TOPICS ON FINANCIAL CRISES IN EMERGING COUNTRIES

CASE OF JORDAN

By

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ABSTRACT

This thesis investigates the effect of monetary policy on financial stability and part of the real side of the Jordanian economy over the time period 1976-2009. It uses a number of empirical methodologies including: a Vector Autoregressive (VAR) to investigate the relationship between monetary policy and financial stability in Jordan; A Logit model and Markov switching model to study the currency crisis in Jordan; and an Autoregressive Distributed Lag (ARDL) to estimate an investment function for the Jordanian economy.

Findings of the VAR models confirmed the relationship between monetary policy and financial stability in Jordan. However, a number of indictors were found to have a significant effect on the currency crisis in Jordan. These indictors included the real exchange rate, money supply-reserves ratio, and growth rate of domestic credit. On the other hand, a stable long-run investment function exists. Real income and real credit were found to have a positive impact on real investment. However, the user cost of capital has had a negative impact on real investment.

DEDICATION

To my parents, sisters and my beloved Ghada and Hashem,,,

ACKNOWLEDGEMENT

Firstly, I would like to praise the Almighty Allah, the Gracious and the Most Merciful, for giving me the strength and motivation to finish this study.

I would like to thank my Supervisors, Mr Nick Horsewood and Professor David Dickinson, especially Mr Horsewood not only for his several insightful comments concerning the direction and the content of this thesis, but also for his human attitude and for being understanding. I honestly appreciate the time he has devoted to supervise my research. This thesis would ever been completed without his help. Next, I thank all staff members of the department of Economics and Business school at the University of Birmingham for providing encouragement and facilities for this study.

I wish to acknowledge my thanks to the University of Jordan for granting me a scholarship to study for a PhD in Economics.

I also acknowledge all the help extended from all my friends everywhere, in the UK and Jordan. I deeply appreciate all kinds of support, patience and encouragement, which without this work never come to end.

Finally, for the support that has mattered most in my efforts, I would like to give my special acknowledgment and precious thanks to my parents, sisters and my wife for their love, patience and honest support.

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1.1 Research background

Since the financial crises in Latin America and East Asia, international organizations, like the International Monetary Fund (IMF), and academics have devoted their efforts to investigate the causes and factors that lead to a financial crisis. Although each crisis has its own features and causes, there are common factors that affect these crises. Some of these factors are external and others are internal or domestic, some due to a failure in the economic structure and others due to factors within the banking system itself. As the IMF (2011) reported:

> *'... Key factors can include weak domestic financial systems; large and persistent external or domestic imbalances (including current account deficits or fiscal deficits, or both); high levels of external and/or public debt; exchange rates fixed at inappropriate levels; spillovers of economic and financial crises from other countries; natural disasters; armed conflicts or large swings in the price of key commodities, such as food and fuel.'*

Consequently, there is no widely accepted definition of a financial crisis, however, most agree on defining it as a deep and sharp imbalance and sudden disruption in some economic balance, followed by a collapse in financial institutions and in key performance indicators. And this collapse may be extended to other sectors.

Emphasis should be placed on the importance of studying monetary policy in dealing with crises. The monetary policy transmission mechanism process can transmit

the impact of changes of a monetary policy to the financial markets and to real economy (see Krugman (2008) and Mishkin (2009)).

Many studies have attempted to investigate the relationship between monetary policy and financial stability and stressed the importance of such a relationship (for example, see Bergman and Hansen (2002), Boiro (2005, 2006), De Gregorio (2009)). However, many more have tried to study currency crises, which are considered as being part of financial crises, for a specific country or group of countries (see, Kaminsky *et al.* (1998), Berg and Pattillo (1999a,b), Feridun (2007)).

1.2 Research motivation

Jordan is a developing country located in the Middle East. Despite its location, it has insufficient supplies of natural resources, such as water and oil, underling the government's heavy dependence on two main sources, Jordanian workers' remittances and foreign grants. This fact makes the economy, which is dominated mainly by services and composes about two-thirds of GDP, vulnerable and very sensitive to the conditions of the region.

As a result of the late 1970s oil price shock, net Jordanian workers' remittances coupled with foreign grants, especially from the Arab oil-exporting countries, increased by more than a half. By the mid 1980s, workers' remittances and foreign grants decreased as a result of the collapse in the price of oil, creating several problems in the Jordanian

economy. These started with a fiscal deficit and extended to serious financial imbalances, caused by a rapid increase of the external debt servicing payment. These imbalances ended with a currency crisis in the late 1980s, where a large devaluation of the Jordanian dinar and a huge increase in inflation rate occurred. In order to deal with this crisis, the authorities introduced several reforms, mainly in the exchange rate and with interest rate policies. These reforms were supported by the International Monetary Fund (IMF) and the World Bank and were aimed at reducing the budget deficit and balance of payment deficit and promoting fiscal and monetary stability. The reform programmes were continued until the mid 2000s.

These circumstances allowed for monetary policy, undertaken by the Central Bank of Jordan (CBJ), to be adopted, its policies accordingly consistent with such a situation. The main goal of monetary policy is price level stability, by controlling inflation. However, most Central Banks, in developed and developing countries, have two main objectives: to undertake monetary policy and to maintain financial stability. Unlike monetary policy, there is no widely accepted definition of financial stability. Many attempts to define financial stability can be found in the literature. These definitions focused on the idea that the financial system is stable if it functions well and can manage any risk it may face. On the other hand, a financial stability index can be constructed following the literature.

In practice, the expansion of domestic credit is considered as the operational medium target for monetary policy in Jordan. As a result, both the excess reserves and

the cost of credit have always been monitored by the CBJ. Prior to late 1993, the CBJ used the discount rate and the reserve-requirement ratio as the main policy instruments. Since September 1993, in addition to the discount rate as a key instrument of monetary policy, the CBJ has depended mainly on open market operations to affect excess reserves and the cost of credit. The Central Bank manages its policy through semi-monthly auctions of the certificates of deposits (CDs). However, by 2000 the CBJ introduced an overnight window as a new instrument to be used to influence the banking sector activities.

As well as Jordan, over the last two decades many countries, such as Mexico, Russia, Argentina and Turkey, and countries in East Asia, witnessed financial instability and were affected by currency crises. These crises embarrassed policy-makers and led to huge losses in income. Therefore, these severe effects have drawn widespread attention to study the indicators and methods that could assist to explain and understand the crises.

The repetition of these crises creates a number of possible explanations of their causes. Some theories link currency crises with weak fundamentals, whereas others believe they are associated with market expectations. Other theories attribute them to banking sector weaknesses and contagion effects. Despite these theories, there is no single explanation in the literature as to what causes currency crises.

At the empirical level, many studies in the literature of currency crises attempted to investigate a number of key indicators of a currency crisis using many techniques. An index for exchange market pressure could be constructed to represent a currency crisis which varies according to the definition of the crisis. These studies considered exchange

rate depreciation as part of crisis definition. This index can then be employed in different models, aiming to investigate the leading indicators of a currency crisis.

The strategic location of Jordan, at the crossroads between Europe, Asia, Africa, and attached to the Red Sea through the Gulf of Aqaba port and other ports via neighbouring countries, makes it attractive for investors. Furthermore, life in Jordan can be characterised as a stable political environment. However, since the mid 1990s, the Jordanian authorities have passed suitable legislation aimed at creating a proper investment environment that encourages investors to put money in Jordan. In addition to signing several bilateral and multilateral agreements with neighbouring and other countries, various contracts have been put in place to promote the appropriate infrastructure needed for investment. Among these agreements are the free trade agreements (FTA) between Jordan and the United States, the Euro-Mediterranean Association Agreement, and the free trade agreement with Arab countries.

There are number of reasons for the importance of studying the determinants of investment in Jordan. Firstly, investment is highly volatile; thus investment demand movements have important effects on the short-run fluctuations of employment, income, and productivity. Secondly, it is important in determining how much of an economy's output is invested. Consequently, in the long run, investment creates economic growth and affects the future standard of living of the population. Thirdly, investment establishes some important issues relating to the financial markets, and it has important feedback effects on these markets.

In addition to these reasons, investment can be considered as part of the real side of the economy. Therefore, studying the determinants of investment can explain the relationship between the nominal and real side of the economy, and map out part of the monetary transition process.

Overall, the literature on financial crises in emerging economies is very inclusive. However, in this research it is intended to study some important aspects in this area. More particularly, it intends to study the impact of changes in monetary policy of a small open economy on financial stability as the first aspect. In other words, it intends to discuss the relationship between monetary policy and financial stability in Jordan. The second aspect is the currency crisis in Jordan, which is considered as an important part of financial instability. The Jordanian economy has suffered from the severe impact of the 1988-1989 crisis for the last two decades. Finally, it considers the implication of monetary policy on the real side of the economy. In this regard, the existence of a stable investment function has been investigated; this has important implications for the financial sector and the real economy.

1.3 Research contribution

The literature on the Jordanian economy lacks a study that investigates the implication of monetary policy on the country's financial stability and the real economy. This study intends to fill this gap in the literature through making some contributions to the research in this area.

Firstly, according to the author's knowledge, there is no study in the literature that constructs a financial stability index for the Jordanian financial system. This study contributes to the literature by constructing two financial stability indices. These indices will be used in the empirical analysis to examine if there was any impact of changes in monetary policy on the financial stability in Jordan.

The literature of currency crises is huge, and many studies have investigated currency crises in Jordan as a country within a panel data analysis. The second contribution that this thesis makes is that it undertakes a specific country analysis using time series analysis. Many studies considered the depreciation of the exchange rate as defining a currency crisis. However, this study considers exchange rate appreciation as well as depreciation in the definition of a currency crisis.

The third contribution this thesis makes is that it investigates whether a stable investment function in Jordan exists, in particular identifying the key determinants of such a function. This analysis allows us to investigate the relationship between monetary policy, represented by interest rate, and the real economy, represented by investment.

1.4 Research objectives

This research is trying to raise a general question of what the implication of changes in monetary policy would be on a small open economy like Jordan. In particular, the aim of this thesis is to investigate, on the one hand, the relationship between monetary policy and financial stability in Jordan, and, on the other hand, monetary policy and currency crisis in Jordan. The choice of Jordan in this research is based on two points. Firstly, the severe effects of the currency crisis that hit the economy in 1988-1989 remain unexplored, even though these effects forced the authorities to devaluate the exchange rate by a third. Secondly, according to the knowledge of the author, no previous study has taken Jordan as the main focus of attention. This study aims to fill this gap in the literature.

In the financial stability respect, this study tries to investigate whether changes in monetary policy affect financial stability in Jordan. In this regard, two financial stability indices are constructed, and included in a monetary policy framework. The objective is to investigate the impact of changes in monetary policy, represented by changes in excess reserves, on the financial stability indices.

The second area to be investigated is the currency crisis in Jordan. The objective here is to identify a number of leading indicators that can help to understand the crisis.

At the real sector level, the existence of a stable investment function will be investigated, with attention placed on the role of the interest rate, as a representative of monetary policy, in such a function. It is intended to investigate the interaction between monetary policy and the real sector by determining the key features of investment in Jordan.

Briefly, this research is intended to provide some answers for the following questions:

1- What is the impact of monetary policy on financial stability in Jordan?
2- How we can explain the 1988-1989 currency crisis in Jordan? And what are the leading indicators of the crisis?
3- Does a stable investment function exist? If it does, how significant is the role of interest rate in such a relationship?

1.5 Research Methodology

To achieve the above objectives, this thesis will rely on time series analysis using appropriate models suggested by the theory. For time series data, it will employ data covering the period 1976-2008, obtained from several sources, mainly data published by the IMF's International Financial Statistics, various annual reports of the Central Bank of Jordan, and the World Bank.

The methodologies implemented in this thesis are based on Vector Autoregressive (VAR) analysis, Logit and Markov switching models, and an Autoregressive Distributed Lag (ARDL) model. In order to investigate the relationship between monetary policy and

financial stability it employs a VAR model and checks the impulse responses of financial stability. Multinomial Logit and three-regime Markov switching models are used to investigate the main indicators of the currency crisis in Jordan. However, an ARDL model is employed to estimate an investment function in Jordan.

1.6 Research structure

This thesis contains six chapters, and is structured as follows:

The first chapter introduces the thesis and discusses the contribution of the study. It also provides an overview of the main objectives targeted to be achieved by the end of this study. Moreover, it represents the research methodologies that this study relies on.

Chapter two sheds some light on the main economic indicators in the Jordanian economy, and the development of these indicators over time to provide an overview of the Jordanian economy, covering 1976 to 2009. Most of these indicators will be used later in the empirical work.

In chapter three, the financial stability index is constructed for the Jordanian economy, and is included in a monetary policy framework. Our objective is to investigate the impact of monetary policy changes on the financial stability index.

In the fourth chapter, we employ quantitative models, Multinomial Logit and three-regime Markov switching models, to explain the currency crisis in Jordan trying to

develop an early warning system and to identify a number of leading indicators that can help understanding the crisis.

Chapter five presents estimates of an investment function to investigate whether investment is sensitive to the interest rates. If so then monetary decisions can be transmitted to the real side of the economy.

The sixth chapter concludes the main findings of the thesis and provides some directions for further research.

Chapter 2

The Economy of Jordan: An Overview

The Economy of Jordan: An Overview

2.1 Introduction

Jordan is a developing country located in the Middle East. It has a total area of 89,342 square km, consisting of desert in the east, highlands in the northwest, and a fertile rift valley along the west. Despite its location, it has insufficient supplies of natural resources, such as water and oil, making the economy heavily dependent on foreign assistance.

The World Bank classifies Jordan as a lower middle income country, with a population of 6.41 millions in 2010 (The World Bank, 2011). Jordan is a relatively small, open economy, with nominal Gross Domestic Product (GDP) of JD 15056 millions in 2008, about JD 9000 millions in real terms. Nominal GDP per capita increased continuously from JD 285.2 in 1976 to JD 2573.9 in 2008, about JD 1466.8 in real terms. In 2009, the economy was dominated by services, which made up about two third of GDP, with industry being about 20 percent (Central Bank of Jordan, 2009).

Because of the scarcity of natural resources, the Jordanian authorities have given exceptional consideration to education. Consequently, the Jordanian labour force became highly demanded in the region, mainly in the education sector and in the field of consulting. As a result, net workers' remittances during the 1970s and the beginning of the 1980s increased by more than a half. This made workers' remittances, coupled with the increase in foreign grants, especially from the Arab oil-exporting countries, the main source of finance for development in Jordan.

By the mid 1980s, the main sources of finance started to decline; workers' remittances and foreign grants decreased after the oil price collapsed, and created several problems in the Jordanian economy. A fiscal deficit led to serious financial imbalances due to a rapid increase of the external debt servicing payment. These imbalances ended with a currency crisis, a large devaluation of the Jordanian dinar and a huge increase in the inflation rate during late 1988 and early 1989.

In order to deal with this crisis, the authorities introduced several reforms mainly in the exchange rate and interest rate policies. These reforms, supported by the International Monetary Fund (IMF) and the World Bank, were aimed at reducing the budget deficit and balance of payment deficit and at promoting fiscal and monetary stability (see table 2.1 for a summary of the objectives, targets and strategies of the IMF reform programmes and policies undertaken in Jordan). The first reform programme, which started in 1989, was interrupted by the Gulf War in 1990. Though the success of the programme was damaged as a result of this war, further imbalances in the economy appeared as Jordan lost its major trading partners, Iraq plus other major local markets in the Gulf region. In addition, around 350 thousand Jordanian workers were sent back from some of the Gulf countries. After 1991, the authorities continued their reform efforts, leading to a second reform programme beginning in 1992. Since the new reform programme was applied, the Jordanian economy has recovered from the severe economic crisis. Indicators such as trade, exchange rate and inflation performed better than expected by the reform programme. Later, more reform programmes took place in 1994 and 1999, and were designed to keep the economy on the right path.

Table (2.1): IMF reform programmes in Jordan

Date	Objectives	Targets	Strategies	Policies
1989	1- Increase the rate of economic growth. 2- Maintain price stability. 3- Reduce budget and balance of payments deficit.	1- Economic growth rate to 4% by 1992. 2- Reduce inflation from 14% to 7% by 1993. 3- Eliminate external current account deficit by 1993.	1- Boost investment incentive. 2- Eliminate government dissaving. 3- Seek rescheduling of external debt-service obligations.	1- Reduce the government budget deficit by: Increases petroleum product prices, increases in tax rate on certain products and reduction in subsidies. 2- Monetary expansion. 3- Manage exchange rate. 4- Trade liberalization and tariff reform.
1992	1- Restore and sustain economic growth. 2- Generate employment. 3- Achieve budgetary and balance of payment viability.	1- Increase real GDP growth rate to 4%. 2- Reduce inflation to less than 5% in 1997. 3- Reduce external current account deficit near balance in 1998.	1- Increase domestic saving and investment. 2- Improve the efficiency of investment.	1- Resduce budget deficit. 2- Pursue a tight credit policy. 3- Maintain flexible exchange rate policy.
1994	1- Sustain economic growth. 2- Enhance job opportunities. 3- Improve living standards.	1- Real growth of 6% a year until 1998. 2- Hold inflation at 4-5%. 3- Eliminate exceptional financing by 1998. 4- Maintain a comfortable level of foreign exchange rate.	1- Increase domestic savings.	1- Reduce fiscal deficit to GDP to 2.5%. 2- Maintain flexible exchange rate policy. 3- Accept obligations under IMF Article VIII. 4- Switch to indirect monetary control.
1999	1- Sustain economic growth. 2- Maintain low inflation. 3- Strengthen the international services position.	1- Raise growth to 3.5% by 2001. 2- Keep inflation in the range of 2-3%. 3- External current account deficit of GDP to 5.3 by 2001. 4- Increase foreign exchange reserves to $1.7 billion.	1- Fiscal consolidation. 2- Wide ranging structural reforms.	1- Reduce budget deficit to GDP to 4% by 2001. 2- The exchange rate peg will continue to serve as a nominal anchor. 3- Monetary policy to build up foreign reserves and maintain low inflation. 4- Tax and tariff reforms.

Source: IMF (2005).

However, the banking system exhibited major problems in the mid 1980s as a consequence of the recession during that period. For instance, Petra Bank, which was one of the major financial institutions in Jordan, failed, generating a banking crisis in 1989. Later, in 1992, the government succeeded in stabilising the economy and pursued the reform programmes. Since then, the banking system has performed well and became one of the most well developed systems in the region.

Monetary policy in Jordan is regulated by the Central Bank of Jordan (CBJ), which was established in October 1964. According to the CBJ law No. 23 of 1971, article 4 describes its objectives and functions:

"The objectives of the Central Bank shall be to maintain monetary stability in the Kingdom and to ensure the convertibility of the Jordan Dinar, and to promote the sustained economic growth in the Kingdom in accordance with the general economic policy of the Government."[1]

In practice, the expansion of domestic credit has been considered as the operational medium target for monetary policy in Jordan. As a result, both the excess reserves and the cost of credit have always been under examination by the CBJ. During the 1970s and 1980s, the CBJ had issued several directives to influence banking sector activities in Jordan, such as determining the interest rates structure, and issuing various restrictions on foreign exchange transactions. Therefore, the discount rate and the reserve-required ratios were used as the main policy instruments.

[1] See: http://www.cbj.gov.jo/pages.php

Since September 1993, the CBJ moved to indirect monetary policy control, which depends mainly on open market operations, in addition to the discount rate as a key instrument of the monetary policy, and introduced a special type of securities called Certificates of Deposits (CDs). These CDs are used to control and affect the excess reserves and the cost of credit in the economy.

This chapter will endeavour to shed some light on the main economic indicators in the Jordanian economy, and the development of these indicators over time, covering the period from 1976 to 2008. Most of the data are obtained from the IMF's International Financial Statistics and the Central Bank of Jordan.

The rest of this chapter is structured as follows: Section 2.2 discusses economic growth and inflation. Section 2.3 considers the balance of payments, with the following section talking about the financial system. Section 2.5 deals with monetary policy in Jordan. Section 2.6 concludes.

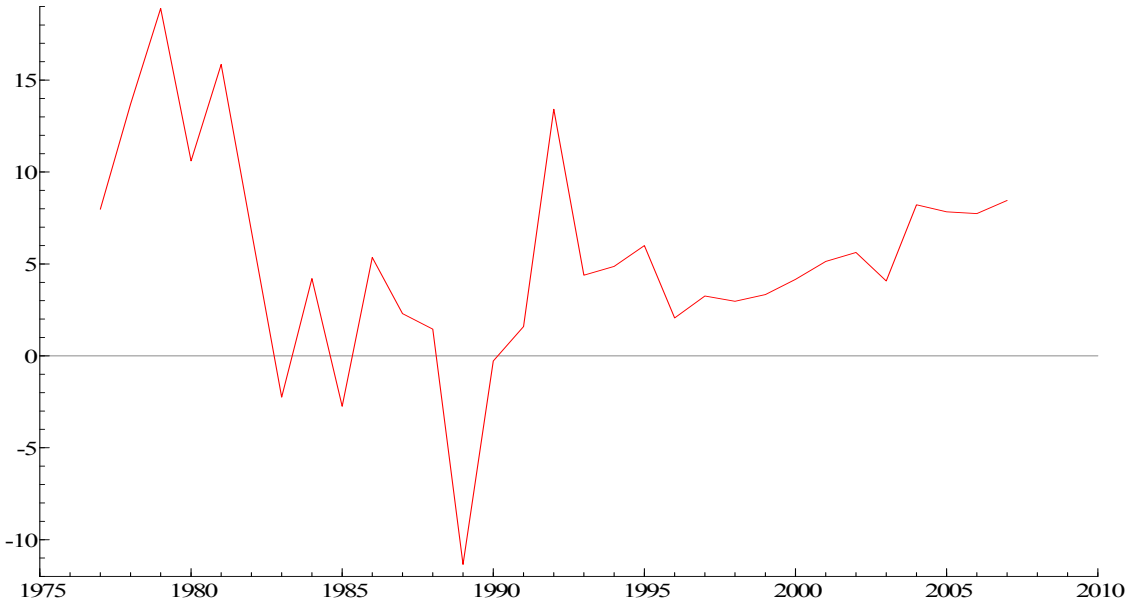
2.2 Economic growth and Inflation:

2.2.1 Economic growth:

Because Jordan does not have natural resources and its economy depends on workers' remittances from abroad, coupled with foreign aid, real GDP growth depends on external factors, being vulnerable to the regional and global situation. In the late 1970s, the effect of the oil price shock increased the inflow of workers' remittances[2] and grants from Arab oil-exporting countries, making real growth increase to double digits. It averaged 13.4 percent until 1981 and investment was about 37 percent of GDP. The growth rate then started to follow a declining trend and became negative in 1983, due to the collapse of oil prices in the early 1980s. In 1981, real GDP growth was 15.9 percent, and declined to 6.8 percent in 1982, then decreased further to -2.2 percent in 1983 (see Figure 2.1).

[2] Whereas before the 1990, about a third of the labour-force employed abroad, mainly in the Gulf States, with about $600-$1200 average monthly wages, compared with about $150 average monthly wages in Jordan (The World Bank, 1994).

Figure 2.1: Real GDP Growth Rate (1977-2008)



The decrease was caused by the decline in workers' remittances and foreign grants and assistance, which dragged the economy into a recession in early 1980s. Thus the government started to depend heavily on debt to cover this decline. A rapid growth of debt and the debt servicing burden drove the economy to experience an economic crisis in the late 1980s. This crisis was noticeable by the sharp decrease in real GDP growth, -11.3 percent in 1989. Investment declined to less than 20 percent of GDP.

When the economic difficulties reached a peak in 1989, the government introduced a number of economic reforms, supported by the IMF and the World Bank, to overcome the severe crisis. These reforms aimed to correct the imbalances in the economy and maintain a sustainable growth rate. The first reform programme, started in 1989, was interrupted by the Gulf war in 1990. After that the reforms continued in 1992. The growth rate increased to 13.4 percent, reflecting the success of the reform policies,

coupled with an expansion of workers' remittances from the Jordanians expelled from Gulf States, mainly Kuwait, as a consequence of the end of the Gulf War. The economy has maintained a sustainable growth, about 5.1 percent on average during the period 1993-2008. By 1993, real GDP grew by 4.3 percent, and 5.1 percent in 2001, and was 3.7 percent in 2008. This achievement was the outcome of the economic and political stability in Jordan, which enabled the economy to improve economic performance in several sectors, mainly construction, trade, and financial services.

2.2.2 Inflation:

During the 1970s the Jordanian economy experienced a relatively high inflation rate, with the annual percentage change of the consumer price index (CPI) being about 10 percent. The income inflow of the Jordanian workers, foreign aid from neighbouring countries, and high import prices were considered as the main reasons for the high prices (Maghyereh, 2001). However, as the economy moved into recession in the early 1980s the rate of inflation slowed down, averaging 4.6 percent. In 1989, inflation increased severely to reach 20.45 percent, as a result of the crisis experienced by the Jordanian economy and the consequent inflationary effects linked to the devaluation of the dinar. Then, after the reform programmes started, the aim of the last two decades has been to keep inflation below 10 percent (see Figure 2.2).

Figure 2.2: Inflation rate (1976-2008)

After the economic crisis in 1989, the government continued to approve economic stability policies, suggested by the economic reforms, and aimed at controlling the growth rate of aggregate demand with the intention of maintaining inflationary pressures in the Jordanian economy.

The inflation rate fell to 3.2 percent in 1993, 0.6 percent in 2000, and 5.1 percent in 2007, with the average rate over the last two decades of around 3 percent. In 2008 the inflation rate hit a new high of around 13 percent, reflecting the change in government policy with the removal of oil subsidies.

2.3 Balance of Payments:

The current account of the balance of payments in Jordan suffered a deficit over the period 1976-2008, the average of deficit-to-GDP ratio amounted to 31.5 percent. The major source of this deficit was the trade balance, which suffered from a declining trend over the sample period. The reason for this continual deficit was due to the structure of exports and imports in Jordan. The main exports commodities are clothing, fertilities, potash, phosphates, vegetables, and pharmaceuticals. On the other hand, crude oil, machinery, transport equipment, iron, and cereals are considered as the main commodities imported. In 2009, the main trading partners of Jordan, ranked by ascending order, were Saudi Arabia, United States, China, Iraq, India, and Egypt, these countries shared about half of the external trade volume with 15.5%, 9.6%, 8.3%, 5.1%, 5.1%, and 5%, respectively (Central Bank of Jordan, 2009).

The Jordanian economy is relatively small and open, with an external trade[3] to GDP ratio of 115.7 percent in 2008 compared with 71 percent in 1976 (see Figure 2.3). This ratio reached its lowest value in 1986, with less than 50 percent, due to a recession in the economy after the decrease in the aggregate demand caused by the oil price collapse.

[3] Calculated in terms of summation of total exports plus total imports.

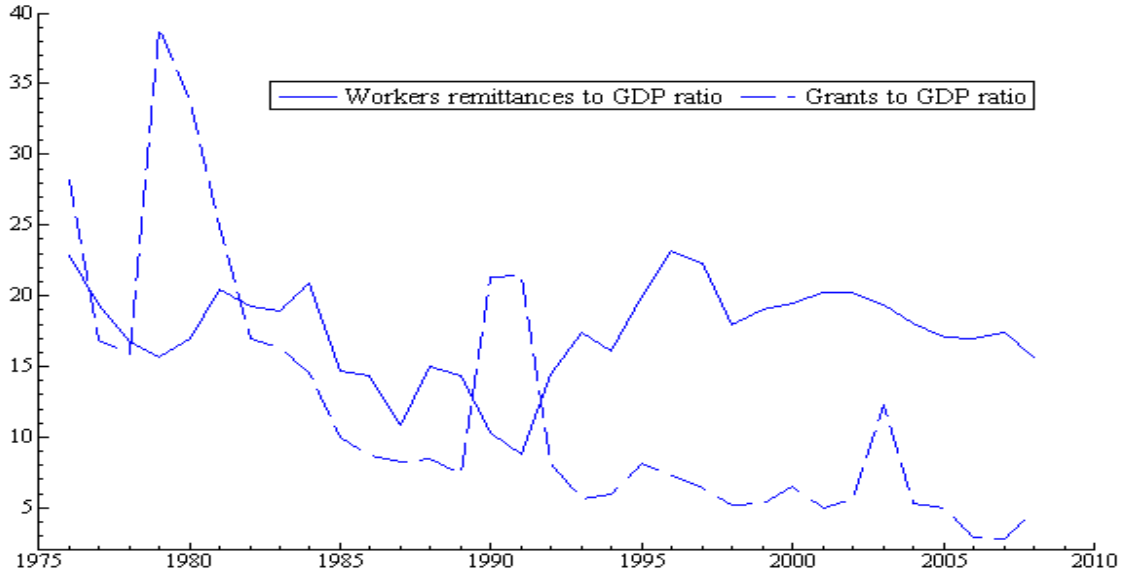
Figure 2.3: External trade as a percentage of GDP (1976-2008)

Although this ratio has fluctuated, it has been trending upward during the 2000-2008 period, and reflects government policies. The government has liberalised the trade regime sufficiently to secure Jordan's membership at the World Trade Organisation (WTO) in 2000, a free trade agreement with the US in 2000, and association agreement with the European Union in 2001. These policies aimed to remove all restrictions and controls on international trade, and improve productivity and have put Jordan on the foreign investment map. Although the trade balance exhibited a deficit, the balance of net services experienced some periods of surplus.

For instance, net workers' remittances during the 1970s and the beginning of the 1980s increased by more than a half, from JD 130 millions in 1976 to JD 300 millions in 1980, reflecting the increase in demand for skilled Jordanian labour by neighbouring oil-exporting countries after the oil prices shock. By the mid 1980s, workers' remittances

started to decrease until 1991 as a result of the oil prices collapse; accordingly, the ratio of workers' remittances to GDP declined by more than a half, from around 20 percent in 1981 to around 8.8 percent in 1991. Foreign grants declined as well, with the grants-to-GDP ratio decreasing sharply from around 40 percent in 1979 to less than 8 percent in 1989 (see Figure 2.4).

Figure 2.4: Workers remittances and grants as a percentage of GDP (1976-2008)

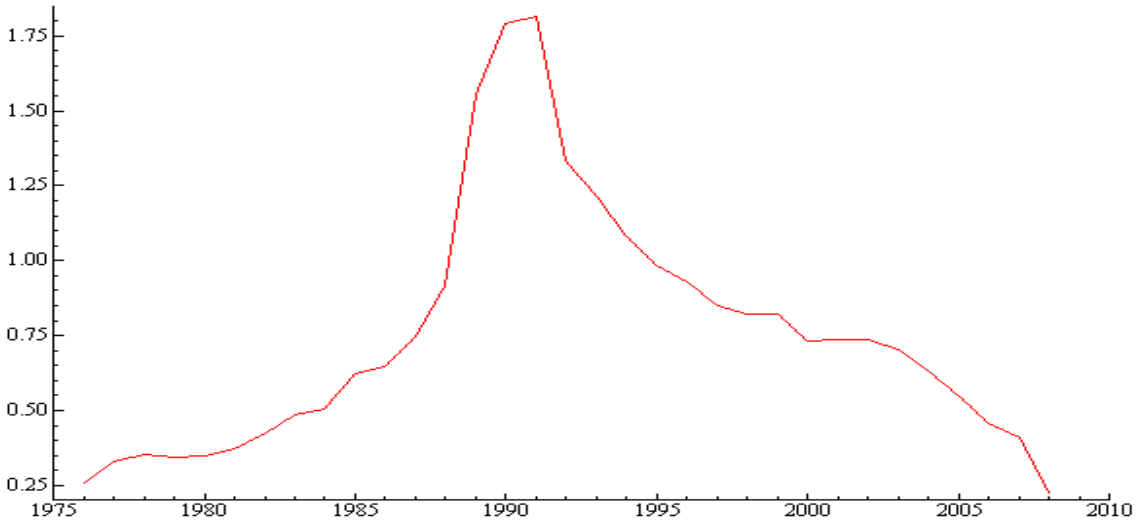


Later workers' remittances increased from JD 261 millions in 1991 to JD 524 millions in 1992, or around a 100 percent annual average increase, and continued to follow an upward trend. On average, the ratio of workers' remittances to GDP fluctuated around 18 percent during the period from 1991-2008. On the other hand, foreign grants increased in 1990 and 1991, from JD 178.5 millions in 1989 to JD 589.1 millions in 1990 and JD 633.4 millions in 1991, around 21 percent of GDP, reflecting the foreign grants offered from the IMF and the World Bank in the first reform programme. During the

period 1992-2008, the average rate of foreign grants-to-GDP was approximately 6 percent.

Figure 2.5 shows clearly the upward trend of the external debt-to-GDP ratio. After the drop in foreign grants and workers' remittances in the mid 1980s, the authorities relied on external borrowing to compensate for the fall in foreign currency. Consequently, external debt continued to increase sharply and GDP started to have negative growth rates. As a result, the external debt-to-GDP ratio increased from about 50 percent in 1984 to more than 90 percent in 1988. In 1989, the external debt-to-GDP ratio jumped sharply to reach around 155 percent, during the aftermath of the crisis. In the next couple of years this ratio increased to be about 180 percent in 1991. Thereafter, the ratio took a downward trend to reach less than 25 percent in 2008, an annual average decrease by about 78 percent. These decreases reflect the authority's policies of replacing the external debt by internal debt.

Figure 2.5: External debt as a percentage of GDP (1976-2008)



2.4 Financial system:

The financial system in Jordan consists of the CBJ, licensed banks, and Special Credit Institutions. The responsibility of the CBJ is the monetary policy, and will be discussed in the next section. There were twenty-three banks operating in Jordan at the end of 2009, totally privately owned, eight of which are foreign bank branches and two are Islamic banks (Central Bank of Jordan, 2009). The banking system in Jordan is considered to be well developed compared to other countries in the region, and it is characterised by the lack of state banks, interest rate controls, and credit ceilings. Banks are the main source of finance in the economy.

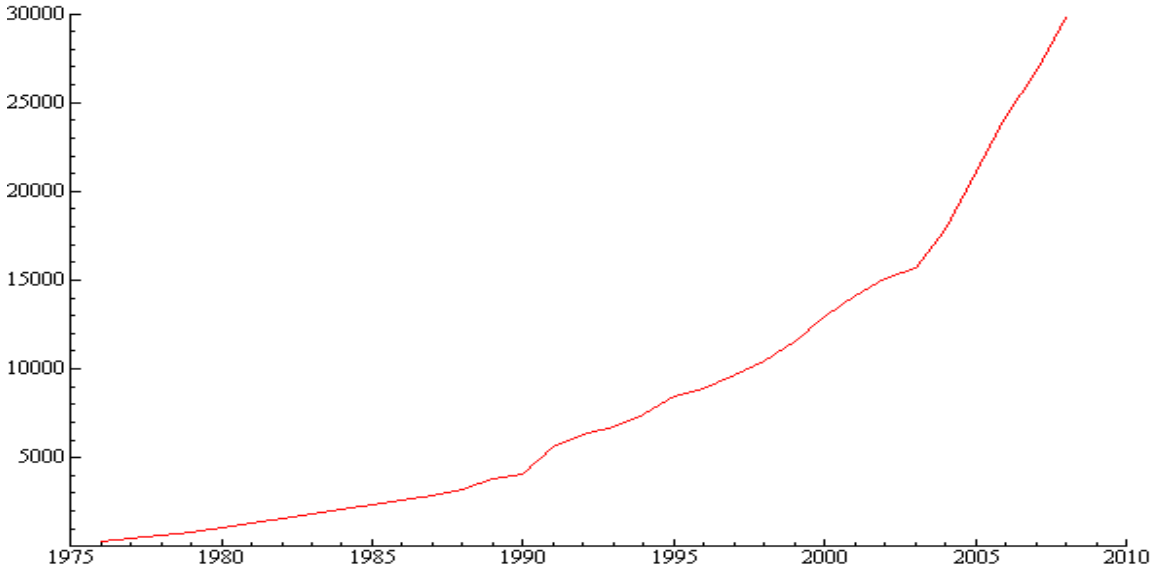
However, in the mid 1980s, the banking system exhibited major problems as a consequence of the recession during that period. For instance, Petra Bank[4], which was one of the major financial institutions in Jordan, failed, generating a banking crisis in the late 1980s. Later, in 1992, the government's macroeconomic policies succeeded in stabilising the economy and reform programmes were pursued, coupled with capital inflows of the Jordanian workers in Gulf countries, economic activities and the banking system recovered.

Banks total assets have shown a remarkable increase (see figure 2.6). They increased to JD 29796.6 million in 2008, compared with JD 333.6 million in 1976, or at an average annual growth rate of 15.2 percent. Total bank assets to GDP ratio, which measures the importance of the banking sector in the economic development process,

[4] It was considered as the third biggest bank in the country.

were 58.8 percent in 1976, and showed a continuous increase to reach 197.9 percent by the end of 2008.

Figure 2.6: Banks' total assets in JD millions (1976-2008)



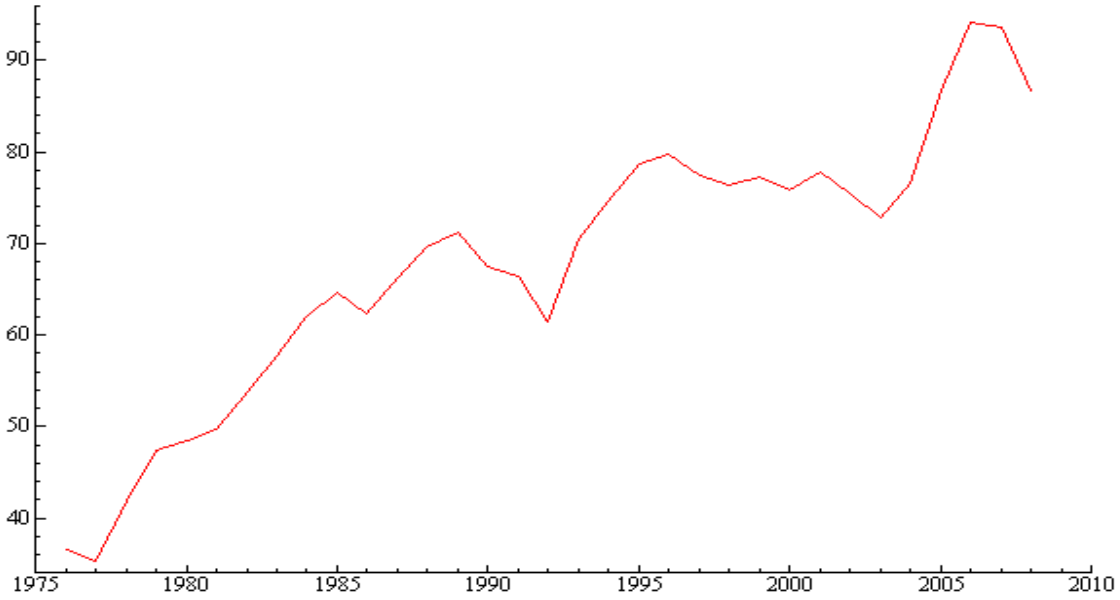
Total deposits held by licensed banks increased dramatically from JD 250 million at the end of 1976 to JD 20298.4 million at the end of 2008, an average annual increase of 14.8 percent. As a percentage of GDP, total deposits increased from 44.1 percent in 1976 to 120.2 percent in 2008 (see Figure 2.7).

Figure 2.7: Banks' total deposits as a percentage of GDP (1976-2008)

Banks financed their activities mainly by time deposits, which accounted for an average share of 61.2 percent of total deposits at the end of 2009, followed by demand deposits that accounted for 26.1 percent.

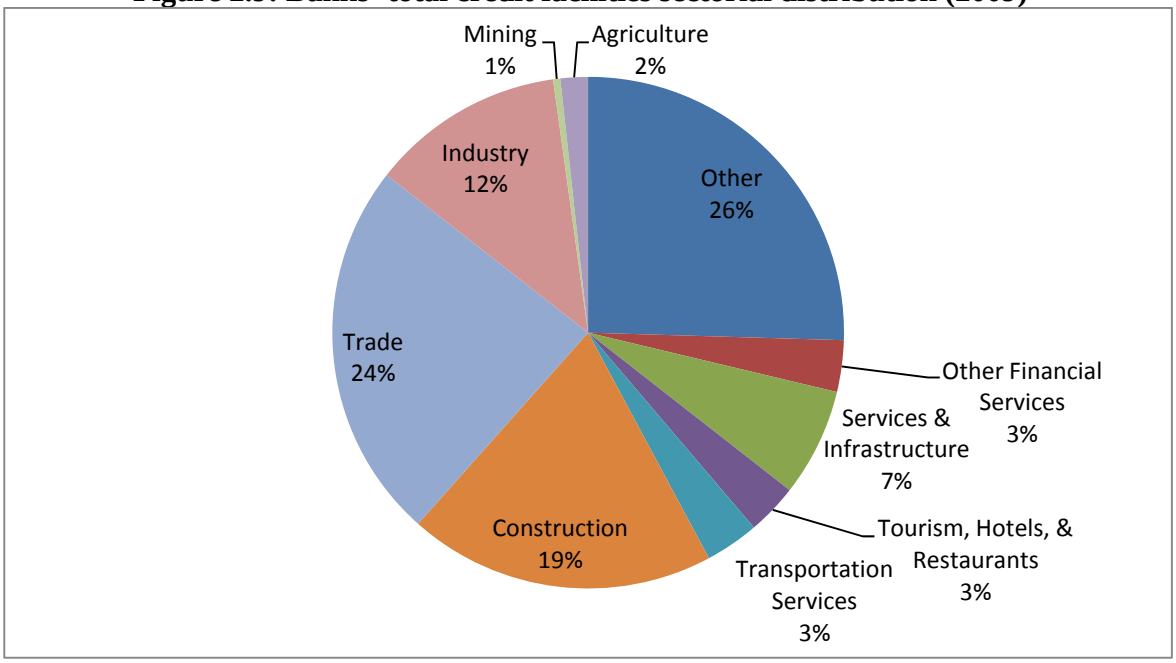
Total credit facilities extended by licensed banks rose sharply from JD 207.1 million in 1976 to JD 13317.2 million in 2008, registering an average annual growth rate of 13.8 percent. As a percentage of GDP, credit facilities increased from 36.5 percent in 1976 to 86.6 percent in 2008 (see Figure 2.8).

Figure 2.8: Banks' total credit facilities as a percentage of GDP (1976-2008)



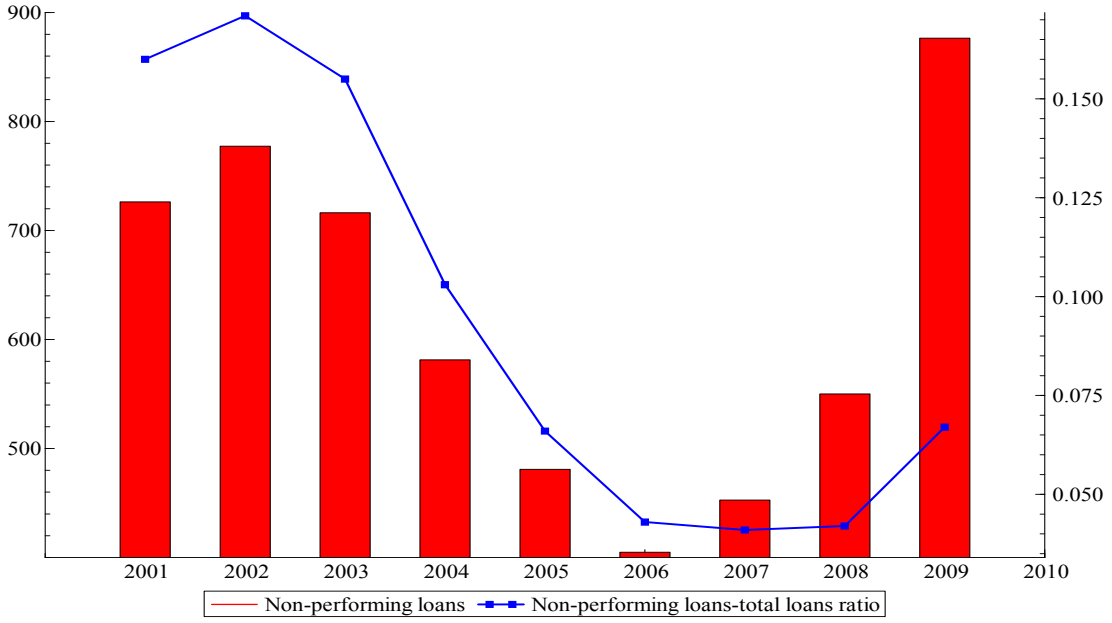
Data on the sectorial distribution of outstanding credit facilities in 2009 (Figure 2.9) show that about a quarter of the licensed banks' credit facilities go to the trade sector, followed by construction and industry, with 20 percent and 12 percent, respectively. Therefore, the commodity producing sectors received a low proportion of credit, with agriculture receiving about 2 percent and industry and mining about 13 percent. The explanation could be due to both sectors depending upon credit provided by the special credit institutions.

Figure 2.9: Banks' total credit facilities sectorial distribution (2009)



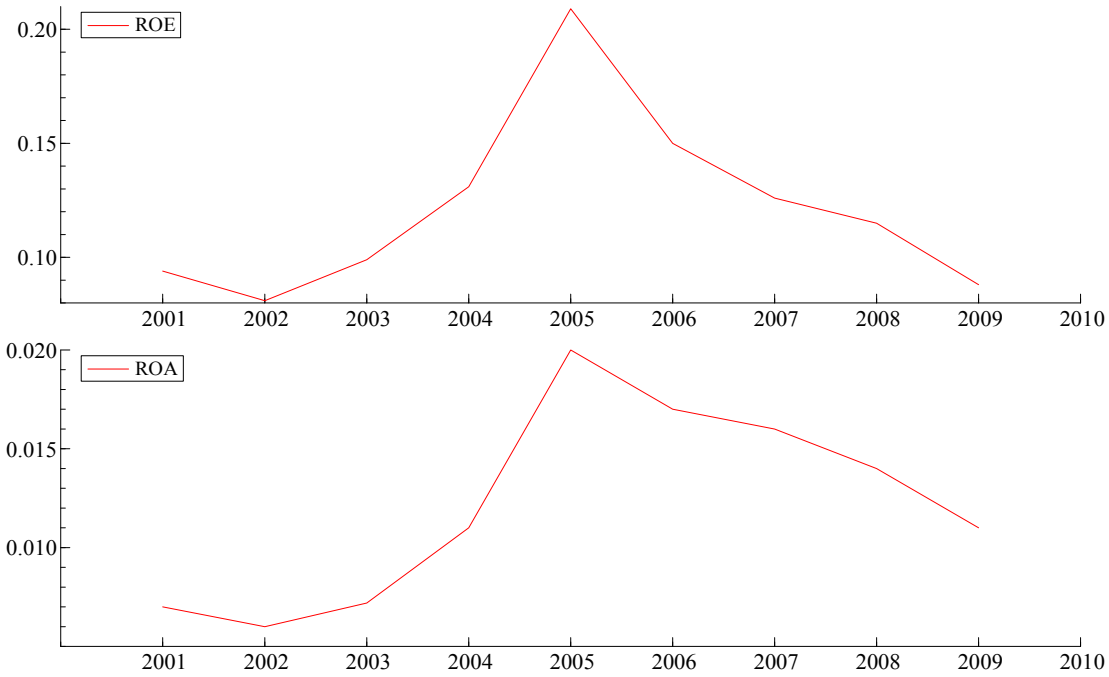
The main macroeconomic prudential indicators, including non-performing loans-total loans, return-on-equity (ROE) and return-on-assets (ROA) ratios, show the performance of the banking sector during the 2000s. The non-performing loans, which are defined by the regulations of the CBJ as loans that have been due for 90 days or more, decreased from JD 777 millions in 2002 to JD 404 millions in 2006, or an average decrease of 10 percent per annum. As a result, the non-performing loans-total loans ratio decreased from 17 percent in 2002 to 4 percent in 2006 (see Figure 2.10). These decreases reflect the increase of efficiency of the banking sector in managing their assets and collecting their dues. However, non-performing loans started to increase in 2007, reflecting delay of repaying for a number of borrowers of their obligations to banks due to the international financial crisis (Association of Banks in Jordan, 2010).

Figure 2.10: Non-performing loans and non-performing loans- total loans ratio (2001-2009)



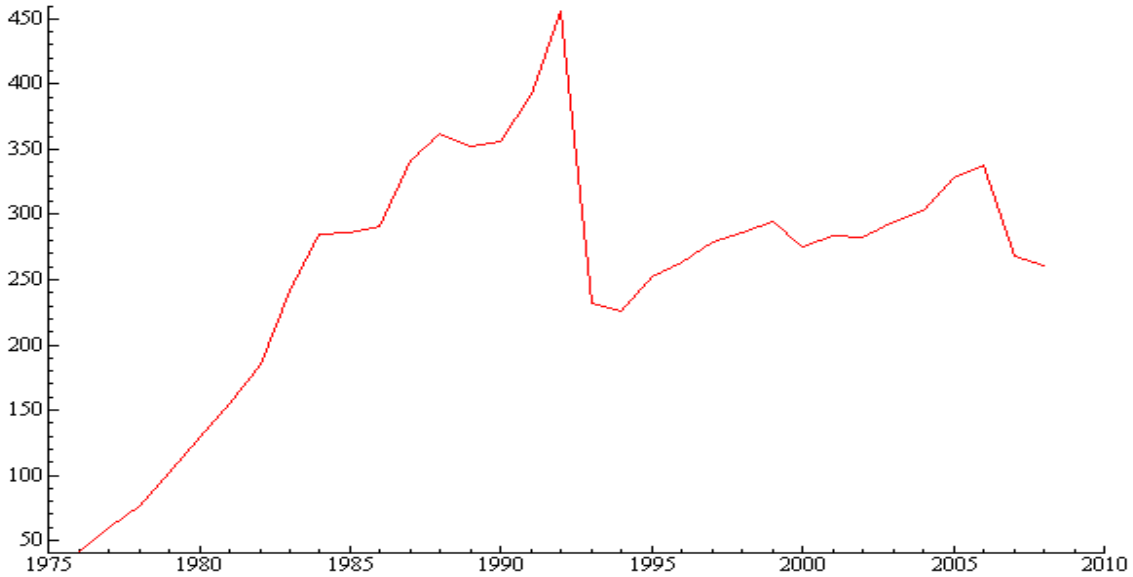
ROE and ROA ratios increased from 8 percent and 0.6 percent in 2002 to reach highs of 21 percent and 2 percent respectively in 2005, (see Figure 2.11). These ratios started to decrease slightly, reflecting an increase in shareholder's equity and bank assets. The decrease continued due to the international financial crisis (Association of Banks in Jordan, 2010).

Figure 2.11: Return-on-Equity (ROE) and Return-on-Assets (ROA) ratios (2001-2009)



Besides banks, specialised credit institutions (SCI) were established to provide credit facilities appropriate for the financing for the development of small and medium sized projects in different economic sectors, mainly agriculture, industry, and housing. In 2008, there were four specialised credit institutions in Jordan, three of which were owned by the government, while the public and private sectors jointly owned the fourth one. According to their date of establishment, the SCIs in Jordan are the Agricultural Credit Corporation, the Industrial Development Bank (Jointly owned), Housing and Urban Development Corporation, and Cities and Village Development Corporation (Central Bank of Jordan, 2009).

Figure 2.12: Special Credit Institutions total credit facilities in JD millions (1976-2008)



Total credit of specialised credit institutions to the private sector shows an incredible increase from JD 42 million in 1976 to JD 455.4 million in 1992, an average annual rate of 16.8 percent. In 1993, a sharp decline can be noticed; this decrease was due to the conversion of one of the main specialised credit institutions to a commercial bank, affecting significantly the credit facilities, which were cut by more than a half. It left SCI with about JD 280 millions on average, or an increase of only 1.1 percent per annum during 1993-2008 (see Figure 2.12).

2.5 Monetary policy in Jordan:

Monetary policy in Jordan is undertaken by the Central Bank of Jordan (CBJ), which was established in October 1964, and its aims are to maintain monetary stability, control inflation, ensure the convertibility of the Jordanian dinar, and promote sustained economic growth.

During the 1970s and 1980s, the CBJ had issued several directives to influence banking sector activities in Jordan, using the discount rate and the required-reserve ratio, determining the interest rates structure, and issuing various restrictions on foreign exchange transactions. Since the beginning of 1990, the CBJ moved to indirect monetary policy control, and started to free interest rates and remove restrictions on foreign exchange transactions. This change in the CBJ's policy was combined with a change in policy instruments used. In addition to discount rate and required-reserve ratio, the CBJ used open market operation. Since 1993, the CBJ started to issue a special type of securities, on semi-monthly bases, called Certificates of Deposits (CDs). These CDs are used to control the money supply in the economy.

2.5.1 Monetary policy and domestic liquidity:

During the 1970s and the beginning of the 1980s, the CBJ maintained a tight monetary policy using direct instruments, which were limited at that time and were represented mainly by the required-reserve ratio and interest rate, to influence domestic liquidity and banks credit. The main goals of monetary policy were to control inflation, encourage economic growth, and stabilise the exchange rate. These goals were reachable

as a consequence of the increase in workers' remittances coupled with the increase of foreign grants. These contributed to an increase in foreign reserves. The CBJ increased the required-reserve ratio on banks' deposits from 12 percent in 1976 to 16 percent in 1979, and put limits on the credit ceiling of 70 percent of the total deposits in 1976. Also, the CBJ increased the discount rate from 5.5 percent in 1976 to 6.5 percent in 1982.

As a result of the monetary policy adopted, domestic liquidity, measured by the money supply (M2), increased considerably from JD 378.4 million in 1976 to JD 1615.2 million at the end of 1983, or at an average annual rate of around 24 percent.

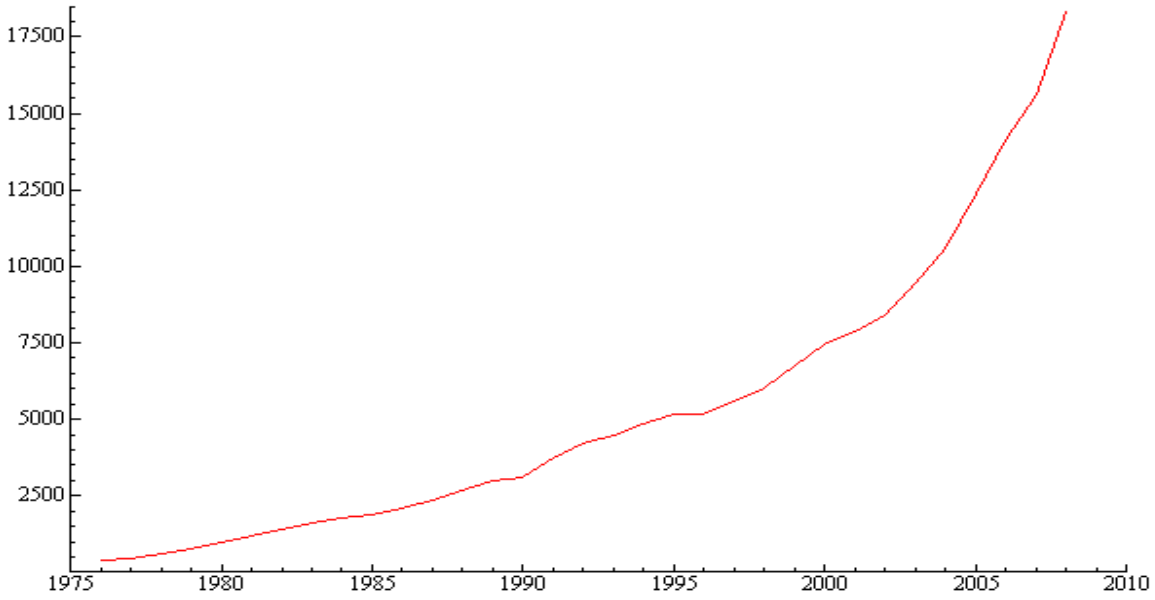
During the period 1984-1989, the economy experienced a recession and, as a result, the CBJ started to follow an expansionary policy. Consequently, the required-reserve ratio decreased gradually to 5 percent in 1987, and the discount rate decreased to 5.75 percent, aiming to encourage banks to create more credit. After the crisis in late 1988 the CBJ responded by increasing them to 11 percent and 8.5 percent, respectively, reflecting a tight policy; M2 increased by a relatively low average growth rate of 10 percent per annum, compared with the previous period.

The CBJ also put a number of restrictions on the credit facilities and committed banks and other financial institutions to keep 35 percent of their foreign currency deposits as a required-reserve in the form of time deposit (Central Bank of Jordan, 1989).

Until the late 1980s, the CBJ followed a direct monetary policy to influence the banking system activities, in particular, to support foreign reserves and maintain the stability of the exchange rate. Thereafter, the CBJ moved towards an indirect monetary policy to improve the performance of the policy and its impact on liquidity and banks credit. The CBJ continued increasing the required-reserves ratio to reach 15 percent in

1993, to limit the inflationary effects of the 1988-1989 crisis. To realise its policy, the CBJ started to issue CDs as an indirect tool to influence banking liquidity and credit. In September 1993, the CBJ began frequently issuing three and six months CDs in Jordanian dinar. The rate on these instruments was determined by auctions. The basic idea behind this tool was that the Central Bank issues fewer amounts of CDs when it tries to transfer an expansion monetary policy, aiming to increase banks' credit. On the other hand, the Central Bank will issue larger amounts of CDs when looking to withdraw more money from banks; credit in turn decreases, which represents a contractionary monetary policy. This monetary policy performed well in controlling the growth rate of M2. In 1990, M2 increased sharply from JD 3122.6 million to JD 18304.2 million at the end of 2008, an average annual rate of 10.4 percent (see Figure 2.13).

Figure 2.13: Domestic liquidity (M2) in JD millions (1976-2008)

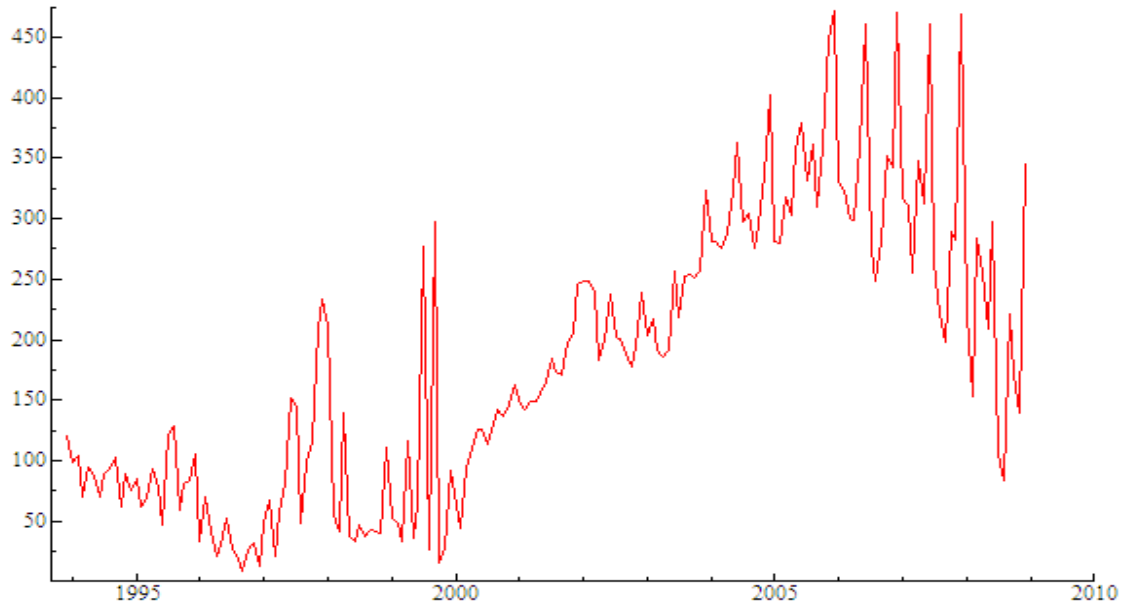


2.5.2 Excess reserves

Excess reserves considered as a monetary policy indicator. It is defined as the reserves held by banks beyond what is required by the Central Bank. The CBJ regulations allow commercial banks to keep a proportion of the obligatory required-reserves in hand during a month. However, the full amount of the required-reserves should be kept at the Central Bank by the end of each month.

During the 1994-1997, excess reserves averaged about JD 67 millions, this low level of excess reserves reflect a period of tight monetary policy (see Figure 2.14). As for the period 2000-2006, excess reserves follow an upward trend, reflecting the easy monetary policy during that period, averaged about JD 250 millions. However, as a consequence of the international credit crunch, the excess reserves fluctuated between JD 85-470 millions.

Figure 2.14: Excess reserves in JD millions (1976-2008)



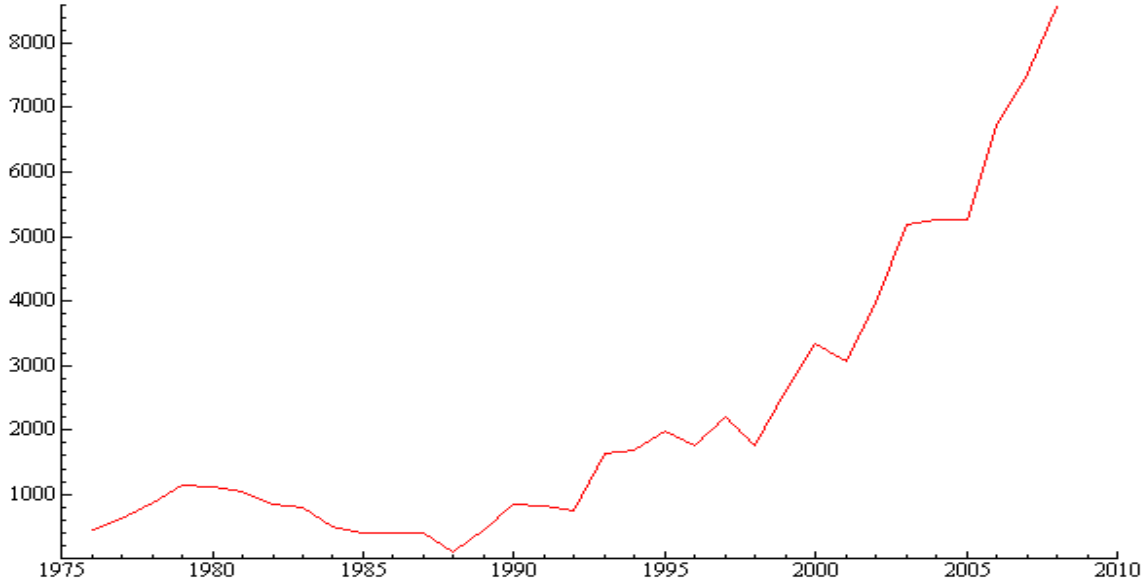
2.5.3 Foreign Reserves

One of the CBJ's responsibilities is to keep and manage foreign reserves. Therefore, the CBJ maintains a suitable stock of each currency, according to the developments in each one, to ensure safety and profitability.

During the 1970s, the economy started to build up a significant level of foreign reserves as a result of the increase in the workers' remittances and foreign grants, especially from the Arab oil exporting countries. After the collapse of oil prices, these sources of foreign reserves started to diminish, and resulted in a sharp decrease in the stock of these reserves which led to the 1988-1989 currency crisis, as the exchange rate is fixed.

In the early 1990s, the controls on foreign exchange were removed gradually by the CBJ, with the aim of making international dealings easier. The CBJ also removed restrictions on the Jordanian dinar and allowed it to be fully convertible. These liberalisation policies allowed the CBJ to build up a significant level of foreign reserves, which reached US$ 8558 million in 2008, compared with US$ 456.2 million in 1976, with an annual average rate of 19.9 percent (see Figure 2.15).

Figure 2.15: Foreign reserves in US$ millions (1976-2008)



2.5.4 Dinar's Exchange Rate:

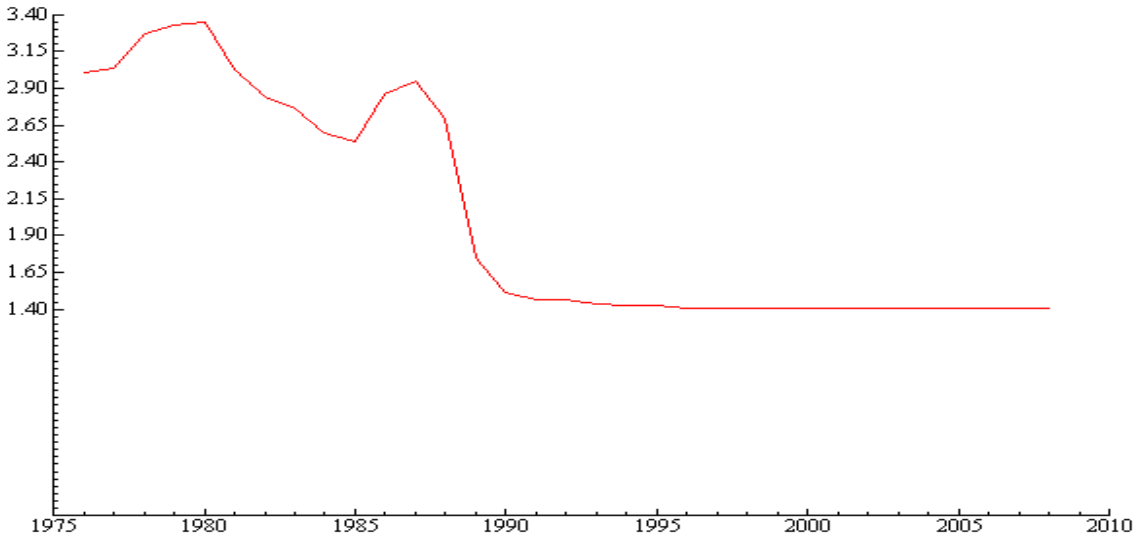
During the 1976-1986 period, the Jordanian dinar was pegged to the SDRs, at a rate of SDR 2.57895 per dinar with band of +/- 2.25 percent, and showed stability, supported by large capital inflows, mostly in the remittances of the Jordanians working abroad and foreign grants. By the mid 1980s, the real exchange rate appreciated, making Jordanian products more expensive than foreign products, hence the trade balance's deficit increased and the foreign reserves started to diminish.

The economy experienced a recession during the second half of the 1980s due to the oil price collapse and the effect of the decrease in workers' remittances and foreign grants, and the balance of payment pressures forced the authorities to follow a partial flotation of the dinar. In late 1988, the dinar was put on a managed float (Central Bank of

Jordan, 1989). In February 1989, the dinar was linked by the US$, then the authorities devalued it by about a third, at the rate of US$ 1.76 per Dinar (see Figure 2.16).

The crisis continued to get deeper. In order to stabilise the economy, the authorities delinked the Jordanian dinar from the US$, on May 1989, and instead linked it to a basket of currencies. Two months later, a dual exchange rate was applied temporary (Central Bank of Jordan, 1990). This policy was terminated, and again the authorities linked the dinar to a basket of currencies. The exchange rates were combined at US$ 1.49 per dinar.

Figure 2.16: Official exchange rate (US$:JD) (1976-2008)



By October 1995, the CBJ pegged the Jordanian dinar to the US$, at rate of US$ 1.4 per dinar, aiming to keep the dinar's exchange rate stable against the US$. Since then, exchange rate stability has been a key factor of the monetary policy in Jordan.

2.5.5 Interest Rate:

During the 1980s, the CBJ set a fixed interest rate structure to be operated in the financial system. Because of a huge amount of excess liquidity in the money market, in addition to a low level of credit demand, any changes in the discount rate did not have a strong effect on the behaviour of banks. The discount rate moved from 5.5 percent in 1976 to 8.5 percent in 1990, representing a conversion of monetary policy from an expansionary to a tight policy[5] after the currency crisis. This rate remained constant during the 1990s and then fluctuated to reach 4.75 percent in 2009.

By 1990, the CBJ reduced their control over the interest rate system, thus the interest rates on deposits and loans became fully liberalised. In 1993, an unrestrictive monetary policy was undertaken by the CBJ and aimed to maintain high interest rates with the intention of stabilising the domestic currency and build up foreign reserves. To that end, the CBJ introduced three and six months CDs in an attempt to free up interest rates and let them be determined by the market. The rate on these CDs was 3.25 percent on three months and 4.10 percent on six months; by the end of 2009 the rates had reached 5.641 percent and 5.936 percent, respectively (see table 2.2).

[5] See Maziad 2009.

Table (2.2): Interest rate structure (1976-2009)

Year	Deposit Rate			Loans & Advances	CDs Rate		Repo	Discount Rate
	Time	Saving	Demand		Six Months	Three Months		
1976	5.50	5.00	2.00	9.000				5.500
1977	5.50	5.00	2.00	9.000				5.500
1978	5.50	5.00	2.00	9.000				5.500
1979	6.00	5.00	2.00	8.500				6.000
1980	6.00	5.00	2.00	8.500				6.000
1981	6.00	5.00	2.00	8.500				6.500
1982	6.00	5.00	4.00	8.500				6.500
1983	8.00	6-6.5	4.00	8.625				6.250
1984	8.50	6.5-7	4.00	8.625				6.250
1985	8.50	6.5-7	4.00	8.625				6.250
1986	7.50	5.5-6	3.00	7.625				5.750
1987	7.50	5.5-6	3.00	7.625				5.750
1988				9.00				7.000
1989				10.00				8.500
1990	8.23	5.18	1.69	10.51				8.500
1991	7.82	5.00	1.54	10.22				8.500
1992	6.95	5.01	0.74	10.20				8.500
1993	6.87	5.14	0.88	10.27	4.100	3.250		8.500
1994	7.33	4.96	1.15	10.42	7.940	7.750	8.438	8.500
1995	7.97	5.01	1.04	10.74	9.000	8.750	9.500	8.500
1996	8.85	5.22	1.19	11.60	9.500	9.250	10.00	8.500
1997	8.91	4.79	1.27	12.55	6.500	6.250	9.000	7.750
1998	8.33	4.56	1.35	12.89	9.550	9.450	11.50	9.000
1999	7.89	4.19	1.46	12.67	8.250	6.000	9.250	8.000
2000	6.55	3.76	1.20	11.38	6.050	6.000	7.500	6.500
2001	5.19	2.91	1.06	10.45	4.000	3.900	6.000	5.000
2002	3.97	1.84	0.91	9.85	3.450	3.000	5.500	4.500
2003	2.75	0.88	0.50	8.92	2.150	2.100	3.500	2.500
2004	2.49	0.73	0.38	7.59	3.200	2.850	4.750	3.750
2005	3.52	0.83	0.47	8.10	6.950	6.200	7.500	6.500
2006	5.13	0.99	0.87	8.56	6.862	6.700	8.500	7.500
2007	5.56	1.10	0.94	8.86	5.867	5.750	6.750	7.000
2008	5.66	1.04	1.01	9.48	5.936	5.641	6.000	6.250
2009	4.23	0.84	0.67	9.07	5.936	5.641	4.500	4.750

2.6 Conclusion

As a result of the scarcity of natural resources in Jordan, the increase in workers' remittances during the 1970s and the beginning of the 1980s, coupled with the increase in foreign grants from the Arab oil-exporting countries, were considered as the main source of finance for development. Therefore, real GDP growth in Jordan was vulnerable to the regional and global situation. However, foreign reserves built up to a significant level, over a US$ 1 billion by 1981.

By mid 1980s, these sources started to decline due to the oil price collapse, and created several problems in the Jordanian economy. A fiscal deficit led to serious financial imbalances caused by a rapid increase of the external debt services payment. The external debt-to-GDP ratio jumped sharply to reach around 155 percent in 1989. The banking system also exhibited major problems as a consequence of the recession during that period and led to a banking crisis by the failure of one of the major banks, Petra Bank. These imbalances ended with a currency crisis, with a large devaluation of the Jordanian dinar by more than a third, and a huge increase in the inflation rate, which reached about 20 percent, by late 1980s. This crisis was noticeable by the negative rate of real GDP growth, being -11.3 percent in 1989.

In order to deal with this situation, the authorities introduced several reforms, supported by the International Monetary Fund (IMF) and the World Bank, aimed at reducing the budget deficit and balance of payment deficit and at promoting fiscal and monetary stability. Since reform programmes were applied, the economy has improved. Also, the banking system has performed well and became one of the most well developed

systems in the region. The economy has maintained sustainable growth, about 5.1 percent on average during the period 1993-2008.

On the other hand, the operational medium target for monetary policy in Jordan, which is regulated by the Central Bank of Jordan (CBJ), is the expansion of domestic credit. During the 1970s and 1980s, the CBJ followed an expansionary policy and issued several directives to influence banking sector activities in Jordan by using its limited policy instruments, the discount rate and the required-reserve ratios. After 1990, and as a consequence of the currency crisis, the CBJ followed a tightened monetary policy. Since September 1993, the CBJ has moved to indirect monetary policy control, which depends mainly on open market operations, in addition to the discount rate as a key instrument of the monetary policy, and has introduced a special type of securities called Certificates of Deposits (CDs). These CDs are used to control and affect the excess reserves and the cost of credit in the economy.

Chapter 3

Financial Stability and Monetary policy in Jordan

Financial Stability and Monetary Policy in Jordan

3.1 Introduction

Until recently Central Banks have had two goals: to undertake monetary policy and to maintain financial stability. Besides their main goal of maintaining price stability, Central Banks in developed countries have a natural role to ensure financial stability, which requires supervisory information to execute this role (Schinasi, 2003). This role has been separated off recently. Central Banks in developing countries are required to manage price and financial stability as well (De Gregorio, 2009). In a series of papers, Borio (2004, 2005, 2006) argues that to achieve monetary and financial stability may require some significant refinements to the current policy framework based on "closer cooperation between prudential and monetary authorities".

Unlike monetary policy, there is no widely accepted definition of financial stability. Crockett (1997), for instance, defines financial stability as the absence of instability, so the financial institutions and market are stable. Schinasi (2004) in turn provides a survey of financial stability definitions and then defines it "in terms of its ability to facilitate and enhance economic processes, manage risks, and absorb shocks" (see page 1). The Central Bank of Bahrain (Alawode and al Sadek, 2008) also provides a comprehensive survey of the literature on financial stability definitions and defines it as "a situation where the financial system is able to function prudently, efficiently and uninterrupted, even in the face of shocks" (see page 16).

On the empirical side, a number of studies have tried to investigate the relationship between monetary policy and financial stability. Bergman and Hansen (2002) examined empirically the relationship between financial instability and monetary

policy in Sweden. They used measures of financial instability in a standard vector autoregressive (VAR) framework with output, prices, and interest rate, and then extended it to include measures of credit expansions. The measures of financial stability constructed used firm bankruptcies and excess return on housing. They found that there was a significant effect of higher interest rates and lending expansions on financial instability, and a strong impact of price shocks as well. They concluded that price stability and financial stability cannot be rejected as mutually consistent goals for monetary policy. Dayyat (2006) tested the impact of monetary policy on the capital market in the Jordanian economy using VAR models; she found that there is an impact of the money supply on Treasury bills and government bonds and the stock price index in Jordan.

Granville and Mallick (2009) defined financial stability by considering a number of indicators, including the changes in share prices, interest rate spreads, the nominal exchange rate, house price inflation, and the bank deposit-loan ratio. Applying VAR models, using data of the twelve European Monetary Union countries over the period fourth quarter 1994-second quarter 2008, they found that there is a pro-cyclical relationship between monetary and financial stability. De Graeve *et al.* (2008) suggest a multi-level analysis to provide empirical evidence of the relationship between monetary policy and financial stability. They constructed a bank distress, for Germany, measured from microeconomic level data, which was then aggregated and included in a VAR model. Their findings confirm the link between monetary policy and banking distress.

In the present chapter, two financial stability indices are constructed following the approach in the literature. The first one is constructed in terms of changes in a

weighted combination of a number of variables including the real exchange rate, the real interest rate, the stock price index, and a volatility indicator. However, the second index is constructed in terms of three equations estimated using Full Information Maximum Likelihood (FIML) method, including equations representing the equity market, the bonds market, and banking sector.

The analysis employs a vector autoregressive (VAR) framework containing indicators of policy instruments; banks credit and deposits as policy medium targets, and the indicators of real economic activity being output and prices. The objective is not to estimate exact relationships for the impact of monetary policy actions, but to check the presence of the credit and money channels in order to assess the effectiveness of monetary policy in affecting the financial stability index.

The rest of this chapter is as follows: Section 3.2 describes the financial stability index. Section 3.3 describes the data and methodology. Section 3.4 discusses the results of the empirical work. Section 3.5 concludes the analysis.

3.2 The construction of a financial stability index[6]

Although several Central Banks have started developing measures to assess financial market conditions, very few have constructed a single measure of financial stability (Gadanecz and Jayaram, 2009). The IMF published a global financial stability report on a semi-annual basis to provide risk assessments of global financial markets and to address emerging markets financing. The Bank of England presented an overview of the financial system in the UK using quantitative models to assess the sources, likelihood and the impact of risk on a number of key vulnerabilities in the financial system[7].

Illing and Lui (2003) constructed a composite financial stability index for the Canadian financial system. The variables used in their index can be categorised into four factors, namely, the banking sector, foreign exchange markets, debt markets, and equity markets. They argued that this index could provide an ordinal measure of financial market stress and any changes in this index may be useful in evaluating the changes in the stress level. Another financial stability index was constructed by Van den End (2006) for the Nederlandsche bank. The index combined market and institutional information and has a more significant contribution to using indicators in financial stability reports, where it covers virtually the whole financial market. Variables included in this index are real interest rates, the real exchange rate, house prices, stock prices, a solvency indicator, and volatility of the stock price index. Following Sterken (1991), Hadad *et al.* (2007)

[6] See Appendix I for survey of a number of financial stability indices.
[7] According to the Bank of England's Financial Stability Reports, the six key vulnerabilities are: low risk premia, global imbalances, global corporate debt, UK household's debt, Large Complex Financial Institutions stress, and infrastructure disruption.

constructed a model to formulate a financial stability index for Indonesia based on three factors, including the equity market, the bond market, and the banking sector.

The Central Bank of Jordan (CBJ) has recently started to publish an annual financial stability report. In their report, financial stability was assessed using a number of key indicators including macroeconomic prudential indicators, asset quality and credit risks, profitability and operational efficiency ratio (See Central Bank of Jordan, 2011).

Literature on financial stability index shows that an aggregate index is comprised of a number of indicators that reflect the various aspects of financial system. These indicators emphasize the stock market performance, banks and credit quality, the macroeconomic situation.

This section will attempt to construct two indices for the Jordanian economy following Van den End (2006) and Hadad *et al.* (2007). The choice of these indices depends on two factors. Firstly, the construction of these indices is direct forward depending on key indicators of the financial system of a developing country, for example Jordan, number of studies considered these two approaches in constructing financial stability index. Secondly, constructing two indices enables comparisons to be made between them to determine the way each one can represent the financial system stability.

3.2.1 Van den End (2006) approach (*FSIV*)

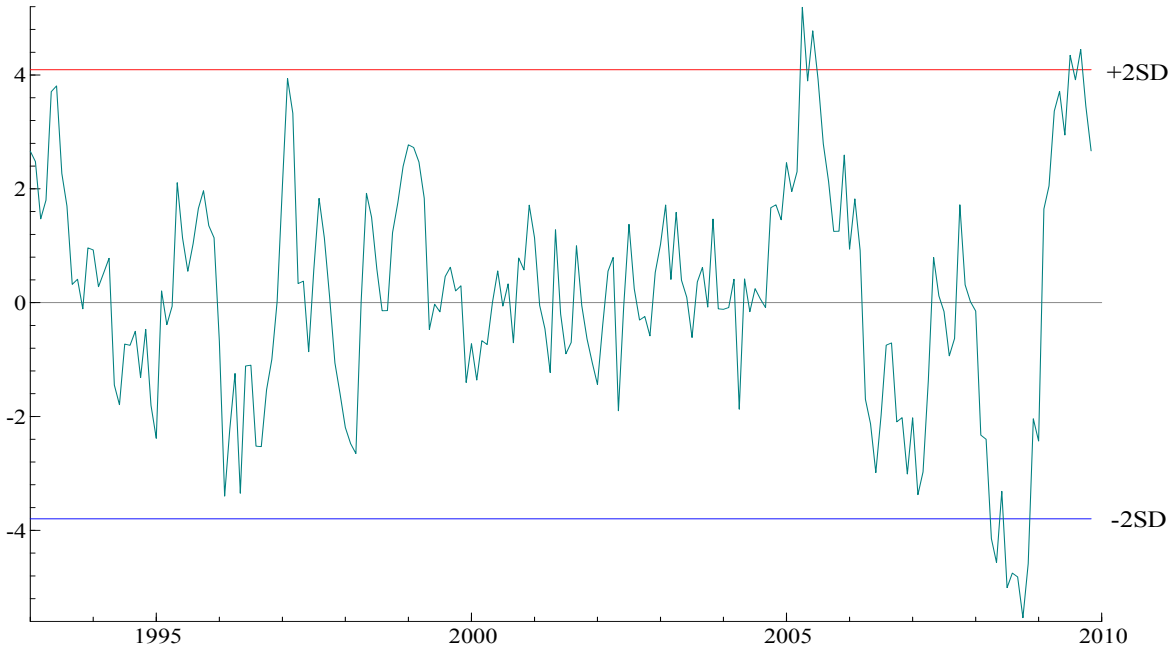
Following Van den End (2006), the financial stability index for the Jordanian economy can be constructed as:

$$FSIV = w_1 \Delta RER + w_2 \Delta RIR + w_3 \Delta SP + w_4 \Delta VOL \qquad (1)$$

where Δ denoted annual change, *RER* is the real exchange rate, *RIR* is the real interest rate calculated as the difference between the discount rate and inflation rate, *SP* denotes the natural logarithm of the stock market price index, *VOL* is the standard deviation of the natural logarithm of the change in the share price index of the banking sector (returns) and provides a measure of stock market volatility (data on stock prices obtained from Amman Stock Exchange), and w_i is a weighted average calculated as: $1/\sigma_i$, where σ_i is the standard deviation of the full sample for series *i*. It uses monthly data covering the time period from January 1993 to December 2009.

The financial stability index is measured as a weighted average of the change in the real Jordanian dinar exchange rate against the US dollar, change in the real interest rate, change in the stock market price index, and change in volatility. These weights are calculated as the inverse of the standard deviation of each series over the period January 1993 to December 2009. Figure 3.1 plots the financial stability index (*FSIV*).

Figure (3.1): Plot of the financial stability index (*FSIV*) (1993-2009)



Van den End (2006) argues that the financial stability index would be more meaningful when it has critical boundaries. Therefore, financial stability is moving within a corridor bounded by critical values at which the system appears to function well. Instability, for instant, occurred when this index exceeds the critical values. Usually these critical values calculated as: the index mean ± 2 standard deviations. In other words, financial instability represented by large movements of the index.

3.2.2 Hadad *et al.* (2007) approach (*FSIH*)

Following Hadad *et al.* (2007), the financial stability index for the Jordanian economy can be constructed from a system of simultaneous equations consisting of three equations. These equations include the equity market (*EM*), the bond market (*BM*), and the banking sector (*BS*). It uses monthly data covering the time period from May 1998 to November 2008. Then the financial stability index can be presented as:

$$FSIH = \widehat{EM} + \widehat{BM} + \widehat{BS} \qquad (2)$$

Equity market fluctuations affect financial stability through its effects on the demand of investment, household's wealth, and company's balance sheets. These effects can be formulated as:

$$EM = \alpha_0 + \alpha_1 i^{cr} + \alpha_2 Infl + \alpha_3 LTV \qquad (3)$$

where *EM* denotes natural logarithm of stock market price index, i^{cr} represents the interest rate on banks credit, *Infl* is the inflation rate calculated using consumer price index, and *LTV* is natural logarithm of value traded on the stock market.

However, bond spreads can be used to explain instability in the bond market. The formulation of the bond market is expressed as:

$$BM = \beta_0 + \beta_1 i^d + \beta_2 LM + \beta_3 LBON \qquad (4)$$

where *BM* is interest rate on Certificate of Deposits[8] (CDs) issued by the Central Bank, i^d represents discount interest rate, *LM* is natural logarithm of money supply (M2), and *LBON* denotes natural logarithm of CDs value.

Instability in the banking sector can be expressed as fluctuations in the ratio of banks credit to deposits. An increase in this ratio may increase risks facing the banking sector. However, the formulation of the banking sector can be presented as:

$$BS = \gamma_0 + \gamma_1 RER + \gamma_2 LY + \gamma_3 LM + \gamma_4 LCR \qquad (5)$$

where *BS* represents banks credit to deposits ratio, *RER* is the real exchange rate, *LY* denotes natural logarithm of income approximated by the industrial production (where income data is available in annual and quarterly frequent only), *LM* is natural logarithm of the money supply (M2), and *LCR* denotes the natural logarithm of credit to the private sector.

These equations (equations 3, 4, and 5) are estimated simultaneously using the Full Information Maximum Likelihood (FIML) method (see appendix II for full estimation results). All estimated coefficients are consistent with the theory.

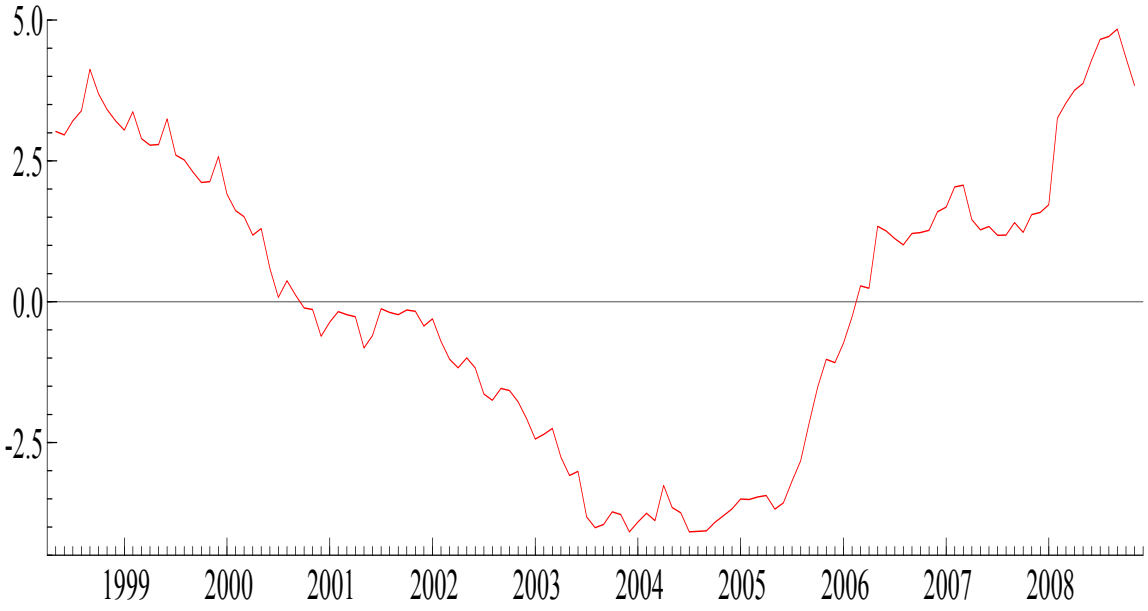
In order to estimate the financial stability index for the Jordanian economy following Hadad *et al.* (2007), the output of the system estimation into equation 2 is modified as:

$$FSIH = w_1 \widehat{EM} + w_2 \widehat{BM} + w_3 \widehat{BS} \qquad (6)$$

[8] Because of there are few corporation bonds issued during the period of study, and there is no organised bonds market in Jordan, we choose CDs issued by the CBJ to estimate the bonds market equation.

where the fitted values are adjusted by computing the difference between observations in each series and the mean value of the series, and w_i is a weighted average calculated as: $1/\sigma_i$, where σ_i is the standard deviation of the full sample for series i. Figure 3.3 shows the plot of the financial stability index (*FSIH*). Financial stability represented by the low values of the index.

Figure (3.3): Plot of the financial stability index (*FSIH*) (1998-2008)



To summarise, the financial stability index is considered as an information variable, therefore, a better index, as it covers more information. For instance, *FSIV* combines changes in the exchange market, the investment market, the stock market and the banking sector. However, *FSIH* combines three markets, the equity and bond markets and the banking sector. Both indices, to some extent, draw the same picture of the financial system stability in Jordan; they show that the Jordanian financial system is stable during the time period from 2000 to the end of 2004. However, the differences between them can be referred to the difference in time span of each index, where the weightings used depend on the sample size for each index.

According to the *FSIV*, the financial system was stable during the period 1998-2004. Thereafter, the stock market started to create a pressure on the financial system due to the increase in the stock market price index[9]. This pressure is reflected in financial imbalances in the *FSIV* during 2005-2006. The increase in the price level started in 2007, which was caused by the government's removal of oil subsidies, increased the pressure, this time, on financial instability. This instability was reflected by the decrease in real interest rate in 2008 coupled with the decrease in real exchange rate in 2007.

On the other hand, prior to 2002, the *FSIH* showed instability due to the high level of the interest rate in early 2000. The index represented a stable financial system during the period 2002-2005. However, by end of 2005, the index started to suffer from upward pressure in the three markets, reflecting instability in the financial system.

[9] The increase in the price index of the stock market caused by the increase in capital inflow from the investors, mainly the Iraqi investors who find in the Amman stock market good environment for investment after the Iraq war in 2003.

3.3Data and methodology

To assess the effect of monetary policy on the financial stability index in Jordan, a vector autoregressive (VAR) approach is applied. The choice of the VAR for the purpose of this chapter is based on an approach widely used in empirical studies dealing with the transmission mechanism of monetary policy.

VAR models, as introduced by Sims (1980), consist of a system of dynamic linear equations, where all variables in this system are considered as endogenous variables. Therefore, the reduced form of the system will give one equation for each variable, which states that variable as a function of its own lagged values and all lagged values of other variables in the system.

There are several advantages of using the VAR methodology. VAR analysis is not too concerned about the stationarity of the individual variables, as the main objective of the VAR analysis is to find out the inter-relationship between the variables of the model. Another advantage of using the VAR analysis is that there is no need to distinguish between endogenous and exogenous variables in the system, where all variables are effectively treated as endogenous (Sims, 1980).

The number of variables used in empirical studies of the impact of monetary policy on real economic activity tends to be three or four. These variables can be categorised as: monetary policy indicator variables, mainly an interest rate and reserve requirements; banks credit; a measure of real economic activity, mainly real GDP, and the price level.

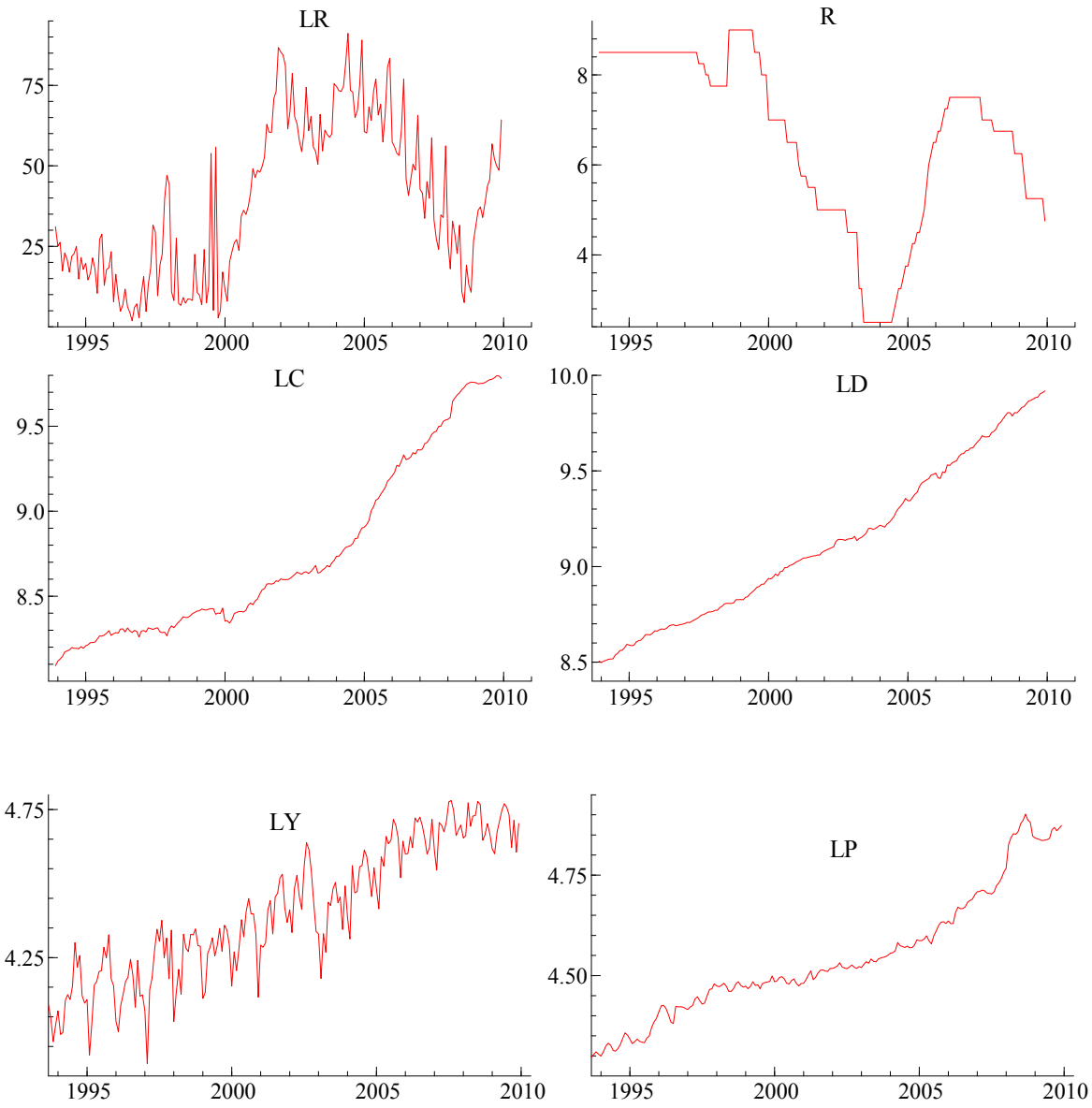
In practice, the operational medium target for monetary policy in Jordan is the expansion of domestic credit. As a result, both the excess reserves and the cost of credit have always been under examination by the Central Bank of Jordan (CBJ). Excess reserves are defined as the reserves held by banks beyond what is required by the Central Bank. Prior to late 1993, the CBJ used the discount rate and the reserve-requirement ratio as the main policy instruments. Since September 1993, in addition to the discount rate as a key instrument of the monetary policy, the CBJ has depended mainly on open market operations to affect the excess reserves and the cost of credit. The Central Bank manages its policy through semi-monthly auctions of the certificates of deposits (CDs). The Central Bank issues fewer amounts of CDs when it tries to undertake an expansion monetary policy, aiming to increase the amount of excess reserves. However, the Central Bank will issue bigger amounts of CDs looking to withdraw more excess reserves from banks, which represent a contractionary monetary policy.

3.3.1 Data

The data set includes monthly observations on excess reserves of the banking system (the excess reserves-to-total reserves ratio used because the data consistency), *LR*; discount rate, *R*, obtained from the Central Bank of Jordan; total bank deposits, *LD*; domestic credit, *LC*; income approximated by the industrial production index (data of income available annually or quarterly, not monthly), *LY*; the consumer price index, *LP*, were assembled from the IMF's International Financial Statistics; and the financial stability indices, *FSIV* and *FSIH*, that were constructed in the previous section. And *L* denotes natural logarithm. The data cover September 1993, where the CBJ started open market operations, to December 2009 (except for *FSIH* from May 1998 through November 2008, according to the availability of the data).

Figure 3.4 shows the plots of the data series. It is worth noting that the pattern of the excess reserves series had changed by 2000. This change reflected the decrease in fluctuation of excess reserves due to the new instrument introduced by the CBJ, over-night window rate. Over-night window became a risk free option for banks to invest their excess reserves. Other variables are discussed in detail above in chapter 2.

Figure (3.4): Plots of data series 12:1993-12:2009



3.3.2 Methodology

A VAR model is used to capture the impact of monetary policy shocks on the financial stability index in Jordan, trying to investigate the relationship between monetary policy and financial stability. The matrix representation of such a linear dynamic system is formed as:

$$\beta x_t = \Gamma_0 + \Gamma_1(L)x_t + \varepsilon_t \qquad (6)$$

where x_t is a vector of the endogenous variables, β is a matrix of the parameters on contemporaneous endogenous variables, $\Gamma_1(L)$ is the matrix polynomial in the lag operator, and ε_t is a vector of uncorrelated structural shocks where $\varepsilon_t \sim N(0, \sigma^2)$. Following Enders (1995) the reduced form of this system could be represented as:

$$x_t = A_0 + A_1(L)x_t + e_t \qquad (7)$$

where $A_0 = \beta^{-1}\Gamma_0$, $A_1(L) = \beta^{-1}\Gamma_1(L)$, and $e_t = \beta^{-1}\varepsilon_t$.

Given that the matrix polynomial $A_1(L)$ can be inverted, the VAR in (7) can be transformed into a moving average (MA) formulation represented by:

$$x_t = A_0 + D(L)e_t \qquad (8)$$

where $D(L) = [I - A_1(L)]^{-1}$.

This form represents the impulse response function, where each of the endogenous variables in the system is determined by the accumulation of a series of shocks, where $D(L)$ is the lag operator of the responses of the endogenous variables (x_t) to a disturbance shock (ε_t).

The stability of the system is a necessary condition to obtain a reasonable structural economic interpretation from the impulse response function. Therefore, all the roots of *D(L)* should be less than unity.

As mentioned by Sims (1980), a reasonable economic interpretation is possible from the estimated VAR reduced form by estimating the long-term structural disturbances through the analysis of the system's responses to random shocks.

In order to obtain the impulse response and the variance decomposition functions, Cholesky's decomposition of the disturbance term (the moving average representation, equation (4)), has been used to decompose the covariance matrix of the reduced-form residuals.

3.4 Estimation results:

Excess reserves are considered as a key indicator of banks' ability to meet any immediate demand for credit. Consequently, excess reserves have been the first intermediate target for Central Banks to affect monetary policy (Mousa, 2010). Central banks usually intend to affect the credit and the market interest rates through affecting the level of excess reserves. These changes will affect private sector decisions with regard to spending, borrowing and saving, which in turn have an impact on the real economic activity and the price level. Within this framework, a shock to excess reserves is considered an indicator of a change in monetary policy, therefore, this shock is expected to create a series of future changes to banks' deposits and, consequently, to credit, the price level, income and financial stability. The same effect is expected when the discount rate changes. Therefore, Central Banks raise the discount rate to represent a tight monetary policy, and decrease it for an expansionary monetary policy.

3.4.1 Unit root test

According to Figure 3.2, most of variables have a constant and trend over time. Therefore, a constant and trend have been included in the equations to test for unit roots (see appendix III for more details about testing the unit root).

An inspection of the variables in the data set confirmed that all are $I(1)$. Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowiski-Phillips-Schmidt-Shin (KPSS) unit root tests confirmed the stationary hypothesis for the first difference. Table 3.1 summarizes ADF, PP, and KPSS unit root tests results.

Table (3.1): Unit root tests results:

	ADF		PP		KPSS	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
LR	-1.100	-8.401*	-3.832**		0.321	0.093*
LC	-1.073	-11.950*	-1.057	-11.933*	0.322	0.070*
LP	0.057	-9.744*	0.108	-9.649*	0.303	0.075*
LY	-0.771	-4.233*	-2.338	-21.102*	1.271	0.100*
FSIV	-2.988	-8.193*	-3.178	-3.689**	0.328	0.071*
FSIH	-0.241	-9.962*	-0.387	-9.997*	0.328	0.102*

-ADF, Augmented Dickey-Fuller; PP, Phillips-Perron; KPSS, Kwiatkowiski-Phillips-Schmidt-Shin. For ADF Schwarz information criterion used to select the lag length and the maximum number of lags was set to be 14. For PP and KPSS Barlett-Kernel was used as the spectral estimation method and Newey-West used to select the bandwidth.
-ADF & PP critical values: 1% -4.006, 5% -3.482, KPSS critical values: 1% 0.216, 5% 0.146.
-*Significant at 1% and **significant at 5%.

For the level variables, under ADF and PP the null hypothesis of a unit root cannot be rejected at the 5% significance level, except for *LR* in PP test. However, the null that the first difference of the variables has a unit root is rejected at the 5% significance level. According to the KPSS test, the null hypothesis of stationarity can be rejected at the 5% significance level for the variables in level. However, the null that the first difference of the variables cannot be rejected at 5% level.

3.4.2 Lag order selection

Tables 3.2 and 3.3 provide the lag length of the two models suggested by the information criteria statistics (LR: sequential modified LR test statistic (at 5%), AIC: Akaike information criterion, SC: Schwartz information criterion, HQ: Hannan-Quinn information criterion). According to the table 3.2, the SC and HQ statistics suggest one lag and two lags, respectively, where LR and AIC suggest nine lags and ten lags, respectively. However, according to the table 3.3, the SC suggests no lags, and HQ statistics suggest two lags, AIC statistic suggests three lags, whereas LR suggests seven lags.

Table (3.2): Information criteria statistics for the lag order selection:

Lag	LR	AIC	SC	HQ
0	NA	-16.13282	-16.01347	-16.08438
1	177.9263	-17.33039	-16.6143*	-17.03974
2	75.37051	-17.62032	-16.30753	-17.0875*
3	38.80609	-17.57752	-15.668	-16.80245
4	35.14371	-17.5166	-15.01036	-16.49933
5	39.98267	-17.53107	-14.4281	-16.27159
6	21.92062	-17.35724	-13.65755	-15.85556
7	42.60974	-17.46182	-13.16541	-15.71793
8	22.34554	-17.32901	-12.43587	-15.34291
9	43.31703*	-17.52201	-12.03214	-15.2937
10	35.03984	-17.6347*	-11.54813	-15.16421

Table (3.3): Information criteria statistics for the lag order selection:

Lag	LR	AIC	SC	HQ
0	NA	-11.98436	-11.8650*	-11.93592
1	100.3048	-12.4698	-11.75373	-12.17915
2	72.46072	-12.73176	-11.41896	-12.1989*
3	45.60653	-12.7577*	-10.84813	-11.98258
4	28.86582	-12.62995	-10.12371	-11.61268
5	30.91172	-12.54249	-9.439522	-11.28301
6	34.32585	-12.51635	-8.816656	-11.01466
7	41.00286*	-12.60059	-8.304172	-10.85669
8	30.59758	-12.57929	-7.686146	-10.59319
9	28.33484	-12.55515	-7.065289	-10.32684
10	18.13444	-12.40372	-6.317133	-9.933205

3.4.3 Granger Casualty test

The Granger causality test is a test to determine the direction of causality of a variable to another variable (Enders, 2004). Where the null hypothesis of this test is constructed as:

H_0: X_1 does not granger cause X_2

This null can be tested using F-statistic. If the calculated F-statistic greater than the critical value, then the null can be rejected, thus X_1 does granger cause X_2.

In order to investigate the relationships between the financial stability and monetary policy, the Granger causality test is implemented. Tables 3.4 and 3.5 represent the directions of causality between financial stability indices (FSIV and FSIH, respectively) and the rest of variables.

Table (3.4): Granger Causality test (variables $\Delta LR\ \Delta LC\ \Delta LY\ \Delta LP\ \Delta FSIV$)

Null Hypothesis:	*Obs*	*F-Statistic*	*Prob.*
Δ(LC) does not Granger Cause Δ(LR)	117	2.515	0.016
Δ(LR) does not Granger Cause Δ(LC)		2.655	0.011
Δ(LY) does not Granger Cause Δ(LR)	117	0.511	0.846
Δ(LR) does not Granger Cause Δ(LY)		1.455	0.183
Δ(LP) does not Granger Cause Δ(LR)	117	1.883	0.071
Δ(LR) does not Granger Cause Δ(LP)		1.982	0.056
Δ(FSIV) does not Granger Cause Δ(LR)	117	4.954	0.000
Δ(LR) does not Granger Cause Δ(FSIV)		3.396	0.002
Δ(LY) does not Granger Cause Δ(LC)	117	1.498	0.168
Δ(LC) does not Granger Cause Δ(LY)		1.552	0.149
Δ(LP) does not Granger Cause Δ(LC)	117	0.669	0.718
Δ(LC) does not Granger Cause Δ(LP)		1.114	0.360
Δ(FSIV) does not Granger Cause Δ(LC)	117	1.341	0.232
Δ(LC) does not Granger Cause Δ(FSIV)		2.134	0.039
Δ(LP) does not Granger Cause Δ(LY)	117	0.792	0.611
Δ(LY) does not Granger Cause Δ(LP)		0.731	0.664
Δ(FSIV) does not Granger Cause Δ(LY)	117	0.988	0.450
Δ(LY) does not Granger Cause Δ(FSIV)		0.718	0.675
Δ(FSIV) does not Granger Cause Δ(LP)	117	0.677	0.710
Δ(LP) does not Granger Cause Δ(FSIV)		1.117	0.359

Table (3.5): Granger Causality test (variables $\Delta LR\ \Delta LC\ \Delta LY\ \Delta LP\ \Delta FSIH$)

Null Hypothesis:	*Obs*	*F-Statistic*	*Prob.*
Δ(LC) does not Granger Cause Δ(LR)	116	2.346	0.019
Δ(LR) does not Granger Cause Δ(LC)		2.738	0.007
Δ(LY) does not Granger Cause Δ(LR)	116	0.752	0.660
Δ(LR) does not Granger Cause Δ(LY)		1.237	0.282
Δ(LP) does not Granger Cause Δ(LR)	116	1.348	0.223
Δ(LR) does not Granger Cause Δ(LP)		1.716	0.096
Δ(FSIH) does not Granger Cause Δ(LR)	116	2.476	0.014
Δ(LR) does not Granger Cause Δ(FSIH)		1.660	0.109
Δ(LY) does not Granger Cause Δ(LC)	116	1.435	0.184
Δ(LC) does not Granger Cause Δ(LY)		1.566	0.136
Δ(LP) does not Granger Cause Δ(LC)	116	0.961	0.477
Δ(LC) does not Granger Cause Δ(LP)		1.493	0.161
Δ(FSIH) does not Granger Cause Δ(LC)	116	1.452	0.177
Δ(LC) does not Granger Cause Δ(FSIH)		2.806	0.006
Δ(LP) does not Granger Cause Δ(LY)	116	0.820	0.599
Δ(LY) does not Granger Cause Δ(LP)		0.652	0.750
Δ(FSIH) does not Granger Cause Δ(LY)	116	1.037	0.417
Δ(LY) does not Granger Cause Δ(FSIH)		1.224	0.290
Δ(FSIH) does not Granger Cause Δ(LP)	116	0.634	0.765
Δ(LP) does not Granger Cause Δ(FSIH)		0.816	0.603

Table 3.4 shows that the null hypothesis of financial stability index (*FSIV*) does not granger cause the excess reserves can be rejected at the 1% level of significant. However, the excess reserves and credit do granger cause *FSIV* at the 1% and 5% level of

significant, respectively. This result gives evidence that the relationship between monetary policy and financial stability in Jordan does exists.

On the other hand, Table 3.5 shows that the null hypothesis of financial stability index (*FSIH*) does not granger cause the excess reserves can be rejected at the 5% level. Nonetheless, the null of bank's credit does not granger cause *FSIH* can be rejected at the 1% level.

3.4.4 VAR results

In order to estimate the relationship between monetary policy and financial stability in Jordan, two VAR models are estimated. In the first model we employ five variables including *FSIV*. In the second model we replace *FSIV* by *FSIH*, as an index of financial stability in Jordan. The VAR used are with **first difference** as all variables included are integrated of degree 1, *I*(1). Following the literature, the order of the variables in the system will be, firstly, monetary policy variables followed by banks credit, output, the price level, and finally, the financial stability index[10].

[10] Both interest rate and deposits are excluded from the models as they give an unstable VAR model.

3.4.4.1 VAR results with *FSIV*

A standard VAR system consisting of five endogenous variables, including excess reserves, LR, banks credit, LC, output, LY, the price level, LP, and the financial stability index, FSIV[11], is estimated with the lag length set to be from 1 lag up to 10 lags.

Table 3.2 provides the lag length suggested by the information criterion statistics.

Hence, the VAR system with up to eight lags was evaluated to identify the right lag length depending on information criteria statistics.

Accordingly, the results of the diagnostic tests are presented in Table 3.6. The results confirm that there is no serial correlation in the residuals of the system, and no hetroskedasticity at 5% level of significant.

Table (3.6): Diagnostic tests results:

	Test statistic	P-value
LM test (for no serial correlation, 9 lags)	24.952	0.465
Chi square (for Hetroskedasticity)	1156.733	0.811

[11] The index transformed using moving average to have the same pattern of the other index (see Appendix IV for the plot of the transformed index).

Based on the VAR graphical analysis in Figure 3.5, the system performs well. The actual and fitted values and the cross plot of them give support for the goodness of fit except, to some extent, for the excess reserves equation. However, the density distribution of the residuals shows that the residuals are not normally distributed. This lack of normality is not expected to create serious problems to the analysis, where it is due to the excess kurtosis rather than excess skewness (Johansen and Juselius, 1990).

Figure 3.6 shows the impulse response functions, using one standard deviation positive innovation and the bands given by ±2 standard error, of all variables against the financial stability index based on the Cholesky decomposition. An expansionary monetary policy, represented by a positive shock to excess reserves, is expected to have a positive impact on the financial stability index. This impact is not clear. In the same direction, any increase in domestic credit is expected to have a positive effect on the financial stability index. On the other hand, a change in income and the price level have a negative impact on the financial stability. A clearer image can be drawn by the accumulated impulse response presented in figure 3.7.

Figure (3.5): Graphical VAR analysis:

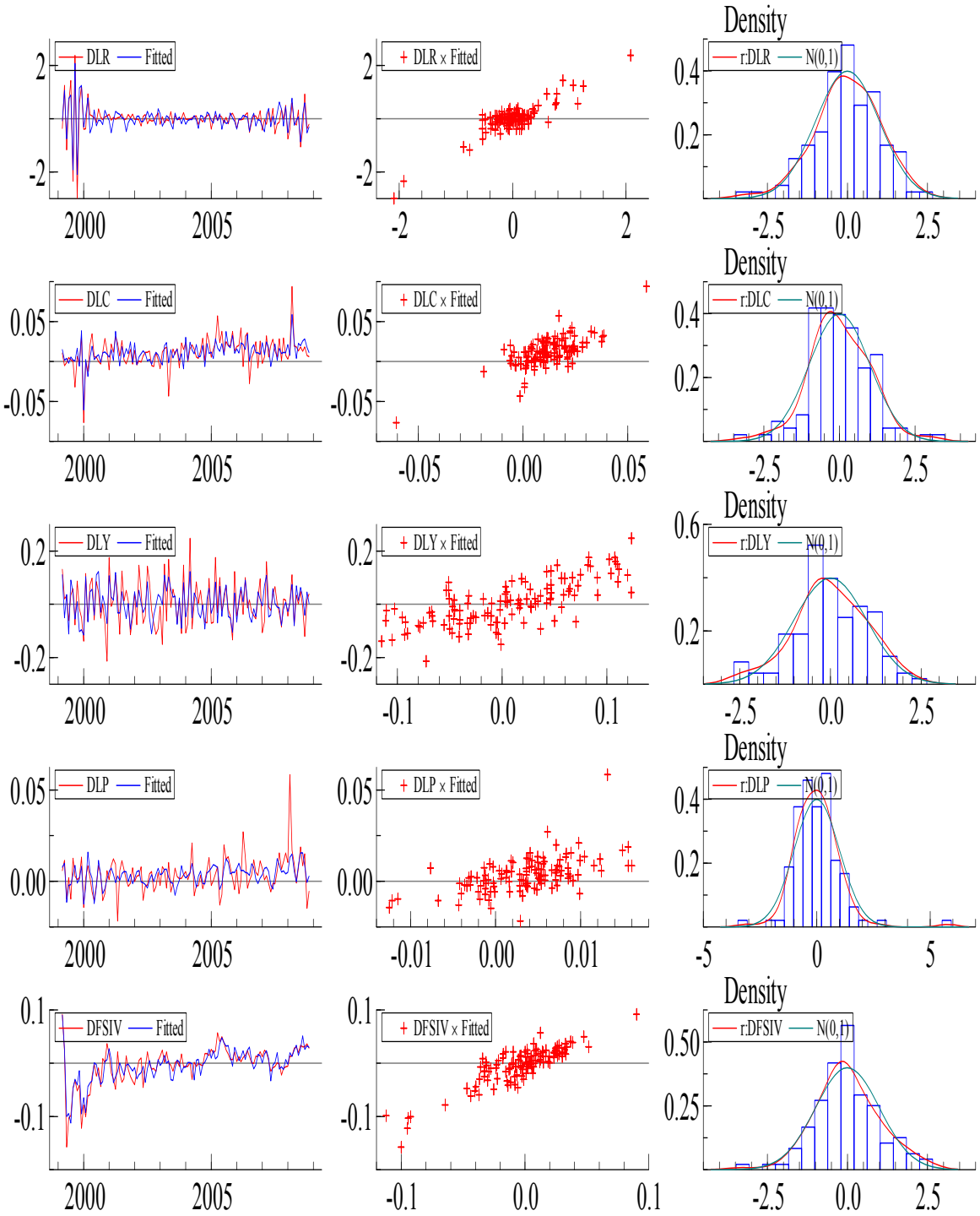


Figure (3.6): Impulse response of Financial Stability Index to all variables:

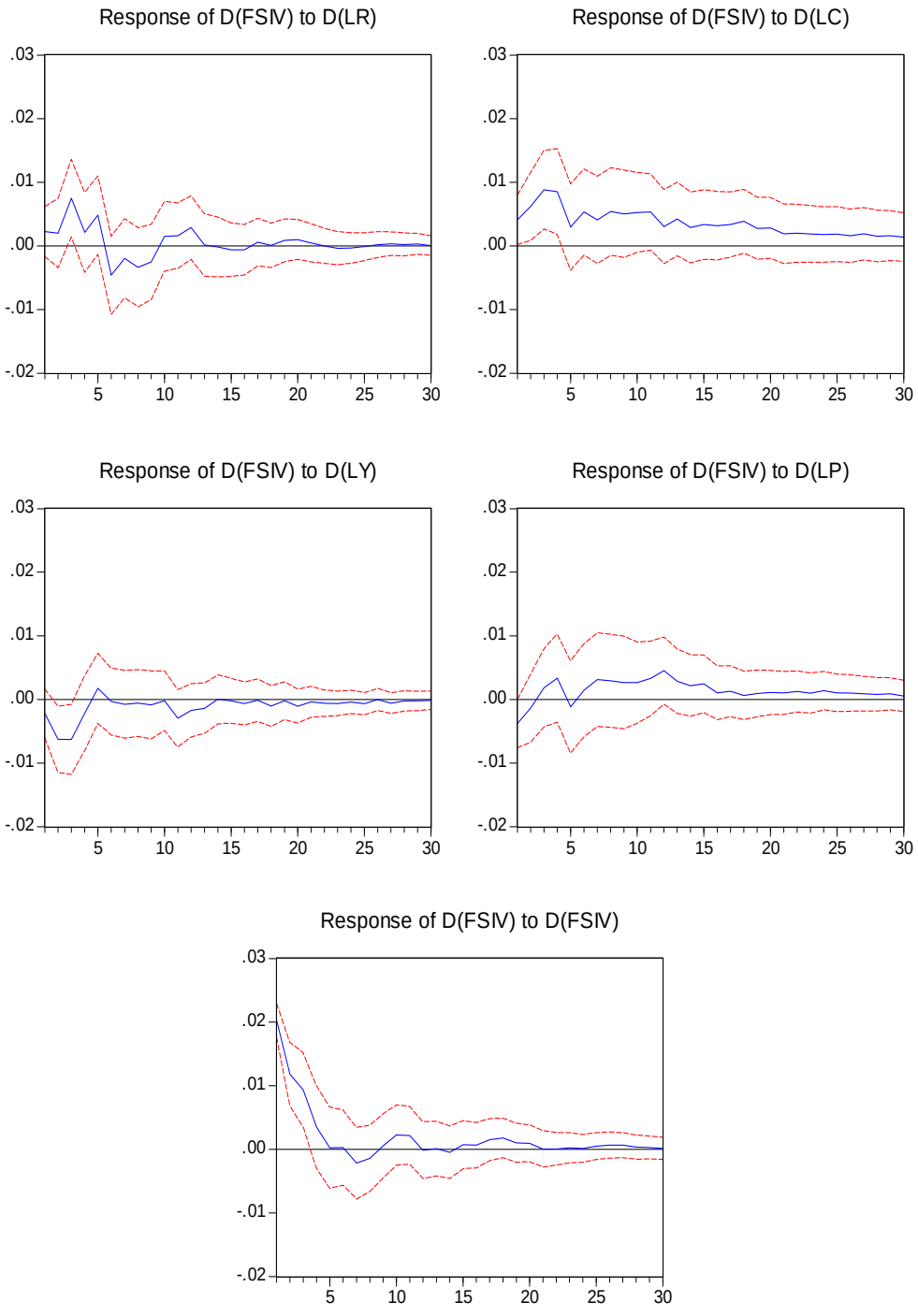
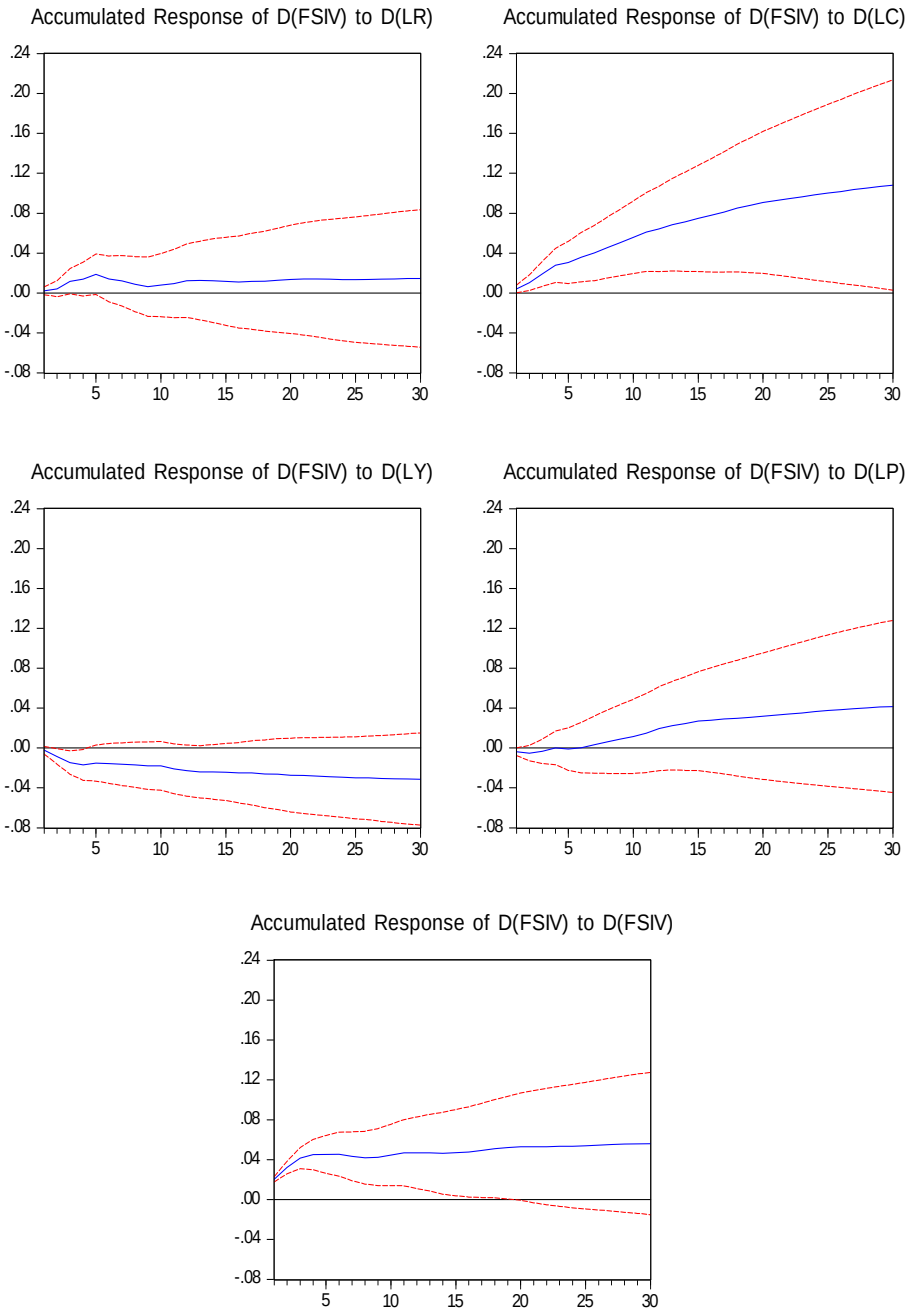


Figure (3.7): Accumulated impulse response of Financial Stability Index to all variables:



The variance decomposition of the variables included in the system, especially for the financial stability index, may shed more light on the impact of the changes in the system variables expected to have on the financial stability variable. Table 3.7 shows the variance decomposition of the financial stability index. After 10 periods, shocks to banks credit seem to explain about 26 percent of the variations in the financial stability index. Changes in excess reserves followed by the changes in income and the price level have about 11 percent, 7 percent and 5 percent, respectively. However, after 12 periods, no significant changes appear to take place except the proportion of the banks' credit, which increased to about 32 percent. These values support the idea that financial stability in Jordan may not be affected directly by monetary policy changes, but it could be affected indirectly through the policy's intermediate target, through banks credit.

Table (3.7): Variance decomposition of *FSIV*:

Period	S.E.	Δ(LR)	Δ(LC)	Δ(LY)	Δ(LP)	Δ(FSIH)
1	0.338	1.127	3.713	1.073	3.169	90.918
2	0.487	1.357	8.223	6.527	2.398	81.495
3	0.537	6.958	14.198	8.909	2.072	67.862
4	0.560	6.691	19.714	8.459	2.948	62.188
5	0.579	8.635	19.866	8.453	2.974	60.071
10	0.624	10.617	26.267	7.163	5.096	50.856
11	0.650	9.956	30.708	7.173	7.958	44.205
12	0.654	9.721	31.791	7.095	8.364	43.028

3.4.4.2 VAR results with *FSIH*

The next set of results considers the financial stability index *FSIH*. A standard VAR system consists of five variables, excess reserves, *LR*, banks credit, *LC*, output, *LY*, the price level, *LP*, and *FSIH*, and is estimated with the lag length set to be from 1 lag up to 10 lags.

Table 3.3 provides the lag length suggested by the information criterion statistics.

Hence, the VAR system with up to nine lags was evaluated to identify the right lag length depending on information criteria statistics.

Accordingly, the results of the diagnostic tests are presented in Table 3.8. The results confirm that there is no serial correlation in the residuals of the system, and no hetroskedasticity at the 5% level of significance.

Table (3.8): Diagnostic tests results:

	Test statistic	P-value
LM test (for no serial correlation, 9 lags)	17.217	0.874
Chi square (for Hetroskedasticity)	1192.614	0.555

Based on the VAR graphical analysis in Figure 3.8, the system performs well. The actual and fitted values and the cross plot of them give support for the goodness of fit. However, the density distribution of the residuals shows that the residuals are not normally distributed.

Figure 3.9 shows the impulse response functions, corresponding to a one standard deviation positive innovation, along within ±2 standard error, of all variables against the financial stability index based on the Cholesky decomposition. A positive shock to the excess reserves is expected to have a positive impact on the financial stability index. In the same direction, any increase in the domestic credit is expected to have a positive effect on the financial stability index. On the other hand, a change in income and the price level has a negative impact on the financial stability. These impacts are not clear. A clearer image can be drawn by the accumulated impulse response presented in figure 3.10.

Figure (3.8): Graphical VAR analysis:

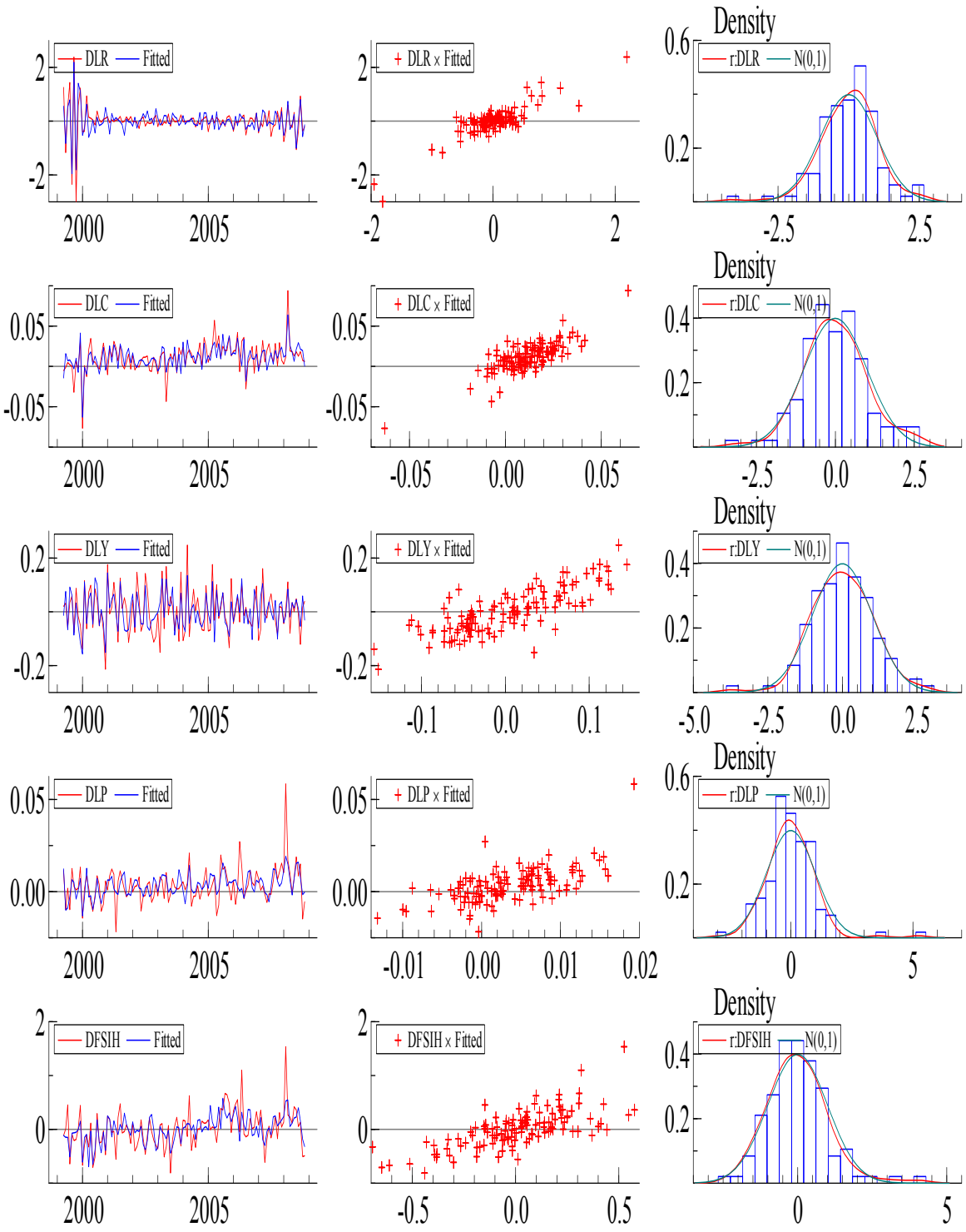


Figure (3.9): Impulse response of Financial Stability Index to all variables:

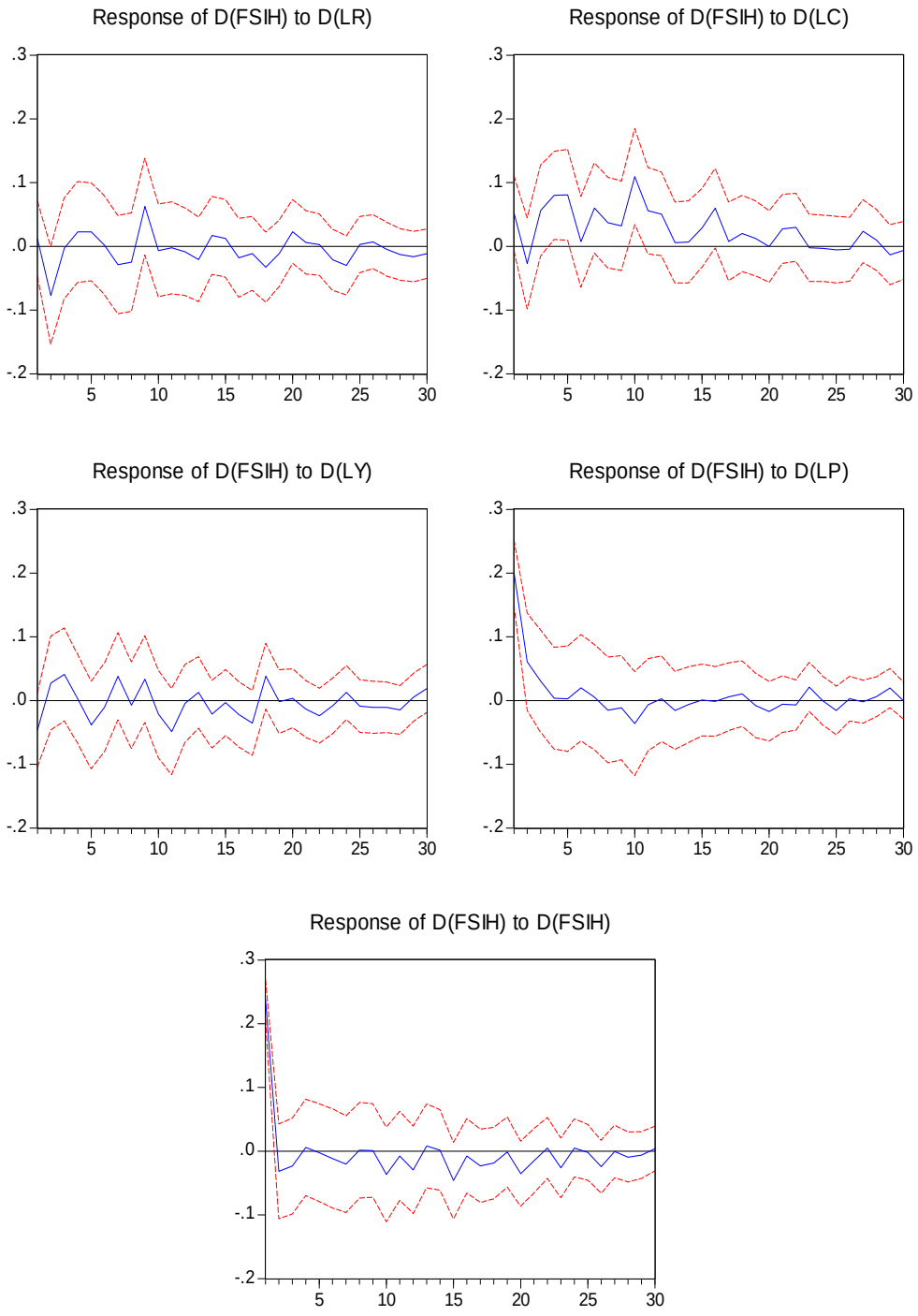
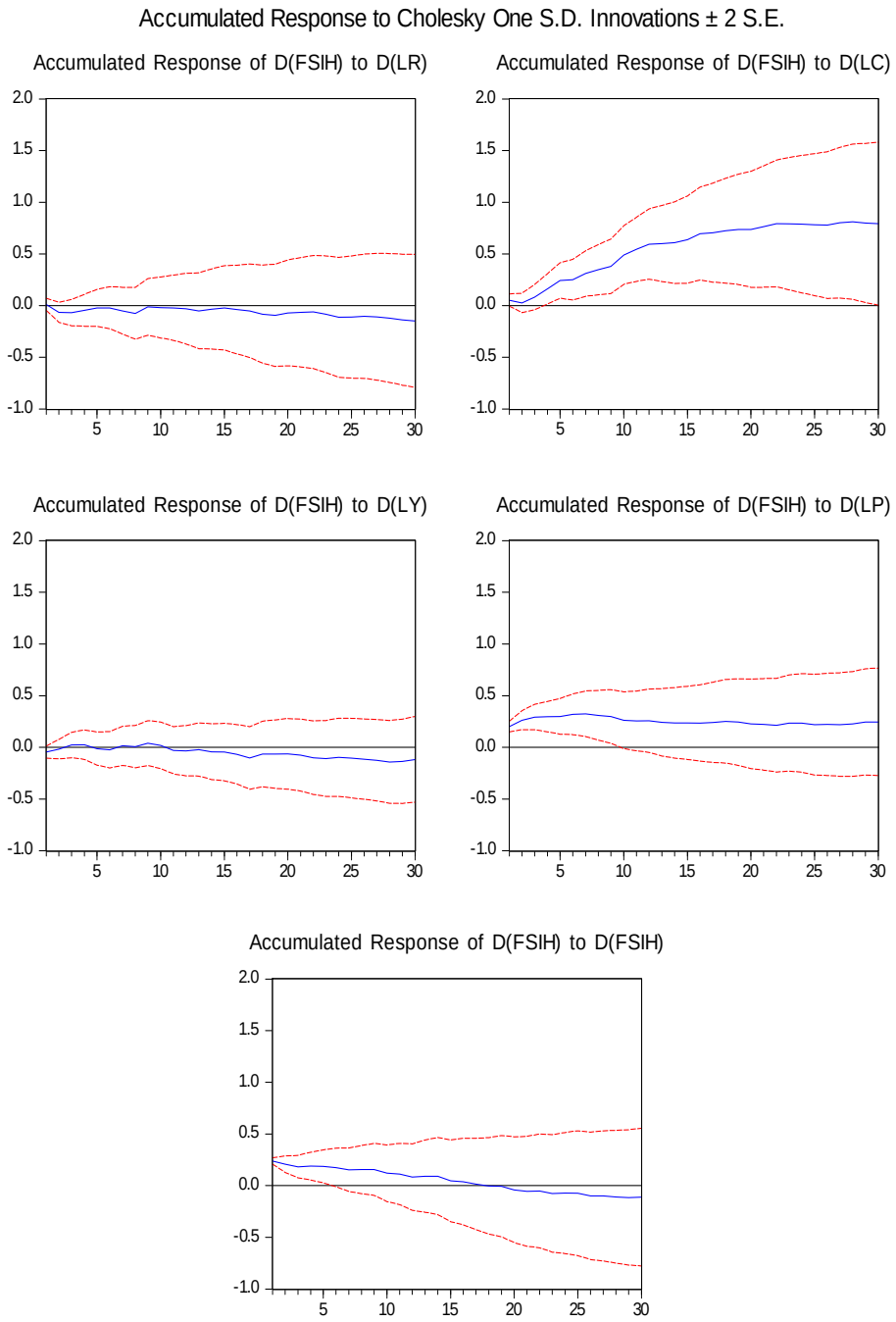


Figure (3.10): Accumulated impulse response of Financial Stability Index to all variables:



The variance decomposition of the variables included in the system, especially for the financial stability index, may shed more light on the impact that the changes in the system variables are expected to have on financial stability variable. Table 3.9 shows the variance decomposition of the financial stability index. After 10 periods, shocks to excess reserves explain just 7.5 percent of the variations in the financial stability index. Changes in income have the lowest proportion, about 5.5 percent. While changes in banks credit can explain about 22.6 percent. However, changes in the price level have the highest proportion, about 28 percent. After 12 periods, no significant changes appear to take place. Except that the effect of the price level decreased to reach 24 percent. These values support the idea that financial stability in Jordan may not be affected directly by monetary policy changes, but it could be affected indirectly through the policy intermediate target, through credit.

Table (3.9): Variance decomposition of *FSIH*:

Period	S.E.	Δ(LR)	Δ(LC)	Δ(LY)	Δ(LP)	Δ(FSIH)
1	0.365	0.130	2.685	2.082	39.601	55.502
2	0.471	5.332	3.031	2.519	38.634	50.483
3	0.502	5.059	5.507	3.778	37.374	48.282
4	0.518	5.184	10.224	3.576	35.344	45.672
5	0.534	5.239	14.368	4.428	33.141	42.824
10	0.624	7.516	22.578	5.524	28.294	36.088
11	0.661	8.117	25.086	7.991	24.875	33.932
12	0.671	8.746	25.188	8.553	24.314	33.199

3.5 Conclusion

This chapter attempted to investigate any potential effect of monetary policy on financial stability within the Jordanian economy. To do so, two financial stability indices for the Jordanian economy (*FSIV* and *FSIH*) were constructed. The former index, following Van den End (2006), was constructed in terms of changes in a weighted measure combine real exchange rate, real interest rate, stock price index, and volatility indicator. The latter index, following Hadad *et al.* (2007), was constructed in terms of three equations estimated using the FIML method, including the equity market, the bond market, and the banking sector. These indices were included in two separate monetary policy vector autoregressive (VAR) models containing, in addition to the indices, indicators of policy instrument, banks credit as policy medium target, and indicators of real economic activity, mainly output and prices.

The findings emphasised the relationship between financial stability and monetary policy. The impact of monetary policy shocks, represented by changes in the excess reserves on the financial stability indices, is positive, regardless of the index included, which is consistent with the theory. However, the effect is small in magnitude. On the same direction, changes in domestic credit have a significant impact on the financial stability indices. On the other hand, changes in income and the price level do not have significant impact the financial stability indices, except the negative impact of the price level on the *FSIH*. These findings support the explanation that monetary policy has a significant effect on the financial stability through affecting its medium target, using its instruments, mainly excess reserves.

Appendix I: Survey of financial stability indices

Study	Data / Model	Indicators
Illing and Liu (2006)	1980-2005 for Canada Using: factor analysis, credit weight, variance-equal weight, transformation using sample CDFs, comparison of weights methods	- Bank sector stress. - Foreign exchange market pressure. - Debt market: risk spread, liquidity measure and deviations in short-term and long-term interest rate. - Equity market crises.
Aspachs *et al.* (2006)	1990:Q4-2004:Q4 for 7 developed countries	- Banking sectors' default risk. - GDP growth rate. - Annual growth rate of the bank equity risk. - Inflation rate.
Van den End (2006)	1988:Q1-2004:Q4 for Netherland Using: factor analysis, VAR, equal weights	- Real interest rate. - Real exchange rate. - House prices. - Stock prices. - Solvency buffer. - Volatility.
Hadad *et al.* (2007)	2001:M1-2005:M6 for Indonesia Using: factor analysis, credit aggregate weight, equal variance weight	- Banking sector: non-performing loans function of real effective exchange rate, GDP, M2, credit to the private. - Stock market: stock price index function of supply shares by corporation, inflation level, short-term interest rate. - Bond market: bond's interest rate function of discount rate, M2, supply of bonds by corporation. - Real sector.
Klomp and de Haan (2009)	1980-2005 for 75 developed and developing countries Using factor analysis	- Banking sector variables: Δbank liabilities to assets ratio, Δbank reserves to assets ratio, Δcapital to assets ratio, Δshare of demostic credit by banks, credit to the private to GDP, 2 other indicators. - Risk return variables: Δreal interest rate, Δinterest rate spread, Δrisk premium, Δbank discount rate, Δshare price index, Δgovernment bond yield. - Monetary authorities: Δmoney, qusai money, M2-GDP ratio, Central Bank assets to GDP, Δnet foreign assets to GDP.

Albulescu (2010)	Q1:1996-Q4:2008 Romania	- Financial development index, including: market capitalisation/GDP, total credit/GDP, interest spread, banking reform and interest rate liberalisation. - Financial stability vulnerability, including: budget deficit/GDP, current account deficit/ GDP, REER, non-governmental credit/ total credit, loans/deposits, deposits/M2, (reserves/deposits)/(note & coins/M2). - Financial soundness index, including: non-performing loans/total loans, regulatory capital/risk weighted assets, own capital ratio, liquidity ratio. - World economic climate index, including: economic climate index, world inflation, world economic growth rate.
Morales and Estrada (2010)	01:1995-11:2008 Colombia	ROA, ROE, non-performance loans/total portfolio, net loan losses/total loan portfolio, intermediation spread, liquid liabilities/liquid assets, interbank funds/liquid assets, uncovered liabilities ratio, no. Of financial institutions with high stress level.
Morris (2010)	03:1997-03:2010 Jamaica	Follow Albulescu (2010)
Cheng and Choy (2010)	1996-2010 Macao	Follow Albulescu (2010)

Appendix II: FIML estimation results

Estimation Method: Full Information Maximum Likelihood (Marquardt)
Sample: 1998M05 2008M11
Included observations: 127
Total system (balanced) observations 381
Convergence achieved after 105 iterations

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	5.459	0.523	10.985	0.000
C(2)	0.034	0.035	0.519	0.604
C(3)	0.012	0.011	1.640	0.101
C(4)	0.416	0.041	9.331	0.000
C(5)	4.910	3.602	0.164	0.870
C(6)	1.085	0.074	14.548	0.000
C(7)	-1.058	0.340	-3.679	0.000
C(8)	0.489	0.383	3.397	0.001
C(9)	1.335	0.058	15.809	0.000
C(10)	-0.469	0.050	-7.110	0.000
C(11)	-0.033	0.013	-0.898	0.369
C(12)	-0.521	0.019	-26.155	0.000
C(13)	0.524	0.018	28.978	0.000

Log likelihood	349.1686	Schwarz criterion	-5.00286
Avg. log likelihood	0.916453	Hannan-Quinn criter.	-5.17571
Akaike info criterion	-5.293993		
Determinant residual covariance		8.21E-07	

Equation (1): EM=C(1)+C(2)*ICR+C(3)*INFL+C(4)*LTV			
Observations: 127			
R-squared	0.926713	Mean dependent var	8.008984
Adjusted R-squared	0.924926	S.D. dependent var	0.689952
S.E. of regression	0.189045	Sum squared resid	4.395767
Durbin-Watson stat	0.773459		
Equation (2): BM=C(5)+C(6)*ID+C(7)*LM+C(8)*LBON			
Observations: 127			
R-squared	0.924429	Mean dependent var	5.265646
Adjusted R-squared	0.922586	S.D. dependent var	2.030408
S.E. of regression	0.564928	Sum squared resid	39.25468
Durbin-Watson stat	0.363539		
Equation (3): BS=C(9)+C(10)*RER+C(11)*LY+C(12)*LM+C(13)*LCR			
Observations: 127			
R-squared	0.978673	Mean dependent var	0.607638
Adjusted R-squared	0.977973	S.D. dependent var	0.062139
S.E. of regression	0.009222	Sum squared resid	0.010376
Durbin-Watson stat	0.393679		

Appendix III: Testing for Unit Roots

The Augmented Dickey-Fuller test (ADF), Dickey and Fuller (1979, 1981), tests the null hypothesis that a time series y_t is integrated of degree 1, $I(1)$, against the alternative that it is $I(0)$, with the assumption that the dynamics in the data have an ARMA structure. Thus the ADF test is based on estimating the following test regression:

$$\Delta y_t = a_0 + a_1 t + (\phi - 1) y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta y_{t-j} + \varepsilon_t \qquad (1)$$

where a_0 and $a_1 t$ are deterministic terms, constant and trend, respectively. p is the lagged difference terms, Δy_{t-j} are used to approximate the ARMA structure of the homoskedastic errors. Under the null hypothesis, y_t is $I(1)$ when $\phi = 1$. The ADF t-statistic is based on the least squares estimates of equation (1) and given by:

$$ADF_t = t_{\phi=1} = \frac{\hat{\phi} - 1}{SE(\phi)} \qquad (2)$$

Phillips and Perron (1988) developed a number of unit root tests that considered a comprehensive theory of unit root. Their tests are similar to ADF tests and often give the same conclusions, but there are some differences mainly in the way they deal with the error's autocorrelation and heteroskedasticity.

The ADF and PP unit root tests are to investigate the null hypothesis that a time series y_t is $I(1)$. Alternatively, stationarity tests are for the null that y_t is $I(0)$. The KPSS test, Kwiatkowski *et al.* (1992), is the most commonly stationarity test used. The test derived using the model:

$$y_t = a_0 + a_1 t + \mu_t + u_t \qquad (3)$$

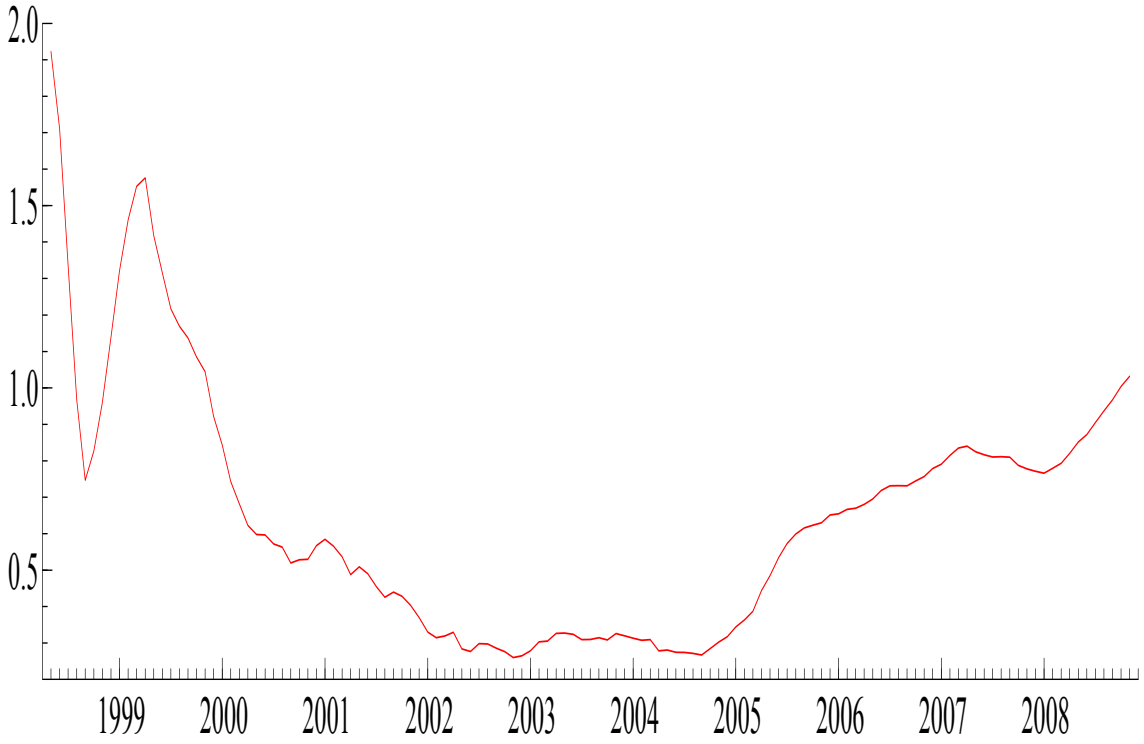
$$\mu_t = \mu_{t-1} + \varepsilon_t, \varepsilon_t \sim N(0, \sigma_\varepsilon^2) \qquad (4)$$

where a_0+$a_1 t$ are the deterministic components, the constant plus time trend, u_t is $I(0)$ and may be heteroskedastic, and μ_t is a random walk with innovation variance σ_ε^2. Under the null hypothesis, y_t is $I(0)$, H_0: $\sigma_\varepsilon^2 = 0$, which means that μ_t is a constant. The KPSS test statistic is calculated using the Lagrange Multiplier (LM) for testing the null hypothesis, $\sigma_\varepsilon^2 = 0$, against the alternative, $\sigma_\varepsilon^2 > 0$. This statistic is given by:

$$KPSS = \frac{T^{-2} \sum_{t=1}^{T} \widehat{S_t^2}}{\widehat{\lambda^2}} \qquad (5)$$

where $\widehat{S_t} = \sum_{j=1}^{t} \widehat{u_j}$, $\widehat{u_t}$ is the residual of a regression of y_t on the deterministic components, and $\widehat{\lambda^2}$ is an estimate of the long-run variance of u_t.

Appendix IV: Plot of the transformed *FSIV*:



Chapter 4

Currency Crisis in Jordan

Currency Crisis in Jordan

4.1 Introduction

Over the last two decades many countries have witnessed financial instability and were affected by financial crises. These crises embarrassed policy makers and took them somewhat by surprise and tended to lead to huge losses in income. These events have been the focus of research attention in an attempt to develop methods that could assist explaining and understanding the cause of crises and to identify indicators that could predict them.

There is no widely accepted definition of a currency crisis, which is normally considered as part of a financial crisis. Kaminsky *et al.* (1998), for instance, define currency crises as when a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in exchange reserves exceeds its mean by more than three standard deviations. Frankel and Rose (1996) define a currency crisis as a nominal depreciation of a currency of at least 25% but it is also defined at least 10% increase in the rate of depreciation. In general a currency crisis can be defined as a situation when the participants in an exchange market come to recognise that a pegged exchange rate is about to fail, causing speculation against the peg that hastens the failure and forces a devaluation or appreciation.

Jordan is a small open economy, with a fixed exchange rate, and was hit by a currency crisis in 1988-1989. Prior to the crisis, the economy exhibited several imbalances caused by a huge deficit of the trade balance, a lack of foreign exchange reserves, which arose as a result of the decrease in workers' remittances and foreign grants, banking problems, a recession and a decrease in the growth rate.

This chapter aims to employ quantitative models to explain the currency crises in Jordan, using multinomial Logit and Markov switching models. The objective is to develop an early warning system to explain any potential currency crisis in Jordan over the time period January 1976 to December 2009. This system can be used as a useful policy tool to serve policy makers, besides providing them with a way to forecast crisis development. Moreover, this chapter attempts to identify a number of leading indicators that can help our understanding of crises.

The remainder of this chapter is structured as follows: Section 4.2 reviews the theoretical and empirical work. Section 4.3 discusses the data and methodology used in the analysis. Section 4.4 reports the empirical results. Section 4.5 concludes the analysis.

4.2 Literature review

4.2.1 Theoretical work

The theoretical literature on currency crises distinguishes three types of models, according to the cause of the crises. First generation models emphasize the role of economic fundamentals to explain the crises. Second generation models, so called 'self-fulfilling' models, were developed when crises occurred in countries with sound fundamentals and emphasized the role that expectations played in the crises. Finally, the third generation models, which emerged after the late 1990s, when the East Asian currency crises occurred, emphasized the role of the banking and financial sectors in the crises and discussed the issue of contagion.

First generation models, pioneered by Krugman (1979) and Flood and Garber (1984), and expanded by Agenor *et al.* (1992), argue that unsustainable fiscal policies caused a collapse of a fixed exchange rate. The main cause of the currency crisis is weak fundamentals. The first generation models assume a small open economy, producing only one tradable good. The price of the good follows purchasing power parity:

$$P = sP^* \qquad (1)$$

where P is the domestic price level, P^* is the foreign price level, and s is the exchange rate of the domestic currency in relation to the foreign currency. For simplicity, it is assumed that P^* is fixed and equal to 1. Thus, the domestic price level equals the nominal exchange rate, as a consequence the domestic inflation rate is identical to the devaluation rate.

Capital is assumed to be perfectly mobile, so there is perfect substitution between domestic and foreign bonds, and the nominal interest rate (i) is determined by uncovered interest rate parity:

$$i = i^* + s^{*e} \qquad (2)$$

where i and i^* are the domestic and foreign interest rate, respectively, and s^{*e} is the expected devaluation rate.

According to the Central Bank, the money supply (M) consists of two elements, domestic credit (D) and foreign reserves (R):

$$M = D + R \qquad (3)$$

The money market is formulated to be a negative function of the domestic interest rate, and output is normalised to be zero, because it is constant:

$$\frac{M}{P} = -L(i) \qquad (4)$$

As a final simplifying assumption, there is perfect foresight so the expected devaluation rate is equal to the actual rate ($s^{*e} = s^*$) with a fixed exchange rate at rate ($\bar{s}$), $s^{*e} = 0$ and $i = i^*$. Therefore, the monetary equilibrium condition can be formulated as:

$$\frac{D + R}{\bar{s}P^*} = -L(i^*) \qquad (5)$$

Now under a fixed exchange rate, with P^* and i^* fixed, suppose that the government is financing a constant budget deficit, μ, by a continuous rise in domestic credit. As a result, foreign reserves will fall at the same rate:

$$\dot{R} = -\mu \qquad (6)$$

where $\dot{R}$, the derivative of R with respect to time, denotes the change in the foreign reserves. However, when the government faces a budget deficit and finances it by

increasing domestic credit, the domestic currency will be devalued because of the pressure on the fixed exchange rate. In this situation the Central Bank will run down their foreign reserves, which are finite, to defend the exchange rate. While the reserves are declining, speculators attack the currency, and when reserves are exhausted completely, a currency crisis occurs. In other words, an expanding domestic credit policy to finance the budget deficit will lead to a continuous decrease in the foreign reserves at the same rate as the increase in domestic credit. When these reserves have fallen to a specific (critical) value, the government will be forced to abandon the fixed exchange rate regime, switching to a floating exchange rate regime. At that time, speculators will attack the currency because they expected the switching reaction of the government (under full the foresight assumption), they can make a profit. This is when the currency crisis occurs.

In the first generation models the change in the exchange rate regime is determined by the government, whereas in **the second generation models**, the government maximizes an explicit objective function or minimizes a loss function (Obstfeld, 1986 and 1996). The crises occur because of market expectations not because of economic fundamentals. Second generation models are characterised by multiple equilibria and the interactions between market expectations and policy outcomes, which can lead to a self-fulfilling crisis. The framework of these models can be illustrated by three functions: government's preferences, economic variables, and the cost of devaluation (Rangvid, 2001). The government uses a function that features a trade-off between the preferred exchange rate regime and real variables, which could be

production, unemployment, taxes, or/and public debt, taking into account the cost of devaluation.

The Obstfeld (1994) model assumes perfect capital mobility and the domestic interest rate follows the uncovered interest parity condition. Therefore, assuming perfect foresight, domestic and foreign interest rates must be equal *ex post*. The private money demand (M) at time t is determined by the simple quantity equation:

$$M_t = ks_t y \qquad (7)$$

where y is real output and assumed to be constant, s_t is the exchange rate, k is a constant, and t = 1,2.

Consider the government aims to minimize the distortionary effects of inflation and the taxation imposed on the economy. Given the depreciation rate of the domestic currency against the foreign currency (represented as $\varepsilon=(s_2-s_1)/s_2$)) and the tax rate ($\tau$), the objective function of the government in period 2 ($\varepsilon = \tau = 0$ in period 1) can be written as follows:

$$min.L = \frac{1}{2}\tau^2 + \frac{\theta}{2}\varepsilon^2 \qquad (8)$$

where θ>0 and measures the weight placed on depreciation between period 2 and 1.

The budget constraint of the government can be represented as:

$$\varepsilon(d_{12} + d_{02} + ky) + \tau y = d_{12} + d_{02} + g_2 - f_{12} - f_{02} \qquad (9)$$

where

$$d_{12} = (1+i)\left(d_{01} + g_1 - f_{01} + \frac{f_{12}}{1+i^*}\right) \qquad (10)$$

where d_{ts} denotes the real value of depreciation in domestic currency at period t regarding the issuing date s, f_{ts} denotes payments in the foreign currency at period t regarding the

issuing date s, and g_t denotes public consumption at period t. This budget constraint underlines the fiscal role given to depreciation.

Minimizing (8) subject to (9) produces the following reaction function for the government:

$$\varepsilon = \frac{(d_{12} + d_{02} + ky)(d_{12} + d_{02} + g_2 - f_{12} - f_{02})}{(d_{12} + d_{02} + ky)^2 + \theta y^2} \qquad (11)$$

The market interest rate, i, enters the reaction function (equation 11) through d_{12}, which gives an expression for real domestic currency claims issues in periods 1 and 2. Therefore, the depreciation rate preferred by the government is affected by the market interest rate and determined according to the undertaken rate. This interest rate is to be determined by a market reaction function, which shows the expected depreciation rate compatible with the domestic interest rate established in period 1. The reaction function for the markets can be written as follows:

$$\varepsilon = \frac{i - i^*}{1 + i} \qquad (12)$$

where i is domestic interest rate, i^* is the foreign interest rate.

In equilibrium, Obstfeld (1994) shows a result where there are two equilibria points for the combination of depreciation and expected market interest rates. Therefore, the interaction between the government reaction function and the interest rate parity curve determines the possible equilibria points of currency depreciation and inflation rates.

Third generation models are common in emphasizing the role of banking and the financial sector weaknesses in the currency crises, along with the contagion issue.

Some studies, for example Kaminsky and Reinhart (1999), emphasize the balance sheet effects associated with devaluation. They notice that the banking sector in the emerging markets explicitly have mismatches on their balance sheets, when they borrow foreign currency and lend domestic currency. They will face high credit risk when there is a devaluation in the currency. Another explanation focuses on the importance of the contagion effect, or moral hazard process. If a country faces a crisis or devalues its currency, the other countries, such as partners in trade, will be forced to devaluate their currencies too (Jeanne, 2000). When a crisis occurs in an emerging country, this will affect the expectations of the foreign investors negatively in other emerging countries.

4.2.2 Empirical work[12]

There are various types of models used empirically to investigate, firstly, the significant indicators of currency crises and, secondly, the timing of the crisis for a specific country or for a group of countries. The main approaches are categorised by their research methodology: (1) A non-parametric criteria, signals approach, which monitors some key indicators which tend to perform at the beginning of the crisis. The performance of certain macroeconomic factors changes in the build-up to a currency crisis from that of tranquil periods, enabling observers to identify the main reasons behind the increase in risk potential of currency crisis; (2) Econometric modelling, Logit-probit and Markov switching models, in such approaches researchers estimate a

[12] A detailed summary of the literature on the empirical applications is given in Appendix I.

quantitative model, reflecting the probability of a currency crisis on a group of economic indicators.

Kaminsky *et al.* (1998) and Tambunan (2002) used the signals approach to analyse currency crises, using data for 20 countries and Indonesia, respectively. They defined a currency crisis as a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in foreign exchange reserves when they exceed the mean by more than 1.1 or 3 standard deviations. They found that the exchange rate changes were the main indicator in any early warning system. In Bruggemann and Linne (2002), a currency crisis is defined as a 20% depreciation against the US dollar within ten trading days, and they found that, in addition to the overvaluation of the exchange rate, weak exports, falling foreign exchange reserves, and banking sector indicators were useful in assessing crisis vulnerabilities.

Frankel and Rose (1996) used a probit model to analyze a currency crisis, employing data for 105 countries. They defined a currency crisis as a nominal depreciation of the currency by at least 25% or at least a 10% increase in the rate of depreciation. They found that currency crises will occur when output decreases, domestic credit growth increases, foreign interest rates rise and when the exchange rate is overvalued. Bussiere and Fratzscher (2002), Lestano and Kuper (2003), and Feridun (2008) developed a Logit model for 32 emerging countries, six Asian countries and Turkey, respectively. They found that many variables play a significant role in

predicting a currency crisis, such as the ratio of M2 to foreign reserves, the domestic real interest rate, and the use of contagion variables.

Abiad (2003) and Schweickert *et al.* (2005) used a Markov-switching model for five Asian countries and Russia and Brazil, respectively. They found that the majority of crises events can be explained by the negative evolution of macroeconomic fundamentals and financial sector variables. Boinet *et al.* (2005) and Cipollini *et al.* (2008) studied currency crises in Argentina and the European monetary system, respectively; using Markov switching models to investigate whether first or second generation can explain the crises in these countries. Furthermore, Ford *et al.* (2007) developed a GARCH and path independent Markov-switching GARCH model for four Asian countries. They employed five indicators in the analysis, including market pressure on the exchange rate; M2/international reserves; growth in domestic credit; real exchange rate; and risk premium. They found that macroeconomic variables can explain the crises and the probability of its occurrence at any time. Recently, Ford *et al.* (2010) used a three-regime Markov-switching model for Indonesia and Taiwan. They found that three regimes of market pressure can be distinguished in both countries. However, macroeconomic fundamentals, such as the growth of domestic credit, the reserves position, the real exchange rate, the current account and the government's fiscal balance, are important determinants of market pressure for Indonesia, and to some extent for Taiwan.

Other studies used different techniques, for example Sachs *et al.* (1996) used cross-sectional analysis, for 20 countries at 1995, depending on an equation for the index of the crisis. This index is a function of a number of indicators, including the real exchange rate, lending boom, and weak fundamentals. They found that some degree of previous misbehaviour was a necessary condition for a crisis. The misalignment takes the form of an overvalued real exchange rate and a recent lending boom, coupled with low reserves relative to the Central Bank's short-term commitments. Aziz *et al.* (2000) use a comparison approach of pre- and post-crisis behaviour of indicators, including measures of overheating, external imbalances, unemployment rate, short-term capital inflows, and the world interest rate. They found that overvaluation, terms of trade, inflation, domestic credit growth, M2-reserves ratio, world interest rate, and the current account are all useful indicators.

To summarise, these studies used various models and techniques first to find the significant indicators of currency crises and then the timing of the crisis for a specific country or for a group of countries. Nevertheless, a number of leading indicators were suggested by the empirical studies. These indicators were found to be important in determining currency crises, and included macroeconomic fundamentals, such as the real exchange rate, the money supply-reserves ratio, the growth rate of domestic credit, the current account balance and the debt-GDP ratio. Other indicators included a measuring of banking sector fragility and financial sector weaknesses, such as banks' reserve-assets ratio, banks' loans-deposits ratio and portfolio-capital flows ratio. Therefore, the survey provides a solid base as a starting point for this chapter.

4.3 Data and Methodology

4.3.1 Data

This section analyses the empirical effects of fundamentals on market pressure in Jordan, using monthly observations over the period January 1976 to December 2009. The objective is to estimate a model to capture the key determinants of a market pressure index for the Jordanian exchange market. It employs eight variables in the empirical model, namely market pressure on the exchange rate, MP_t; the real exchange rate, RER_t; the ratio of broad money supply (M2) to reserves, $M2R_t$; the growth rate of domestic credit; ΔDC_t; the ratio of Central Bank's foreign assets to foreign liabilities; AL_t; the growth rate of exports, ΔX_t; the growth rate of imports, ΔM_t; and the output growth rate approximated by industrial production (as output data are available annually or quarterly only), ΔIP_t. All data are assembled from the International Monetary Fund's International Financial Statistics (IFS)[13].

4.3.1.1 Market pressure on the exchange rate (*MP*):

Central Banks arbitrate in the foreign exchange market through either reducing its holding of foreign exchange reserves or increasing the interest rates aiming to avoid exchange rate fluctuations. Therefore, an ideal exchange rate market pressure index should include, in addition to exchange rate changes, changes in the reserves, and changes in the interest rates.

[13] Appendix II shows the data source.

An index of speculative pressure that incorporates the measures of speculative attack on the exchange rate is labelled as *MP* with a currency crisis defined as when this index exceeds a certain threshold. Following Eichengreen *et al.* (1995), the market pressure index can be calculated as:

$$MP_t = \alpha \Delta ex_t - \beta \Delta r_t + \gamma \Delta i_t \qquad (13)$$

where: Δ denotes monthly percentage change; ex_t is the nominal exchange rate (Jordanian dinar: US$); r_t is the Central Bank's foreign exchange reserves; i_t is the discount rate; the parameters α, β, and γ are weighted average calculated as: $1/\sigma_i$, where σ_i is the standard deviation[14] of the full sample for the exchange rate, reserves, and interest rate, respectively. A positive value of *MP* indicates increased pressure in the foreign exchange market that can be caused by any combination of a devaluation of the nominal exchange rate, a loss of the reserves, or an increase in the interest rate. While a negative value of *MP* can be caused by an appreciation, an increase of reserves, or a decrease in the interest rate. Figure 1 shows the plot of *MP*. Therefore, a currency crisis will occur if this value of *MP* exceeds a particular threshold. The threshold[15] is a certain value set as the average of *MP* ± standard deviation of *MP*. This generates two bounds for the market pressure index; the upper bound represents the depreciation case and the lower bound denotes appreciation. In order to make a comparison, three thresholds are calculated using 1, 1.5, and 2 standard deviations in each case.

[14] Eichengreen *et al.* (1995) suggest weighting the components of the index by the inverse of their standard deviation aiming to equalize the weights of the components, thus, avoiding the most volatile component dominating the index.

[15] The choice of the standard deviation to calculate a threshold value is arbitrary, according to the literature it lays between 1 and 3 standard deviations.

In this study, the market pressure index is measured as a weighted average of the Jordanian dinar depreciation (appreciation) against the US dollar, change in reserves, and change of discount rate. These weights are country specific, and calculated as inversely related standard deviation of each series over the period January 1976 to December 2009.

Figure (4.1): Market Pressure Index (1976-2009):

Table 4.1 shows crisis episodes captured by the estimated *MP* index. It is clear that the index successfully captures the late 1980s crisis. However, the fluctuations in the index prior to 1990 were due to changes in the exchange rate and the interest rate, while thereafter it is caused by changes in interest rate and changes in reserves, as the

exchange rate is pegged with US dollar (see appendix III for plots of changes in exchange rate, interest rate, and reserves).

Table (4.1): Crisis episodes captured by the estimated *MP* (1976-2009):

	Threshold 1		Threshold 2		Threshold 3	
	+1 SD	-1 SD	+ 1.5 SD	-1.5 SD	+2 SD	-2 SD
MP Date as: (M/Y)	12/76, 12/79, 09/81, 10/88, 11/88, 02/89, 06/89, 07/89, 02/90, 08/91, 08/98, 09/04, 11/04, 12/04, 02/05, 03/05, 05/05, 08/05, 09/05, 10/05, 11/05, 12/05, 02/06, 04/06, 05/06, 03/08	12/93, 07/97, 10/97, 12/97, 07/99, 10/99, 01/00, 09/00, 02/01, 06/01, 10/01, 11/02, 04/03, 05/03, 06/03, 08/06, 11/06, 09/07, 02/08, 04/08, 06/08, 07/08, 11/08, 03/09, 04/09, 07/09, 12/09	12/76, 12/79, 09/81, 11/88, 02/89, 07/89, 02/90, 08/91, 08/98, 05/05, 09/05, 10/05, 11/05, 03/08	12/93, 07/99, 10/99, 01/00, 09/00, 02/01, 10/01, 11/02, 04/03, 05/03, 06/03, 09/07, 02/08, 07/08, 11/08, 03/09, 04/09, 07/09, 12/09	12/76, 09/81, 07/89, 02/90, 08/91, 08/98, 09/05, 10/05, 03/08	12/93, 07/99, 10/99, 01/00, 09/00, 02/01, 11/02, 04/03, 06/03, 09/07, 02/08, 03/09, 04/09, 12/09
No. of crises	26	27	14	19	9	14

4.3.1.2 Explanatory variables:

The real exchange rate overvaluation, *RER*, is measured by the difference between *REX* and REX^e (see Feridun (2008)), where *REX* is the real exchange rate calculated by multiplying the official exchange rate, *e*, (JD: $US) by the US wholesale price index, *P**, and divided by the consumer price index of Jordan, *P*, as:

$$REX = e(\frac{P^*}{P})$$

and REX^e is the deterministic trend of the real exchange rate.

RER is a measure of international competitiveness and is a proxy for over (under) valuation. We expect the *RER* will affect *MP* negatively, where an overvalued real exchange rate leads to a high probability of a currency crisis.

The ratio of the money supply (M2) to total reserves minus gold in the Central Bank, *M2R*, measures the available foreign exchange reserves. This indicator captures the extent to which the liabilities of the banking system are backed by foreign currencies. In the event of a currency crisis individuals may rush to convert their domestic currency deposits into foreign currency and so this ratio captures the ability of the Central Bank to meet their demand. We expect to find a positive relation between *M2R* and *MP*.

Domestic credit growth rate, ΔDC, is calculated by taking the change in the natural logarithm of domestic credit. An increase in domestic credit growth may serve as an indicator of the fragility of the banking system. We expect that ΔDC will have a positive effect on *MP*.

The ratio of a Central Bank's foreign assets to foreign liabilities, *AL*, is an indicator of banking fragility. Therefore, any decrease in this ratio reflects a decrease in

a Central Bank's ability to manage its foreign commitments. We expect to find a negative relation between *AL* and *MP*.

The growth rate of exports and imports, ΔX and ΔM, are calculated by taking the change in the natural logarithm of exports and imports. Declining export growth implies that there is a loss in competitiveness in the international goods market. That decline may be caused by an overvalued domestic currency; also it indicates the country's ability to earn foreign currency to finance an existing current account deficit. On the other hand, excessive import growth may show that the exchange rate is overvalued, which could lead to a loss in competitiveness and a worsening in the current account. We expect to find a negative relationship between ΔX and *MP*, and a positive relationship between ΔM and *MP*.

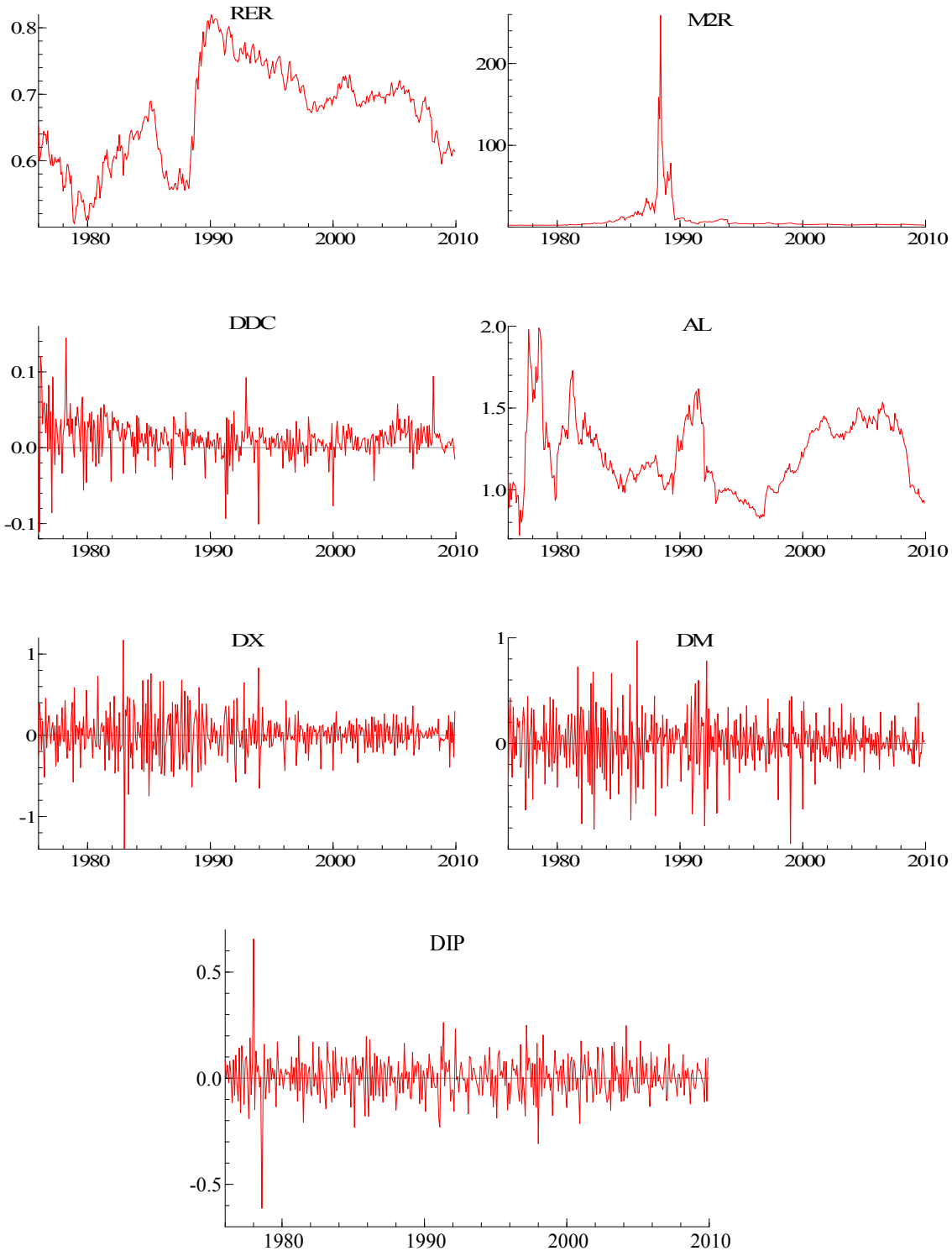
The growth rate of industrial production index, ΔIP, is used as a proxy of the output growth, where a recession often precedes financial crises. We expect to find a negative relationship between ΔIP and *MP*.

The discussion above considers the effect of each variable on *MP* in the case of depreciation; however, the expected signs are reversed in the case of appreciation. Figure 4.2 shows the plots of the explanatory variables. The patterns of these variables are discussed above in chapter 2. Table 4.2 summarizes the explanatory variables and their expected effect on the market pressure index (depreciation case) as mentioned in the literature.

Table (4.2): Explanatory variables and the expected effect on MP:

Indicator	Expected effect on MP	References
Real Exchange Rate (*RER*)	-	Frankel & Rose (1996), Kaminsky *et al.* (1998), Berg & Pattillo (1999), Edison (2003), Ford *et al*. (2007), Feridun (2008)
M2 over Reserves (*M2R*)	+	Frankel & Rose (1996), Berg & Pattillo (1999), Edison (2003), Ford *et al.* (2007)
Domestic Credit Growth (ΔDC)	+	Kaminsky *et al.* (1998), Berg & Pattillo (1999), Edison (2003), Feridun (2008)
Ratio of foreign assets to foreign liabilities (*AL*)	-	Frankel & Rose (1996), Kaminsky *et al.* (1998), Feridun (2008)
Export Growth (ΔX)	-	Kaminsky *et al.* (1998), Berg & Pattillo (1999), Edison (2003), Feridun (2007)
Import Growth (ΔM)	+	Kaminsky *et al*. (1998), Berg & Pattillo (1999), Edison (2003), Ford *et al*. (2007)
Industrial Production (ΔIP) Growth	-	Kaminsky *et al.* (1998), Berg & Pattillo (1999), Feridun (2008)

Figure (4.2): Plots of the explanatory variables (1976-2009):



4.3.2 Methodology

Previous studies are followed by using econometric models to analyse currency crises, particularly the Logit and Markov switching models. The aim is to capture the main indicators responsible for explaining a currency crisis. A group of economic indicators suggested by the literature will be used to model the probability of a currency crisis using the index of market pressure (*MP*). The suggested model can formed as follows:

$$MP_t = \beta_0 + \beta_1 RER_t + \beta_2 M2R_t + \beta_3 \Delta DC_t + \beta_4 AL_t + \beta_5 \Delta X_t + \beta_6 \Delta M_t + \beta_7 \Delta IP_t + \varepsilon_t \quad (14)$$

4.3.2.1 Multinomial Logit model:

Since the objective of this chapter is to analyse the determinants of a currency crisis in Jordan, following the literature, the multinomial Logit model used in this study, in view of the fact that the market pressure can be converted to three outcomes; -1, 0 and 1 according to the definition of the currency crisis followed in this study by taking appreciation in account.

In line with Feridun (2008) the dependent variable (*MP*) can be converted to a binary representation as:

$$Y = f(x) = \begin{cases} 1, & MP > AVG(MP) + 2SD(MP) \\ -1, & MP < AVG(MP) - 2SD(MP) \\ 0, & otherwise \end{cases} \quad (15)$$

i.e. *f(x)* has three outcomes. When market pressure exceeds its average plus two standard deviation, (Y=1), the crisis happened because of a depreciation. When market pressure is less than its average minus two standard deviation, (Y=-1), the crisis happened because of an appreciation. When the market pressure index lies between the two bounds, (Y=0), then the currency is not facing pressure to change. In such a situation, a linear regression model cannot be used because it would lead to an egregious regression. Instead, a non-linear probability model will be employed using a multinomial Logit model, giving a S-shaped logistic function to constrain the probabilities into an interval of (-1,1). The econometric regression is run on a number of variables to explain a dichotomous indicator equal to 1 or -1 if a crisis occurs within the specified time period, or equal to zero otherwise,

$$P(Y = 1) = \Omega(\alpha_1 + \beta_1 X) = \frac{e^{(\alpha_1+\beta_1 X)}}{1+e^{(\alpha_1+\beta_1 X)}} \qquad (16)$$

$$P(Y = -1) = \Omega(\alpha_2 + \beta_2 X) = \frac{e^{(\alpha_2+\beta_2 X)}}{1+e^{(\alpha_2+\beta_2 X)}} \qquad (17)$$

where Ω is the logistic cumulative distribution function, and β_i represents a vector of the coefficients of the explanatory variables. Positive values of these coefficients mean an increase in the probability of crises and negative ones imply the opposite.

In order to interpret the coefficients, the marginal effect for each coefficient is estimated, where the coefficients themselves represent probabilities. The marginal effect can be expressed as:

$$\frac{dy}{dx} = \beta_i \Omega'(\alpha_i + \beta_i X) \qquad (18)$$

Using this model resolves some disadvantages associated with other approaches. Here the results appear easier to interpret, because they are the probabilities of a crisis. Furthermore, statistical tests are immediately available, and the effect of all explanatory variables can be captured simultaneously. Finally, these models are flexible enough to deal with different functional forms for the relationship between the dependent and explanatory variables, including dummy variables (Schardax, 2002).

4.3.2.2 Three regimes Markov switching model

Unlike the Logit model, applying a Markov switching model does not require the conversion of the market pressure index to a binary form. Here we have to evaluate the reality of one, two and three regimes, by initially estimating the models with varying transition probabilities posited to be determined by the variables that are assumed to affect market pressure.

Following Ford *et al*. (2010), the transition probability matrix, for states (s) or regimes, 1, 2 and 3 is:

$$P = \begin{bmatrix} p_{11} & p_{21} & p_{31} \\ p_{12} & p_{22} & p_{32} \\ p_{13} & p_{23} & p_{33} \end{bmatrix}; p_{j1} + p_{j2} + p_{j3} = 1; j = 1,2,3 \qquad (19)$$

where:

$$p_{ij} = P(s_t = j | s_{t-1} = i) \qquad (20)$$

where, *p* denotes probability.

To estimate the probabilities, the log likelihood function is maximised over *T* observations. It is assumed that they are constant and errors from the *MP* equation are normally distributed in each regime,:

$$L(\theta) = \sum_{t=1}^{T} \log f_s(y_t|\Psi_{t-1}) \, ; s = 1,2,3 \qquad (21)$$

And $$f_s(y_t|\Psi_{t-1}) = \frac{\pi_s}{\sqrt{2\pi\sigma_s^2}} exp\left[\frac{-(y_t - x_t\beta_s)^2}{2\sigma_s^2}\right] \qquad (22)$$

Estimating these transition probabilities allows us to estimate several important characteristics of each regime including their "limit", unconditional, probabilities; forecasts of the probability that a given regime will follow a current regime in the next period; when the system is in a given regime, the average length of time before another specific regime is reached; and the variances of those mean values.

4.4 Empirical Results

4.4.1 Unit root test

According to figure 4.2, all variables have just an intercept and no trend. Therefore, a constant has been included in the unit root tests.

A visual inspections of the data confirmed that all variables were $I(0)$. Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowiski-Phillips-Schmidt-Shin (KPSS) unit root tests confirmed the stationary hypothesis for the level of each series. Table (4.3) summarizes unit root tests results.

Table (4.3): Unit root tests results (Intercept included):

Variables	ADF	PP	KPSS
MP	-7.956*	-18.608*	0.454
RER	-2.993***	-2.593***	0.451
M2R	-4.253*	-6.183*	0.688
ΔDC	-8.827**	-22.401**	0.659
AL	-2.907**	-3.219**	0.192
ΔX	-10.822*	-43.662*	0.020
ΔM	-6.913*	-51.832*	0.022
ΔIP	-6.534*	-28.198*	0.065

-ADF, Augmented Dickey-Fuller; PP, Phillips-Perron; KPSS, Kwiatkowiski-Phillips-Schmidt-Shin. For ADF Schwarz information criterion used to select the lag length and the maximum number of lags was set to be 17. For PP and KPSS Barlett-Kernel was used as the spectral estimation method and Newey-West used to select the bandwidth.

-ADF & PP critical values: 1% -3.447, 5% -2.869, KPSS critical values: 1% 0.739, 5% 0.463.

-*Significant at 1%, **significant at 5%, and ***significant at 10%.

For the level variables[16], under ADF and PP the null hypothesis of a unit root is rejected at the 5% significance level, except for *RER* which can be rejected at the 10% significance level. While according to KPSS test, the null hypothesis of stationarity cannot be rejected at level 1% significant, except for *M2R* and ΔDC which cannot be rejected at the 5% significance level.

4.4.2 Multinomial Logit model results

In order to estimate the probability of currency crises, *MP* values are converted to three values, -1, 0, and 1, to represent the dependent variable in the multinomial Logit model. The conversion procedure depends on table 4.1. Therefore, three market pressure indices are constructed following the number of the standard deviations used in calculating the threshold. MP1 used 1 standard deviation, MP2 used 1.5 standard deviation, and MP3 used 2 standard deviation.

Tables 4.4, 4.5, and 4.6 show the results of the multinomial Logit models which investigate the probability of the currency crises employing the explanatory variables mentioned above. The second column represents results of the appreciation of *MP*; i.e. when *MP* less than its average minus the standard deviations. The fourth column, on the other hand, shows the results of the depreciation of *MP*; i.e. when *MP* exceeds its average plus the standard deviation. The third and the fifth columns report the marginal effect for each output.

[16] Keep in mind that most variables included are growth rate, so we expect variables to be *I*(0).

Table (4.4): Coefficient estimates of the multinomial Logit model (MP1):

Variables	(Y=-1)	ME (Y=-1)	(Y=1)	ME (Y=1)
RER	2.567 (2.829)	0.154 (0.158)	-3.765*** (2.096)	-0.223*** (0.123)
M2R	-0.421*** (0.232)	-0.024*** (0.013)	0.007 (0.008)	0.002*** (0.001)
Δ*DC*	-23.842* (7.633)	-1.356* (0.433)	7.564 (8.005)	0.501 (0.456)
AL	-0.519 (0.933)	-0.034 (0.052)	1.773*** (0.927)	0.103*** (0.055)
Δ*X*	-0.926 (1.008)	-0.058 (0.056)	2.025** (0.875)	0.119** (0.052)
Δ*M*	-0.782 (0.981)	-0.044 (0.055)	0.142 (0.967)	0.010 (0.055)
Δ*IP*	1.262 (2.019)	0.072 (0.113)	-0.648 (2.080)	-0.041 (0.119)
Constant	-0.213 (1.535)	-	-5.186* (1.239)	-
LR statistic (df=14) Probability	42.37 0.000		Log likelihood	-173.114

-Standard error in brackets,
-* 1%, ** 5% and *** 10% Significant levels.

Results, in table 4.4, show that there is strong evidence that the money supply to reserves ratio (*M2R*) and domestic credit growth (Δ*DC*) play a significant role in the appreciation case (Y=-1). However, the real exchange rate (*RER*), foreign assets to liabilities ratio (*AL*) and growth rate of exports (Δ*X*) play a significant role in depreciation case (Y=1). The marginal effect is varying. The impact of Δ*DC* has the greatest marginal effect, in both cases being -136 percent for an appreciation; nonetheless it is not significant in the depreciation case.

All signs appear to be consistent with the theory, except for Δ*X* where the probability of a crisis is increased by an increase of exports growth. Although it is a

significant probability, it has a small marginal effect, 12 percent. This finding may reflect the fact that most of the Jordanian exports are not a significant source of foreign currency.

Table 4.5 shows the results of the estimated model using MP2, which is calculated using 1.5 standard deviations as the threshold value. It shows that there is no difference in signs or magnitudes of the probabilities of the explanatory variables when including the new market pressure index.

Table (4.5): Coefficient estimates of the multinomial Logit model (MP2):

Variables	(Y=-1)	ME (Y=-1)	(Y=1)	ME (Y=1)
RER	2.407 (3.416)	0.101 (0.138)	-3.536 (2.766)	-0.117 (0.093)
M2R	-0.561*** (0.336)	-0.023 (0.014)	0.005 (0.010)	0.001 (0.001)
Δ*DC*	-24.582* (8.480)	-0.992* (0.355)	2.867 (10.804)	0.119 (0.346)
AL	-0.841 (1.104)	-0.034 (0.045)	0.415 (1.260)	0.014 (0.041)
Δ*X*	-1.044 (1.209)	-0.044 (0.049)	2.250** (1.102)	0.074*** (0.039)
Δ*M*	-0.851 (1.152)	-0.034 (0.046)	-0.022 (1.292)	0.0002 (0.042)
Δ*IP*	1.691 (2.274)	0.071 (0.092)	-2.945 (2.801)	-0.097 (0.093)
Constant	0.192 (1.927)	-	-4.098** (1.605)	-
LR statistic (df=18) Probability	31.93 0.004		Log likelihood	-121.144

-Standard error in brackets,
-* 1%, ** 5% and *** 10% Significant levels.

Table (4.6): Coefficient estimates of the multinomial Logit model (MP3):

Variables	(Y=-1)	ME (Y=-1)	(Y=1)	ME (Y=1)
RER	-1.884 (4.208)	-0.052 (0.120)	-3.142 (3.794)	-0.059 (0.075)
M2R	-0.762*** (0.424)	-0.022*** (0.013)	-0.015 (0.042)	0.0001 (0.001)
Δ*DC*	-22.927** (9.237)	-0.658** (0.283)	12.662 (12.345)	0.252 (0.246)
AL	-0.874 (1.264)	-0.025 (0.036)	-0.187 (1.585)	-0.003 (0.030)
Δ*X*	-0.962 (1.488)	-0.028 (0.043)	0.652 (1.578)	0.013 (0.030)
Δ*M*	-0.808 (1.395)	-0.024 (0.040)	1.186 (1.645)	0.023 (0.032)
Δ*IP*	0.599 (2.888)	0.018 (0.082)	-2.070 (3.693)	-0.040 (0.072)
Constant	0.556 (2.238)	-	-3.843*** (2.029)	-
LR statistic (df=14) Probability	20.43 0.117		Log likelihood	-86.492

-Standard error in brackets,
-* 1%, ** 5% and *** 10% Significant levels.

Table 4.6 shows the results of the estimated model including MP3, which is calculated dependent on 2 standard deviation. It shows that as the bounds of the threshold get wider (the number of estimated crises decreased), the estimated coefficients become insignificant and wrong in sign. However, in the appreciation case, *M2R* and Δ*DC* are the only significant estimated coefficients in the model with correct signs of the influence of the explanatory variables. The marginal effect of these probabilities is -2 percent and -66 percent, respectively.

For each model, the Likelihood Ratio (LR) statistic, which is testing whether the coefficients are simultaneously significantly different from zero, confirms the general

statistical significance of the first and second models at the 1% level of significance. However, the third model appears to be not significant.

4.4.3 Markov switching model results

Following Hansen (1992, 1996), the number of states in the Markov switching model has been tested. The null hypothesis under this test is linearity against of nonlinearity; a linear against 2 regime Markov switching, and 2 regime against 3 regime. A linear model and 2, 3 regime Markov switching models are estimated. Table 4.8 reports the results of the linear and 2 regime Markov switching.

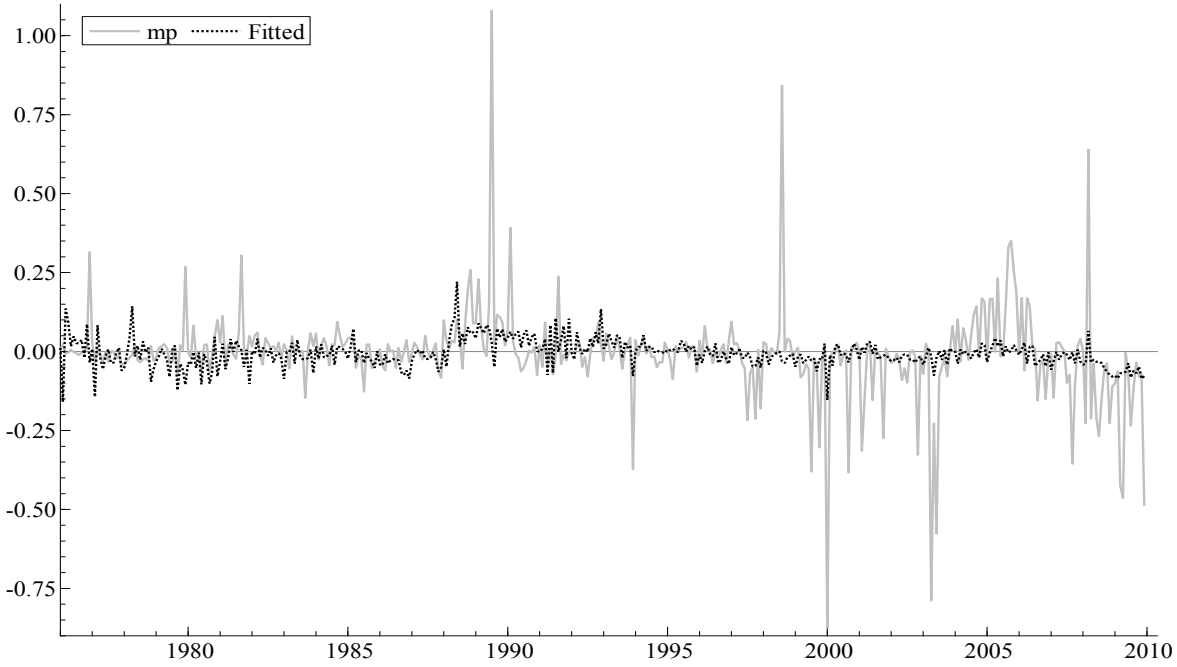
The results are varies in terms of the signs and magnitudes. All estimated coefficients of the linear model are significant at the 5% level, except for ΔDC at the 10% level. However, in the 2 regime model, we allow for switching in the mean and the variance. The constant coefficients appear to be not significant; nonetheless, the coefficients of the variance are significant at the 1% level. This result gives some evidence that the market pressure index may be affected by its changes. In other words, the crisis may categorise as a 'self fulfilling' crisis, following the second generation models.

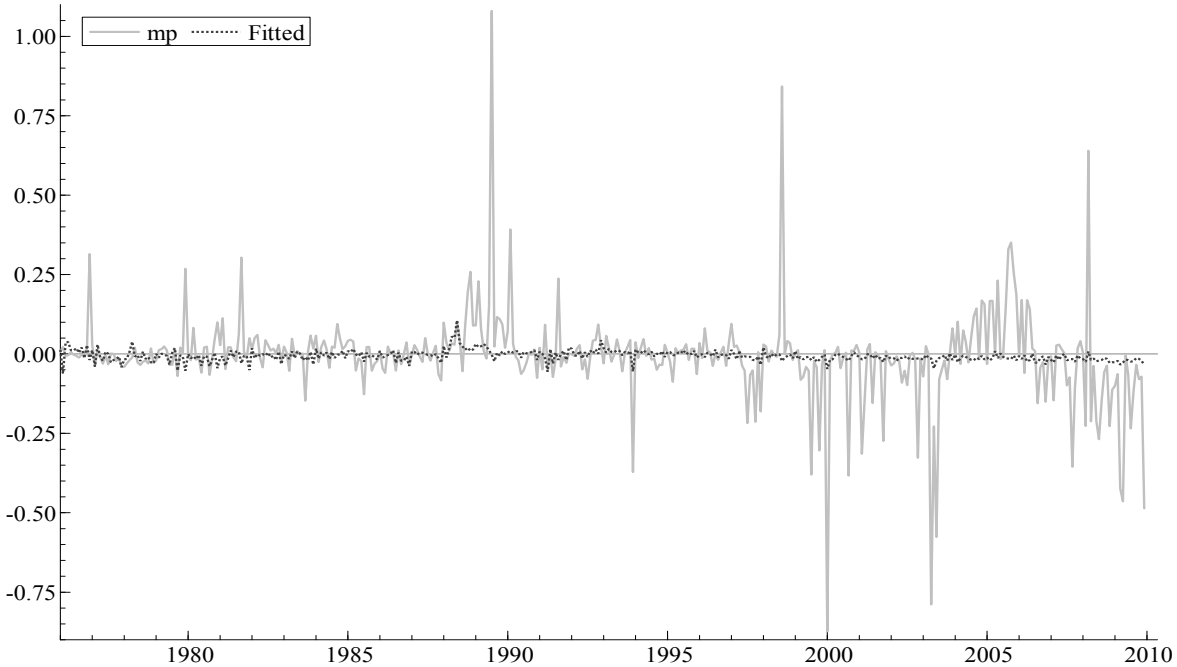
Table (4.8): Estimation results of the linear and 2 regime Markov switching:

	Linear	2 regime Markov
RER	0.401 (0.036)	0.096 (0.009)
M2R	0.001 (0.017)	0.0004 (0.000)
ΔDC	1.292 (0.054)	0.457 (0.000)
AL	0.013 (0.000)	-0.013 (0.162)
ΔX	0.053 (0.009)	0.010 (0.200)
ΔM	0.012 (0.000)	-0.018 (0.033)
Δ*IP*	-0.016 (0.000)	-0.016 (0.441)
Constant(0)	-0.046 (0.004)	0.003 (0.782)
Constant(1)		-0.007 (0.825)
sigma(0)	0.135	0.033 (0.000)
sigma(1)		0.284 (0.000)
p_{0|0}		0.834 (0.000)
p_{0|1}		0.572 (0.000)

Figure 4.3 represents the plots of the actual and the fitted lines of the estimated models the linear and 2 regime Markov switching, respectively. It is clearly showing that the two models failed to give good estimation of the actual line.

Figure (4.3): Actual and fitted of the linear and 2 regime models:





The Hansen test depends on a standardised likelihood ratio test. Suppose α is the regime switching parameter, where is:

$$\alpha = (\mu_1 - \mu_2, \sigma_1^2 - \sigma_2^2, p_{11}, p_{22})$$

Under the null of no regime switching, α tend to be zero, and will not have effect on the likelihood function.

Table (4.9) represents the results of Hansen test. Results give evidence that 3 regime Markov switching exists thus the null hypotheses are rejected (linearity and 2 regime).

Table (4.9): Hansen test (number of the Markov switching states):

H0	Linearity VS 2-regime	2-regime VS 3-regime
LR	4.621	3.542
M=0	(0.0001)	(0.0019)
M=1	(0.0001)	(0.0023)
M=2	(0.0001)	(0.0027)
M=3	(0.0001)	(0.0031)
M=4	(0.0001)	(0.0039)

-Standard error in brackets.

Table 4.10 shows the Markov switching results for the three regimes, the first regime represents the appreciation case, R(0), the second regime represents the stable case, R(1), and the third regime represents the depreciation case, R(2).

Table (4.10): Coefficient estimates of the Markov switching model:

Variables	R(0)	R(1)	R(2)
RER_{t-1}	-0.136 (0.719)	0.126* (0.046)	3.194* (0.467)
$M2R_{t-1}$	0.003* (0.001)	0.001* (0.0001)	-0.008* (0.001)
ΔDC_t	2.006** (0.972)	0.640* (0.140)	3.236* (0.802)
AL_{t-1}	0.501* (0.151)	0.013 (0.015)	-1.333* (0.131)
ΔX_t	0.297** (0.138)	0.028** (0.014)	-0.115 (0.175)
ΔM_t	0.034 (0.184)	-0.008 (0.015)	0.096 (0.113)
ΔIP_t	1.092* (0.392)	-0.014 (0.034)	1.973* (0.238)
Constant	-0.942** (0.418)	-0.115* (0.039)	-0.047 (0.296)
Sigma	0.063* (0.002)		

-Standard error in brackets,
-* 1% and ** 5% level of significance.

According to the result in table 4.8, every variable, except ΔM, has a statistically significant effect on *MP* in one regime or another. For regime (0), all variables, except for *RER* and ΔM, appear to have a significant effect on market pressure. Where in

regime (1), AL, ΔM and ΔIP do not have a significant effect, and for regime (2) ΔX and ΔM are not significant.

However, the signs of their impact are mixed and the actual signs do not always match them. In some instances, the change in sign returns to the nature of the regime; and offers some evidence as to which condition each regime might represent.

The estimation of the variance of the residuals (sigma in table 4.9) appears to be statistically significant, and the estimation of the transition probabilities is reported in table 4.11, with unconditional probabilities on the diagonal. The results give some evidence to that about 71 percent of the appreciation states tend to return to the stable state in the next period, and about 81 percent of the depreciation states tend to return to the stable state in the next period. However, the unconditional probabilities vary across the regime states. While it is about 93 percent for regime (1), it is 23 percent and 19 percent for regimes (0) and (2), respectively.

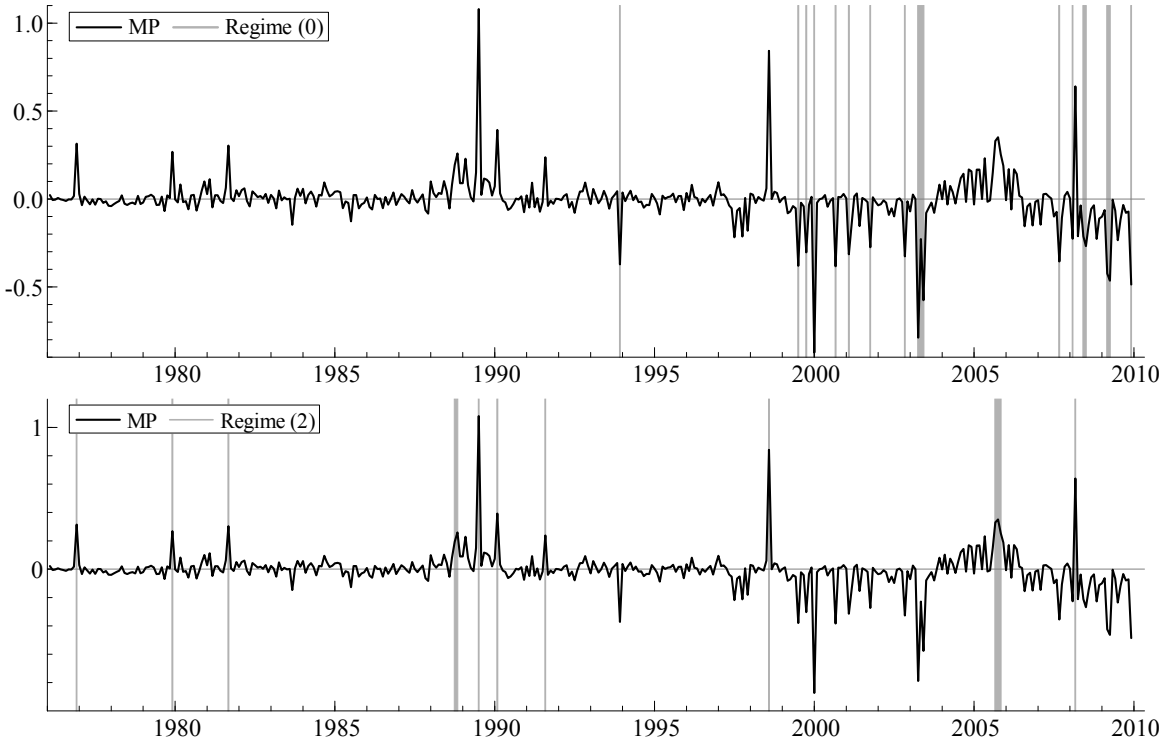
Table (4.11): The transition probabilities:

	R0,t	R1,t	R2,t
R0,t+1	0.228*	0.041*	0.000
R1,t+1	0.707*	0.929*	0.809*
R2,t+1	0.065	0.030	0.191

*significant at 1%.

Figure 4.4 shows the graphical analysis. It indicates that the model does match all large movements in the market pressure index (*MP*); i.e. for appreciation (Regime (0)) and depreciation (Regime (2)).

Figure (4.4): Graphical analysis:



4.5 Conclusion

This chapter attempts to develop an early warning system to explain any potential currency crisis in Jordan and identify a number of leading indicators that can help our understanding of the crisis. To achieve these objectives, a market pressure index (*MP*) was constructed and employed in a multinomial Logit model and three-regime Markov switching model, using monthly data for Jordan covering the time period from January 1976 to December 2009.

In the former model, three indices were used in transforming the *MP* to a binary variable, using different thresholds. It was found that regardless of the index included in the model, real exchange rate (*RER*), money supply-reserves ratio (*M2R*), growth rate of domestic credit (ΔDC) and Central Bank foreign assets to liabilities ratio (*AL*), play a significant role in explain the currency crises. While their marginal effect varies, they are consistent with theory in terms of sign.

A three-regime Markov switching model was then employed. The results of this model emphasise the significant role of variables such as *RER*, *M2R* and *AL* in explaining the currency crisis. The main findings centred on the impact of the macroeconomic fundamentals on the market pressure index. Nevertheless, the model captures all large movements in the *MP* successfully.

The estimated coefficients of the two models, the multinomial Logit model using MP1 and three regime Markov switching model, seem to be in the same direction, except for growth rate of domestic credit in the depreciation case.

Appendix I: Survey of the empirical work review:

Study	Data / Model	Indicators	Findings
Frankel & Rose (1996)	Panel data for 105 countries, 1971-1992 (annual). Probit model. Currency crisis defined as: a nominal depreciation of the currency at least 25% that is also at least a 10% increase in the rate of depreciation.	Commercial bank debt; concessional debt; variable-rate debt; short-term debt; FDI; public sector debt; multilateral debt; each expressed as a percentage of total debt. And the ratio of international reserves to monthly imports; the current account as a percentage of GDP, the external debt as a percentage of GNP; real exchange rate divergence (over-valuation); the government budget as a percentage of GDP; the percentage growth rate of domestic credit; the percentage growth rate of real output per capita; the foreign interest rate; the northern growth rate.	Currency crashes tend to occur when FDI inflows dry up, when reserves are low, when domestic credit growth is high, when northern interest rates rise, and when the real exchange rate shows overvaluation. They also tend to be associated with sharp recessions, though the causal linkages are very unclear. Curiously, neither current account nor government budget deficits appear to play an important role in a typical crash.
Sachs *et al*. (1996)	Cross sectional data for 20 countries, at 1995. Constructed an equation for crisis index	RER: real exchange rate; LB: lending boom; WF: weak fundamentals.	Some degree of previous misbehaviour is necessary condition for crisis, this misbehaviour take the form of overvalued RER and recent LB coupled with low reserves relative to the Central Bank's short term commitments.

Berg & Pattillo (1999a)	East Asian countries, Reestimate Frankel Rose, Kaminsky *et al.*, and Sachs *et al*. models	All variables used in the three models.	Two out of three models (FR & STV) provide forecasts out of sample better than guesswork.
Kaminsky & Reinhart (1999)	Panel data for 20 countries (15 developing, 5 industrial), 1970-1995 (monthly). Signals approach. Currency crisis defined as: a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in reserves exceeds its mean by more than three standard deviations.	M2 multiplier; domestic credit/ GDP; real interest rate; lending deposit rate ratio; excess M1 balances; M2/ reserves; bank deposits; exports; real exchange rate; terms of trade; imports; reserves; real interest rate differential; output; stock prices.	Banking and currency crises are closely linked in the aftermath of financial liberalization. Banking crises, in general, beginning before the currency collapse.
Bussiere *et al*. (2002)	Panel data for 32 open emerging markets, 1993:12-2001:09. Multinomial Logit model.	Effective RER overvaluation; current account/GDP; trade balance/GDP; terms of trade; export & import growth; short term debt/reserves; total debt/reserves; debt composition; FDI, portfolio investment; total net capital inflows; reserves (level, growth rate); real GDP growth rate; fiscal stance; public debt/GDP; inflation; domestic investment ratio;	Applying a multinomial Logit model, which allows distinguishing between more than two states, is a valid way of solving this problem and constitutes a substantial improvement in the ability to forecast financial crises. The use of contagion variables helps to improve the predictive power of EWS models.

		real estate sector; domestic credit to private & gov. sector (level, growth rate); deposit/lending i.r spreads; M1,M2 /GDP & reserves; bank deposits.	
Tambunan (2002)	Data for Indonesia, 1990-2001 (monthly). Signals approach. Currency crisis defined by the behaviour of an index of exchange market pressure (IEP), which is a weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in reserves exceeds its mean by more than 1.1 standard deviations.	M2/net international reserves; domestic interest and inflation rates; value of imports; terms of trade; total bank loans.	Some non-economic factors and economic factors (such as inflation, increasing interest rates, and exchange rate volatility) have been among the key contributors to business pessimism in Indonesia.
Abiad (2003)	Data for five Asian crisis countries, 1972-1999 (monthly). Markov Switching Model.	Deviation of real interest rate from trend; current account/GDP; export growth rate; M2/reserves (level, growth rate); reserves growth rate; growth rate of real domestic credit; industrial production growth rate; real GDP growth rate; stock market performance growth rate; real interest rate; LIBOR; bank assets/GDP (growth rate); short term debt/reserves; non-FDI flows/GDP;	Real exchange rate is the common across countries indicator in their predictive ability. Accounting for dynamics is important, and different sets of variables are relevant for different countries.

		portfolio flows/total capital flows; bank reserves/total bank assets; CB credit to banks/total bank liabilities; bank deposits/M2 (level, growth rate); loans/ deposits (level, growth rate).	
Lestano & Kuper (2003)	Panel data for six Asian countries, 1970-2001 (monthly). Multivariate Logit model. Financial crisis categories to three types: currency crisis, banking crisis and debt crisis.	Real exchange rate; export growth; import growth; terms of trade; current account/GDP; M2/foreign reserves; foreign reserves growth; M1 & M2 growth; M2 multiplier; domestic credit/GDP; excess real M1 balances; domestic real interest rate; lending and deposit rate spread; bank deposits; bank reserves/bank assets; fiscal balance/GDP; growth of industrial production; stock prices; inflation rate; GDP per capita; national saving; growth of world oil prices; US interest rate; OECD GDP growth.	The rates of growth of money (M1 and M2), bank deposits, GDP per capita and national savings correlate with all three types of financial crises, whereas the ratio of M2 to foreign reserves, and the growth of foreign reserves, the domestic real interest rate and inflation play an additional role in banking crises and some varieties of currency crises.
Choo (2005)	Data for five Asian countries (South Korea, Thailand, Indonesia, Malaysia), 1970Q1-2001Q4	Domestic credit growth, fiscal balance to GDP ratio, RER, current account balance to GDP ratio, reserves to M2 ratio.	Third generation of currency crises models can explain market pressure in these countries except for Malaysia which follows the first generation models.

Schweickerh *et al.* (2005)	Data for Russia & Brazil, 1993:12-2004:05. Markov switching model.	As Abiad (2003), in addition to Brent oil prices in Russia case.	The majority of crises events can be explained by the negative evolution of macroeconomic fundamentals and financial sector variables.
Davis & Karim (2006)	Panel data for 105 countries, 1979-2003 (annual). Using two models: multivariate Logit model and signals approach.	Real GDP growth; change in terms of trade; nominal depreciation; real interest rate; inflation; fiscal surplus/GDP; M2/foreign reserves; credit to private sector/GDP; bank liquid reserves/total bank assets; real domestic credit growth; real GDP per capita; deposit insurance (dummy).	The use of the multinomial Logit model may be better suited to a global EWS whereas the signal extraction approach may be better suited to country specific EWS. Furthermore, it is important to consider the policy maker's objectives when designing predictive models and setting related thresholds since there is a sharp trade-off between correctly calling crises and false alarms.
Feridun (2007)	Data for Turkey, 1998:01-2006:06. Multivariate Logit model. Crisis defined as: $EMP_t = \alpha\Delta e_t + \beta\Delta(i_t - i^*_t) - \gamma(\Delta\tau_{,t} - \Delta r^*_t)$	38 indicators used. New: Government consumption/GDP, US real T-Bill rate, US GDP, banking sector fragility index.	Current account balance/GDP, short-term debt/long-term debt, domestic credit/GDP, foreign liabilities/foreign assets of banks, and fiscal balance/GDP are significant with correct signs.

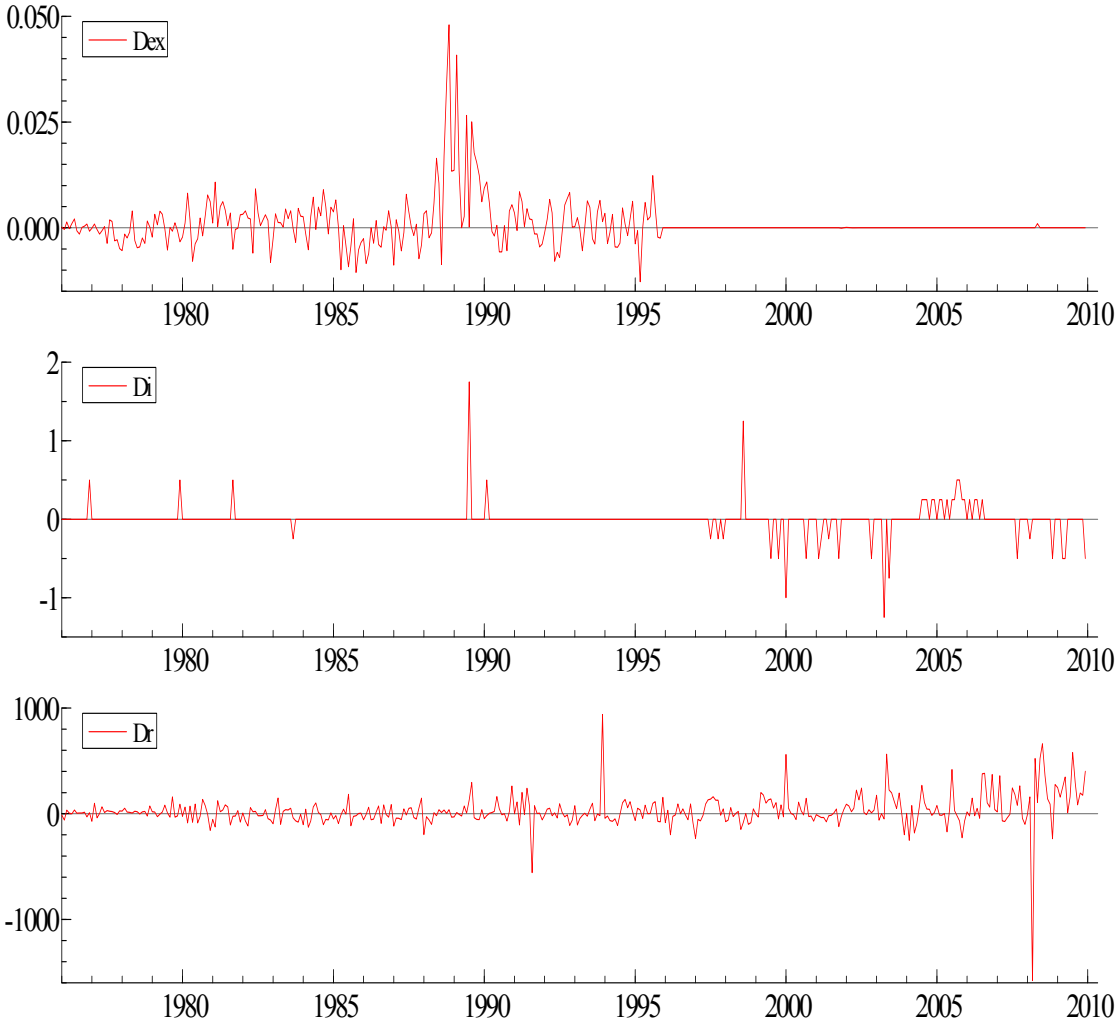
Ford *et al*. (2007)	Panel data for four Asian countries, 1973:02-1999:11. GARCH Markov switching model Currency crisis defined as: $Mp_t = w_1\Delta ex_t + w_2$ $(-\Delta r_t) + w_3\Delta i_t >$ Threshold	Market pressure on exchange rate; M2/international reserves; growth in domestic credit; real exchange rate; risk premium.	Macroeconomic variables can explain the crises and the probability of occurrence at any time.
Ford *et al*. (2010)	Data for Indonesia and Taiwan, 1980q1-2007q4. Three-regime Markov switching model Currency crisis defined as: $Mp_t = w_1\Delta ex_t + w_2$ $(-\Delta r_t) + w_3\Delta i_t >$ Threshold	Domestic real credit growth; the government's fiscal (surplus) balance to GDP; the real exchange rate; the ratio of foreign exchange reserves to broad money; the ratio of the current account to GDP; the risk premium; three indicators of the possible role of the bank lending channel include the ratios of foreign currency denominated assets (liabilities) to total assets (liabilities) in the banking system and the ratio of non-performing bank loans to total credit granted; variables to characterise the degree of deregulation and financial liberalisation, and to measure the extent of financial development.	All the macroeconomic fundamentals can explain the crises. The estimation of Markov switching models suggests that three regimes of market pressure can be determined in both countries.

Appendix II: Data sources:

All data are assembled from the International Monetary Fund's International Financial Statistics (IFS) as follows:

Variable	IFS Line
Official exchange rate (JD:$)	..AF.ZF
Consumer price index	64...ZF
Discount rate	60...ZF
Foreign exchange	.1D.DZF
Domestic credit	32...ZF
Total reserves minus gold	.1L.DZF
Foreign assets	21...ZF
Foreign liabilities	26C..ZF
Exports	70...ZF
Imports	71...ZF
Industrial production index	66...ZF

Appendix III: Plots of MP's components:



Chapter 5
Investment in Jordan

Investment in Jordan

5.1 Introduction:

Economic theory stresses the importance of investment for economic growth, development, and economic stability. As a result, a number of reasons can be proposed to justify a study of investment. Firstly, investment is highly volatile; thus investment movements have important effects on the short-run fluctuations of employment, income, and productivity. Secondly, it is important in determining how much an economy's output is invested to increase future capacity. In the long run, investment demand is considered to be one of the important determinants affecting the future of living standards of the population. Thirdly, investment establishes some important issues relating to the financial markets, and it has important feedback effects on these markets.

Jordan has a strategic location. It is located at the crossroads between Europe, Asia and Africa, and is attached to the Red Sea through the Gulf of Aqaba port and other ports via neighbouring countries. Furthermore, life in Jordan can be characterised as a stable political environment. These features make Jordan attractive for investors. However, since the mid 1990s, the Jordanian authorities passed suitable legislations in an attempt to build a proper investment environment that encourages investors to invest in Jordan, in addition to holding several bilateral and multi-trade agreements with neighbouring and other countries, and formatting appropriate infrastructure needed for investment.

Among these agreements is the Free Trade Agreement (FTA) between Jordan and the United States. It was the first convention of its kind to be signed with an Arab country. The agreement provides for an ending of all types of tariffs on industrial goods

and farm products. As the convention on the Euro-Jordanian partnership, which plays an important role in encouraging investment in Jordan, Jordan signed the Euro-Mediterranean Association Agreement, which has the status under which there is free trade with European countries, as well as the free trade agreement with Arab countries to facilitate and develop trade exchange between Arab countries.

Investment in Jordan, defined here as the change in the level of the fixed capital stock, has fluctuated over time. This chapter attempts to investigate whether there is a stable investment function for the Jordanian economy. Determining the key features of investment enables policy makers to identify one part of the monetary transmission mechanism to the real side of the economy.

The rest of this chapter is structured as follows: Section 5.2 discusses the investment theories and reviews the previous empirical work. Section 5.3 discusses the data and methodology used in the analysis. Section 5.4 reports the empirical results. Section 5.5 provides the conclusion.

5.2 Investment theories and review of the empirical work:

Net investment can be defined as the net change in the capital stock (K) since the previous time period (K_t - K_{t-1}) and equals total investment (I_t) minus replacement investment (δK_{t-1}),

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

where (δ) is the capital stock depreciation rate and is measured to be constant.

The next four sub-sections will discuss a number of different theories of investment behaviour, starting with the Keynesian theory and the accelerator models, followed by the neoclassical model of investment, and Tobin's q model. Finally, it will discuss the uncertainty and irreversible investment.

5.2.1 The Keynesian and the accelerator models:

Keynesians considered investment as one of the key determinants of macroeconomics activity. Keynes (1936) emphasised the essentially unstable nature of investment, because investment is based on expectations. However, he derived an investment demand function which was inversely linked to the interest rate, which then formed a key transmission mechanism between monetary policy and the real side of the economy.

The Keynesian theory assumed that firms would implement an investment project only if the discounted flow of expected future revenue from that project (ER) exceeded the total cost (C). Thus the firm invests if the net return (NR) is positive.

$$NR = \sum_{t=1}^{n} \frac{ER_t}{(1-r)^t} - C_t > 0 \qquad (2)$$

The rate of return, *r*, required to equate total revenue with total cost (or *NR*=0) was termed the marginal efficiency of capital by Keynes. When this rate exceeded the market interest rate, which represented the opportunity cost, the investment project would be undertaken. A decrease in the market interest rate resulted in the marginal investment of projects becoming more profitable, thus the total demand for capital in the economy would increase. However, Keynes argued that the supply of capital would be unable to meet these increases in demand caused by changes in the interest rate, and from this he constructed an investment marginal efficiency curve that was inversely connected with the market interest rate.

Changes in monetary policy, that caused the interest rate to change, would affect the investment volume in the economy, Keynes argued. Thus, he emphasised the interest rate was the main transmission mechanism between monetary policy and investment. However, his theory did not ignore the importance of other factors, such as prices and wages, in determining the demand of investment.

The naive accelerator model, elaborated by Clark (1917), is based on the assumption of a fixed capital-output ratio. This implies that prices, wages, interest rates, and taxes may have indirect impacts on the capital stock. The naive accelerator model defines the optimal capital stock (K^*_t) as a constant proportion of output (Y_t):

$$K_t^* = \mu Y_t \qquad (3)$$

where μ represents the capital-output ratio. Furthermore, while the capital stock is always optimally adjusted in each period (i.e. $K^*_t = K_t$) net investment (NI_t) will be equal to:

$$NI_t = K_t - K_{t-1} = \mu(Y_t - Y_{t-1}) \qquad (4)$$

The flexible accelerator model, derived by Chenery (1952) and Koyck (1954), which is a more general form of the naive accelerator models, is based on the gap between the existing capital stock level (K_{t-1}) and the desired capital stock (K^*_t). λ is a constant proportion and lies ($0< \lambda <1$), then net investment is:

$$NI_t = \lambda(K_t^* - K_{t-1}) \qquad (5)$$

Output, funds, costs and other variables may include in the model as determinants of the desired capital stock, proportional of output.

5.2.2 The neoclassical model:

The neoclassical approach has gained importance in the investment literature following the work of Jorgenson, who presented a 'neoclassical theory of optimal accumulation of capital'.

The main assumptions behind the neoclassical approach are that there is perfect certainty, in other words all agents in the market perform with the same certain expectations about the future, and there is a perfect capital market, though all agents in the capital market are price takers (Jorgenson, 1967).

The main feature of the neoclassical theory of investment is that it is based on a model of optimisation, in which the desired capital stock is determined by interest rates, output, capital prices and tax policies. Assuming a firm produces output, *Y*, by using two inputs, *K* and *L*. Jorgenson's approach modelled the firm's net worth maximisation

objective as its optimal objective, which equals the sum of the discounted value of the cash flow of profits from time zero, subject to a neoclassical production function: $Y_t = f(K_t, L_t)$. Then the optimisation problem is:

$$max_{K,L,I} V = \int_0^{\infty} \exp(-R_t)\,[p_t f(K_t, L_t) - w_t L_t - q_t I_t] dt \qquad (6)$$

where $R_t = \int_0^t i_s\, ds$, and i_s is the interest rate at time s, I_t is gross investment at time t, the output is sold at price p_t and the inputs are bought at the prices w_t and q_t respectively. Under a perfectly competitive market, the firm is a price taker, therefore the firm has to choose L_t, K_t and I_t to maximise the discounted value of cash flow of the firm.

The Lagrangian multiplier yields the conditions for solving the optimisation problem, for capital and labour:

$$p_t \frac{\partial Y_t}{\partial K_t} = r_t \equiv MP_{K,t} = \frac{r_t}{p_t} \qquad (7)$$

$$p_t \frac{\partial Y_t}{\partial L_t} = w_t \equiv MP_{L,t} = \frac{w_t}{p_t} \qquad (8)$$

where $MP_{K,t}$ and $MP_{L,t}$ represented the marginal products of K and L, respectively. Under the theoretical conditions for profit maximisation, firms will employ a set of inputs; for each input the marginal product of employing another unit of the input should equal the marginal cost of employing that additional input, thus the additional real user-cost of capital or real wage.

The user-cost of capital, r_t, represents the true cost to the firm of holding its assets in the form of the capital stock. It is composed of three elements. The first is the cost taking place from the interest rate foregone from not investing elsewhere, the opportunity cost. The second element is a cost caused by the depreciation of the capital stock. The

third is the possible capital gain (loss) occurred as a result of a change in the market value of the capital over the period.

5.2.3 Tobin's *q* investment theory:

Tobin (1969) generalised a cash-flow model and presented a framework for an investment model where net investment depends on the ratio of the market value of additional capital stock to its replacement costs. This ratio is known as *marginal q*. The naive form of the Tobin's *q* model is specified by:

$$q - 1 = C'(I) \qquad (9)$$

It implies that whenever *marginal q* deviates from unity, this indicates that there are incentives to investment or disinvestment the capital by the firm.

The marginal valuation approach is therefore basically a predictor of investment, the underlying principle of this theory is to provide a link between monetary policy and the real side of the economy. For this purpose, the market interest rate, which measures the opportunity cost of investment, is seen as a crucial determinant of investment, without, of course, ignoring the importance of other factors.

5.2.4 Uncertainty and irreversible investment:

Some recent literature on investment concerns uncertainty. Romer (2001) argues that uncertainty about profitability can have effects on the expected future value of the project, and can affect investment. 'Thus with asymmetry in adjustment costs, uncertainty about the position of the profit function reduces expectations of future profitability, and thus reduces investment' (Romer, 2001). Investment is considered to be irreversible with

this type of costs. However, since investment is irreversible, there is an option value to waiting rather than investing.

Pindyck (1991) underlines uncertainty due to irreversible investment. He argues that since capital goods are firm specific, disinvestment became more costly than investment.

5.2.5 Review of Empirical work[17]:

Many empirical studies have used a number of variables, suggested by the theory, in an attempt to describe the determinants of investment in both developed and developing countries. Shafik (1992) provided a comprehensive survey of the empirical work on estimating investment function before 1990s on developing countries. She used an error-correction model and co-integration to test Egyptian data for a private investment function that takes into account some features of developing countries. She found that a number of variables, including mark ups, internal financing, demand and the cost of investment, are the main determinants of the private investment in Egypt. Sun (1998), using data on China for the period 1953 to 1995, found that the long-run investment function can be characterised by co-movements of real fixed investment, grain output per capita, and energy supply per capita.

In their article, du Toit and Moolman (2004) found that, in South Africa, investment depends on the interest rate (the user cost of capital), international position, and domestic and foreign financial constraints. Ismihan *et al.* (2005) used data from Turkey covering the period 1963 to 1999. The main findings they made were that capital formation and growth are seriously affected by the macroeconomic instability of the Turkish economy. Anoruo *et al.* (2007) estimated a neoclassical model of investment for Bangladesh covering the time period 1973 to 2004. They found that there is an equilibrium relationship between the investment-output ratio, real output, and real interest rate.

[17] Appendix I details the literature survey.

Heim (2008) identified seven major variables that have a significant effect on the investment demand in the US economy for the period 1960 to 2000. These variables are the crowd out problem, depreciation, growth rate of GDP, interest rate, growth in stock values, exchange rate changes, and company profitability.

Moore (2010), using panel data for 107 developing countries over the period 1970 to 2006, tested McKinnon's hypothesis that the rate of return on money does matter for investment in developing countries. His findings appear to support this hypothesis under a number of conditions.

5.3 Data and methodology:

5.3.1 The data:

This section analyses the empirical effects of economic fundamentals on aggregate investment in Jordan, using annual observations over the period 1976-2009. The objective here is to investigate whether a stable investment function exists. The variables included are the natural logarithm of real investment, LRI_t; the natural logarithm of real gross domestic product (GDP), LRY_t; the natural logarithm of real credit, $LRCR_t$; the user cost of capital, UCC_t; the inflation rate, $Infl_t$; external debt-to-GDP ratio, ED_t; natural logarithm of capital formation depreciation, $LRDep_t$; and natural logarithm of trade-to-GDP ratio, $LOpen_t$.

Real investment is approximated by using gross fixed capital formation in constant prices. Table 5.1 represents the average distribution of the gross fixed capital formation for the period 1985-2006. It shows, on average, that the services sector has the greatest share with about 80 percent of the gross fixed capital formation followed by the industrial sector with about 20 percent.

Table (5.1): Distribution of Gross Fixed Capital Formation (1985 – 2006)

	Agriculture	Industry	Construction	Services	Public services
1985-1992	0.02	0.14	0.01	0.58	0.25
1993-1999	0.02	0.20	0.01	0.53	0.24
2000-2006	0.01	0.19	0.01	0.53	0.27

Real GDP is calculated as nominal GDP deflated by the GDP deflator. A positive growth rate represents an increase in aggregate demand, which in turn increases investment, and then we expect a positive sign with investment.

Real credit is measured by the domestic credit provided to the private sector deflated by the GDP deflator. An increase in credit increases investment, and then we expect a positive sign with investment.

The user cost of capital can be constructed as follows:

$$UCC_t = \frac{P_t^K(i_t + \delta_t)}{P_t} \qquad (10)$$

where P_t^K is the price of capital measured by the gross capital formation deflator, i_t is the average of interest rate on loans and advances, δ_t is the depreciation rate, and P_t is the GDP deflator. We assume a negative relation between user cost of capital and investment.

The inflation rate is approximated as the annual difference in CPI, and we expect a positive effect on investment.

A high external debt-to-GDP ratio, on one hand, makes less funds investable available in the economy which in turn decreases the total investment. On the other hand, investors may monitor this ratio to build their expectation about the economy in general. We expect a negative sign between external debt-to-GDP ratio and investment.

Trade liberalisation or the degree of economy openness, represented as trade-to-GDP ratio, is calculated as the sum of exports and imports divided by GDP. An increase in trade liberalisation expressed by decreasing barriers gives incentives for investment and may affect their expectations about the new markets available. We expect a positive sign with investment.

Most of the data are obtained directly from the World Development Indicators of the World Bank and International Financial Statistic of the IMF (Appendix II provides a detailed accord of the sources of the data).

Tables 5.2 and 5.3 report the data descriptive statistics and the correlation matrix. Figure 5.1 represents plots of the variables. Gross fixed capital formation in real term had a positive trend during 1976-1981, from JD 512.8 millions in 1976 to JD 1328.0 millions in 1981 or an annual average growth of 21.7 percent, which is the case for GDP and credit (a more detailed discussion of the other variables is available in chapter 2), these upward being the result of the expansion that occurred in the economy. The increasing demand for Jordanian products came from the neighbouring oil exporting countries, which were affected by the oil price shock in the late 1970s. Investment started to decrease sharply, about 14.6 percent, because of the recession in the economy until the mid-1980s, followed by an increase until 1989. Then it decreased again reflecting the increase in the price level in the late 1980s. During 1991-1994 investment started to follow a positive trend, from JD 755.8 millions in 1991 to JD 1391.6 millions in 1994 or on annual average growth of 23.8 percent, reflecting the improvements in the economy during the second reform programme, which started in 1992. These improvements did not last long because of the recession in the mid 1990s. During the 2000s, investment followed an upward trend reflecting the openness that occurred in the economy after Jordan became a member in the World Trade Organisation (WTO) in 2000. Investment increased from JD 1059.6 millions in 2001 to JD 2140.6 millions in 2008, an annual average of 11.2 percent.

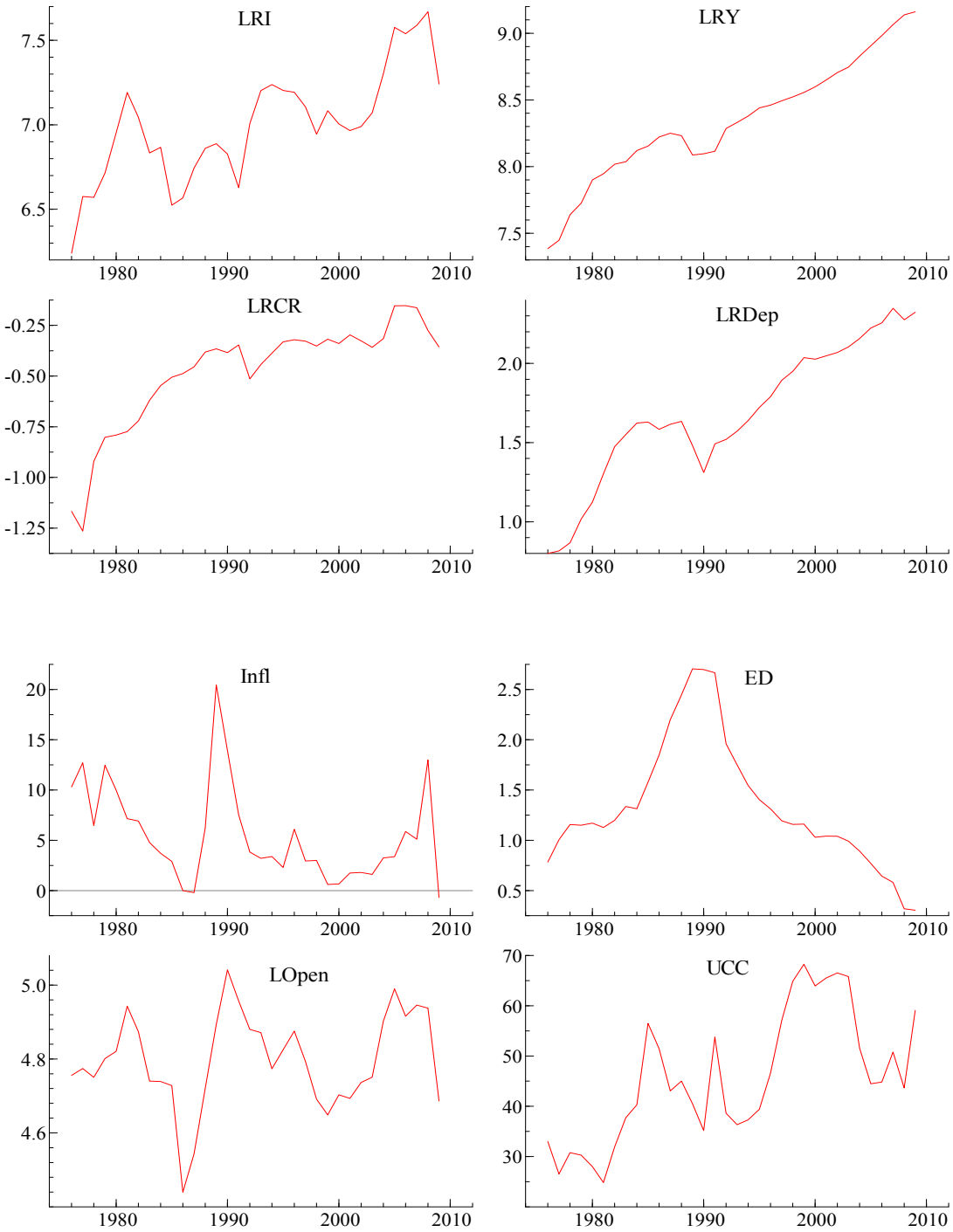
Table (5.2): Data descriptive statistics (1976 – 2009)

	LRI	*LRY*	*LRCR*	*CRY*	*Infl*
Mean	6.999	8.342	-0.478	68.769	5.485
Maximum	7.669	9.161	-0.153	93.116	20.454
Minimum	6.240	7.385	-1.264	34.484	-0.683
Std. Dev.	0.328	0.454	0.265	13.813	4.776
Observations	34	34	34	34	34
	LRDep	*ED*	*LOpen*	*UCC*	
Mean	1.685	1.338	4.798	45.694	1.685
Maximum	2.348	2.705	5.041	68.260	2.348
Minimum	0.800	0.306	4.440	24.848	0.800
Std. Dev.	0.437	0.630	0.127	12.846	0.437
Observations	34	34	34	34	34

Table (5.3): Correlation matrix

	LRY	*LRCR*	*CRY*	*Infl*
LRY	1.000			
LRCR	0.869	1.000		
CRY	0.899	0.975	1.000	
Infl	-0.448	-0.374	-0.321	1.000
LRDep	0.978	0.877	0.900	-0.507
ED	-0.395	0.039	-0.068	0.245
LOpen	0.114	0.149	0.173	0.531
UUC	0.643	0.640	0.610	-0.583
	LRDep	*ED*	*LOpen*	*UCC*
LRDep	1.000			
ED	-0.375	1.000		
LOpen	0.036	0.002	1.000	
UUC	0.728	-0.153	-0.359	1.000

Figure (5.1): Data plots (1976-2009)



5.3.2 Methodology:

Following the literature on investment, a general model is considered to formulate empirically the investment function in Jordan, which could be expressed as:

$$LRI_t = f(LRY_t, LRCR_t, UCC_t, \Delta ED_t, \Delta LOpen_t) \qquad (11)$$

Using the technique of 'General-to-Specific' it will estimate a number of models and then choose the most accurate one, which represented the investment function in Jordan.

These models are estimated depending on an Autoregressive Distributed Lag (ARDL) approach by Pesaran and Shin (1999), where this procedure allows us to apply the model regardless of the stationarity of the variables. The results of this approach are equivalent to the results of the Error-Correction Models (ECM) (Hassler and Wolters, 2006). ARDL is adopted for a mixture of stationary and non-stationary variables, the advantage of ARDL over the ECM is that it can be applied irrespective of whether the regressors are *I*(0) or *I*(1).

The autoregressive distributed lag (ARDL) approach, developed by Pesaran and Shin (1999) and Pesaran *et al.* (2001), is also known as the ARDL bounds test. The ARDL approach has numerous advantages which make it preferable over other methods in estimating the long-run co-integration relationships. The main advantage is that it is not necessary for testing the unit root of the variables, where the ARDL can be applied irrespective whether regressors are *I*(0) or *I*(1).

Following Pesaran and Shin (1997) and Pesaran *et al.* (2001), a general ARDL (*p,q*) model can be presented as follows:

$$y_t = \alpha_0 + \alpha_1 t + \sum_{i=1}^{p} \varphi_i y_{t-i} + \acute{\beta} x_t + \sum_{i=0}^{q-1} \acute{\beta}_i^* \Delta x_{t-i} + u_t \qquad (12)$$

$$\Delta x_t = P_1 \Delta x_{t-1} + P_2 \Delta x_{t-2} + \cdots + P_s \Delta x_{t-s} + \varepsilon_t \qquad (13)$$

where y_t represents the dependent variable, x_t is a vector of explanatory variables and u_t, ε_t are uncorrelated error terms with zero mean and constant variance. The model can be rewritten as:

$$\varphi(L) y_t = \alpha_0 + \alpha_1 t + \sum_{i=0}^{k} \acute{\beta}_i(L) x_t + u_t \qquad (14)$$

where $\varphi(L) = 1 - \varphi_1 L - \varphi_2 L^2 \ldots - \varphi_p L^p$, $\acute{\beta}(L) = \beta_0 - \beta_1 L - \beta_2 L^2 \ldots - \beta_q L^q$, and L is the lag operator. For simplicity define:

$$\delta = \frac{\alpha_1}{1-\varphi} \; and \; \theta = \frac{\beta}{1-\varphi} \qquad (15)$$

Then y_t can be expressed as:

$$y_t = \mu + \delta t + \sum_{i=0}^{k} \acute{\theta}_i(L) x_t + v_t \qquad (16)$$

where $\mu = \frac{\alpha_0}{1-\varphi} - (\frac{\varphi}{1-\varphi})\delta$, and $v_t$represents the error term.

The long-run co-integrating vector can be expressed as:

$$y_t - \hat{\theta}_0 - \hat{\theta}_1 x_{1t} - \hat{\theta}_2 x_{2t} - \cdots - \hat{\theta}_k x_{kt} = v_t \qquad (17)$$

Using the lag and first differences of *y* and *x*, we obtain:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{r} \beta_i y_{t-i} + \sum_{j=i}^{k} \sum_{i=1}^{r} \delta_{ji} x_{j,t-i} + \sum_{i=1}^{r} \pi_i \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{i=1}^{r} \gamma_{ji} \Delta x_{j,t-i} + u_t \quad (18)$$

where β_0 is a deterministic variable, j is the number of explanatory variables, r is the number of lags selected based on the information criteria, and u_t is a white noise disturbances. The implementation of this technique involves two stages. First one, test for the existence of co-integration relationship among y_t and x_{jt} variables by the bounds test, using a Wald-test (F-test). The test null hypothesis that there is no co-integration relationship among the variables, and can be conducted as a joint significance test on lagged level variable's coefficients as follows:

$$H_0: \beta_i = \delta_{ji} = 0 \qquad \forall\, i = 1,2,\dots r \; and \; j = 1,2,\dots k$$

The computed Wald test gives two sets of critical values, bounds, one set based on the assumption that all variables in the ARDL model are $I(1)$, and the other set assumes that all variables are $I(0)$. If the calculated F is higher than the upper critical bound, then the null hypothesis is rejected, therefore a co-integration relationship between the variables exists. If the test statistic is below the lower critical bound, then the null hypothesis cannot be rejected. And if the calculated F-test is between the bounds, then the test cannot give a conclusive inference.

In the second stage, if the long-run relationship exists, then the long-run and short-run coefficients of the equation (18) can be estimated.

The investment function can be presented as follows:

$$\Delta LRI_t = \alpha_0 + \alpha_1 LRI_{t-1} + \sum_{i=1}^{p} \beta_i \, \Delta LRI_{t-i} + \sum_{i=0}^{p} \sum_{j=1}^{k} \gamma_{ji} \, \Delta DEP_{j,t-i} + \sum_{j=1}^{k} \delta_j \, DEP_{j,t-1} + \varepsilon_t \quad (19)$$

where Δ denotes the first difference, and p=1,2 is the number of lags determined by information criteria, and k is the number of independent variables, and DEP_t represented a vector of the explanatory variables of the real investment.

5.4 Empirical results:

5.4.1 Unit root tests:

According to figure 5.1, most variables have a trend over the sample period. Therefore, a constant and trend have been included in the unit root test.

A visual inspections of the data confirmed that all variables were *I*(1), except for *LRCR*, *Infl* and *LOpen* which are *I*(0). The Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowiski-Phillips-Schmidt-Shin (KPSS) unit root tests confirmed the stationary hypothesis for the first difference. Table 5.4 summarizes unit root tests results.

For the level variables, under ADF and PP the null hypothesis of a unit root cannot be rejected at the 5% significance level, except for *LRCR*, *Infl* and *LOpen* which can be rejected at level 5% and 10%. However, the null that the first difference of the variables has unit root is rejected at the 5% level. While according to the KPSS test, the null hypothesis of stationarity can be rejected at level 5% significant, except for *LRCR, CRY* and *ED* which cannot be rejected at level 5%. However, the null that the first difference of the variables is stationary cannot be rejected at the 5% significance level.

Table (5.4): Unit root tests results:

	ADF		PP		KPSS	
	Level	1st Difference	Level	1st Difference	Level	1st Difference
LRI	-2.906	-4.525*	-2.906	-4.456*	0.061	
LRY	-3.097	-3.666**	-2.403	-4.089**	0.093	
LRCR	-4.289**		-1.962	-6.672*	0.242	0.075
CRY	-2.591	-4.837*	-2.084	-4.512*	0.156	0.053
Infl	-3.485***		-3.436***		0.064	
LRDep	-1.886	-4.186**	-2.149	-4.228**	0.076	
ED	-1.984	-3.313***	-1.563	-3.232***	0.171	0.068
LOpen	-3.309***		-2.667	-3.932**	0.050	
UCC	-2.486	-5.804*	-2.598	-5.805*	0.075	

-ADF, Augmented Dickey-Fuller; PP, Phillips-Perron; KPSS, Kwiatkowiski-Phillips-Schmidt-Shin. For ADF Schwarz information criterion used to select the lag length and the maximum number of lags was set to be 8. For PP and KPSS Barlett-Kernel was used as the spectral estimation method and Newey-West used to select the bandwidth.
-ADF & PP critical values: 1% -4.263, 5% -3.558, 10% -3.212, KPSS critical values: 1% 0.216, 5% 0.146, 10% 0.119.
-*Significant at 1%, **significant at 5%, and ***significant at 10%.

5.4.2 Co-integration tests

In order to check the existence of a co-integration relationship among the variables, the bounds test, Pesaran *et al.* (2001), is implemented, which is based on testing the null hypothesis of no co-integration relationship among the variables. The test uses the F-statistic depend on Wald test on equation (19):

$$\Delta LRI_t = \alpha_0 + \alpha_1 LRI_{t-1} + \beta_1 \Delta LRI_{t-1} + \beta_2 \Delta LRI_{t-2} + \gamma_{11} \Delta LRY_{t-1} + \gamma_{12} \Delta LRY_{t-2}$$
$$+ \gamma_{21} \Delta LRCR_{t-1} + \gamma_{22} \Delta LRCR_{t-2} + \gamma_{31} \Delta LRDep_{t-1} + \gamma_{32} \Delta LRDep_{t-2}$$
$$+ \gamma_{41} \Delta ED_{t-1} + \gamma_{42} \Delta ED_{t-2} + \gamma_{51} \Delta LOpen_{t-1} + \gamma_{52} \Delta LOpen_{t-2}$$
$$+ \gamma_{61} \Delta UCC_{t-1} + \gamma_{62} \Delta UCC_{t-2} + \delta_1 LRY_{t-1} + \delta_2 LRCR_{t-1}$$
$$+ \delta_3 LRDep_{t-1} + \delta_4 ED_{t-1} + \delta_5 LOpen_{t-1} + \delta_6 UCC_{t-1} + \varepsilon_t$$

Where the null and the alternative hypotheses are constructed as follows:

H_0: $\alpha_0 = \alpha_1 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$

H_1: At least one is not zero

Table (5.9): the bound test results:

F statistic	Critical values*		
	Sig level	Lower bound	Upper bound
3.87	5%	2.69	3.83
	10%	2.38	3.45

* The critical values are obtained from Pesaran *et al.* (2001), table CI(v).

From Table 5.9, the calculated F-statistics for all models are exceeding the upper critical bound at the 5% level of significance. Thus the null hypothesis of no co-integration can be rejected, so only one co-integration relationship exists in these models.

The long-run relationship can be estimated as:

$$LRI_t = 3.349 + 0.817LRY_t + 0.246LRCR_t - 0.806LUCC_t$$

R^2= 0.883, *RSS*= 0.322, *F*(Prob.)= 70.74 (0.00)

The above estimation represents the long-run relationship between investment and its determinants. Real investment depends positively on real income and real credit, and negatively on the user cost of capital. All signs and coefficients magnitude seem to be consistent with the economic theory.

5.4.3 Estimation results

Table (5.7): The short run results of investment equations:

	Dependent variable: ΔLRI			
	Model 1	Model 2	Model 3	Model 4
LRI_{t-1}	-0.365 (0.099)	-0.379 (0.092)	-0.361 (0.168)	
LI/Y_{t-1}				-0.547 (0.149)
$\Delta_3 LRY_t$	0.715 (0.176)	0.844 (0.171)	0.956 (0.158)	0.514 (0.138)
$\Delta LRCR_t$				0.621 (0.247)
$\Delta LRCR_{t-1}$	0.485 (0.314)			
$\Delta\Delta LRCR_t$	0.771 (0.281)	0.409 (0.167)	0.748 (0.194)	
LRC/Y_{t-1}				0.251 (0.073)
$\Delta LUCC_t$	-0.759 (0.106)	-0.598 (0.114)	-0.450 (0.115)	-0.507 (0.112)
$\Delta LOpen_t$		0.394 (0.151)	0.425 (0.134)	0.371 (0.147)
ΔED_t				-0.303 (0.084)
$\Delta\Delta ED_t$			-0.280 (0.104)	
$LRCR_{t-1}$	0.692 (0.215)	0.641 (0.190)	0.604 (0.170)	
$LUCC_{t-1}$	-0.260 (0.102)	-0.228 (0.095)	-0.198 (0.085)	-0.276 (0.130)
Constant	3.777 (1.040)	3.714 (0.958)	3.442 (0.856)	2.455 (0.648)
SE	0.155	0.132	0.099	0.107
R^2	0.840	0.864	0.897	0.889
$\bar{R}^2$	0.791	0.882	0.860	0.823
F-statistic	17.21	20.81	24.02	18.48
Prob(F-statistic)	0.000	0.000	0.000	0.000

Table 5.7 represented the results of the ARDL estimation of the short run for four suggested models (just significant variables included which driven from a general model). The results of these models appear to be similar. Nonetheless, each explanatory variable added, in the models 2 and 3, increases the explanatory power; as R^2 increased from 84 percent to 90 percent.

The coefficient of LRI_{t-1} in the first three models, that measures the speed of adjustment, appears to be negative and less than 1 in magnitude, about -37 percent, and they are statistically significant at 1% level. Thus, it seems that the model takes about three years to be adjusted. However, the speed of adjustment in the fourth model represented by LI/Y_{t-1} coefficient, about -55 percent, or about two years to be adjusted.

The real income and real credit have a positive effect on real investment. The real income varies among the models, but less than unity, however the real credit has a more stable effect among the models, 60-70 percent.

A more trade liberalisation, positively affect the real investment, about 40 percent. However, any 1 percent increase in the external debt-to-GDP ratio, decreases the real investment by about 30 percent.

The log of the user cost of capital lagged one period appears to be consistent with the theory in all models; it has a magnitude between -20 percent and -27 percent. Thus any increase in interest rate by 1 percent, may decrease investment by about 20 and 27 percent.

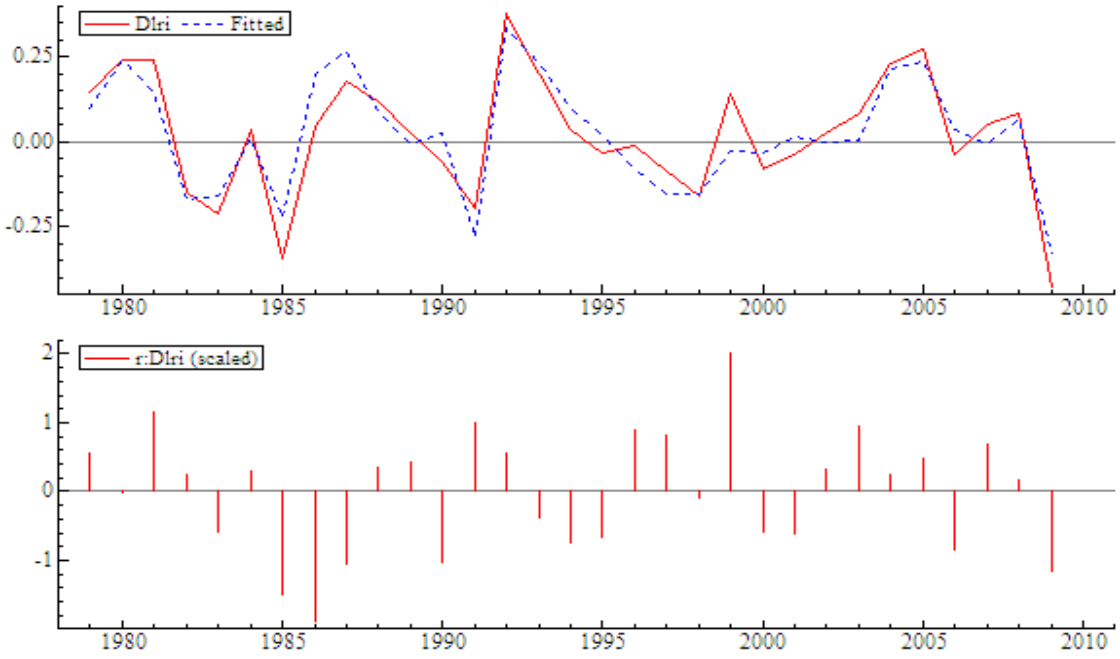
The goodness of fit of these models is relatively high. And the overall models are significant. The regression specifications fit well and pass all diagnostic tests against serial correlation, autoregressive conditional heterosedasticity, non-normal residual, heterosedasticity, and incorrect functional form. Table 5.8 reports the diagnostic tests. Figure 5.2 shows residuals, actual, and fitted lines.

Table (5.8): Diagnostic tests:

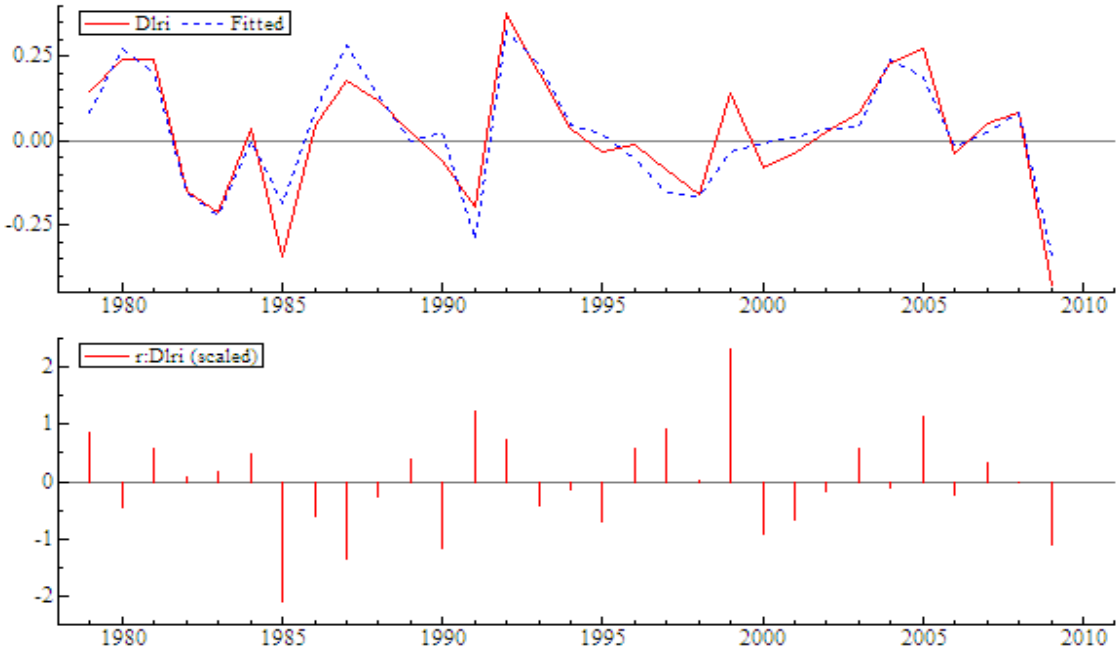
	Model (1)	Model (2)	Model (3)	Model (4)
ARCH 1-1 test	F(1,21)= 0.342 [0.714]	F(1,21)= 0.120 [0.668]	F(1,20)= 0.181 [0.675]	F(1,20)= 0.024 [0.880]
Normality test	χ^2 (2)= 0.167 [0.920]	χ^2 (2)= 3.283 [0.194]	χ^2 (2)= 3.172 [0.205]	χ^2 (2)= 4.355 [0.113]
Hetero. Test	F(14,8)= 0.275 [0.983]	F(14,8)= 0.356 [0.956]	F(16,5)= 0.165 [0.997]	F(16,5)= 0.170 [0.997]
RESET test	F(1,22)= 1.071 [0.311]	F(1,22)= 0.278 [0.604]	F(1,21)= 1.366 [0.256]	F(1,21)= 1.475 [0.238]

Figure (5.2): Actual, Fitted and Residuals lines

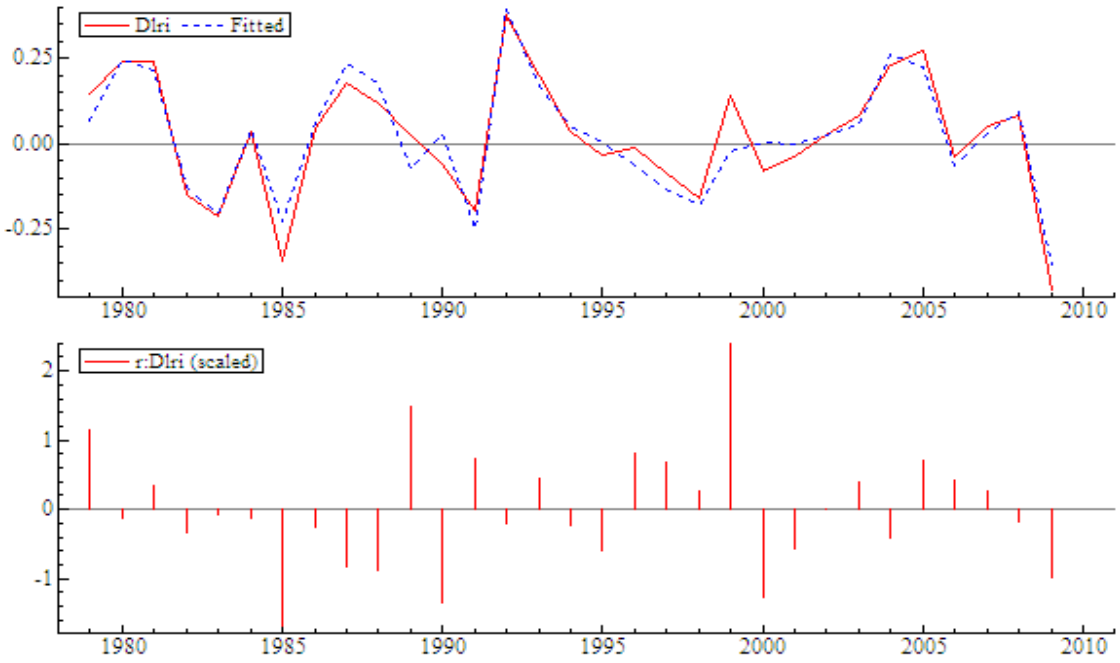
Model (1)



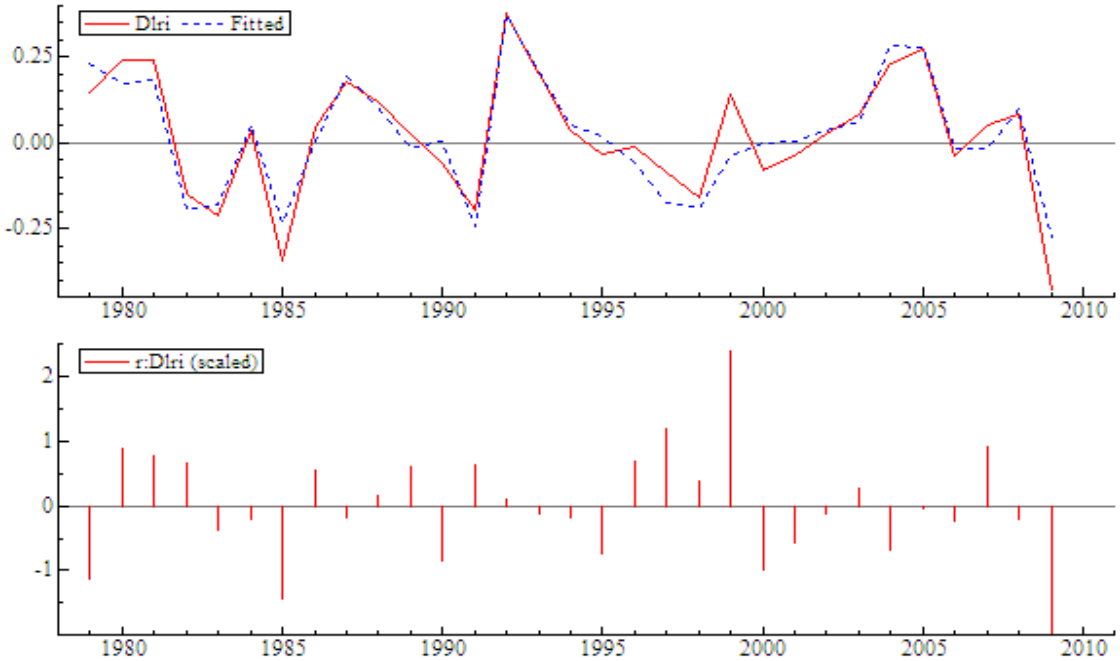
Model (2)



Model (3)



Model (4)



5.5 Conclusion

As investment theories emphasise the importance of investment for economic growth, development, and economic stability, this chapter looks at the potential determinants of investment for Jordan, trying to formulate an investment function and attempting to capture the role played by monetary policy in the real economy. It employs a number of variables depending on the theory in an attempt to capture their effect on investment in Jordan covering the time period 1976 to 2009, using the Autoregressive Distributed Lag (ARDL) model, by Pesaran and Shin (1999), which is the procedure used when some of the variables, being used in the analysis, are *I(1)* and others are *I(0)*. In order to check the existence of a long run relationship among the variables exists in the model, the bounds test was implemented, and it found that there is strong evidence that at least one co-integration relationship exists.

The OLS estimation was used to estimate the long-run relationship between investment and its determinants. In the long-run, real investment depends positively on real income and real credit, and negatively on the user cost of capital.

The speed of adjustment appears to be negative and less than 1, about -37 percent for the first three models and -55 percent for the fourth model, and they are statistically significant at 1% level. This speed of adjustment coefficients is considered to have about three and two years to adjust, respectively.

The coefficient of the user cost of capital, represents the interest rates, appears to be negative and significant. This finding emphasise the importance of the monetary policy effects on the real economy.

Appendix I: Literature survey:

Study	Variables used	Findings
Anderson, 1981	Nominal investment, Nominal output, Liquidity flow	The financing variable is relevant in such a model lending support to either a putty-clay or credit rationing formulation.
Shafik, 1992	GDP, R, MARKUP, ICOSTS, PRVCRD, PVCRDY, GVIINF, DBFGD, GDVEX, GOVI, NIGVEX,…	Private investment depends on mark ups, internal financing, demand, and the cost of investment.
Voth, 1995	Cost of unit of labour, real interest rate, real wage, demand of economy	Lower wages would have lowered investment and that high interest rates acted as the main brake on investment during the second half of the 1920s in Germany.
Nazmi & Ramirez, 1997	Private investment, output growth, export growth, Public investment, government consumption, interest rate	Public investment had a positive and significant effect on output growth, and this effect was statistically identical to the impact of private investment.
Sun, 1998	Fixed investment, Deflator of investment, energy consumption per capita, Grain output per capita	A large part of the cyclical pattern of investment growth can be explained by the adjustment to the co-movement path and by the relevant changes in energy supply and agricultural output.
Toit & Moolman, 2004	Financial constraints, International position, User cost of capital, Dummy	It is necessary to incorporate the significant role played by financial constraints (internal and external) on investment.
Ismihan et al 2005	Real Private investment, real Public investment, real GDP, real public fixed core infrastructural investment, macroeconomic instability index	The chronic and increasing macroeconomic instability of the Turkish economy has seriously affected her capital formation and growth. Furthermore, the Turkish experience indicates that chronic macroeconomic instability seems to be a serious impediment to public investment, especially to its infrastructural component, and shatters, or even reverses, the complementarity between public and private investment in the long run.

Aysan et al 2007	Share of private investment in GDP, various measures of governance, and control variables as real interest rate, GDP growth, financial development, others.	Governance plays a significant role in private investment decisions. Also, structural reforms like financial development, trade openness, and human development affect private investment decisions directly, and/or through their positive effect on governance.
Johgwanich and Kopaiboon, 2008	output growth, growth of real cost of capital, availability of financing, real public investment, economic uncertainty, output gap, real exchange rate	It was capital fund shortages rather than existing spare capacity that hindered short-run investment recovery. While the health of the financial institutions must be kept in check, policy attention should be geared more toward credit availability to ensure that prudent investors can access credit adequately and accelerate investment recovery. In the long run, policy emphasis should be on promoting a conductive investment climate.
Heim, 2008	Change in output, Depreciation, Interest rate, Crowd out , Dow Jones index, Capital, Corporate profitability, Exchange rate	Investment demand depends on crowd out problems caused by government deficits, available depreciation allowances, rates of growth of the economy, changes in the prime interest rate, growth in stock values, exchange rate changes, and company profitability.
Ang, 2009	GDP, Cost of Capital, Public investment, Direct Credit Programs, Interest Rate Restrains, Reserves Liquidity Requirements.	There is a significant directed credit programs favouring certain priority sectors tend to discourage private capital formation in India and Malaysia. Interest rate controls appear to have a positive impact on private investment, with the effect being more pronounced in Malaysia. While high reserve and liquidity requirements exert a negative influence on private investment in India, the effect is found to be positive in Malaysia.
Frimpong and Marbuah, 2010	Real GDP, public investment, credit to the private, inflation, external debt to GDP, real interest	Private investment affected by public investment, inflation, openness, real exchange rate in the short-run, however, in the long-run private investment determined

	rate, trade openness, real exchange rate, and a dummy.	by real GDP, inflation, external debt, real interest rate, openness and real exchange rate.
Moore, 2010	Broad money, CPI, GDP, deposit rate, expected inflation, credit/GDP, other of explanatory variables include: fd_{it} (financial development), FDI_{it}, ODA_{it}, g_{it} (government expenditure), $trade_{it}$ (foreign trade), and income dummy for low and upper-middle income groups	The long-run and dynamic estimation results based on McKinnon's theoretical model are supportive of the hypothesis that: Does the real rate of return on money matter for investment in developing countries?

Appendix II: Data sources:

Variable	Value	Source
Real Gross Fixed Capital Formation	At constant prices in JD millions	World Development Indicators of the World Bank
Gross Domestic Product (GDP)	At current prices in JD millions	World Development Indicators of the World Bank
GDP Deflator	Index	World Development Indicators of the World Bank
Domestic Credit to the Private Sector	At current prices in JD millions	International Financial Statistic of the IMF
Interest Rate on Loans and Advances	Weighted average	International Financial Statistic of the IMF
Consumer Price Index (CPI)	Index	International Financial Statistic of the IMF
Real Tax on Products	At constant prices in JD millions	World Development Indicators of the World Bank
FDI to GDP ratio	Percentage	World Development Indicators of the World Bank

Chapter 6

Conclusion

6.1 Introduction

6.2 Main findings of the research

6.3 Study limitations and directions for further research

6.1 Introduction

The Jordanian economy depends on foreign assistance; mainly Jordanian workers' remittances and foreign grants, especially from the Arab oil-exporting countries. These are considered the main source of finance for development in Jordan. This fact makes the economy vulnerable and very sensitive to the conditions of the region. A clear example of this dependence was the consequences of the oil price collapse at the beginning of the 1980s; workers' remittances and foreign grants dried up and created several problems in the Jordanian economy, resulting in a currency crisis in the late 1980s.

Later the authorities introduced a number of economic reforms, supported by the International Monetary Fund (IMF) and the World Bank, aimed at reducing the imbalances and promoting fiscal and monetary stability. The Jordanian economy has recovered from the severe economic crisis. Indicators such as trade, the exchange rate and inflation performed better than expected by the reform programme. The reform programmes were continued until the mid 2000s.

This research raises a general question of what is the implication of changes in monetary policy on a small open economy, Jordan. In this regard, three main subjects are investigated including, financial stability, currency crisis and investment function. In the financial stability respect, this study investigates whether changes in monetary policy affect financial stability in Jordan. The second area investigated is the cause of currency crisis in Jordan. At the real sector level, the existence of a stable investment function in Jordan is investigated, with attention to the role of the interest rate.

The research employs a number of time series econometric tests and models including, unit root tests (ADF, PP, KPSS and MacKinnon procedure), co-integration tests (Johansen's technique and bounds test), a vector autoregressive model (VAR), impulse response function, recursive estimates, multinomial Logit model, a three-regime Markov switching model and an autoregressive distributed lags model (ARDL). A number of econometric packages are used including Eviews, OxMetrics and Stata.

6.2 Main findings of the research

This study has investigated a number of important aspects of financial crises in an emerging economy, Jordan. These topics included the implication of changes in monetary policy on financial stability in Jordan, currency crisis in Jordan, and a stable investment function for the Jordanian economy.

The research is intended to provide some answers to a number of questions, including what is the impact of monetary policy on financial stability in Jordan? How can the 1988-1989 currency crisis in Jordan be explained? What are the leading indicators of the crisis? Does a stable relationship of investment exist? If it does, how significant is the role of interest rate in such a relationship?

To introduce, a number of indicators of the Jordanian economy have been discussed, to shed some light on the development of the main indicators over the period

of study (1976-2009). This overview provides the historical movements of the key variables in the Jordanian economy, including economic growth and inflation, balance of payments, financial system and monetary policy.

In order to investigate the relationship between monetary policy and financial stability, first, two financial stability indices for the Jordanian financial system are constructed (*FSIV* and *FSIH*). The former index, following Van den End (2006), combines a number of indictors including real exchange rate, real interest rate, stock price index, and volatility indicator. The latter index, following Hadad *et al.* (2007), is constructed in terms of three equations comprising the equity market, the bond market, and the banking sector. Each index is employed in a VAR monetary policy framework including excess reserves, domestic credit, output and prices, as well as the financial stability index. The objective here is to investigate the impact of changes of monetary policy on the financial stability index. To estimate the directions of such a relationship, an impulse response functions is implemented.

The main results of the first VAR model employed, which considered the *FSIV*, show that any positive shock to the excess reserves, as a monetary policy indicator, and domestic credit is intended to have a positive impact on the financial stability index. However, shocks to the output and prices have a negative impact on the index. Although the magnitude of the effects is very small, a clear effect is obtained from the accumulated impulse response functions. On the other hand, a positive shock to the excess reserves and domestic credit is intended to have a positive impact on the *FSIH*, however, there is no clear impact from the positive shock to the output and prices on the index. Regardless

the index employed, findings confirm the relationship between monetary policy and financial stability in Jordan.

A currency crisis in Jordan is defined to depend on a market pressure index (*MP*) which is constructed following Eichengreen *et al.* (1995). This index is measured by combining the Jordanian dinar depreciation (appreciation) against the US dollar, change in reserves, and change of discount rate. However, a crisis occurs as the exchange rate depreciated (or appreciated, which is considered one of the contributions of this study), a significant loss of foreign reserves, a significant change in the interest rates, or a combination of them.

The index is employed in two models. In the first model, the *MP* is converted to a binary variable, it takes three values: (-1) when the index exceeds its mean minus 1,1.5 or 2 standard deviations, and (1) when the index exceeds its mean plus 1,1.5 or 2 standard deviations and (0) otherwise. The converted version of the index is included in a multinomial Logit model. On the other hand, the index is employed in a three-regime Markov switching model, this is considered as a new version of the two-regime Markov switching model, as it allow for appreciation as well depreciation. The objective here is to develop an early warning system to explain any potential currency crisis in Jordan and identify a number of leading indicators that can help understand the crisis.

In the multinomial Logit model, we find that number of indictors including real exchange rate (*RER*), money supply-reserves ratio (*M2R*), growth rate of domestic credit (ΔDC) and Central Bank foreign assets to liabilities ratio (*AL*), play a significant role in explaining the currency crises. Although their marginal effect varies, they are consistent

with theory in terms of directions. This finding gives evidence to support the second and third generation models in explaining currency crises in Jordan.

The results of the three-regime Markov switching model did not change from the previous model. The main findings centred on the impact of the macroeconomic fundamentals on the market pressure index. Nevertheless, the model captures all large movements in the *MP* successfully.

At the real sector level, an investment function for the Jordanian economy is estimated. The objective is to investigate the significant role played by interest rate, through the user cost of capital indicator, on the real investment. A number of variables were employed depending on the theory using the Autoregressive Distributed Lag (ARDL) model. The bound test (Pesaran *et al.* (2001)) is implemented for testing co-integration.

The findings confirm that there is a co-integration relation among the variables exists. The estimation of the long-run relationship between investment and its determinants shows that real income and real credit have a positive impact on real investment. However, the user cost of capital has a negative impact on real investment.

6.3 Study limitations and directions for further research

There are a number of limitations faces this study that should be addressed. The main point is data consistency and availability. For instance, the available data that are used to construct the financial stability index limits the investigation to two short time spans. If more data were available, a clearer image could be drawn for the financial system in Jordan. Also the available data frequency which is limits the investigation to use proxies for unavailable required frequent data. For example, the industrial production index is used as a proxy for the income, because there is no available monthly data for income.

Another point which should be noted is the complicated interactions in some factors which are affected by the economic and political decision in a developing country such as Jordan. These interactions make it difficult to investigate the exact effect of indicators on dependent variables.

The findings of this research raise concerns on a number of important issues and may provide avenues for further research. For instance, two financial stability indices were constructed. One can construct other indices following the literature which may be required more data or effort to be assembled.

Within the VAR framework in chapter 3, excess reserves were considered as a monetary policy instrument. Other instruments of the monetary policy can be employed, such as interest rate and required-reserve ratio. Nonetheless, in cases of currency crisis, a dynamic analysis could be employed instead of the static analysis which was implemented in the multinomial Logit model.

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