that a reliable medium of exchange is needed in order to sustain growth in the long run. This can be provided by setting up of an efficient and adaptable system of payments. With the absence of such a system, transaction costs may cancel out the productivity gains related with the division of labor and the beginning of the growth. Since growth is a long run process, the systems of payments should adapt alongside. In order to sustain the volume of economic activity and to meet the increasing complexity of exchanges, monetization of the economies is needed. Furthermore, banking intermediaries,

who manage credit relations, are necessary due to the necessity of decreasing opportunity cost of holding money. Beside this, Hermes and Lensink (1996) mention that technical advances bring about creation of financial assets, which are substitutable to the traditional monetary assets. With these developments, there is an increase in the portion of financial activities in the GDP and this is associated with economic development. Moreover, Bencivenga and Smith (1991) mentioned in their paper that an efficient financial sector would increase the investment level which will lead to rise in growth.

3.2.3. Efficiency of Capital

Tsuru (2000, p.7) explains that a financial system can be efficient if capital is transferred to more productive and successful projects. When equation (3.1) is considered, an efficient allocation of capital could increase productivity of capital which in turn could increase economic growth. Detecting the highest profitable project and gathering information is not easy. It takes time and money to the financial intermediary. Moreover, most of the investors are risk-averse and do not want to invest in riskier projects, which means high return projects. In order to direct investors to high return investments, financial intermediaries should share the risk. Greenwood and Jovanovic (1990) try to examine this role of financial intermediaries and they conclude that feasibility of selecting higher return investment is higher for individuals with the help of financial intermediaries.

Waqabaca (2004) mentions that Schumpeter (1911 [1912]) claims existence of a supply-leading relationship between financial deepening and economic growth. If there is a well functioning financial system, it can identify potentially successful sectors and finance these ones. This can lead to economic growth by affecting technological improvement. Waqabaca (2004) also explains that Schumpeter (1911 [1912]) claims identification of successful sectors for well

functioning and efficient capital allocation mechanism. On the other hand, Bagehot (1873) and Hicks (1969) states that financial sector should give importance to essential sectors in the economy. Moreover, King and Levine (1993b) formed a technological development model including cost decreasing innovations applied to an intermediary good. According to this model, financial intermediaries and capital markets provide some investors involve in innovative activities. This situation affects economic growth by increasing productivity.

Hermes and Lensink (1996) explain the efficiency of capital mechanism with the role of financial markets that they mobilize savings and transfer these savings into various investment projects. They summarize that available savings can be better mobilized by financial markets and banking intermediaries. With the existence of such services, firms have more opportunities to invest in higher investment needing projects. Moreover, financial markets can provide higher returns for savers which contribute to increase in capital productivity. This leads to a speeding up of growth. This is additional factor that contributes to deepening of financial sector and economic growth. However, higher expected return can have a positive or negative effect on economic growth depending on the domination of income and substitution effects; it may have negative or positive effect on growth. While mobilization of savings is an important factor in growth, quality of allocation is another essential factor in providing growth.

Levine (2004) states that with more effective pooling of savings, financial systems can increase savings, take advantage of economies of scale, and overcome investment indivisibilities which can have effect on economic growth. Better savings mobilization can improve both capital accumulation and resource allocation; thus, technological innovation may be fostered. If there is no access to multiple investors, economies of scales would not be reached in most of the production processes. Moreover, some investments need enormous capital that one investor cannot effort. Moreover, Levine (2004) mentions that the monitoring investments and exerting corporate governance after providing

finance function of financial sector makes investors routinely check their return position and may lead them to innovations. Thus, technological improvement can be achieved. By this way economic growth can be fostered.

The roles mentioned in the previous paragraphs cover security markets, as well. Stock market allows investors to buy and sell shares in the case of liquidity problems and to invest in diversified portfolios which have decreased risk. Levine (1991) deals with the rise in economic growth through the stock market. This relationship is examined by the role attributed to stock market about increasing firm efficiency.

CHAPTER 4

LITERATURE REVIEW

In the growth literature, there is an increased interest on the effect of financial deepening on economic growth. The reason for this increased interest is that the process of economic growth is getting more complex for all countries. Moreover, there are changes in most of the countries' financial sector and there are also new financial instruments introduced in the market. All of these changes have different effects on the real economy and this is considered important by a growing number of researches.[4] This chapter provides an overview of empirical studies in the literature.

As emphasized by Patrick (1966), the analysis of the relationship between financial deepening and economic growth shows a bi-directional relationship. The first direction is from financial development to economic growth, which is called *supply-leading.* Here, creation of financial intermediaries, institutions and markets leads to increase in financial services and this relationship claims that with the help of financial sector allocation of resources mechanism, resources can be transferred from inefficient sectors to more efficient and modern sectors and economic growth process is fostered. In their study, Calderon and Liu (2002) mention studies which support the supply-leading hypothesis.[5] The other direction is called *demand-following* and it is from the economic growth to the financial development. In this direction, Patrick (1966) claims that the real sector

[4] The relationship between financial deepening and growth is basically investigated in the light of two discussions: financial liberalization and financial repression. These two different views mainly come from the role attributed to money. Financial liberalization claims that existence of money increases the growth process of an economy while financial repression states the opposite. Financial liberalization assumes that money is a productive factor of production and with this feature; it can contribute to the growth process. On the other hand, financial repression assumes that money is a way of decreasing savings available for investment in physical capital when the savings are made in the form of money balances (Kularatne, 2001).

[5] Such studies include McKinnon (1973), King and Levine (1993a, b), Neusser and Kugler (1998) and Levine, Loayza and Beck (2000).

demand creates financial development in the economy. This means that financial sector activities are responses to the activities of the real sector. The supporters of this hypothesis are Gurley and Shaw (1967), Goldsmith (1969) and Jung (1986).

In the literature, most of the studies, investigating the causality between finance and growth, model this relationship on the assumption of well functioning money systems, banking sector and capital markets. Besides this assumption, some studies discuss the advantages of different type of financial systems. Among them some studies claim that bank based financial systems are more advantageous for the countries and some state that capital market based financial systems are better.

The results of theoretical and empirical studies show that there is significant and positive relationship between financial deepening and economic growth. If this relationship is ignored, understanding of economic growth will really be restricted. However, conflicting results of theoretical and empirical studies cause not to be able to say certain conclusion on the relationship between financial deepening and economic growth.

In the following parts, empirical studies on the relationship between financial deepening and economic growth and related studies on Turkey is explained.

4.1. Empirical Studies

In the empirical literature, the relationship between financial deepening and economic growth is investigated by using three different approaches: cross-country studies, firm or industry-level studies and country specific studies. In the cross-country studies, cross-section or panel data is used and result of every country is examined in order to reach a complete conclusion on the relationship

between financial deepening and economic growth. In the second approach, with cross-section or panel data, firm or industry specific results reveal direction of this relationship. Country specific studies use time series data or panel data.

The study conducted by King and Levine (1993a) uses cross-country approach and tries to find evidence on the views of Schumpeter (1911 [1912]) on the relationship between financial sector and economic growth that financial sector activities stimulate the long-run economic growth. The analysis is done for 80 developed and developing countries with pooled cross-country data. Long-run real per capita GDP growth is used as economic growth indicator and liquid liabilities of the financial system to GDP, ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets and ratio of claims on the non-financial private sector to total domestic credit as financial indicators which measure liquidity of financial sector, relative importance of specific financial institutions and domestic asset distribution, respectively. Cross-country regressions are used in order to find the correlation between financial development and growth indicators. The findings reveal that there is a strongly positive relationship between financial deepening and economic growth for the pooled data between the years 1960-1989 and this relationship is from finance to the growth.

In another study, Calderon and Liu (2002) use panel data for 109 developing and emerging countries from 1960 to 1994. Their study investigates degree of dependence or the extent of kinds of feedback between the financial deepening and economic growth indicators. There are two financial development indicators in this study: ratio of broad money (M2) to GDP and share of credits provided by financial institutions to private sector in GDP. Real GDP per capita growth rate is used as growth indicator. The results show that causality between financial development and economic growth is generally from financial development towards economic growth, there is some bi-directional relationship and in longer samples, better relationships can be obtained

Kemal, Qayyum and Hanif (2007) investigate the relationship between financial development and economic growth for high income countries. There are 19 high income countries in their set and the period covers years from 1974 to 2001. Four different financial deepening measures are used: currency plus demand and interest bearing liabilities of banks and other financial intermediaries divided by GDP, private sector credit to GDP ratio, the stock market capitalization to GDP ratio and share of total value of the shares traded in the stock market to GDP. Economic growth proxy is real per capita GDP growth. Moreover, a set of controlling variables are used. The methodology used in this study goes from non-dynamic panel estimation to dynamic panel estimation. The results reveal that finance is significantly and positively related to economic growth. A recent study by Zang and Kim (2007) investigates the causal link between financial development and economic growth using large panel data set of seven time periods and about 74 countries for1961-1995 period provided by Levine, Loayza and Beck (2000). Panel estimation with country-specific fixed effects is formulated. Results show that growth of the real economy should precede subsequent financial development.

Demirgüç-Kunt and Maksimovic (1998) take a micro-approach and try to investigate the effect of underdevelopment of legal and financial systems on firms' abilities of investing in potentially profitable growth opportunities. In order to examine this, a firm-level approach is used. In this study, 30 countries are used and the data constitutes the period 1980-1991. The analysis uses a micro level test of the hypothesis that claims financial markets and intermediaries being determinant of economic growth. Demirgüç-Kunt and Maksimovic show that in countries with good legal systems, firms use long term external financing to fund the growth.

Besides cross-country and firm-level studies, there are many researches following country specific approach.[6] The study of Boulila and Trabelsi (2004) reveals that the causality is from real to financial sector. On the other hand, Kwan, Wu and Zhang (1999) examine the relationship with exogeneity analysis and find that financial deepening has positive effect on economic growth. Moreover, Zhang and Yao (2002) find a positive relationship between financial sector and economic growth, as well. Furthermore, Law, Azman-Saini and Smith (2006) find that finance plays a crucial role in promoting economic growth. Filer, Hanousek and Campos (1999) observe that there is little evidence of causality from stock market to economic growth.

In one country specific study, Kularatne (2001) use South African time series data for the years 1985-1992 in his analysis on financial development and economic growth. Financial development indicators are ratio of private credit extensions to GDP and value added ratio which measures the level of stock market liquidity. Per capita GDP is used as the economic growth indicator. The effect is evaluated with two different models using the Johansen Vector Error Correction Model (VECM). In the first model, type of the effect of financial sector on economic growth is determined by direct and indirect effects. The direct effect is the effect of financial development on economic growth and the indirect one is from the financial development to the growth through the investment. The second model tries to examine the feedback effect between financial and real sectors. The results show that there is a positive indirect effect between the two indicators and it is found that there exists a feedback effect between finance and growth.

In another study, Waqabaca (2004) investigates this relationship for the years 1970-2000 for Fiji. There are three financial development measures: ratio of financial assets to GDP, ratio of liquid liabilities to GDP and share of private

[6] Such studies include Kwan, Wu and Zhang (1999); Filer, Hanousek and Campos (1999); Kularatne (2001); Zhang and Yao (2002); Waqabaca (2004); Boulila and Trabelsi (2004); Law, Azman-Saini and Smith (2006).

sector credit to GDP. On the other side of the model three different economic growth indicators are used: level of real GDP, level of real GDP per capita and ratio of investment to GDP. The methodology used in this analysis is bi-variate Vector Auto-regression (bVAR). The results of the causality tests reveal that the relationship is from economic growth to financial development.

4.2. Related Studies on Turkey

There are some studies about the relationship between financial deepening and economic growth on Turkey.

Kar and Pentecost (2000) are first researchers to examine the relationship between financial development and economic growth in Turkey. They used 1963-1995 annual time series data. The methodology followed in this study is Granger causality and error correction mechanism in order to test the relationship. Domestic credit to GNP, M2 to GNP, bank deposit liabilities to income, private sector credit to domestic credit and private sector credit to income ratios are used as financial development indicators. Per capita GNP is used as the growth indicator. Results of the analysis show that in most of the financial development indicators, the relationship is from growth to finance.

1970-2001 time series data is used in the study of Ünalmış (2002) and its purpose was to determine the causal relationship between finance and growth. Domestic credit as a ratio of GNP, private credit as a share of domestic credit, broad money supply as a ratio of GNP and total deposits as a ratio of GNP are proxies for financial development while growth indicator is per capita GNP at constant prices. The Granger non-causality tests are applied in context of VAR. The analysis is done for both cointegrated and non-cointegrated variables and resulted in bi-directional causality in the long-run for cointegrated variables. On

the other hand, there is supply leading -from finance to growth- relationship in the short-run.

In their study, Ardıç and Damar (2006) aim to analyze the contribution of developments in Turkish banking sector to regional economic growth. Pooled data of 81 provinces of Turkey for the years 1996-2001 is used. Real per capita GDP is used as growth indicator and the ratio of total bank deposits to GDP is used as financial development indicator. Besides these variables, population growth, education, health and openness indicators are used in the analysis. Cross-section ordinary least square is used as the methodology of this study. This study shows that financial deepening and economic growth is negatively related.

Aslan and Küçükaksoy (2006) use 1970-2004 annual data in their study. First difference of real GNP per capita and natural logarithm of private sector credits are growth and finance indicators, respectively. The methodology of this study is Vector Auto-regression (VAR) technique and Granger causality test. It is concluded that financial development causes economic growth, that is supply-leading hypothesis is found.

CHAPTER 5

EMPIRICAL ANALYSIS OF THE CROSS-COUNTRY DATA

In this chapter; to bring a broad understanding of the relationship between financial deepening and economic growth, a cross-country analysis of OECD and emerging countries is provided. For this purpose, we employ panel data estimation technique. We consider fixed and random effect specification and the results indicate that the relationship between financial deepening and economic growth is from the former to the latter. The chapter is outlined as follows: first granger causality technique for each country data is applied, then cointegration analysis is given for each country and lastly panel data estimation is carried out.

5.1. Data

In this section, cross country data is used. The data consists of 49 countries which are OECD members[7] and emerging markets[8]. 30 countries are OECD members and remaining 28 countries are emerging market countries. 7 countries belong to both groups and when they are excluded, we are left with 51 countries. However, no data exists for two countries, namely Russia and Taiwan. Analysis is therefore carried out with 49 countries (see Table 5.1 for name of the countries). Since each country has different time scale for the economic growth and financial deepening proxies, we end up with an unbalanced panel data for 1953-2005 period.

[7] These countires may be seen at
http://www.oecd.org/countrieslist/0,3351,en_33873108_33844430_1_1_1_1_1,00.html

[8] These countries may be seen at
http://globaledge.msu.edu/ResourceDesk/mpi/ and
http://en.wikipedia.org/wiki/Emerging_markets

Table 5.1 Countries and Abbreviation of Each Country of Cross-Country Analysis

Country	**Abbr.**	**Country**	**Abbr.**
Argentina	ARG	Korea	KOR
Australia	AUS	Luxembourg	LUX
Austria	AUT	Mexico	MEX
Belgium	BEL	Malaysia	MLS
Brazil	BRZ	Netherlands	NET
Canada	CAN	Norway	NOR
Chile	CHL	New Zealand	NZL
China	CHN	Pakistan	PAK
Colombia	COL	Peru	PER
Czech Republic	CZH	Philippines	PHL
Denmark	DEN	Poland	POL
Egypt	EGT	Portugal	POR
Finland	FIN	South Africa	SAF
France	FRN	Saudi Arabia	SAR
Germany	GER	Singapore	SIN
Greece	GRE	Slovak Republic	SLV
Hong Kong	HKG	Spain	SPN
Hungary	HUN	Sweden	SWN
Iceland	ICE	Switzerland	SWT
India	INA	Thailand	THL
Indonesia	INS	Turkey	TRK
Ireland	IRE	United Kingdom	UKN
Israel	ISR	United States	USS
Italy	ITL	Venezuela	VEN
Japan	JPN		

The proxies of economic growth are: natural logarithm of real GDP (LGDP), used in the paper by Waqabaca (2004), growth rate of real GDP, natural logarithm of real GDP per capita (LCAPGDP), used by Zhang and Yao (2002), and growth rate of real GDP per capita, used by Kemal, Qayyum and Hanif (2007). In the empirical studies, each of the financial deepening proxy represents different aspect of the financial sector. In their study, Aslan and Küçükaksoy (2006) use natural logarithm of private sector credit (LPC) which measures the

elasticity relationship with the growth data assumed to be led to the causality issue. In their study, Kar and Pentecost (2000) use ratio of private sector credit to domestic credit (PCDC) and this proxy captures the aspect of domestic asset distribution of an economy. While private sector credit to GDP ratio (PCY), as used in the study by Waqabaca (2004), measures the activity of financial intermediaries, domestic credit to GDP (DCY) ratio gives the domestic assets of the financial sector, see Kar and Pentecost (2000). In the empirical studies, there is a variable measured by (M3-M1) and it is called financial savings (FS). A rising ratio of financial savings to GDP (FSY) may reflect an improvement in bank deposits of other financial resources and this proxy is used in the paper by Boulila and Trabelsi (2004). Another measure of financial deepening used in Kar and Pentecost (2000) is the ratio of M2 to GDP (M2Y) and this indicates the degree of monetization in the economy. The ratio of currency to M2 (CURM2) measures the complexity (or sophistication) of domestic financial markets and used as the proxy of financial deepening in the study of Zhang and Yao (2002). All of the data is obtained from International Financial Statistics (IFS) database of the International Monetary Fund (IMF) and the proxies are calculated accordingly.

5.2. Methodology

In this section, Granger causality test, unit root tests, cointegration analysis and panel data technique is explained.

5.2.1. Granger Causality Test

The relationship between financial deepening and economic growth for each country may be examined by using Granger causality technique. The following model is an example of a bi-variate VAR model used in Granger causality test:

$$x_t = \alpha_{11} + \sum_{i=1}^{p} \lambda_{1i} z_{t-i} + \sum_{i=1}^{p} \delta_{1i} x_{t-i} + e_{1t} \quad (5.1)$$

$$z_t = \alpha_{21} + \sum_{i=1}^{p} \lambda_{2i} z_{t-i} + \sum_{i=1}^{p} \delta_{2i} x_{t-i} + e_{2t} \quad (5.2)$$

where x_t and z_t are endogenous variables, λ_{1i} and δ_{1i} are coefficients of lagged endogenous variables, α_{11} and α_{21} are intercept terms, e_{1t} and e_{2t} are the error terms and p is the lag length. It is accepted that z_t does not Granger cause x_t if all coefficients of lagged z_t in (5.1) are equal to zero. Similarly, x_t does not Granger cause z_t if all coefficients of lagged x_t in (5.1) are equal to zero. In order to apply VECM or VAR methodologies the data used in the analysis should be investigated for order of integration and stationarity analysis should be employed. In order to determine order of integration, Dickey-Fuller, Augmented Dickey Fuller or Phillips-Perron tests can be used.

5.2.2. Unit Root and Cointegration Analysis

5.2.2.1. Unit Root Analysis

As noted before, a time series data should be examined for the stationarity or order of integration. Time series data is accepted to be stationary if "it exhibits mean reversion in that it fluctuates around a constant long-run mean, has a finite variance that is time invariant and has a theoretical correlogram that diminishes as the lag length increases" (Asteriou, 2006, p.247). First of all, it is assumed that the series has m unit roots. We take m^{th} difference of the series and test whether this series is stationary. If it is stationary, $(m-1)^{th}$ difference of the series is tested for the presence of unit root. If this series is found to be stationary, then the series in $(m-2)^{th}$ difference is tested for the order of integration. This analysis is done until we reach to the series at levels. During this analysis, if a non-

stationary series is found (at order *(d-1)*), we conclude that the series in examination is integrated of order *d*, *I(d)*. Since most of the time series data contains one unit root, we start our analysis by taking first difference of each of the series. Then investigate the presence of unit root in the series at levels.

There are many tests trying to find the order of integration of series and among them Dickey-Fuller, Augmented Dickey-Fuller and Phillips and Perron tests are the most widely used ones in testing the presence of unit roots. Dickey-Fuller (DF) test is based on the following model:

$$y_t = \phi y_{t-1} + e_t \tag{5.3}$$

The model can also be expressed as:

$$\Delta y_t = \gamma y_{t-1} + e_t \tag{5.4}$$

where $\gamma = (\phi - 1)$. This model is called pure random walk model. Null hypotheses are H_0: $\phi = 1$ for model (5.3) and H_0: $\gamma = 0$ for model (5.4).The corresponding alternative hypotheses are H_a: $\phi < 1$ and H_a: $\gamma < 0$, respectively. If DF test statistic (t-statistic of lagged dependent variable) is less than the critical value, we reject the null hypothesis and conclude that the series is stationary (there is no unit root). Model (5.4) can be extended by including a constant term and/or the trend. The corresponding models are called random walk with drift and random walk with drift and time trend:

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + e_t$$
$$\Delta y_t = \alpha_0 + a_2 t + \gamma y_{t-1} + e_t$$

where $\gamma = (\phi - 1)$. The two models have same testing procedures with the random walk model.

Equation (5.4) does not consider autocorrelation. Augmented Dickey-Fuller (ADF) test is used to test existence of unit root when there is autocorrelation in the series and lagged terms of the dependent variable are included in the equation. The following three models represent pure random walk, random walk with drift and random walk with drift and trend used in Augmented Dickey Fuller tests:

$$\Delta y_t = \gamma\, y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + e_t$$

$$\Delta y_t = \alpha_0 + \gamma\, y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + e_t$$

$$\Delta y_t = \alpha_0 + \gamma\, y_{t-1} + a_2 t + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + e_t$$

where $\gamma = (\phi - 1)$. The null hypothesis is H_0: $\gamma = 0$ and alternative hypothesis is H_a: $\gamma < 0$. If ADF test statistic (t-statistic of lagged dependent variable) is less than the critical value, we reject the null hypothesis and conclude that the series is stationary (there is no unit root).

Phillips-Perron test is a modified Augmented Dickey-Fuller test and it takes into account the independent and identical distribution of error terms which is the feature of Dickey-Fuller test. The following model is used in Phillips-Perron test.

$$\Delta y_t = \alpha_0 + \beta\, y_{t-1} + e_t$$

In the above model the coefficient β has a t-statistic that is a corrected t-statistic of coefficient γ in the ADF model. The null hypothesis is H_0: $\beta = 0$ and alternative hypothesis is H_a: $\beta < 0$. If PP test statistic (t-statistic of lagged y_t) is less than the critical value, we reject the null hypothesis and conclude that the series is stationary (there is no unit root).

Beside these test, correlogram of each series may be examined. If the autocorrelation function (ACF) does not decrease fast enough, while lag length is increasing, stationary does not exist.

5.2.2.2. Cointegration Analysis

When variables in the analysis are non-stationary and integrated of order *d*, *I(d)*, we can take their differences for *d* times to make them stationary. However, there may be cointegrating relationship between the variables. If two variables are integrated of the same order and they are non-stationary, linear combination of these two variables may be stationary which is called cointegration.[9] If the two variables constitute a cointegrating relationship, there will be loss of information in the case of differencing. Suppose that we have the following equation:

$$x_{1t} = \beta_1 + \beta_2 x_{2t} + ... + \beta_n x_{nt} + e_t$$

If we solve for the error term we obtain the following equation:

$$e_t = x_{1t} - \beta_1 - \beta_2 x_{2t} - ... - \beta_n x_{nt}$$

Considering this, Engle and Granger (1987) introduced concept of cointegration with a set of economic variables in long-run equilibrium.

$$\beta_1 x_{1t} - \beta_2 x_{2t} - ... - \beta_n x_{nt} = 0$$

[9] There may be cointegrating relationships between the variables having different order of integration which is called multicointegration. This case is out of the scope of this thesis. For this reason, it is not explained.

where β is the cointegrating vector containing β_i's. Since deviation from long-run equilibrium is e_t, we can write the following equation:

$$\beta_1 x_{1t} - \beta_2 x_{2t} - \ldots - \beta_n x_{nt} = e_t$$

If the equilibrium is meaningful, e_t has to be stationary. With this methodology, non-stationary variables can form a linear relationship. Engle-Granger Methodology may be used in seeking cointegration by trying to determine stationarity of the residuals of the equilibrium relationship. First of all, order of integration of each variable is determined with the unit root test described in the previous section. Since we ignore presence of multicointegration, which is out of scope of this thesis, all variables should be integrated of the same order. Then, the long-run equilibrium relationship is estimated with the following equation:

$$x_t = \alpha_0 + \alpha_1 z_t + e_t \tag{5.5}$$

If there is cointegration, α_0 and α_1 estimates reveal "super-consistent" estimators in the OLS regression. In this estimation fitted values of e_t series ($\hat{e}_t$) is tested for stationarity. In this analysis DF or ADF may be used. However, in hypothesis testing, critical values constructed by McKinnon (1991) is used.[10] If this series is stationary, we can conclude that there is cointegration between x_t and z_t. $\hat{e}_t$ may be used as error correction term of the model.

5.2.3. Panel Data Specification

The methodology used for the analysis of the cross-country relationship between financial deepening and economic growth is panel data technique. In this procedure, there are both cross-sectional units and time dimensions of data.

[10] See Appendix B for critical values of McKinnon (1991).

Panel data may be named differently such as pooled data, longitudinal data, micropanel data, event history analysis and cohort analysis (Gujarati, 2003). There are some advantages of using panel data. "They provide more efficient estimations of parameters by considering broader sources of variation, they outsource more information to the analyst, and they allow the study of dynamic behavior of the parameters" (Asteriou, 2006, p.368). The following model is a simple linear panel data model with one explanatory variable:

$$Y_{it} = a + \beta X_{it} + u_{it} \tag{5.6}$$

where i = 1, 2, … , N sections and t = 1, 2, … , T periods. If each section consists of observations for T periods, this data set is called balanced. Otherwise, it is called unbalanced panel data. According to the assumptions made about the intercept, slope and error terms, the models may differ. Gujarati (2003) classifies these models as follows:

1. "Intercept and slope coefficients are constant across time and space, and the error term captures differences over time and individuals.
2. The slope coefficients are constant but the intercept varies over individuals.
3. The slope coefficients are constant but the intercept varies over individuals and time.
4. All coefficients (the intercept as well as slope coefficients) vary over individuals.
5. The intercept as well as slope coefficients vary over individuals and time." (Gujarati, 2003, p.640).

In this analysis, we assume that slope coefficient does not vary across space and time and intercept coefficient varies over space only. Therefore, in the following section, first and second models of the previous classification will be explained.

5.2.3.1. Common Constant Model

In this model the intercept coefficient is assumed to be constant over time and space and since we assume that there is no variation in the slope coefficient, we obtain the model (5.6). In this model, each individual section has the same coefficient with the other sections. This model is quite restrictive and for this reason, fixed effects and random effects models are widely used instead of common constant model (Asteriou, 2006).

5.2.3.2. Fixed Effects (FE) Model

In order to take into account section specific differences, fixed effects model is used. This model is also named as least squares dummy variable (LSDV) model because model includes a dummy variable for each of the different constant of each section in the model.

$$Y_{it} = a_i + \beta_1 X_{1it} + \beta_2 X_{2it} + ... + \beta_k X_{kit} + u_{it} \qquad (5.7)$$

where i = 1, 2, … , N sections, t = 1, 2, … , T periods and k = number of explanatory variables. Fixed effects model is compared with the common constant model whether we should treat the section-specific constants differently. In this test, the null hypothesis is H_0: $a_1 = a_2 = \ldots = a_N$ and the alternative hypothesis is H_a: At least one of the a_i is different from the others. The test statistics is F-statistics:

$$F = \left[(R^2_{FE} - R^2_{CC})/(N-1)\right] / \left[(1 - R^2_{FE})/(NT - N - k)\right] \sim F\ (N\text{-}1,\ NT\text{-}N\text{-}k)$$

If we reject the null hypothesis, we can use fixed effects model.

5.2.3.3. Random Effects (RE) Model

An alternative method to take into account the section-specific intercept effects is the random effects model. This model treats the differences among sections as random not fixed. The a_i's in model (5.7) are fixed but in random effects model it is assumed that a_i's are random:

$$a_i = a + e_i$$

Then the equation (5.7) could be written in this form:

$$Y_{it} = (a + e_i) + \beta_1 X_{1it} + \beta_2 X_{2it} + ... + \beta_k X_{kit} + u_{it} \qquad (5.8)$$

$$Y_{it} = a + \beta_1 X_{1it} + \beta_2 X_{2it} + ... + \beta_k X_{kit} + (u_{it} + e_i) \qquad (5.9)$$

In random effects model, some assumptions about the random component have to be made which is a disadvantage of this methodology. On the other hand, compared to fixed effects model, random effects model loses less degrees of freedom and it permits to use group dummies (Asteriou, 2006, p.371).

5.2.3.4. Hausman Test

If one chooses to use the model with constant slope and section specific intercept term, there are two alternatives: fixed effects (FE) vs. random effects (RE) models. Hausman (1978) formulated a test statistic to choose between these two approaches. In this test statistics, the null hypothesis claims that both β estimates of FE and RE models are consistent but β estimates of FE model is inefficient. On the other hand, alternative hypothesis claims that β estimates of FE model

are consistent and β estimates of RE model are inconsistent. Hausman Test statistics is as follows:

$$H = (\hat{\beta}^{FE} - \hat{\beta}^{RE})'\left[Var(\hat{\beta}^{FE}) - Var(\hat{\beta}^{RE})\right]^{-1}(\hat{\beta}^{FE} - \hat{\beta}^{RE}) \sim \chi^2(k)$$

If the Hausman test statistics is greater than the $\chi^2(k)$ critical value, k is the number of explanatory variables, we reject the null hypothesis. And with rejection of the null hypothesis, we conclude that we should use FE model.

5.2.3.5. Panel Unit Root Test

While time series data have answers to stationarity analysis, panel data unit root tests are still in progress.[11] Therefore; in this part, we briefly explain the available panel unit root tests. Levin, Lin & Chu extended Dickey-Fuller (DF) test and examine existence of unit root by considering the variability of lag length among different sections in the panel data. This test may be regarded as pooled DF or ADF test. Besides Levin, Lin & Chu t*-statistic, there are some other test statistics such as: Breitung t-statistic, Im, Pesaran and Shin W-statistic, PP–Fisher Chi-square statistic, ADF–Fisher Chi-square statistic and Hadri Z-statistic. Among the six test statistics, the first five of them have the null hypothesis of unit root existence while the last one has the null hypothesis that there is no unit root in the series.

5.3. Application

In this part of the thesis, we empirically examine the relationship between financial deepening and economic growth. In order to do this, we first make Granger causality analysis for each of the 49 countries. Then panel unit root test

[11] Detailed explanation on time series unit root test is given in section 5.2.2.1.

of the variables used in the analysis is employed and cointegration between the variables for each of the country is investigated. After these examinations, panel data estimation is carried out for the entire sample.[12]

5.3.1. Granger Causality Analysis

Before the panel data estimation, to be able to get an idea about country specific relationship and to be able to choose the variables which may be used in the models, we make the analysis of simple Granger causality for different lag lengths. This analysis consists of 49 countries and the variables, used as proxy for financial deepening and economic growth, are shown in Table 5.2.

Table 5.2 Economic Growth and Financial Deepening Variables

Economic Growth Variables	
Series Name	**Series Definition**
LGDP	Natural logarithm of real GDP
DGDP	Growth rate of real GDP
LCAPGDP	Natural logarithm of per capita GDP
DCAPGDP	Growth rate of per capita GDP
Financial Deepening Variables	
Series Name	**Series Definition**
M2Y	M2 / GDP(Current)
FSY	Financial Savings / GDP(Current)
LPC	Natural logarithm of Private Sector Credit
PCY	Private Sector Credit / GDP(Current)
DCY	Domestic Credit / GDP(Current)
PCDC	Private Sector Credit / Domestic Credit

[12] EViews 5.0 is used in the whole empirical analysis.

In Granger causality analysis, the following model is used:

$$EG_t = \alpha_{11} + \sum_{i=1}^{p} \lambda_{1i} FD_{t-i} + \sum_{i=1}^{p} \delta_{1i} EG_{t-i} + e_{t1} \quad (5.10)$$

$$FD_t = \alpha_{21} + \sum_{i=1}^{p} \lambda_{2i} FD_{t-i} + \sum_{i=1}^{p} \delta_{2i} EG_{t-i} + e_{t2} \quad (5.11)$$

where *EG* denotes economic growth proxy, *FD* denotes financial deepening proxy, *p* is the lag length and *t* is the period.

Results of the analysis for our sample may be categorized in the following classes: bi-directional relationship, uni-directional relationship that is from financial deepening to economic growth or vice versa and no precise relationship. The countries classified according to theses categories are in the Table A.1 (in Appendix A) and Turkey is included in the "EG to FD" (meaning that the relationship is from economic growth to financial deepening) category. If the results are evaluated, we can say that most of the countries are in the uni-directional category. Moreover, eight countries reveal different results according to the proxy used in the model. If the results of each country are generalized, all EG proxies give a causal relationship with the FD proxies. However, the EG series at levels give better causal relationships than the EG series at differences. When the financial deepening variables are considered, credit market variables work better than the money market variables. However, some countries give good results in financial savings to GDP ratio (FSY). For this reason, financial savings to GDP ratio (FSY) and private sector credits as a share of GDP (PCY), as financial deepening variables, and natural logarithm of real GDP (LGDP) and natural logarithm of real GDP per capita (LCAPGDP), as economic growth variables, seem to be appropriate variables in panel data analysis.

5.3.2. Panel Unit Root Analysis

In this section, we apply the available panel unit root test to our sample. EViews 5.0 gives six different test statistics for unit root tests: Levin, Lin & Chu t*-statistic, Breitung t-statistic, Im, Pesaran and Shin W-statistic, PP–Fisher Chi-square statistic, ADF–Fisher Chi-square statistic and Hadri Z-statistic. Unit root test results of our financial deepening and economic growth proxies are given in Table A.2 in Appendix A. From these results, we can conclude that series at levels are not stationary. On the other hand, as expected series at first differences are stationary.

5.3.3. Cointegration Analysis

Before panel data estimation, we make cointegration analysis for each country. Cointegration is tested by Engle and Granger methodology. In this methodology, the model is estimated with the non-stationary and same ordered series, and then fitted values of residuals are tested for stationarity. Stationarity of the series is tested by comparing the ADF test statistic with McKinnon critical values and if the ADF test statistic is higher than the critical value, we reject the null hypothesis of unit root. In Appendix A (Table A.3 and Table A.4), we have the results of cointegration for each country for two economic growth and five financial deepening variables at levels: natural logarithm of real GDP (LGDP), natural logarithm of real GDP per capita (LCAPGDP), natural logarithm of private sector credit (LPC), private sector credit to GDP ratio (PCY), domestic credit to GDP ratio(DCY), share of financial savings to GDP (FSY), ratio of M2 to GDP (M2Y). From this analysis we can conclude that there is no cointegration between financial deepening and economic growth variables for this sample.

5.3.4. Model Estimation

In the literature, there are a wide range of researches that examine the relationship between financial deepening and economic growth under a cross-country framework. Among them Kemal, Qayyum and Hanif (2007) use the following model:

$$EG_{it} = \alpha_i + \beta_i FD_{it} + \gamma_i X_{it} + e_{it} \quad (5.12)$$

where EG_{it} is the economic growth proxy, FD_{it} is the financial deepening proxy, X_{it} is a set of controlling variables and e_{it} is the error term.

In the light of previous examinations, the following panel model is estimated with two different economic growth variables, natural logarithm of real GDP (LGDP) and natural logarithm of real GDP per capita (LCAPGDP), and with two financial deepening variables, ratio of financial savings to GDP (FSY) and private sector credit to GDP ratio (PCY).

$$EG_{it} = \alpha_i + \beta_i FD_{1it} + \gamma_i FD_{2it} + u_{it} \quad (5.13)$$

where FD_{1it} is the first financial deepening proxy – money market measure – and FD_{2it} is the second financial deepening proxy – credit market measure. Since the two financial deepening variables represents different category of financial sector, we include both of them in the model. By including these variables to the equation, we end up with four different models. Moreover, to be able to take into account country specific effects, random and fixed effects models are estimated and Hausman test is carried out. The results reveal that we fail to reject the null hypothesis that both random and fixed effects models are significant but fixed effects model is inefficient because the Hausman test statistic is lower than the $\chi^2(2)$ critical value. For this reason, the results of random effects model is

accepted and given in Table 5.3 (country-specific random effects and detailed estimation results are given in Table A.5 and Table A.6 in Appendix A).

Table 5.3 Random Effects Model Results of Panel Data

		MODEL 1	**MODEL 2**
Dependent Var.		LGDP_?	LCAPGDP_?
Independent Var.		FSY_?, PCY_?	FSY_?, PCY_?
Constant	*Coeff.*	6,7097	10,4766
	S.E.	0,4958	0,4689
	t-Stat.	13,5324	22,3449
	Prob.	0,0000*	0,0000*
FSY_?	*Coeff.*	0,5491	0,3726
	S.E.	0,0624	0,0457
	t-Stat.	8,7943	8,1586
	Prob.	0,0000*	0,0000*
PCY_?	*Coeff.*	0,6888	0,4391
	S.E.	0,0514	0,0376
	t-Stat.	13,4018	11,6899
	Prob.	0,0000*	0,0000*
R^2		0,4541	0,4149
Adjusted R^2		0,4523	0,413
F-stat		245,8224	209,5775
Prob(F-stat)		0,0000*	0,0000*
Hausman Stat.		1,847	1,8549
$\chi^2(2)$		5,9915	5,9915
(?) denotes the country and (*) denotes significance of the coefficient at 5% significance level.			

Each of the two models reveals that both ratio of financial savings to GDP (FSY) and private sector credit to GDP ratio (PCY) are positively related with the economic growth variables, natural logarithm of real GDP (LGDP) and natural logarithm of real GDP per capita (LCAPGDP). Moreover, t statistics of each variable including the constant is significant and the overall significance of the variables, represented by the F-statistic, show that there is joint significance of the independent variables. This means that there is a significant and positive

relationship between financial deepening and economic growth that is from finance to growth. In the analysis, there is the assumption of linearity. Moreover, our data is unbalanced and may consist of structural changes and outliers. For these reasons, results should be treated cautiously.

CHAPTER 6

EMPIRICAL ANALYSIS OF THE TIME SERIES DATA FOR TURKEY

This chapter is devoted to the analysis of Turkish data covering the 1987-2006 period. This period constitutes the period after completion of the financial liberalization in Turkey. Analysis of this period will give us an idea on the effect of financial liberalization on economic growth. We use cointegration technique in order to investigate the effect of financial deepening on economic growth. The results indicate that the relationship between financial deepening and economic growth is significant and positive with the direction being mainly from economic growth to financial deepening. The outline of this chapter is as follows: analysis of Turkish data is given, Vector Autoregression (VAR) and Vector Error Correction (VEC) methodologies are explained and unit root tests, cointegration technique with VECM are employed.

6.1. Data

The period of this study, covers quarterly data from 1987 to 2006. The data used in this study is obtained from Electronic Data Distribution System (EDDS) of Central Bank of Republic of Turkey (CBRT) and proxies are calculated accordingly. Economic growth is measured with natural logarithm of quarterly real gross domestic product (GDP at 1987 constant prices), which is also used in the study of Waqabaca (2004), as economic growth proxy. Besides, GDP at current prices is obtained in order to be used in the calculation of financial deepening measures. Since the data frequency is quarterly, it should be seasonally adjusted (Figure 6.1). This can be done with relevant seasonal adjustment technique, Tramo-Seats. With this methodology seasonal parts of the

data is removed. Seasonally adjusted real GDP series is shown in Figure 6.2. Gross domestic product at current prices (GDP at current prices) has seasonality and it is smoothed like GDP at constant prices (GDP at current prices is shown in Figure 6.3 and seasonally adjusted GDP at current prices is shown in Figure 6.4).

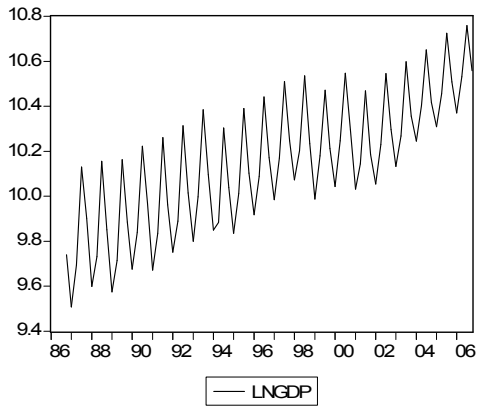


Figure 6.1 Natural Logarithm of GDP at 1987 Constant Prices

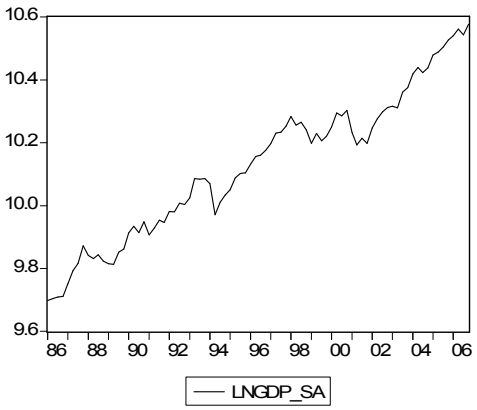


Figure 6.2 Seasonally Adjusted Natural Logarithm of GDP at 1987 Constant Prices

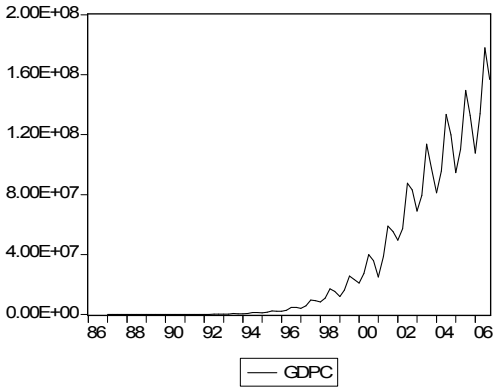


Figure 6.3 GDP at Current Prices

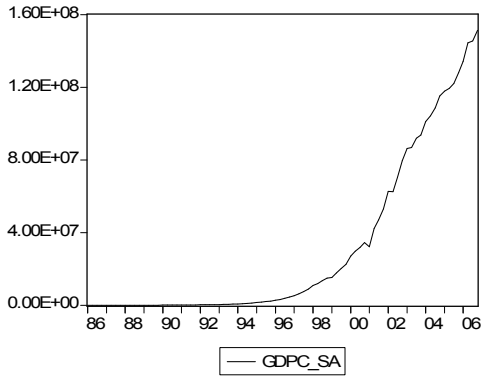
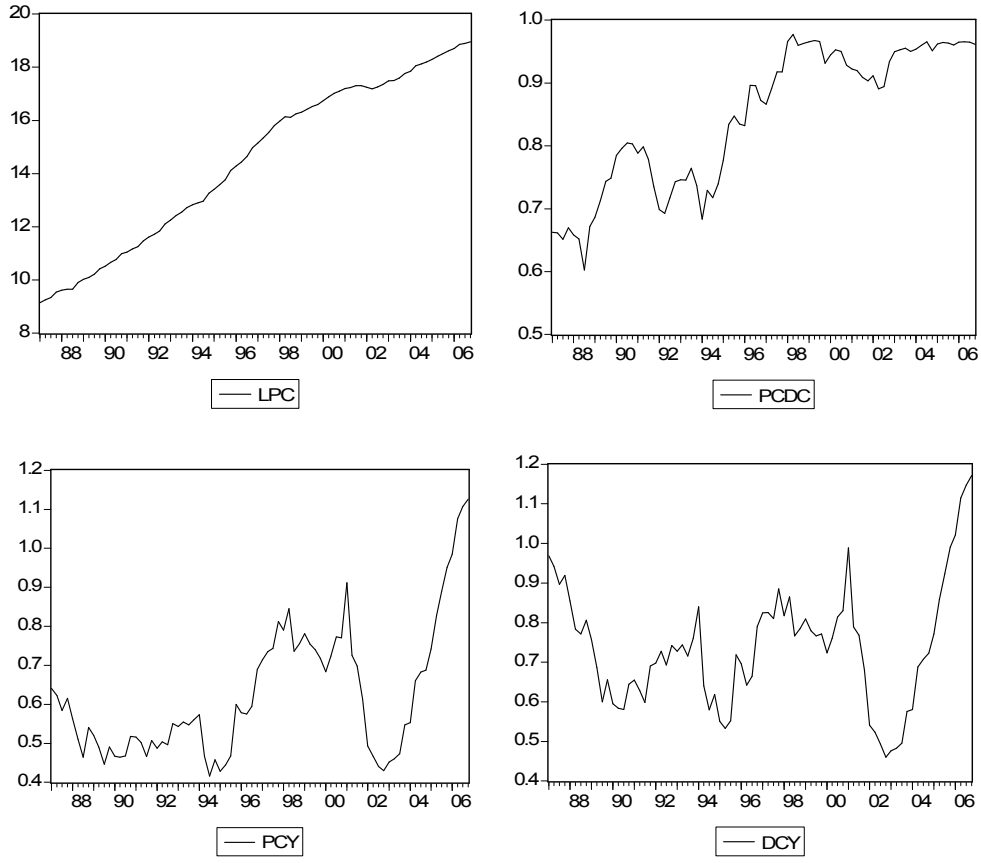


Figure 6.4 Seasonally Adjusted GDP at Current Prices

In the literature, there are several different measures used as proxy of financial deepening. These proxies can be classified under three different categories

depending on the structure of financial market.[13] The first category is credit market and it constitutes the proxies like; natural logarithm of private credit (LPC), private credit as a share of domestic credit (PCDC), private credit as a ratio of GDP (PCY) and ratio of domestic credit to GDP (DCY). Second category are ratios being the variables of money market, such as financial savings (FS=M3-M1) as a share of GDP (FSY), ratio of M2 to GDP (M2Y) and ratio of currency to broad money (M2Y). The last category is stock market and the measure is total traded value of stock market (TVT) as a ratio of GDP (TVTY). As the liquidity measurement of stock market, Gürsoy and Müslümov (1998) use ratio of total trade value of stock market to GDP (TVTY). The following figure shows the graphs of these financial deepening measures.



[13] More detailed explanation on the first two categories of financial deepening variables is given in the previous chapter.

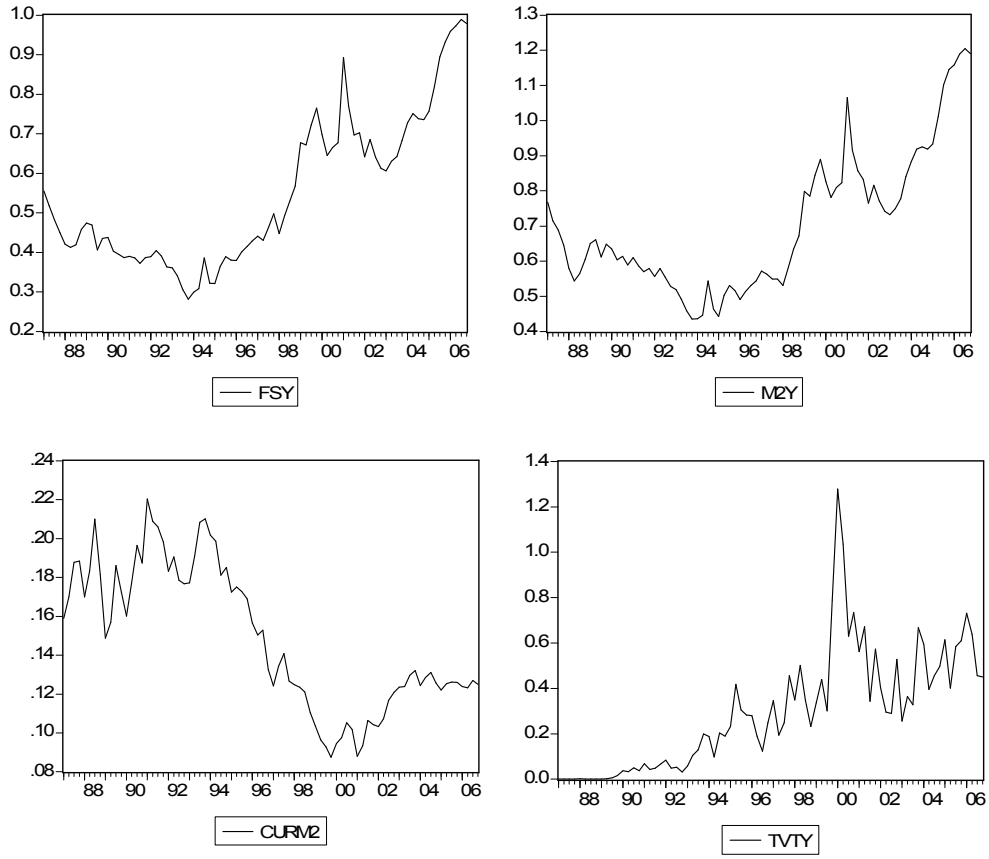


Figure 6.5 Financial Deepening Measures

In the graph of natural logarithm of private credit (LPC), there is an increasing trend in the whole analysis period. Share of private sector credit to domestic credit (PCDC) and ratio of private credit to GDP (PCY) have increasing trends but data have decreasing trends around the years 1994 and 2001, which are the crisis periods in Turkey. Domestic credit as a ratio of GDP (DCY) has a fluctuating pattern in the analysis period and it is decreasing in the years of crisis. These two financial deepening measures, PCY and DCY, reveal similar patterns. Financial savings to GDP ratio (FSY) has a declining trend between the years 1987-1994. After this period it follows an increasing trend except for the year 2001 which is the crisis period in Turkey. Broad money to GDP (M2Y) ratio follows a same pattern with FSY during this period. The last money market measure, currency as a share of M2 (CURM2), is falling till 2000 and it is increasing after this period. Ratio of total trade volume of stock market to GDP

(TVTY) graph shows a rising trend generally but it has a jump and fall between the years 1999-2001. Among these financial deepening proxies, some have fluctuations in this time scale. Moreover, there are some outliers in the series. Although some series seem to have structural changes, most of the financial time series data have this kind of feature. For this reason, analysis is done by following regular procedures including dummy variables to the model under examination.

6.2. Methodology

In order to uncover the relationship between financial deepening and economic growth, we used bi-variate Granger causality test under a Vector Autoregression model (VAR) and Vector Error Correction Model (VECM) context. Equations (5.1) and (5.2) are the models used in Granger causality analysis. In this technique, the direction of causality between the two variables can be determined. In the following sections, unit root tests, VAR and VEC models are explained.

6.2.1. Unit Root Tests

In order to estimate time series data, order of integration of each series should be determined. This can be provided with unit root tests. In Chapter 5, we explained the tests used in stationarity analysis in detail. The most commonly used unit root tests can be listed as: Dickey-Fuller, Augmented Dickey-Fuller and Phillips and Perron tests.

6.2.2. VAR and VEC Models

When there is no certainty whether variables in the equation are exogenous, they should be treated symmetrically. For instance, assume that there is an x_t series that is affected by current and past values of z_t, and a variable z_t affected by current and past values of x_t. According to this situation, the following bi-variate system may be written:

$$x_t = a_{11} - a_{12} z_t + \sum_{i=1}^{p} \tau_{1i} z_{t-i} + \sum_{i=1}^{p} \psi_{1i} x_{t-i} + \xi_{1t} \tag{6.1}$$

$$z_t = a_{21} - a_{22} x_t + \sum_{i=1}^{p} \tau_{2i} z_{t-i} + \sum_{i=1}^{p} \psi_{2i} x_{t-i} + \xi_{2t} \tag{6. 2}$$

This is an example of bi-variate VAR model and it assumes that x_t and z_t are stationary with the error terms being uncorrelated and white-noise. The system of equations formed with (6.1) and (6.2) cannot be estimated directly because x_t is correlated with ξ_{2t} and z_t is correlated with ξ_{1t}. Regressors should be uncorrelated with the error term in the application of standard estimation techniques. In order to estimate VAR model, reduced form of the VAR model is constructed. After making necessary corrections, we get reduced form of the VAR model:

$$x_t = \alpha_{11} + \sum_{i=1}^{p} \lambda_{1i} z_{t-i} + \sum_{i=1}^{p} \delta_{1i} x_{t-i} + e_{1t} \tag{6.3}$$

$$z_t = \alpha_{21} + \sum_{i=1}^{p} \lambda_{2i} z_{t-i} + \sum_{i=1}^{p} \delta_{2i} x_{t-i} + e_{2t} \tag{6.4}$$

The reduced form of the system has e_{1t} and e_{2t} error terms which are composites of the two shocks ξ_{1t} and ξ_{2t}. Since ξ_{1t} and ξ_{2t} are white-noise processes, both e_{1t} and e_{2t} have zero means, constant variances, and are individually serially

uncorrelated. If lag length is set to 1 ($p=1$), error terms e_{t1} and e_{t2} can be written as follows:

$$e_{1t} = \left(\xi_{1t} - a_{12}\xi_{2t}\right)/\left(1 - a_{12}a_{21}\right) \tag{6.5}$$

$$e_{2t} = \left(\xi_{2t} - a_{21}\xi_{1t}\right)/\left(1 - a_{12}a_{21}\right) \tag{6.6}$$

After estimating this system of equations (6.3) and (6.4), we should test whether one of the lagged endogenous variables has effect on the other endogenous variable. In order to test this, the standard F-test is used under the assumption of variable stationarity. In testing whether z_t has an effect on x_t, the null hypothesis is H_0: $\lambda_{1i} = 0$ and alternative hypothesis is H_a: one of the λ_{1i}'s is different from zero, where $i = 1, 2, \ldots, p$. Similarly, in testing whether x_t has an effect on z_t, the null hypothesis is H_0: $\delta_{1i} = 0$ and alternative hypothesis is H_a: one of the δ_{1i}'s is different from zero, where $i = 1, 2, \ldots, p$. If the null hypothesis is rejected, we can conclude that z_t has effect on x_t.

As it is stated previously, linear combination of non-stationary variables may be stationary because of the existence of a cointegrating relationship. If the long-run equilibrium is meaningful, error term has to be stationary. With this feature, a Vector Error Correction Model (VECM) could be formed instead of a differenced VAR model. The following model is an example to the VECM:

$$\Delta x_t = \mu_{11} + \sum_{i=1}^{p-1} \theta_{1i} \Delta z_{t-i} + \sum_{i=1}^{p-1} \gamma_{1i} \Delta x_{t-i} + \beta_{11} EC_{t-1} + u_{1t} \tag{6.7}$$

$$\Delta z_t = \mu_{21} + \sum_{i=1}^{p-1} \theta_{2i} \Delta z_{t-i} + \sum_{i=1}^{p-1} \gamma_{2i} \Delta x_{t-i} + \beta_{21} EC_{t-1} + u_{2t} \tag{6.8}$$

where u_{1t} and u_{2t} are stationary error terms, Δx_{t-i} and Δz_{t-i} are stationary variables and EC_{t-1} is the error correction term. In an error correction model, the deviation from equilibrium affects the short-run dynamics of the variables in the

system. In this methodology, the lagged right hand side variables' coefficients (θ_{1i}, θ_{2i}, γ_{1i} and γ_{2i}) show short run effect which is called impact multiplier. The coefficient of error correction variables (β_{11} and β_{21}) show the correction of the disequilibrium from the long-run equilibrium and the coefficients are called adjustment effects. If coefficient of error correction term is large, response to the previous period's deviation from long-run equilibrium is high while small values of error correction term's coefficient can be interpreted as left hand side variable is unresponsive to last period's equilibrium error (Enders, 2004). With this model; long-run relationship can be captured by the adjustment coefficient. If we find out both coefficients of error correction terms to be zero, we conclude that there is no long-run relationship and model should be estimated by using VAR model. In a VECM; if one of the adjustment coefficient is zero, all adjustment is done by the other adjustment coefficient. In this case, the endogenous variable that has zero adjustment coefficient can be treated as weakly exogenous.

In order to apply VECM, cointegration has to be detected. Engle-Granger Methodology proposes four steps. In the first step, order of integration of each variable is determined with the unit root test described in Chapter 5. In the second step, the long-run equilibrium relationship is estimated with Equation (5.5) and fitted values of e_t ($\hat{e}_t$) series is tested for stationarity by comparing DF or ADF test statistic with McKinnon (1991) critical values. If this series is stationary, we can conclude that there is cointegration between x_t and z_t. $\hat{e}_t$ may be used as error correction term of the VECM which is proposed as an instrumental variable for the $(x_{t-1} - \alpha_1 z_{t-1})$ by Engle and Granger (1987). Equations (6.7) and (6.8) constitute the VECM with EC_{t-1} being $\hat{e}_t$. In the third step, VECM is estimated and significance of each coefficient of lagged endogenous variables and coefficient of error correction terms are examined. Restriction on lagged endogenous variables' coefficients may be tested by F-test and significance of adjustment coefficients may be tested with t-test. As the last step, model adequacy should be tested.

In both VAR and VEC models, lag length may be determined by using standard VAR model in levels. VAR model is estimated by using different lag length selection criteria such as Sequential Modified Likelihood Ratio (LR), the Final Prediction Error (FPE), Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC) and the Hannan-Quinn Information Criterion (HQ). These five information criteria may give conflicting results. Since the aim is to find the best possible results, the criterion is chosen according to the theory and priory knowledge of the relationship in question. Generally, Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC) is used in decision of lag length. The model that minimizes these criteria is chosen as the optimal model.

6.2.2.1. Impulse Response Functions and Variance Decompositions

In order to depict system dynamics; innovation accounting, which is composed of impulse response and variance decomposition analyses, is used. While an impulse response function traces the effect of one standard deviation shock to one of the innovations on current and future values of the endogenous variables, variance decomposition decomposes variation in an endogenous variable into the component shocks to the endogenous variable in VAR.

When equations (6.3) and (6.4) are considered, a shock to one variable affects the variable itself. Since VAR has a dynamic structure, this affect is also transmitted to all of the endogenous variables in the system. For instance, a change in e_{t1} will immediately have an effect on x_t and it will also change future values of x_t and z_t because of the existence of lagged x_t in both equations. If the innovations e_{t1} and e_{t2} are uncorrelated, e_{t1} is innovation for x_t and e_{t2} is innovation for z_t. However, in real data the innovations are usually correlated so that the two variables have a common component which cannot be associated with one of them specifically. This problem could be solved by attributing all of the effect of any common component to the variable that comes first in the VAR

system. This methodology is named as Cholesky decomposition. This analysis can change depending on the order of the variables in the VAR system; for this reason, one should take into account this property in the impulse response analysis.

In variance decomposition analysis, we obtain information about the relative importance of each random innovation to the variables in the VAR. That is to say, variance decomposition "provides the variance of the forecast errors in a specific variable to its own shocks and those of the other variables in the VAR model" (Cortes and Cruz, 2007, p.7).

6.3. Empirical Analysis

In this part of the study; to find out the relationship between economic growth and financial deepening, application of Vector Auto-Regression (VAR) and Vector Error Correction Model (VECM) techniques will be provided. As a first step, stationarity and order of integration of the economic growth and financial deepening measures will be determined. The whole analysis is done using E-Views 5.0.

In many researches[14], the following VAR model – system of equations containing (6.9) and (6.10) – and VECM – system of equations containing (6.11) and (6.12) – are used in the analysis of the relationship between financial deepening and economic growth. In this study, we are going to use these two models:

[14] Some of them can be listed as Filer, Hanousek and Campos (1999); Kularatne (2001); Ünalmış (2002) and Azman-Saini and Smith (2006).

$$EG_t = \alpha_{11} + \sum_{i=1}^{p} \lambda_{1i} FD_{t-i} + \sum_{i=1}^{p} \delta_{1i} EG_{t-i} + e_{t1} \quad (6.9)$$

$$FD_t = \alpha_{21} + \sum_{i=1}^{p} \lambda_{2i} FD_{t-i} + \sum_{i=1}^{p} \delta_{2i} EG_{t-i} + e_{t2} \quad (6.10)$$

$$\Delta EG_t = \mu_{11} + \sum_{i=1}^{p-1} \theta_{1i} \Delta FD_{t-i} + \sum_{i=1}^{p-1} \gamma_{1i} \Delta EG_{t-i} + \beta_{11} EC_{t-1} + u_{t1} \quad (6.11)$$

$$\Delta FD_t = \mu_{21} + \sum_{i=1}^{p-1} \theta_{2i} \Delta FD_{t-i} + \sum_{i=1}^{p-1} \gamma_{2i} \Delta EG_{t-i} + \beta_{21} EC_{t-1} + u_{t2} \quad (6.12)$$

where *EG* denotes economic growth proxy, *FD* denotes financial deepening proxy, *p* is the lag length and *t* is the period.

6.3.1. Stationarity Analysis

As it is mentioned before, order of integration of each series should be determined to be able to apply VAR and VECM methodologies. Both Augmented Dickey-Fuller and Phillips-Perron tests are used in the stationarity analysis. Lag lengths are determined with Akaike Information Criterion (AIC). The Econometrics program (E-Views 5.0) gives appropriate lag length automatically, according to the criteria set by the user. The following four tables show ADF and PP results of each series at levels and at first differences. From these results we can conclude that each series has unit root at levels and it is stationary when first difference is taken. It can be said that all variables are integrated of order 1, *I(1)*. We can confirm this result by heuristic analysis of looking at the graphs of the series in the data part of this chapter. Moreover, we can draw correlograms of these series and make graphical analysis of the stationarity.[15] If the autocorrelation function (ACF) does not decrease fast enough, while lag length is increasing, stationary does not exist. All of these

[15] Correlograms of each variable used in the analysis are shown in Appendix A.

series' (at levels) ACF do not increase fast enough while the lag length is increasing. On the other hand series at first difference do not show such a property. This means that the series in examination are integrated of order 1, I(1).

Table 6.1 ADF Unit Root Test Results, Series at First Differences

ADF at first difference		**D(LGDP)**	**D(LPC)**	**D(PCDC)**	**D(PCY)**	**D(DCY)**	**D(FSY)**	**D(M2Y)**	**D(CURM2)**	**D(TVTY)**
None	ADF test statistic	-2.7368	-0.7942	-7.7787	-4.6180	-8.6256	-8.7345	-8.5946	-8.7755	-6.9949
	P-value	0.0068*	0.3686	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Lag length	5	7	0	1	0	0	0	0	2
Intercept	ADF test statistic	-6.3100	-1.6648	-7.9246	-4.6927	-8.5860	-8.8296	-8.6577	-8.7390	-7.0017
	P-value	0.0000*	0.4446	0.0000*	0.0002*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Lag length	3	7	0	1	0	0	0	0	2
Intercept and trend	ADF test statistic	-6.3233	-2.1116	-7.9093	-4.8815	-8.9668	-9.1667	-9.0457	-8.6797	-6.9540
	P-value	0.0000*	0.5304	0.0000*	0.0008*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Lag length	3	7	0	1	0	0	0	0	2
(*), (**) and (***) denotes rejection of the null hypothesis that there is unit root at 1%, 5% and 10% significance levels.										

Table 6.2 PP Unit Root Test Results, Series at First Differences

PP at first difference		**D(LGDP)**	**D(LPC)**	**D(PCDC)**	**D(PCY)**	**D(DCY)**	**D(FSY)**	**D(M2Y)**	**D(CURM2)**	**D(TVTY)**
None	PP test statistic	-8.1532	-3.4076	-7.7787	-8.5076	-8.7069	-8.7343	-8.5940	-9.0383	-13.9488
	P-value	0.0000*	0.0009*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Lag length	4	15	0	4	4	1	1	8	14
Intercept	PP test statistic	-9.0464	-6.4443	-7.9263	-8.5467	-8.6695	-8.8300	-8.6577	-9.0890	-15.0561
	P-value	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0001*
	Lag length	2	2	1	4	4	1	0	9	15
Intercept and trend	PP test statistic	-9.0014	-6.6625	-7.9105	-8.8000	-8.9705	-9.2921	-9.0577	-9.0080	-15.0527
	P-value	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0001*
	Lag length	2	1	1	4	3	4	3	9	15
(*), (**) and (***) denotes rejection of the null hypothesis that there is unit root at 1%, 5% and 10% significance levels.										

Table 6.3 ADF Unit Root Test Results, Series at Levels

ADF at levels		LGDP	LPC	PCDC	PCY	DCY	FSY	M2Y	CURM2	TVTY
None	ADF test statistic	3.6421	0.7599	1.2784	0.6927	0.1104	1.0838	0.9385	-0.6373	-1.4680
	P-value	0.9999	0.8759	0.9480	0.8631	0.7148	0.9263	0.9061	0.4382	0.1319
	Lag length	4	8	0	2	0	0	0	0	0
Intercept	ADF test statistic	0.3461	-1.5398	-1.4620	-0.7532	-3.1222	0.2271	0.1742	-1.3361	-2.6605
	P-value	0.9792	0.5078	0.5476	0.8262	0.0293**	0.9727	0.9693	0.6091	0.0855***
	Lag length	4	8	1	2	8	0	0	0	0
Intercept and trend	ADF test statistic	-1.8100	-1.2199	-2.1944	-2.9329	-3.1360	-2.2714	-1.9995	-2.3754	-4.2658
	P-value	0.6902	0.8985	0.4858	0.1587	0.1061	0.4441	0.5924	0.3894	0.0058*
	Lag length	4	8	1	8	8	0	0	0	0
(*), (**) and (***) denotes rejection of the null hypothesis that there is unit root at 1%, 5% and 10% significance levels.										

Table 6.4 PP Unit Root Test Results, Series at Levels

PP at levels		LGDP	LPC	PCDC	PCY	DCY	FSY	M2Y	CURM2	TVTY
None	PP test statistic	3.2850	6.7793	1.2784	0.6886	-0.0067	1.1003	0.9336	-0.6499	-1.0937
	P-value	0.9997	1.0000	0.9480	0.8624	0.6775	0.9284	0.9054	0.4326	0.2463
	Lag length	2	5	0	4	4	1	1	9	10
Intercept	PP test statistic	-0.3457	-1.5179	-1.3818	-0.4729	-1.7126	0.2453	0.1634	-1.2005	-2.4288
	P-value	0.9122	0.5195	0.5872	0.8901	0.4211	0.9738	0.9685	0.6708	0.1372
	Lag length	2	4	1	4	4	1	1	6	5
Intercept and trend	PP test statistic	-2.8240	-0.3299	-2.0966	-1.5716	-1.5664	-2.2614	-1.9995	-2.2823	-4.2497
	P-value	0.1933	0.9885	0.5395	0.7954	0.7974	0.4495	0.5924	0.4383	0.0061*
	Lag length	4	4	2	4	3	1	0	2	2
(*), (**) and (***) denotes rejection of the null hypothesis that there is unit root at 1%, 5% and 10% significance levels.										

6.3.2. Model Analysis

In the first part of the analysis, all financial deepening variables are treated as if they are not cointegrated and Granger causality tests are applied in order to get an idea about the relationship between financial deepening and economic growth. Test is applied to the first differenced variables since all the variables are found to be *I(1)*.

Table 6.5 Granger Non-causality Test Results

Lag	Null Hypothesis:	Obs	F-Stat.	Prob.
4	D(LPC) does not Granger Cause D(LGDP)	75	0.7118	0.5868
	D(LGDP) does not Granger Cause D(LPC)		4.5249	0.0027*
4	D(PCDC) does not Granger Cause D(LGDP)	75	0.7692	0.5491
	D(LGDP) does not Granger Cause D(PCDC)		1.3687	0.2543
4	D(PCY) does not Granger Cause D(LGDP)	75	0.3561	0.8389
	D(LGDP) does not Granger Cause D(PCY)		8.7175	0.0000*
4	D(DCY) does not Granger Cause D(LGDP)	75	0.38148	0.8211
	D(LGDP) does not Granger Cause D(DCY)		8.05997	0.0000*
4	D(FSY) does not Granger Cause D(LGDP)	75	0.4199	0.7937
	D(LGDP) does not Granger Cause D(FSY)		0.2245	0.9238
4	D(M2Y) does not Granger Cause D(LGDP)	75	0.4925	0.7412
	D(LGDP) does not Granger Cause D(M2Y)		0.3762	0.8249
4	D(CURM2) does not Granger Cause D(LGDP)	75	1.1392	0.3459
	D(LGDP) does not Granger Cause D(CURM2)		3.9044	0.0066*
4	D(TVTY) does not Granger Cause D(LGDP)	75	1.8757	0.1251
	D(LGDP) does not Granger Cause D(TVTY)		1.3448	0.2627

(*) denotes rejection of the null hypothesis at 5% significance level.
Rejection means there is causality between the variables.

In Table 6.5[16], it is observed that four of the eight financial deepening measures reveal relationship with the economic growth proxy. These measures are natural logarithm of private credit (LPC), ratio of private credit to GDP (PCY), domestic credit as a share of GDP (DCY) and ratio of currency to broad money

[16] Lag lengths are determined with the lag length selection criteria, especially AIC and SBC, which are given automatically by the program for the specified maximum number of lags.

(CURM2). All of them have the same direction, from economic growth to financial deepening.

As it is stated previously, this causality test is applied with ignoring the possible cointegrating relationship between the variables. For this reason, each model will be formed after the examination of cointegrating relationship and according to this; VEC models can be formed.

Engle-Granger methodology proposes estimating long-run equation for each of the proxy and test whether the residuals are stationary. In order to get residuals we estimated the following VAR model:

$$EG_t = \alpha_{10} + \alpha_{11} FD_t + e_{1t} \quad (6.13)$$

$$FD_t = \alpha_{20} + \alpha_{21} EG_t + e_{2t} \quad (6.14)$$

From this analysis, fitted values of e_{1t} ($\hat{e}_{1t}$) and e_{2t} ($\hat{e}_{2t}$) are examined. Table 6.6 shows the results of stationarity analysis of $\hat{e}_{1t}$ and $\hat{e}_{2t}$. If the series is stationary, we conclude that there is cointegration between economic growth measure and each of the financial deepening proxy. As it is mentioned previously, critical values introduced by McKinnon (1991) are used. From this analysis, we fail to reject the null hypothesis that there is unit root in the series of share of private sector credit in domestic credit (PCDC) and ratio of currency to M2 (CURM2). It can be said that there is no cointegrating vector between natural logarithm of real GDP (LGDP) and share of private sector credit in domestic credit (PCDC) also between natural logarithm of real GDP (LGDP) and ratio of currency to M2 (CURM2). On the other hand, we reject the null hypothesis that there is unit root for six of the financial deepening proxies: natural logarithm of private credit (LPC), private credit as a ratio of GDP (PCY), ratio of domestic credit to GDP (DCY), ratio of M2 to GDP (M2Y), financial savings as a share of GDP (FSY) and total traded value of stock market as a ratio of GDP (TVTY). We can

conclude that these six financial deepening measures are individually cointegrated with the economic growth proxy (LGDP). However, one should be very cautious that structural change and/or outlier problems are not considered in the analysis which is done under the assumption of linearity.

Table 6.6 Stationarity Results of Fitted Residuals of the Long-run Equilibrium between EG and FD Proxies

		t-statistic	Critical value
LGDP	e_{1t}	-3.8235*	-3.1000
LPC	e_{2t}	-2.7162	-3.1000
LGDP	e_{1t}	-1.7069	-3.1000
PCDC	e_{2t}	-2.0666	-3.1000
LGDP	e_{1t}	-2.6260	-3.1000
PCY	e_{2t}	-3.1297*	-3.1000
LGDP	e_{1t}	-3.7650*	-3.1000
DCY	e_{2t}	-1.7881	-3.1000
LGDP	e_{1t}	-3.2889*	-3.1000
M2Y	e_{2t}	-2.3044	-3.1000
LGDP	e_{1t}	-3.5569*	-3.1000
FSY	e_{2t}	-2.4899	-3.1000
LGDP	e_{1t}	-1.8686	-3.1000
CURM2	e_{2t}	-2.2796	-3.1000
LGDP	e_{1t}	-2.9594	-3.1000
TVTY	e_{2t}	-4.1388*	-3.1000

* Denotes rejection of the null hypothesis that there is unit root at 10% significance level.

Since there is no cointegrating relationship for two proxies of financial deepening, VECM can be formed with the other six measures, LPC, PCY, DCY, M2Y, FSY, TVTY. Before forming the models, lag lengths of each model is determined. This may be done by estimating the model with regular VAR model

in levels. Optimum lag length is chosen by evaluating Sequential Modified Likelihood Ratio (LR), the Final Prediction Error (FPE), Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC) and the Hannan-Quinn Information Criterion (HQ). AIC and SBC impose a penalty for adding regressors to the model. The model that minimizes these criteria is chosen and AIC is used widely. From lag length selection analysis, lag length of 5 is optimal in series at levels (lag length of 4 for series at first difference). In the model construction, residuals of each model are examined and dummy variables are created for the outliers that lie outside ±2 standard error. In VEC models, lagged endogenous variables show short-run relationship and the error correction term is interpreted as the adjustment to the long-run relationship.

Table 6.7 VECM for LPC, PCY and TVTY with LGDP

		VECM(4)		**VECM(4)**		**VECM(4)**	
		ΔLGDP	**ΔLPC**	**ΔLGDP**	**ΔPCY**	**ΔLGDP**	**ΔTVTY**
Granger Causality/ Block Exogeneity Wald Statistic	*ΔLGDP*	-	17.161** (0.002)	-	19.532** (0.001)	-	4.066 (0.397)
	ΔLPC	4.242 (0.374)	-	-	-	-	-
	ΔPCY	-	-	4.529 (0.339)	-	-	-
	ΔTVTY	-	-	-	-	14.222** (0.007)	-
Error Correction (EC)		-0.0335 [-0.513]	-0.017 [-0.092]	-0.062* [-1.872]	-0.142* [-2.546]	-0.0052 [-0.272]	-0.370* [-3.985]
R-squared		0.479	0.512	0.505	0.288	0.551	0.649
Adj. R-squared		0.388	0.427	0.428	0.177	0.472	0.587
Sum sq. residuals		0.030	0.228	0.028	0.041	0.026	0.602
S.E. equation		0.022	0.060	0.021	0.025	0.020	0.098
F-statistic		5.272	6.007	6.530	2.593	7.025	10.573
Log likelihood		187.294	110.929	189.193	175.578	192.840	74.514
Akaike AIC		-4.674	-2.638	-4.752	-4.389	-4.822	-1.667
Schwarz SC		-4.304	-2.267	-4.412	-4.049	-4.452	-1.296

(**) denotes significance of the lagged endogenous variable and (*) denotes significance of the error correction term at 5% significance level.
Data in ( ) is the p-value and in [ ] is the t-statistic of the variable.

Some models reveal no statistically significant results. Only three of the financial deepening measures give us statistically significant results. VECM results show that natural logarithm of private sector credits (LPC) has a direction from economic growth to financial deepening in the short-run and no significant relationship in the long-run. Model formed with ratio of private sector credits to GDP (PCY) and natural logarithm of real GDP (LGDP) reveals a direction from economic growth to financial deepening in the short-run and a bi-directional long-run relationship. Lastly, total traded value of stock market as a ratio of GDP (TVTY) and natural logarithm of real GDP (LGDP) has a relationship from financial deepening to economic growth in the short-run and long-run relationship is from economic growth to financial deepening.

Before giving the final results of the models, diagnostic check for each of the models should be done. In model adequacy check, we examine whether there is autocorrelation and heteroscedasticity in the model. Moreover, normality of the model is tested. In the hypothesis testing, the null hypothesis is that there is no misspecification in the model. Table B.2 (in Appendix B) shows diagnostic test results of the model and we can conclude that these models pass all diagnostic tests at 5% significance level.

In order to determine system dynamics, innovation accounting is carried out. In this analysis we make impulse response and variance decomposition analyses for each of the model formed previously. In Appendix C, impulse responses of each VECM are shown. From impulse response graphs, we observe that natural logarithm of real GDP (LGDP) has an effect on natural logarithm of private credit (LPC) and ratio of private credit to GDP (PCY). On the other hand, impulse response graph of total trade volume of stock market to GDP ratio (TVTY) and natural logarithm of real GDP (LGDP) reveals that there is a response of TVTY to LGDP. All of the responses are examined for 10 periods and the relevant variable comes to its long-run equilibrium back in this time period. As the variance decomposition of each equation is analyzed, we can

reach the following conclusion (in Appendix C, variance decomposition tables for each model are provided). Variations in each of the variable are largely explained by shocks to the variable itself. However, except for the model with TVTY and LGDP variables, two models reveal that 9%-22% of the variation in financial deepening measures is caused by the shocks to the economic growth proxy (LGDP). Variation in LGDP is not caused by the financial deepening proxies in these two models. Moreover, 9% of the variation in LGDP is caused by the shocks to the TVTY. In innovation accounting, we observe that economic growth proxy has an effect on two of the three financial deepening measures, except for the total trade volume of stock market to GDP ratio (TVTY). This means that the relationship between financial deepening and economic growth is mainly from real sector to financial sector.

6.3.2.1. Results

VEC models together with impulse response and variance decomposition results reveal that there is a relationship between financial deepening and economic growth.

Table 6.8 Summary of the Relationships

	Direction of the Relationship	
	Short-run relationship	*Long-run relationship*
LGDP-LPC	From EG to FD	-
LGDP-PCY	From EG to FD	Bi-directional
LGDP-TVTY	From FD to EG	From EG to FD

Our results, which are summarized in Table 6.8, allow us to conclude that the relationship between financial deepening and economic growth is mainly from economic growth to financial deepening in the short-run as most of the proxies reveal this result. Moreover, it can be interpreted that most of the financial deepening measures reveal a relationship that is from real sector to financial

sector in the long-run and a bi-directional relationship is also observed. However, it is worth to note that the analysis presented here does not consider structural shifts and only consider a linear relationship among variables. Therefore the results should be evaluated cautiously.

CHAPTER 7

CONCLUSION

Determination of the relationship between financial deepening and economic growth is significant for countries because development policies may be implemented according to the direction of this relationship. It can be argued that supply-leading relationship may lead to financial sector liberalization policies. On the other hand, if the relationship is demand-following, more emphasis should be placed on other growth-enhancing policies. For this reason, some empirical analyses on this issue are carried out for Turkey.

When evolution of financial sector since the foundation of Republic of Turkey is evaluated, it can be said that financial liberalization period started in 1980s. In 1990, Turkey had a fully liberalized financial sector which was dominated by banking sector. Moreover, share of financial assets in GDP has an increasing trend during the 1980-2006 period and reaches to 56.8 % in 2000-2006 period.

49 OECD and emerging market countries' empirical analysis give us an idea how the overall relationship may be among our sample for 1953-2005 period. Granger causality tests carried out for each of the country reveals that Turkey has a direction that is from economic growth to financial deepening. Moreover, most of the countries show a uni-directional relationship which is from economic growth to financial deepening or financial deepening to economic growth. Low number of countries reveals a bi-directional relationship. It can be concluded that the proportion of developed countries in bi-directional relationship category is higher than the uni-directional category. In addition, percentage of developed countries is higher in finance to growth direction than the growth to finance direction. The panel data estimation with financial savings to GDP ratio (FSY) and private sector credits as a share of GDP (PCY), natural

logarithm of real GDP (LGDP) and natural logarithm of real GDP per capita (LCAPGDP) variables reveals that financial deepening variables have significant and positive effect on economic growth variables. Therefore, in the light of theoretical model, we can conclude that financial deepening has an effect on economic growth for 49 countries. However, one should be cautious in evaluating the results which do not consider structural shifts and outliers.

This thesis also empirically analyzes the causal link between financial deepening and economic growth for Turkey with quarterly time series data for the 1987-2006 period. In this examination, Granger causality with bi-variate VAR, VECM methodologies along with impulse response and variance decomposition analyses are carried out by using selected financial deepening and economic growth indicators explained in the previous chapters. Cointegration between each financial deepening proxy and economic growth indicator is investigated by Engle-Granger technique. Six of the eight financial deepening proxies show a cointegrating relationship with the economic growth indicators. Therefore, six VEC models are formed. Among the models, three of them give statistically significant results and the variables are natural logarithm of private sector credits (LPC), ratio of private sector credits to GDP (PCY), total traded value of stock market as a ratio of GDP (TVTY) and natural logarithm of real GDP (LGDP). According to these models, impulse response and variance decomposition analyses are done. Most of the models reveal that the relationship between financial deepening and economic growth is from economic growth to financial deepening in the short-run. Moreover, there is long-run relationship for two of the financial deepening measures. For total traded value of stock market as a ratio of GDP (TVTY), the relationship is from real sector to financial sector and a bi-directional relationship is observed in ratio of private sector credits to GDP (PCY).

To sum up, in both cross-country and country-specific analyses, we observe a relationship that is mainly from economic growth to financial deepening for

Turkey. However, the relationship is sensitive to the financial deepening proxy used in the model. Moreover, as it is stated before, assumption of linearity and possibility of structural changes necessitates cautious evaluation of the results. Result of this study supports some of the researches made on Turkey. On the other hand, some researches observe that finance causes growth. The reason for differing result may be the frequency of data. In all of the studies annual data is used whereas quarterly data is employed in this study. Moreover, the time scale of each study is different which may bring about different directions of the relationship.

There are some reasons why finance may not lead real sector. One of them may be that enough financial deepening which would lead economic growth could not be satisfied. Moreover, another reason may be financial sector being less deep in Turkey than the financial sector in more developed countries. Since Turkey is a developing country, economic conditions of Turkey may be affected from the developed countries' economies. For this reason, financial sector may be triggered by the economic conditions. Furthermore, political instability in Turkey may have more effect on economic growth than financial deepening so that economic growth is not effected from financial deepening. Due to fluctuating economic indicators, enough financial deepening may not be satisfied. In addition, since Turkey is a riskier country than developed countries, foreign investments are generally made in shorter terms. For this reason, enough level of financial deepening may not be achieved. These may be the reasons that financial sector functions may not work efficiently and effectively. However, in the log-run, there may be feedback effects between some of the financial deepening variables and economic growth as it is presented in the theoretical studies.

The researches following Granger causality tests do not take into account structural shifts in their models. For future analysis, this study may be carried out with modern estimation techniques by considering structural shifts and

financial crisis in Turkey. Moreover, linearity assumption may be relaxed and relationship between financial deepening and economic growth may be investigated with different methodologies.

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APPENDICES

APPENDIX A

Table A.1 Granger Causality Results of Each Country in Analysis

Bi-directional	Direction changes according to the variables	EG to FD	FD to EG	No precise relationship
Australia	Canada	Argentina	Austria	Ireland
Finland	Greece	Brazil	Belgium	Slovak Rep.
Luxembourg	Mexico	France	Chile	
Singapore	Netherlands	Germany	China	
	New Zealand	Hungary	Colombia	
	Pakistan	India	Czech Republic	
	Peru	Indonesia	Denmark	
	United States	Israel	Egypt	
		Malaysia	Hong Kong	
		Norway	Iceland	
		Philippines	Italy	
		Portugal	Japan	
		South Africa	Korea	
		Saudi Arabia	Poland	
		Sweden	Spain	
		Thailand	Switzerland	
		Turkey	Venezuela	
		United Kingdom		

Table A.2 Unit Root Test Statistics

P-values for Each of The Statistics

	Null: Unit root					**Null: No unit root**
	*Levin, Lin & Chu t**	*Breitung t-stat*	*Im, Pesaran and Shin W-stat*	*PP-Fisher Chi-square*	*ADF-Fisher Chi-square*	*Hadri Z-stat*
LGDP	0,000	0,228	0,656	0,001	0,000	0,000
DGDP	0,000	0,000	0,000	0,000	0,000	0,000
LCAPGDP	0,000	0,149	0,773	0,003	0,000	0,000
DCAPGDP	0,000	0,000	0,000	0,000	0,000	0,000
M2Y	0,000	0,930	0,097	0,335	0,996	0,000
FSY	0,109	0,777	0,331	0,047	0,517	0,000
LPC	0,000	0,751	0,000	0,001	0,001	0,000
PCY	0,403	0,243	0,000	0,734	0,956	0,000
DCY	1,000	0,181	1,000	0,858	0,886	0,000
PCDC	0,000	0,086	0,000	0,000	0,000	0,000
D(M2Y)	0,000	0,000	0,000	0,000	0,000	0,067
D(FSY)	0,000	0,000	0,000	0,000	0,000	0,000
D(LPC)	0,000	0,000	0,000	0,000	0,000	0,000
D(PCY)	1,000	0,000	0,000	0,000	0,000	0,000
D(DCY)	0,000	0,000	0,000	0,000	0,000	0,000
D(PCDC)	0,000	0,000	0,000	0,000	0,000	0,000

This means no unit root.

Table A.3 Cointegration Results of Each Country from FD to EG

	FD to EG									
Dependent Var.	*LGDP*					*LCAPGDP*				
Independent Var.	*M2Y*	*FSY*	*LPC*	*PCY*	*DCY*	*M2Y*	*FSY*	*LPC*	*PCY*	*DCY*
ARG	-1,405	-0,527	-1,351	-1,045	-0,700	-1,406	-0,596	-2,684	-1,343	-0,797
AUS	-1,261	-2,590	-1,505	-1,339	-1,349	-1,261	-2,611	-1,390	-1,661	-1,579
AUT			-4,053	-2,026	-1,959			-3,584	-1,873	-1,923
BEL			-1,907	-1,871	-1,951			-1,938	-1,825	-1,896
BRZ	2,669	2,877	-2,280	2,607	-3,825	2,028	3,202	-8,447	1,975	2,831
CAN	-2,158	-2,061	-1,829	-2,636	-2,334	-2,262	-2,532	-2,127	-2,831	-2,477
CHL	1,356	-1,519	-1,755	-2,234	0,000	1,195	-1,556	-1,651	-2,228	-0,049
CHN	-1,556	-2,071	-0,463	-0,162	-0,510	-1,452	-1,934	-0,146	-0,069	-0,300
COL	-2,390	-2,275	-2,313	-1,252	-2,013	-3,491	-3,050	-2,964	-3,522	-2,454
CZH	-1,216	0,727	0,034	-1,953	-0,346	-1,240	0,813	-0,045	-1,838	-0,421
DEN	-1,482	-1,462			-2,462	-1,519	-1,598			-2,347
EGT	-1,823		-1,117	-2,740	-0,814	-1,872		-1,095	-2,562	-0,443
FIN					-1,747					-1,788
FRN	-1,606	-0,081	-0,028	-1,219	-1,044	-1,674	-0,186	-0,215	-1,040	-1,175
GER	-0,927	-0,424			-1,920	-0,976	-0,453			-1,875
GRE					-1,963					-1,875
HKG	-1,556	-2,071	-0,463	-0,162	-0,510	-1,423	-1,810	0,600	-0,242	-0,382
HUN	1,467	1,243			-0,056	1,193	1,189			-0,106
ICE			-0,696	-1,497	-1,560			-0,547	-1,948	-1,968
INA			-0,394	-5,197	-1,430			0,197	-1,525	-0,996
INS	-3,026		-2,980	0,338	-1,502	-1,928		-3,193	0,249	-1,795
IRE			0,341	2,105	-0,912			0,808	2,568	-0,983
ISR			-3,111	-4,760	-4,728			-10,071	-8,429	-11,851
ITL	-2,551				-2,657	-2,110				-2,701
JPN	-2,795	0,660	1,285	0,531	-0,411	-2,828	0,803	1,156	0,512	-0,406
KOR			-1,726	-1,574	-1,497			-1,958	-1,627	-1,544
LUX	-2,920				-1,822	-2,446				-3,263
MEX	-2,895	-2,131	-0,950	-1,184	-1,396	-3,087	-2,209	-0,887	-1,045	-1,252
MLS	-2,396	-2,309	-2,308	-2,863	-2,996	-3,728	-3,701	-2,451	-2,926	-2,904
NET	-0,728		-0,996	-2,113	-0,853	-0,459		-0,418	-1,050	-0,761
NOR	0,609		-3,019	-2,104	-1,947	-0,028		-1,770	-1,882	-1,893
NZL	-0,059	-1,783	-5,046	-2,326	-2,520	-0,085	-1,599	-3,990	-2,824	-3,083
PAK	-1,680		-2,117	-0,871	0,407	-1,522		-1,998	-0,737	0,504
PER			-1,155	-1,852	-0,237			-3,047	-1,852	-0,061
PHL		-0,875	-1,557	-1,229	-1,415		-0,393	-1,813	-2,247	-2,064
POL	-1,542	1,154			0,115	-1,520	1,369			0,158
POR	-0,332		-2,916	0,643	0,188	-0,307		-2,617	0,744	0,562
SAF	-3,264	1,787	-3,114	-2,796	-2,812	-1,694	-2,771	-1,773	-1,612	-1,821
SAR			-2,474	-3,295	-4,147			-2,840	-2,469	-3,412
SIN	-2,588	-1,269	-0,437	-2,302	-1,359	-2,458	-0,558	-2,008	-2,585	-1,563
SLV	-1,164	-0,968	-1,935	-0,510	-2,039	-1,050	-0,968	-1,854	-0,463	-1,315
SPN	-1,652	-0,758	-2,047	-1,315	-1,139	-1,612	-0,708	-1,765	-0,677	-1,024
SWN	-1,798	-2,912	-2,554	-2,310	-2,270	-1,728	-2,966	-2,591	-2,303	-2,269
SWT	-0,851	-1,938	-2,058	-2,274	-2,418	-0,117	-2,036	-2,079	-2,357	-2,308
THL	-3,183	-1,954	-1,862	-2,060	-2,337	-3,226	-2,061	-1,469	-2,112	-2,469
TRK	-2,297	-2,298	-2,677	-2,456	-2,444	-2,338	-2,490	-2,931	-2,497	-2,434
UKN			-1,726	-1,323	-1,407			-1,743	-1,302	-1,401
USS	-1,145	-1,666	-1,608	-1,244	-1,961	-1,585	-1,888	-1,737	-1,454	-1,928
VEN			-2,800	-3,515	-1,407			-4,028	-0,811	-0,422

This means that there is cointegration.

Table A.4 Cointegration Results of Each Country from EG to FD

	EG to FD									
Dependent Var.	*M2Y*	*FSY*	*LPC*	*PCY*	*DCY*	*M2Y*	*FSY*	*LPC*	*PCY*	*DCY*
Independent Var.	*LGDP*					*LCAPGDP*				
ARG	-1,497	-1,902	-2,037	-1,999	-3,059	-1,276	-1,021	-3,998	-1,632	-3,405
AUS	-1,261	-2,375	-1,345	0,123	-1,684	-1,261	-2,455	-1,241	0,043	-2,087
AUT			-3,780	-1,717	-1,501			-3,280	-1,538	-1,441
BEL			-1,672	-1,176	-1,221			-1,765	-1,193	-1,237
BRZ	1,400	-2,295	-1,946	1,139	-2,761	-3,308	-2,555	-1,756	-6,403	-3,180
CAN	-1,466	-3,639	-1,849	-2,312	-1,897	-1,518	-2,960	-2,123	-2,486	-2,016
CHL	-2,542	-1,514	-5,118	-2,862	-4,054	-2,653	-1,501	-5,067	-2,919	-4,116
CHN	-1,931	-2,415	-2,139	-2,847	-3,505	-1,857	-2,266	-2,229	-2,899	-3,516
COL	-2,692	-3,368	-2,244	-2,854	-2,028	-3,039	-3,876	-2,434	-3,522	-1,972
CZH	-1,582	-2,538	-3,046	-2,901	-0,872	-1,589	-2,496	-3,072	-2,910	-0,901
DEN	-1,092	-1,771			-1,079	-1,118	-1,803			-1,011
EGT	-1,876		-1,165	-2,854	-1,560	-1,809		-1,163	-2,811	-1,543
FIN					-2,280					-2,284
FRN	-2,657	-3,097	-0,704	-4,378	-1,122	-2,628	-3,230	-0,062	-4,876	-1,233
GER	-1,814	-2,233			-1,761	-1,833	-2,238			-1,792
GRE					-1,615					-1,449
HKG	-1,931	-2,415	-2,139	-2,847	-3,505	-1,883	-2,171	-2,220	-2,933	-3,544
HUN	-1,873	-4,376			-3,907	-1,919	-4,398			-3,881
ICE			-0,717	1,223	0,873			-0,544	1,321	0,958
INA			-0,586	-2,071	-1,733			-0,336	-1,385	-1,598
INS	-4,916		-3,180	-1,093	-1,626	-1,646		-3,386	-1,042	-1,823
IRE			-1,111	-2,473	1,579			-1,074	-2,477	0,274
ISR			-2,578	-2,754	-2,351			-4,078	-2,091	-3,124
ITL	-2,123				-0,672	-2,036				-0,688
JPN	-2,837	-1,230	0,831	-1,153	-0,591	-2,852	-1,189	0,745	-1,130	-0,576
KOR			-2,179	-1,266	-1,081			-2,254	-1,414	-1,248
LUX	-2,634				-0,536	-2,602				-0,698
MEX	-2,736	-2,431	-1,198	-1,513	-2,082	-2,986	-2,448	-1,237	-1,442	-2,019
MLS	-2,337	-2,234	-2,030	-1,524	-1,755	-3,207	-3,183	-1,145	-0,037	-0,379
NET	-1,304		-1,259	-2,211	-1,319	-1,201		-1,027	-1,476	-1,338
NOR	-2,509		-2,945	-1,711	-1,508	-2,515		-1,714	-1,466	-1,394
NZL	-1,406	-3,972	-6,915	-3,856	-2,756	-1,517	-4,191	-4,744	-3,483	-3,143
PAK	-3,249		-2,311	-2,040	-1,640	-3,141		-2,319	-2,219	-1,637
PER			-2,625	-1,573	-2,545			-1,869	1,015	-1,622
PHL		-2,803	-1,579	-2,698	-3,613		-2,900	-1,571	-3,238	-3,430
POL	-1,884	-1,869			-1,745	-1,880	-1,855			-1,784
POR	-1,241		-3,103	-1,114	-0,920	-1,261		-2,883	-1,085	-1,233
SAF	-1,348	-0,961	-2,745	-4,892	-0,920	1,208	-2,115	-0,001	-3,666	0,708
SAR			-1,505	-1,098	-2,204			-2,255	-0,771	-2,145
SIN	-2,588	-3,094	-0,604	-2,573	-2,971	-2,416	-3,046	-2,052	-2,794	-3,239
SLV	-1,833	-1,992	-1,944	-2,613	-4,156	-1,779	-1,992	-1,910	-2,615	-4,274
SPN	-1,696	-1,416	-1,925	-2,248	-1,924	-1,683	-1,385	-1,657	-2,186	-1,858
SWN	-1,587	-2,587	-2,142	-0,699	-1,016	-1,501	-2,627	-2,203	-0,729	-1,050
SWT	-2,655	-3,820	-1,601	-1,187	-1,190	-2,403	-3,798	-1,355	-1,028	-1,040
THL	-3,192	-2,545	-1,928	-2,497	-2,524	-3,273	-2,133	-1,653	-2,511	-2,761
TRK	-1,359	-1,570	-2,478	-3,122	-2,059	-1,213	-1,492	-2,445	-3,011	-1,797
UKN			-1,180	0,127	-0,032			-1,275	0,030	-0,144
USS	-1,545	-1,700	-1,426	-1,356	-1,455	-1,487	-1,487	-1,336	-1,317	-1,205
VEN			-0,144	-1,239	-2,083			-1,458	-1,556	-2,466

This means that there is cointegration.

Table A.5 Results of Random Effects Models

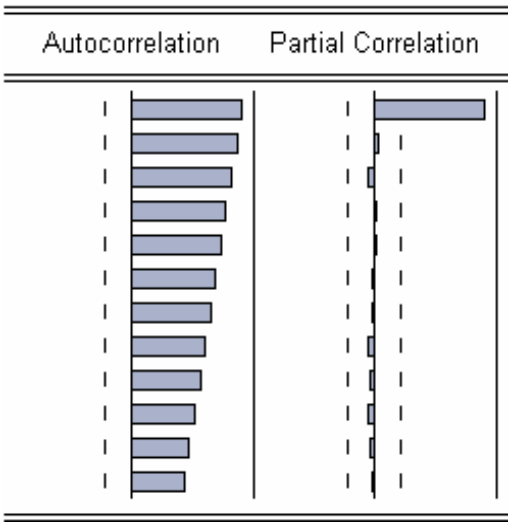
			MODEL 1		MODEL 2	
	Dependent Var.		LGDP_?		LCAPGDP_?	
	Independent Var.		FSY_?	PCY_?	FSY_?	PCY_?
	Constant	*Coeff.*	6.7097		10.4766	
		Std. Err.	0.4958		0.4689	
		t-Stat.	13.5324		22.3449	
		Prob.	0.0000		0.0000	
	Independent Var. Results	*Coeff.*	0.5491	0.6888	0.3726	0.4391
		Std. Err.	0.0624	0.0514	0.0457	0.0376
		t-Stat.	8.7943	13.4018	8.1586	11.6899
		Prob.	0.0000	0.0000	0.0000	0.0000
Effects Specification	*Cross-section random S.D. / Rho*		2.4199	0.9899	2.2918	0.9940
	Idiosyncratic random S.D. / Rho		0.2446	0.0101	0.1787	0.0060
Weighted Statistics	*R-squared*		0.4541		0.4149	
	Adjusted R-squared		0.4523		0.4130	
	S.E. of regression		0.2441		0.1789	
	F-statistic		245.8224		209.5775	
	Prob(F-statistic)		0.0000		0.0000	
	Mean dependent var		0.1482		0.1661	
	S.D. dependent var		0.3298		0.2335	
	Sum squared resid		35.2168		18.9095	
	Durbin-Watson stat		0.2183		0.2184	
Unweighted Statistics	*R-squared*		-0.0233		-0.0089	
	Sum squared resid		3313.74		2808.17	
	Mean dependent var		7.7150		11.1796	
	Durbin-Watson stat		0.0401		0.0504	

Table A.6 Random Effects of Each Cross-section

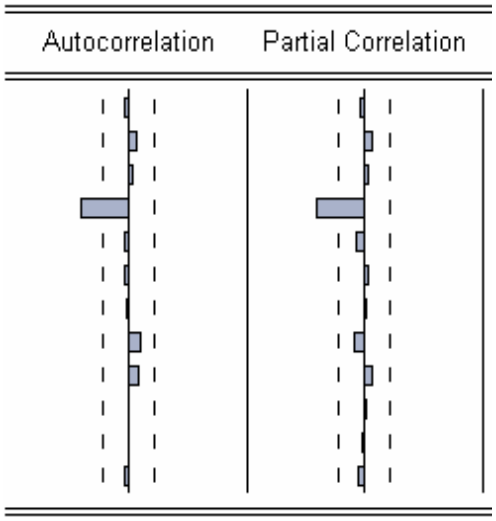
	MODEL 1		MODEL 2	
Dependent Var.	LGDP_?		LCAPGDP_?	
Independent Var.	FSY_?	PCY_?	FSY_?	PCY_?
Random Effects (Cross)	AUS--C	-0.8493	AUS--C	-0.3544
	CAN--C	-1.0141	CAN--C	-0.8601
	CZH--C	0.7541	CZH--C	1.6984
	FRN--C	1.3127	FRN--C	0.7067
	JPN--C	4.4285	JPN--C	3.3736
	MEX--C	-2.6159	MEX--C	-3.5167
	NOR--C	-3.0950	NOR--C	-1.0852
	SLV--C	-0.0424	SLV--C	1.5377
	SPN--C	3.4073	SPN--C	3.2315
	SWN--C	0.0109	SWN--C	1.2360
	SWT--C	-2.3046	SWT--C	-0.5545
	TRK--C	-2.2577	TRK--C	-3.1879
	USS--C	1.3358	USS--C	-0.7733
	ARG--C	-1.2869	ARG--C	-1.6941
	BRZ--C	0.1191	BRZ--C	-1.8145
	CHL--C	3.3260	CHL--C	3.9009
	CHN--C	-1.9535	CHN--C	-5.1249
	COL--C	5.0339	COL--C	4.6205
	HKG--C	-1.9535	HKG--C	0.1032
	MLS--C	0.1689	MLS--C	0.4729
	PHL--C	0.8689	PHL--C	-0.0872
	SIN--C	-3.0091	SIN--C	-0.7816
	SAF--C	-0.7570	SAF--C	-0.8993
	THL--C	0.3730	THL--C	-0.1478

APPENDIX B

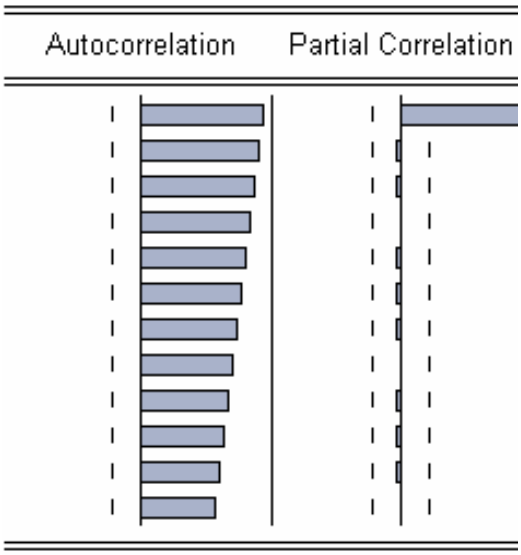
Correlograms



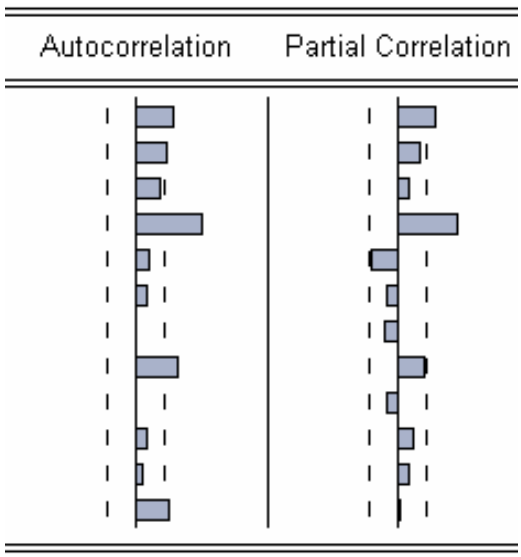
Correlogram of LGDP



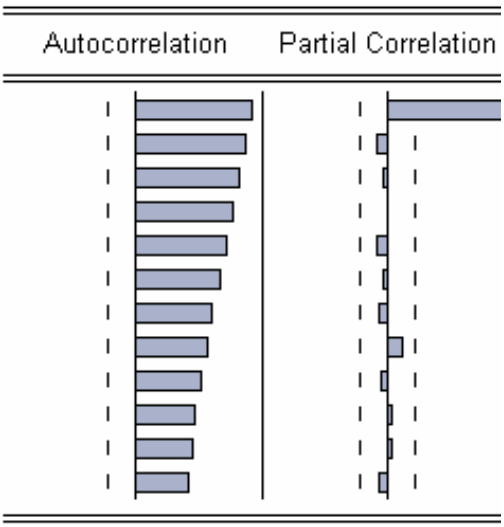
Correlogram of ΔLGDP



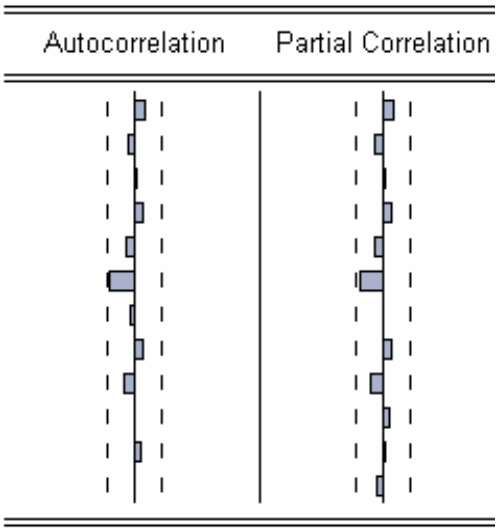
Correlogram of LPC



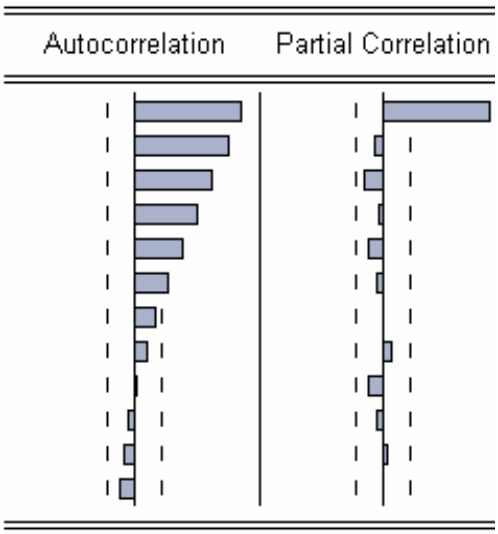
Correlogram of ΔLPC



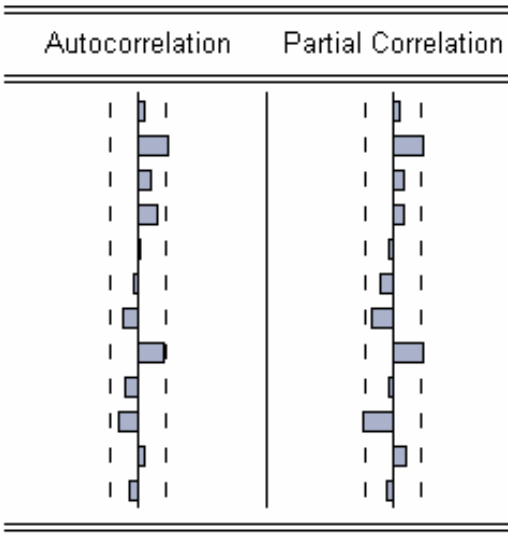
Correlogram of PCDC



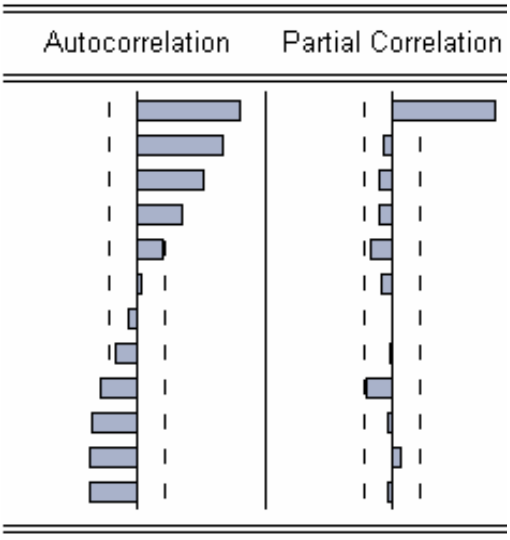
Correlogram of ΔPCDC



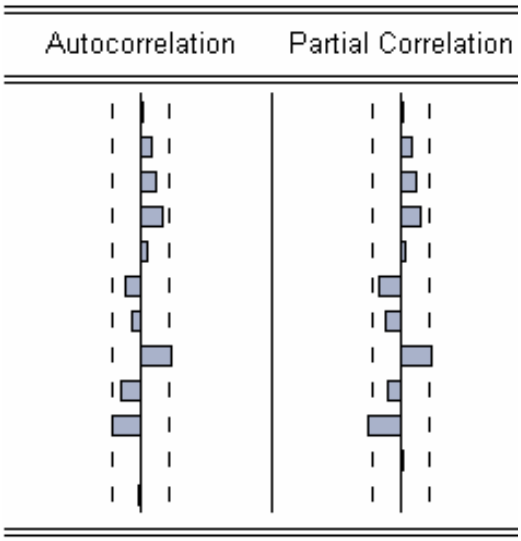
Correlogram of PCY



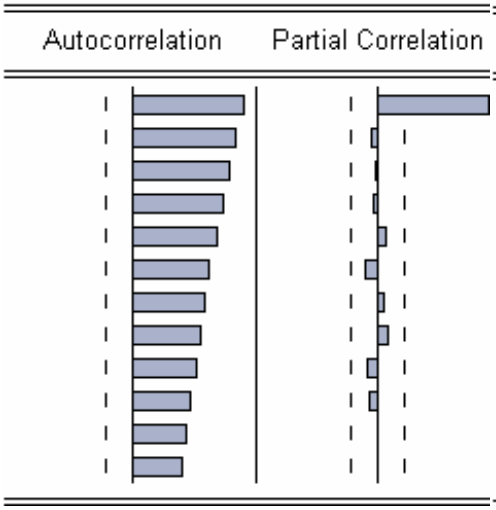
Correlogram of ΔPCY



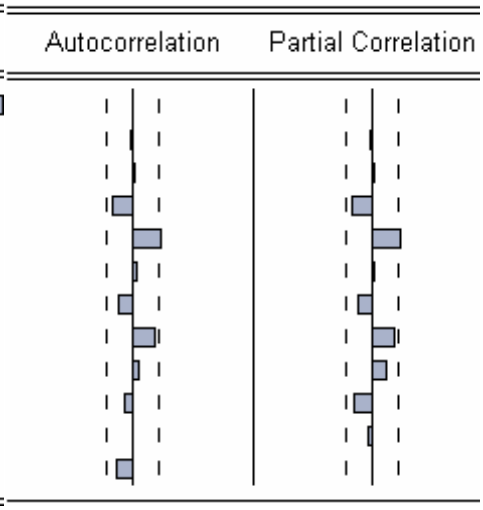
Correlogram of DCY



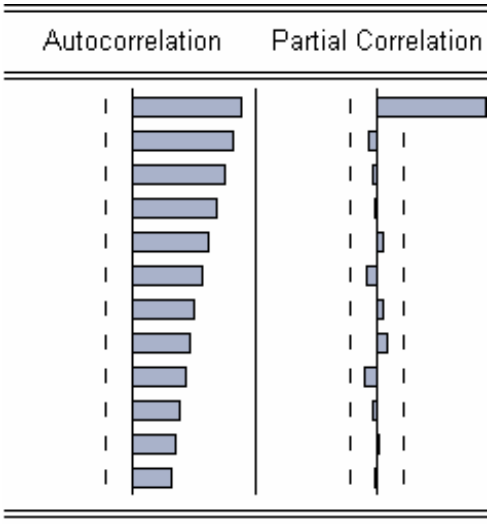
Correlogram of ΔDCY



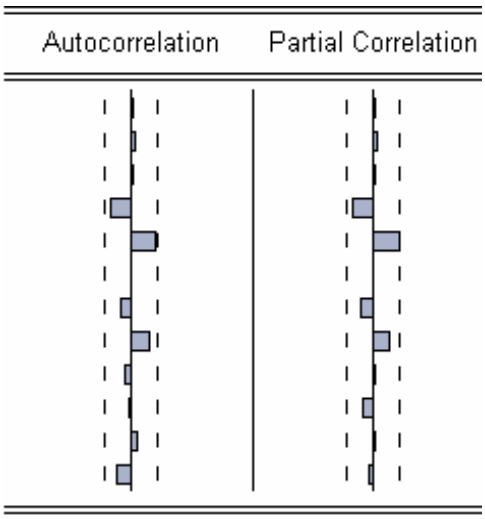
Correlogram of FSY



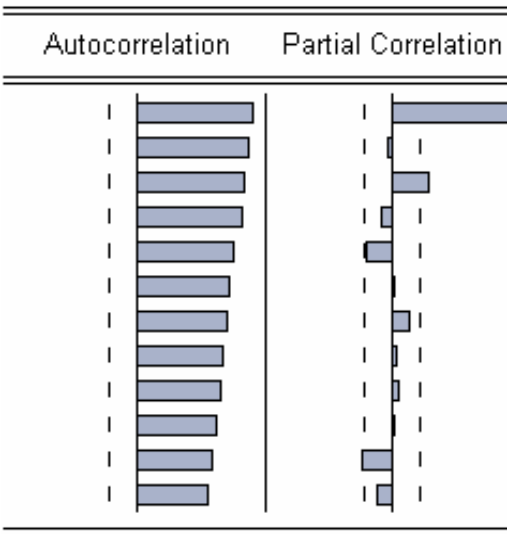
Correlogram of ΔFSY



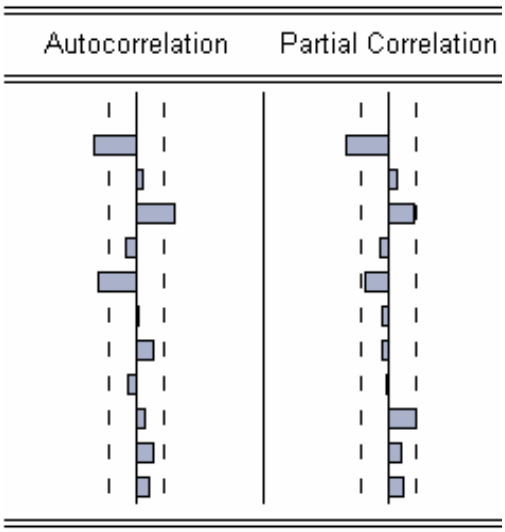
Correlogram of M2Y



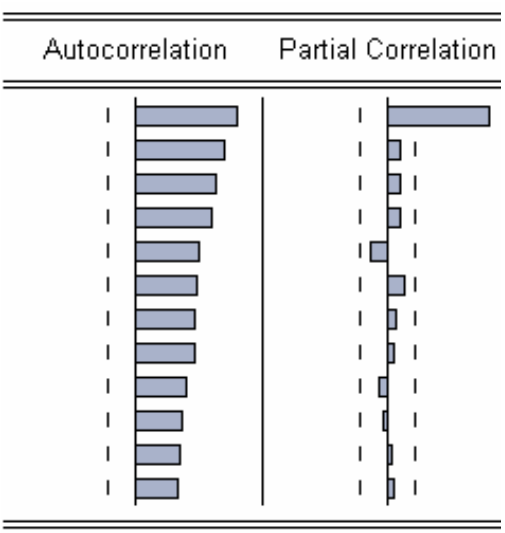
Correlogram of ΔM2Y



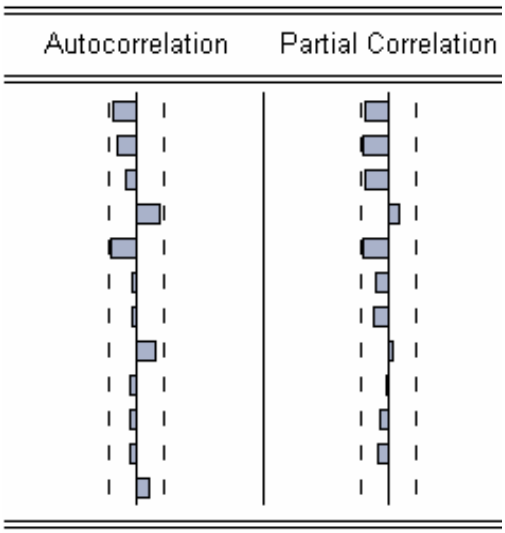
Correlogram of CURM2



Correlogram of ΔCURM2



Correlogram of TVTY



Correlogram of ΔTVTY

Table B.1 Critical Values for Engle and Granger Cointegration Test

T	1%	5%	10%	1%	5%	10%
	Two Variables			**Three Variables**		
50	-4.123	-3.461	-3.130	-4.592	-3.915	-3.578
100	-4.008	-3.398	-3.087	-4.441	-3.828	-3.514
200	-3.954	-3.368	-3.067	-4.368	-3.785	-3.483
500	-3.921	-3.350	-3.054	-4.326	-3.760	-3.464
	Four Variables			**Five Variables**		
50	-5.017	-4.324	-3.979	5.416	-4.700	-4.348
100	-4.827	-4.210	-3.895	-5.184	-4.557	-4.240
200	-4.737	-4.154	-3.853	-5.070	-4.487	-4.186
500	-4.684	-4.122	-3.828	-5.003	-4.446	-4.154

Adopted from Enders (2004) p.441

Table B.2 Diagnostic Tests of the Models

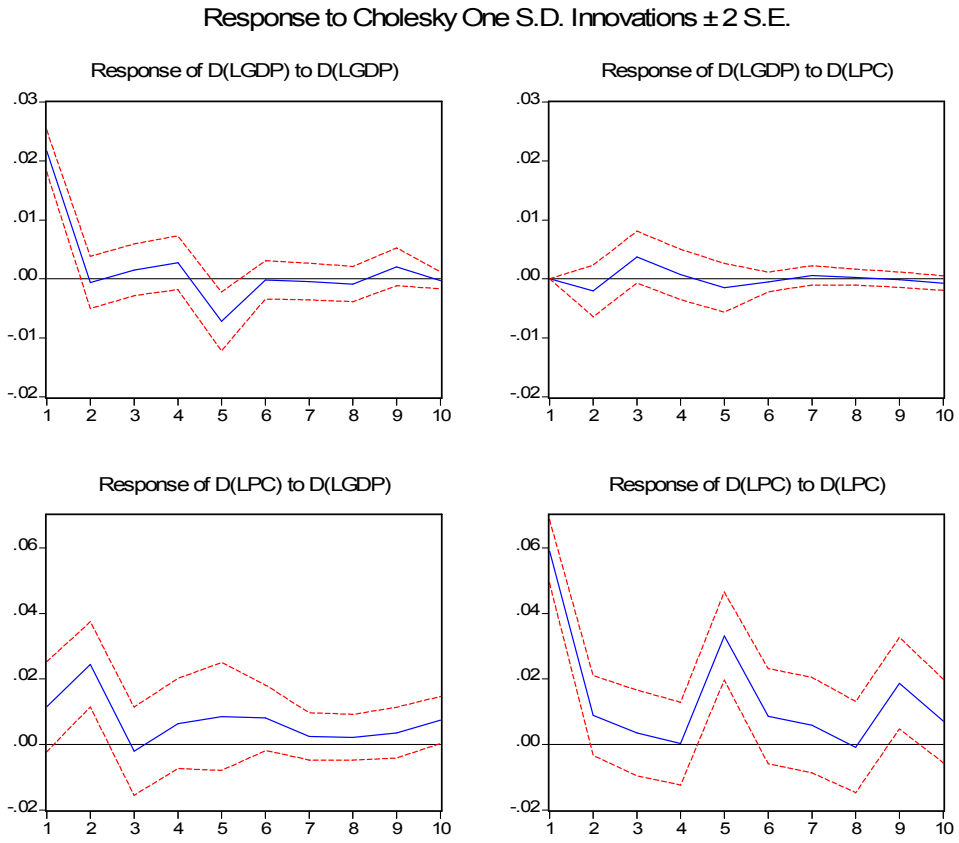
	ΔLGDP, ΔLPC			ΔLGDP, ΔPCY		
	Df.	Test statistic	p-value	Df.	Test statistic	p-value
S.C. Statistic	4	5.2864	0.2592	4	5.4509	0.2441
Het. Statistic	60	77.7229	0.0617	174	193.2930	0.1506
Normality Statistic	4	7.4406	0.1144	4	2.5221	0.6407

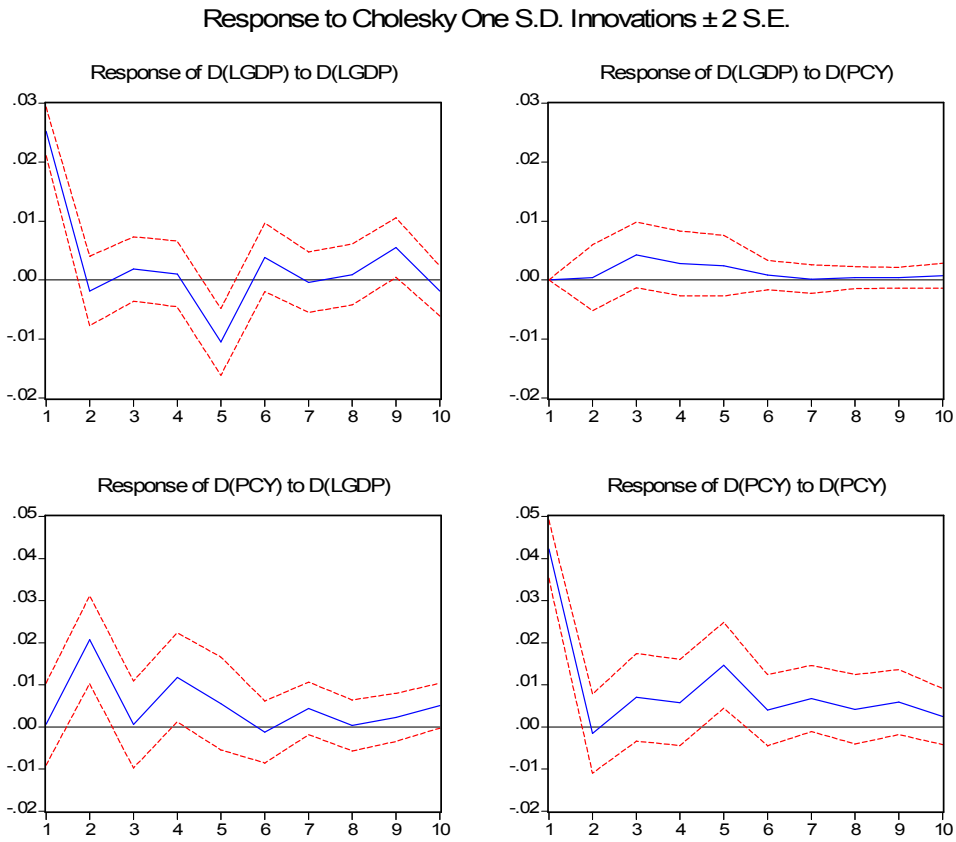
	ΔLGDP, ΔTVTY		
	Df.	Test statistic	p-value
S.C. Statistic	4	3.6470	0.4559
Het. Statistic	60	66.7088	0.2574
Normality Statistic	4	6.0590	0.1948

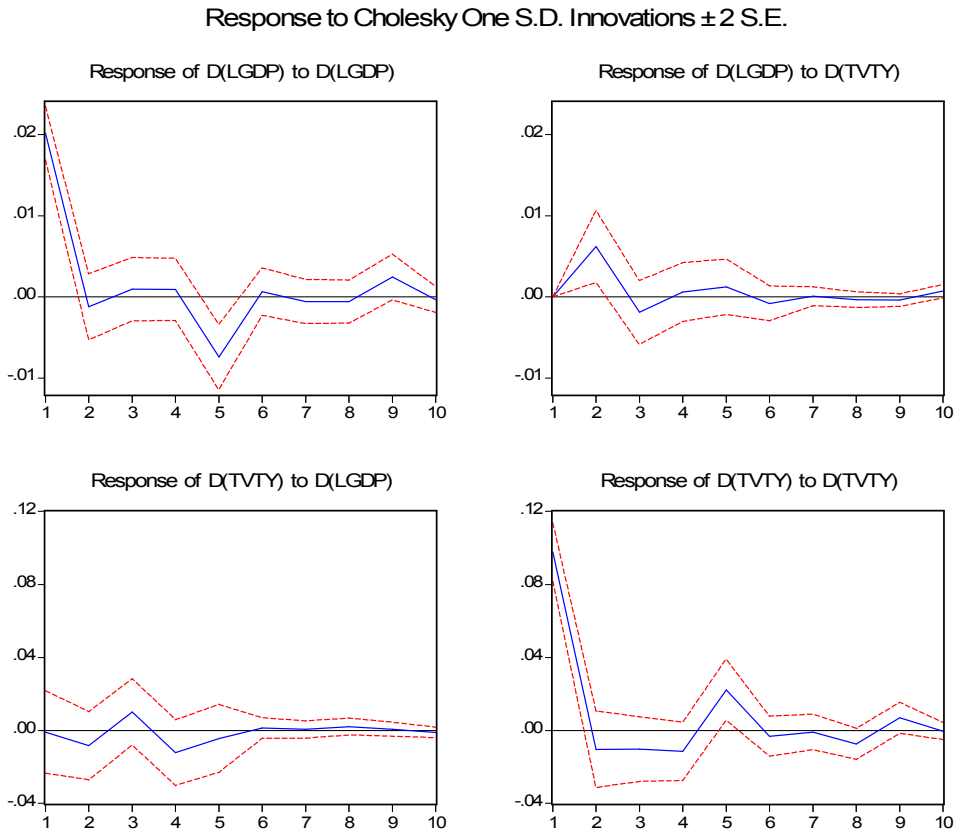
(*) denotes rejection of the null hypothesis of no misspecification at 5% significance level.

APPENDIX C

Impulse Responses




Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of D(LGDP) to D(LGDP)
Response of D(LGDP) to D(PCY)
Response of D(PCY) to D(LGDP)
Response of D(PCY) to D(PCY)


Response to Cholesky One S.D. Innovations ± 2 S.E.
Response of D(LGDP) to D(LGDP)
Response of D(LGDP) to D(TVTY)
Response of D(TVTY) to D(LGDP)
Response of D(TVTY) to D(TVTY)
.02
.01
.00
-.01
.12
.08
.04
-.04
1 2 3 4 5 6 7 8 9 10

Variance Decompositions

Cholesky Ordering: D(LGDP) D(LPC)

Variance Decomposition of D(LGDP):				Variance Decomposition of D(LPC):			
Period	S.E.	D(LGDP)	D(LPC)	Period	S.E.	D(LGDP)	D(LPC)
1	0.0217	100.0000	0.0000	1	0.0602	3.6771	96.3230
2	0.0218	99.1212	0.8788	2	0.0656	17.0605	82.9395
3	0.0222	96.3645	3.6355	3	0.0657	17.0924	82.9076
4	0.0224	96.3158	3.6842	4	0.0660	17.8774	82.1226
5	0.0236	96.2621	3.7379	5	0.0743	15.4063	84.5937
6	0.0236	96.2131	3.7870	6	0.0753	16.1916	83.8084
7	0.0236	96.1498	3.8502	7	0.0756	16.1815	83.8185
8	0.0236	96.1416	3.8584	8	0.0756	16.2510	83.7490
9	0.0237	96.1673	3.8327	9	0.0780	15.4921	84.5079
10	0.0237	96.0750	3.9250	10	0.0786	16.1329	83.8671

Cholesky Ordering: D(LGDP) D(PCY)

Variance Decomposition of D(LGDP):				Variance Decomposition of D(PCY):			
Period	S.E.	D(LGDP)	D(PCY)	Period	S.E.	D(LGDP)	D(PCY)
1	0.0252	100.0000	0.0000	1	0.0422	0.0250	99.9750
2	0.0253	99.9750	0.0250	2	0.0471	19.4002	80.5998
3	0.0257	97.2531	2.7469	3	0.0476	18.9906	81.0094
4	0.0259	96.1001	3.8999	4	0.0494	23.3166	76.6834
5	0.0280	95.9287	4.0713	5	0.0518	22.3274	77.6726
6	0.0283	95.9199	4.0801	6	0.0520	22.2397	77.7603
7	0.0283	95.9178	4.0822	7	0.0526	22.4182	77.5818
8	0.0283	95.9043	4.0957	8	0.0528	22.2817	77.7183
9	0.0289	96.0353	3.9647	9	0.0531	22.1473	77.8527
10	0.0289	95.9900	4.0100	10	0.0534	22.7966	77.2034

Cholesky Ordering: D(LGDP) D(TVTY)

Variance Decomposition of D(LGDP):				Variance Decomposition of D(TVTY):			
Period	S.E.	D(LGDP)	D(TVTY)	Period	S.E.	D(LGDP)	D(TVTY)
1	0.0202	100.0000	0.0000	1	0.0978	0.0080	99.9920
2	0.0212	91.3747	8.6253	2	0.0987	0.7328	99.2672
3	0.0213	90.6442	9.3558	3	0.0997	1.7415	98.2585
4	0.0213	90.5925	9.4075	4	0.1011	3.1477	96.8523
5	0.0226	91.3407	8.6594	5	0.1036	3.1797	96.8203
6	0.0226	91.2292	8.7708	6	0.1037	3.1910	96.8090
7	0.0226	91.2342	8.7658	7	0.1037	3.1929	96.8071
8	0.0226	91.2185	8.7815	8	0.1040	3.2146	96.7854
9	0.0228	91.2889	8.7111	9	0.1042	3.2043	96.7957
10	0.0228	91.2063	8.7937	10	0.1042	3.2174	96.7826