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**Three Essays on the Inflation Targeting
Regime in Egypt**

Doctoral Dissertation

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Title: Three Essays on the Inflation Targeting Regime in Egypt

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I, Ibrahim Lotfi Awad Ibrahim, hereby declare that this dissertation is my own original work and that all source materials used here have been clearly identified and referenced.

Ibrahim Lotfi, Undersigned

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Abstract

This dissertation comprises three empirical essays on adopting the inflation targeting regime in Egypt. It sets out to answer the following questions: (i) Can the central bank of Egypt (CBE) achieve the goal of price stability under the currently applied monetary targeting regime? (ii) Is the legal independence granted to the CBE under the latest legislation promulgated in 2005 factual? (iii) Does the CBE maintain an implicit target for the FX rate? Does the CBE follow an independent monetary policy? Which variables have priority in the reaction function of the CBE? How far can foreign economic shocks explain the behavior of real GDP and price level in the Egyptian economy compared with domestic economic shocks? And which monetary transmission mechanism channels play a dominant role in the Egyptian economy?

The main conclusions of the study came as follows:

(i) Neither the demand for money function nor the velocity of circulation of money is found stable in Egypt. Thus, the study concludes that the CBE cannot achieve price stability under the currently applied monetary targeting regime.

(ii) The legal independence granted to the CBE under the latest legislation is not factual.

(iii) By estimating the monetary transmission mechanisms (MTMs) using a structural VAR model the conclusions of the study were as follows: (1) The CBE is (implicitly) maintaining a target for the FX rate. (2) The CBE does not apply an independent monetary policy. (3) The federal funds rate and the FX rate, respectively, play the most important role among the foreign and domestic variables that influence the reaction of the CBE. (4) Foreign economic shocks play a dominant role in explaining the behavior of real domestic growth, whereas domestic economic shocks play a dominant role in explaining the behavior of domestic inflation, especially in the short run. (5) The interest rate channel explains the MTMs in the Egyptian economy, where changes in domestic interest rate have significant impact on both the rate of growth of real GDP and inflation.

Abstrakt

Disertace se skládá ze tří esejí o cílování inflace v Egyptu. Zaměřuje se na otázky: (i) Může centrální banka v Egyptu dosáhnout cenové stability stávajícím režimem? (ii) Je centrální banka nezávislá de facto? (iii) Udržuje centrální banka implicitní cíl pro kurz? Vykonává centrální banka nezávislou a novou politiku a které proměnné mají prioritu v reakční funkci centrální banky? Do jaké míry může zahraniční šok vysvětlit chování reálného HDP a cenové hladiny ve srovnání s domácím šokem? A které kanály a nové transmise hrají dominantní roli v egyptské ekonomice?

Hlavní závěry jsou následující:

(i) Poptávka po penězích ani rychlost nejsou v Egyptu stabilní. Proto není možné dosáhnout cenové stability ve stávajícím a novém režimu.

(ii) Nezávislost centrální banky udělená stávajícím zákonem není nezávislost de facto.

(iii) Odhadnutím strukturálního modelu VAR lze uinit následující závěry ohledně nové transmise: (1) Centrální banka udržuje implicitní cíl pro kurz. (2) Centrální banka nevykonává nezávislou a novou politiku. (3) Federální úroková míra a kurz hrají dominantní roli mezi proměnnými dležitými pro novou transmisi. (4) Zahraniční šoky jsou dležitější pro vysvětlení chování HDP, zatímco domácí šoky vysvětlují lépe chování inflace. (5) Úrokový kanál patří k nejdležitějším kanálům nové transmise.

هذه الرسالة تشتمل على ثلاثة مقالات عملية عن اختيار نظام استهداف التضخم في مصر. وهي تستهدف الاجابة على الأسئلة التالية: () هل البنك المركزي المصري يمكنه تحقيق هدف الاستقرار السعري في ظل منهج الاستهداف النقدي المطبق حاليا؟ () هل الاستقلال القانوني الممنوح للبنك المركزي المصري في ظل التشريع الأخير المعلن عام 2005 هو استقلال فعلي؟ () هل البنك المركزي المصري يحتفظ بهدف غير معلن لسعر الصرف الأجنبي؟ هل البنك المركزي المصري يطبق سياسة نقدية مستقلة؟ ما هي المتغيرات التي تحتل الأولوية في دالة رد فعل البنك المركزي المصري؟ الى اي مدى يمكن للصددمات الاقتصادية الخارجية ان تفسر سلوك الناتج المحلي الحقيقي و مستوى الأسعار في الاقتصاد المصري مقارنة بالصددمات الاقتصادية المحلية؟ اي القنوات لألية السياسة النقدية تلعب دورا رئيسيا في الاقتصاد المصري؟

:

()

المركزي المصري لا يمكنه تحقيق الاستقرار السعري في ظل منهج الاستهداف النقدي المطبق حاليا. () الاستقلال القانوني الممنوح للبنك المركزي المصري في ظل التشريع الأخير المعلن عام 2005 هو استقلال غير فعلي. () بتقدير اليات السياسة النقدية باستخدام نموذج VAR هيكلية خلصت الدراسة للنتائج التالية:

(1) البنك المركزي المصري يحتفظ حتى الآن بهدف غير معلن لسعر الصرف الأجنبي. (2) المركزي المصري لا يطبق سياسة نقدية مستقلة. (3) معدل الفائدة الأمريكي قصير الأجل و سعر الصرف الأجنبي، على التوالي، يحتلان الأولوية بين التغيرات المحلية و الخارجية في التأثير على رد فعل . (4) تلعب الصدمات الخارجية الدور الرئيسي في التأثير على الناتج المحلي

الحقيقي، بينما تلعب الصدمات المحلية الدور الرئيسي في التأثير على التضخم المحلي خصوصا في الأجل القصير. (5) قناة سعر الفائدة يمكنها تفسير اليات السياسة النقدية في الاقتصاد المصري، حيث ان التغيرات في سعر الفائدة المحلي لها تأثيرا معنويا على كل من معدل النمو الحقيقي و معدل التضخم.

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I. Introduction

Despite the fact that there is no standard definition of inflation targeting (IT), we can think of it as a way of reforming monetary policy by anchoring individuals' expectations about inflation around an announced target. On the basis of the forecasted level of inflation, the central bank (CB) moves the short-term interest rate to drive the expected, and consequently the actual, rate of inflation towards the targeted level. The targeted level of inflation should be publicly announced to serve as an "anchor" for individuals' expectations about the future path of inflation. The announced inflation target is expected to play the role of anchoring individuals' expectations as long as the CB's credibility is high. This is why CB credibility represents a cornerstone of a successful IT regime. Accountability, transparency, and independence are three basic pillars for the CB's credibility.

There has been much debate among economists about the "preconditions" that countries need to meet before applying IT. This debate reflects the fact that there is no generally agreed set of preconditions¹. The disagreement among economists pertains mainly to the question, 'What are the initial conditions or preconditions that need to be met before applying IT, particularly in an emerging market economy?' In the vast majority of the literature addressing this point, there are three elements that are generally demanded for IT to be applied, especially in developing countries and emerging market economies. They are: (i) factual (de facto) independence of the central bank², which comprises three basic pillars: legal instrument independence, the nonexistence of government representatives in the MPC as voting members, and the absence of fiscal dominance, including no obligation for the CB to finance budget deficits; moreover, domestic financial markets should have enough depth to absorb placements of public debt such as treasury bills; (ii) a commitment to price stability, which requires two basic elements: the CB should not target any variables other than the rate of inflation, and the CB should be transparent to the public about the exemptions from its inflation target;

¹ See, for example, Khan (2003, p. 10), Truman (2003, p. 49), and Batini et al. (2006, p. 18)

² See Truman (2003, pp. 49–51), Masson et al. (1998, p. 35), Batini et al. (IMF, 2006, p. 18), Debelle et al. (1998, pp. 11–13), Fraga et al. (2003, pp. 22–25), and Mishkin and Schmidt-Hebbel (2007).

such transparency is a practical device to make the CB accountable to the public for achieving the inflation target; and (iii) forecasting capabilities, including a model for inflation forecasting and inflation projections, a clear idea about monetary policy transmission mechanisms and associated lags, and an inclusive and updated database.

One reason of the rapid spread of IT in different countries is that IT is regarded as a way of reforming monetary policy³. It is widely accepted today that a monetary policy regime is efficient as long as it is able to achieve the goal of price stability⁴. In this respect, a nominal monetary policy anchor is necessary for price stability, because it ties down individuals' expectations about the price level⁵. Thus, the efficiency of a monetary policy regime is determined, first of all, by the ability of the embedded nominal anchor to send the right message to all practitioners about the potential behavior of the price level.

One lesson from the experience of some emerging market economies during the second half of the 1990s is that countries such as Czech Republic, Poland, and Brazil (CPB) were forced to float their currencies in the aftermath of economic crises in order not to lose a large part of their foreign exchange reserves. The decision to float came in the wake of speculative attacks on the domestic currency triggered by both economic crises and external imbalances on their current accounts. These current account imbalances emerged as a result of pegging the exchange rate in conjunction with high domestic inflation, with real appreciation thus occurring. Immediately after floating the domestic currency the CBs in CPB switched their monetary policy regimes to IT. The CPB found that IT was the only available option for achieving the goal of price stability on a forward-looking basis. On the one hand, a monetary policy regime without an explicit nominal anchor, i.e. 'just do it' policy, was not an appropriate alternative for tying down individuals' expectations about inflation, especially under economic turbulences. On the other hand, a monetary targeting regime was also not an appropriate

³ Of course there are other factors for the rapid spread of IT (see Awad, 2008).

⁴ An operational definition of price stability that is now broadly accepted among economists is the one presented by Alan Greenspan: price stability is obtained when economic agents no longer take account of the prospective change in the general price level in their economic decision making (Batini et al., 2005, p. 161).

⁵ Mishkin (1999, p. 1) defines a nominal anchor as a constraint on the value of money. It provides conditions that make the price level uniquely determined. A nominal anchor for this reason is a device to bind individuals' expectations about the nominal price level.

alternative, especially after the liberalization of capital flows and financial markets, which undermined the relationship between the money supply and the price level (Schaechter et al. 2000; Jonas and Mishkin, 2003; Fraga, 2000; Arestis et al., 2008).

This dissertation comprises three empirical essays on adopting IT in Egypt. It is motivated by the following facts:

(i) The reaction of the Central Bank of Egypt (CBE) to the economic crises encountered the economy in the second half of the 1990s was different comparing to CPB. While the CBs in CPB reacted to such economic crises, as mentioned, by switching their monetary policy regimes to IT immediately after floating the domestic currency, the CBE did not.

(ii) High inflation rate in Egypt in recent years is in conjunction with high budget deficit supported by issuing new money. As shown in Table 1, the high numbers of either cash deficit or overall deficit are supported by high contributions of the CBE in financing budget deficit which, presumably, causes an increase in the money supply. Literally, an increase in the money supply, *ceteris paribus*, causes high inflation.

Table 1: Budget defect and sources of financing during the period 2001/02-2006/07

Description	2001/2002	2002/2003	2003/2004	2004/2005	2005/2006	2006/2007 ¹
Cash deficit(% GDP) ²	9.8	9.1	9.1	9.4	9.2	5.7
Overall deficit(% GDP) ³	10.2	10.4	9.5	9.6	8.2	7.5
Domestic financing(% overall deficit)	80	82.5	98.8	123	108	61
Banking financing (% domestic financing)	47	54	46.3	49.4	27	–
CBE financing (% Banking financing)	41	27	112	79	(77.5)	15
Inflation (GDP deflator)	3	7	12	6	7	13

¹Pre-actual data, ² Cash deficit = Total revenues – Total expenditures, ³ Overall deficit = Cash deficit + Net acquisition of financial assets

Source: inflation (GDP deflator) data is calculated from IFS, CD-R 2009.

The rest of the data is calculated from; <http://www.cbe.org.eg/timeSeries.htm>

(iii) The CBE has on several occasions announced its intention to adopt IT as a framework for its monetary policy once the fundamental prerequisites are met (CBE, 2005; IMF, 2007). To date, the CBE has not matched words with deeds.

The dissertation investigates the following two issues: Firstly, can the CBE achieve the goal of price stability under the currently applied monetary policy regime? The answer to this question is important from the point of view of the study because it can guide us to determine whether the CBE should take steps towards adopting IT, especially after floating the FX rate in the start of 2003. The above question cannot be assessed on the basis of the current levels of inflation rate that exist in reality. High inflation rate does not necessarily indicate a faultier of a monetary policy regime itself. Consequently, the above question should be assessed on the bases of the monetary targeting regime itself. The first essay in this dissertation addresses this issue by empirically investigating the stability of the demand for money function and the stability of the velocity of circulation of money in the Egyptian economy.

Secondly, if the CBE should move toward adopting IT, is it qualified to apply IT? As mentioned, there are three prerequisites for IT to be applied. The second and third essays empirically investigate some specific points related to prerequisites for IT. They are: factual independence of CB, the CB should not maintain an implicit target for the FX rate, the impact of foreign economic shocks on both inflation and real growth rates in the domestic economy, and the channels through which monetary policy actions are transmitted to changes in real output and price level. The second essay empirically investigates the first point, i.e. factual independence of the CBE, whereas, the third essay empirically investigates the rest of it.

In the light of this, the dissertation intends to answer the following questions:

(i) Can the CBE achieve the goal of price stability under the currently applied monetary targeting regime?

(ii) Is the legal independence granted to the CBE under the latest legislation promulgated in 2005 factual?

(iii) Does the CBE maintain an implicit target for the FX rate? Does the CBE follow an independent monetary policy? Which variables have priority in the reaction function of the CBE? How far can foreign economic shocks explain the behavior of real GDP and

price level in the Egyptian economy compared with domestic economic shocks? And which monetary transmission mechanism channels play a dominant role in the Egyptian economy?

The main conclusions of the dissertation are as follows:

(i) Using quarterly data on the period 1995Q1-2007Q4, the study estimated the long run demand for money function and the long run velocity of circulation of money in Egypt. By testing for structural change, neither the demand for money function nor the velocity of circulation of money is found stable. Thus, the study concludes that the CBE cannot achieve price stability under the currently applied monetary targeting regime.

(ii) The study assesses factual independence of CB by the ability of the CB to fulfill its target without squeezing private sector. Empirically, the study assesses the independence of CB by linking the CB's actions to the influence on both domestic credit of government and domestic credit of private sector through the sign of the coefficient β_3 . Using either quarterly data on the period 1991Q1-2007Q1 or monthly data on the period 2001M12-2009M6, the study concluded that the legal independence granted to the CBE under the latest legislation is not factual.

(iii) By estimating the MTMs in the Egyptian economy using a structural VAR model in which the Egyptian economy is treated as a small-open economy the results of the study were as follows: (1) The CBE is factually applying the sterilized intervention policy, which indicates that the CBE is (implicitly) maintaining a target for the FX rate. (2) The high variance of domestic interest rate caused by either the federal funds rate or the FX rate indicates that the CBE does not apply an independent monetary policy. (3) The federal funds rate and the FX rate, respectively, play the most important role among the foreign and domestic variables that influence the reaction of the CBE. (4) Foreign economic shocks play a dominant role in explaining the behavior of real domestic growth, whereas domestic economic shocks play a dominant role in explaining the behavior of domestic inflation, especially in the short run. (5) The interest rate channel explains the MTMs in the Egyptian economy, where changes in domestic interest rate have significant impact on both the rate of growth of real GDP and inflation.

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II. The Monetary Targeting Regime in Egypt: Theoretical and Empirical Investigations

Abstract

The purpose of this paper is to answer the following question; can the central bank of Egypt achieve the goal of price stability under the currently applied monetary targeting regime? The answer depends on whether or not the demand for money function is stable in Egypt. Using quarterly data on the period 1995-2007, the study estimated the long run demand for money function in Egypt. By testing its stability for structural change, the demand for money function is found unstable. Thus, the study concludes that the central bank of Egypt cannot achieve price stability under the currently applied monetary targeting regime. As a consequence, the CBE should take steps toward adopting IT.

Keywords: monetary targeting regime; demand for money function; velocity of circulation of money

JEL: E40, E41, E42

1. Introduction

In the late 70s, many countries, motivated by the monetarists' model, applied monetary targeting (MT) regime to fight inflation. The MT regime is established on the assumption that controlling the rate of growth of money gives control of inflation. This assumption finds its origin in the quantity equation by Irving Fisher and recently in Friedman (1968). According to Friedman (1968), monetary policy can affect real economy only during the short run. In the long run, inflation is a monetary phenomenon and real output is driven by real factors, i.e. money is neutral in the long run.

Mishkin (2000) determines three key elements for the MT; (i) announcing targets for monetary aggregates, (ii) reliance on information conveyed by monetary aggregates to conduct monetary policy, and (iii) some accountability mechanisms to prevent the deviations from the monetary targets.

In practice, no central bank applied the MT in the form of Friedman's rule of constant money growth. Moreover, not all monetary targeters disclose numeric money targets. Batini, et al. (2005, 164) indicate that among 22 countries that declared themselves as monetary targeters only 9 periodically disclose their numeric money targets⁶.

The success of the MT in achieving the goal of price stability hinges on two basic assumptions; (i) the relationship between the goal variable and the monetary targets must be strong enough; i.e. the velocity of circulation of money is predictable, (ii) monetary aggregates must be under the control of central bank (CB); i.e. the money multiplier is predictable⁷.

One lesson from the experience of the emerging market economies is that countries like Czech Republic, Poland and Brazil (CPB) were forced to float their currencies on the aftermath of economic crises during the second half of the nineties decade in order not to lose an influential part of their foreign reserves. The decision of floatation came on the backdrop of speculative attacks on domestic currency triggered by both the Asian crisis and external imbalances of current accounts. The imbalances of current accounts emerged because of pegging the foreign exchange (FX) rate in conjunction with high domestic inflation, thereby real appreciation occurred. After floating their currencies, CPB found that the inflation targeting (IT) regime is the only available option to achieve the goal of price stability upon forward-looking bases. The MT regime was not an appropriate alternative to achieve price stability especially after liberalizing capital flows and financial markets, which undermined the relationship between money supply and price level (Awad, 2009, 67-68).

⁶ Although the central bank of Egypt (CBE) is formally targeting the rate of growth of M2, it rarely discloses numeric money targets. During the fiscal year 2002–2003, the CBE was targeting the growth of domestic liquidity at a rate of 10%, irrespective of changes in the exchange rate. The actual rate of liquidity growth, however, reached 9.4% (CBE, 2002–2003, p. 30).

⁷ Factual independence of the CB and a commitment to price stability as a primary goal of monetary policy are two prerequisites have to be in place to ensure a successful application of the MT regime. Factual independence of the CB is based on three basic pillars; (i) Legal instrument independence of the CB, (ii) Nonexistence of government representatives in the monetary policy committee as voting members, and (iii) Absences of fiscal dominance including no obligation for the CB to finance budget deficit. A commitment to price stability means that the CB should not target any other variables, e.g. exchange rate. In other words, price stability should be given a priority if a conflict occurred among monetary policy objectives. For more details, see: Awad (2009).

Although Egypt underwent similar circumstances to the CPB during the second half of the nineties decade, as we will see later, the central bank of Egypt (CBE) did not adopt IT. The CBE has on several occasions announced its intention to adopt IT as a framework for its monetary policy once the fundamental prerequisites are met (IMF, 2007; CBE, 2005). To date, the CBE has not matched words with deeds. It has not disclosed which prerequisites for IT are still unfulfilled. In addition, the steps taken by the CBE to apply IT are still unsatisfactory (Awad, 2009, 69-77).

However, a fundamental question has to be tackled before adopting IT is; can the CBE achieve the goal of price stability under the currently applied MT regime? The answer depends on whether or not the demand for money function is stable in Egypt. Under a stable demand for money function the CBE can accurately predict the demand for money and hence control money supply in such a way that achieves the goal of price stability. Conversely, if the demand for money function is not stable, the CBE should take steps toward adopting IT to achieve price stability, especially after floating the FX rate.

The rest of this paper is organized as follows. Section 2 describes the evolution of monetary policy targets and objectives in Egypt since the 1990s. Section 3 measures the stability of the demand for money function in Egypt. Section 4 investigates the robustness of the estimated results. Section 5 concludes.

2. Monetary policy targets and objectives in Egypt since the 1990s

2.1 Monetary policy targets

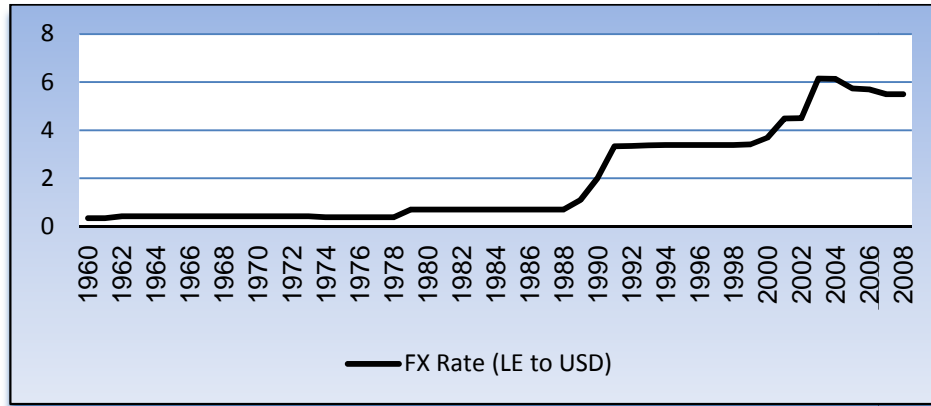
From 1990 until the start of 2003, and for long periods the CBE was targeting the FX rate, as can be inferred from Figure 1⁸.

The economic circumstances in Egypt during the 1990s were very similar to those in the CPB. The application of the economic reform and structural adjustment program (ERSAP) in the start of the 1990s and the pegging of FX rate for long periods of time

⁸ During the periods of 1960-2003, different varieties of exchange rate regimes had been experimented in the Egyptian economy, i.e. conventional peg in the sixties, crawling peg in the seventies and eighties, crawling bands in the nineties and managed floating as of 2003. Beside the official price, FX market witnessed multiple prices including prices of both parallel market and black market. In 2004, Egypt successfully unified FX markets (Kamar and Bakardzhieva, 2005).

were two common aspects between Egypt and CPB. In addition, in the second half of the 1990s, the Egyptian economy encountered a number of external and domestic shocks which negatively affected the performance of external sector. These shocks included: (i) the East Asian crisis in June 1997; (ii) the Luxor terrorist attack in November 1997; and (iii) the fall in oil prices in 1998 (Abu-Elayoun, 2003; Kamar and Bakardzhieva, 2005).

Figure 1: FX rate evolution during 1960-2008



Source: prepared using data from IFS, CD-R , 2009.

The reaction of the CBE to these shocks was dissimilar to that of CPB. The CBE did not use monetary policy tools to respond to economic shocks occurred in the second half of the 1990s. According to Panizza (2001) the CBE during this period was unwilling to have a market-determined pegged exchange rate because of some fears of the pass-through effect. However, as the CBE insisted on defending an unrealistic value of the Egyptian pound during this period, the problems of FX shortages in the economy worsened⁹, the CBE lost a large part of its international reserves (during 1998–2000 the international reserves decreased from USD 18 billion to USD 14 billion), and the FX black market re-emerged.

At the end of 2000, the CBE began moving toward a more flexible exchange rate through a series of step devaluations until 2002. On January 28, 2003, the Prime Minister announced a free float of the Egyptian pound. Galal (2003) assesses the decision of floating the FX rate as an attempt to resolve policy inconsistency originating from the

⁹ Although commercial banks were declaring the price of FX, they did not sell Dollars to anyone, even in limited amounts.

combination of the FX rate rigidity, the reluctance to use international reserves to support the peg to the Dollar and the attempt to reduce the interest rate to activate the economy.

According to Rabanal (2005), the Egyptian pound experienced a cumulative depreciation of 68 percent against the USD in 2000–2004. The active parallel FX market during this period began to converge to the banking rate in mid-2004, prior to the establishment of a formal interbank market for the exchange rate. Currently, the exchange rate in Egypt is unified and reasonably flexible¹⁰.

2.2 Monetary policy objectives

One of the most overarching challenges for a researcher is to determine exactly the objectives of monetary policy that the CBE was actually intending to achieve, especially during the period following the introduction of the ERSAP until the decision of floating the FX rate, January 2003. One reason for this is that the CBE adopted inconsistent objectives for monetary policy during this period (Moursi, et al., 2007, Kamar and Bakardzhieva, 2005, and Panizza, 2001)¹¹.

After the introduction of the ERSAP in 1990, the ultimate objective of monetary policy was determined to be achieving both internal and external stability of domestic currency in line with the national objectives of spurring economic growth and creating more job opportunities. During this period, the intermediate target of monetary policy was determined to be the net of domestic credit and later the rate of growth of money supply (M2). The daily operational target of monetary policy was determined to be

¹⁰ Despite formal liberalization of FX rate in January 2003, the CBE has continued to maintain exchange rate stability as one of its key objectives during the following years 2004 and 2005. That makes many commentators suspect that the CBE still have implicit target for FX rate and do intervene regularly to maintain it (Moursi, et al., 2007, PP 8). Al-Mashat and Billmeier (2007) examined transmission mechanism in Egypt for the period from January 1996 to June 2005 using VAR model. One result of this study is that the exchange rate channel still playing a strong role in propagating monetary shocks to output and prices despite the CBE is, formally, no longer use nominal exchange rate as a nominal anchor for monetary policy.

¹¹ One example for such inconsistent objectives as Moursi, et al. (2007, P 4) mentioned is that the CBE adopted conflicting objectives especially during the period 1992/1993-1996/1997. In 1992/1993 while the CBE aimed at controlling the monetary expansion, it is also called for a reduction of the interest rate on the Egyptian pound to encourage investment and promote economic activity. During the period 1993/1994-1995/1996, monetary policy objectives were swayed between the two objectives of both economic growth and price stability. In 1996/1997, the CBE reverted to the objective of economic growth via monetary stabilization.

banks' excess reserves, which had to be determined in such a way that would achieve the intermediate target (Abu-Elayoun, 2003).

Taking into account that the CBE liberalized domestic interest rates on loans and deposits in 1991, one may ask; how can the CBE maintain the target of FX rate and, at the same time, achieve the goal of price stability through maintaining an implicit target of M2? The sterilized intervention policy can give an answer to this question¹². However, because the monetary policy objectives were inconsistent the CBE was unable to use efficiently either short-term nominal interest rate or banks' excess reserves to manage monetary policy during this period, especially when the economy incurred both external and domestic economic shocks in the second half of the nineties decade.

After liberalizing the FX rate and issuing a new legislation in 2003, governing the CBE, the banking sector and the money, the ultimate objective of monetary policy has changed to focus primarily on the goal of price stability.

As of June 5, 2005, the CBE developed a new framework for monetary policy implementation. This framework relies on the use of the overnight interest rate on the inter-bank transactions as an operational target for monetary policy, instead of banks' excess reserves. The new framework represented the central bank's main policy instrument, providing the outer bounds of a corridor within which the ceiling is the overnight interest rate on lending from the CBE, and the floor is the overnight deposit interest rate at the CBE (CBE, 2005-2006, 1).

3. The stability of the demand for money function in Egypt

3.1 Variables of the demand for money function

The instability of the demand for money can be explained by the instability of the velocity of circulation. More frequently, the instability of the demand for money is illustrated in terms of the factors included in the demand for money function. Anderson (1985) identified three sources of instability of the demand for money; (i) Change in the velocity of circulation in response to fluctuations in interest rates as well as to movements in other arguments of the money demand function other than real income, (ii) The

¹² A sterilized intervention policy itself is fragile and can lead to dramatic consequences. For more details, see: Goodfriend, 2008.

demand for money function itself may shift. For instance, financial innovations and deregulation of interest rates may shift the demand for money at the prevailing levels of nominal interest rates, and (iii) Over shorter periods the money stocks actually held may not correspond to the money balances desired. If the speed of adjustment is low then such discrepancies will induce large and unexpected changes in the velocity of circulation.

Hetzel (1984) used a typical equation expressing the public's demand for real money balances (M^*) in the following form:

$$M^* = F(X) = e^k e^{-at} R^{-b} Y^c \quad (1)$$

Where, M^* , desired real money balances, is a function of nominal interest rate (R) and real income (Y), k is constant and at is the trend rate of growth in the income velocity of money.

(Hetzel, 1984, and Mehra, 1993) measured the stability of the demand for money function by testing the following regression:

$$\ln(M/P)_t = \beta_1 + \beta_2 \ln Y_t + \beta_3 \ln R_t + \epsilon_t \quad (2)$$

Wagner (1981) indicated that once the interest rate appears in the demand for money function, a stable demand for money function no longer implies a stable monetary multiplier. Bichaka and Deme (1995) estimated the demand for money function for Egypt, Morocco and Tunisia using quarterly data from 1964 to 1990. They specified the rate of growth of real demand for money (M/P) as a function of real income, domestic interest rate, expected inflation rate (EP_t), nominal exchange rate (E_t), foreign interest rates and imported inflation.

Following Bichaka and Deme (1995), real income, domestic interest rate, expected inflation rate and nominal exchange rate will be included in the demand for money function. The exclusion of both imported inflation and foreign interest rate from the specification of the demand for money function in Egypt is for two reasons; (i) The rise in domestic price in Egypt during the second half of the seventies decade was partly induced by external factors. The FX rate was pegged to the USD during this period and, at the same time, this period witnessed a growth of inflation rates in the worldwide economy. Thus, domestic prices were negatively affected because of imported inflation

during that time. Although the FX rate was also pegged during the nineties decade, the rate of inflation improved in most countries including Egypt. In addition, after floating the FX rate in the start of 2003, movements in nominal exchange rate in the long run should reflect changes in domestic prices. (ii) The exclusion of foreign interest rate is explained by the high correlation between domestic interest rate, deposits rate, and foreign interest rates, federal fund rate (66 %). In the light of this, the real demand for money in Egypt can be specified as a function of the following variables;

$$(M/P)_t = f(Y_t, E_t, R_t, EP_t) \quad (3)$$

The expected signs of explanatory variables are f_1 and $f_2 > 0$ and f_3 and $f_4 < 0$. That is, real income, Y_t , is positively related with the real demand for money. An increase of real income raises the number of transactions that people make, resulting in a rise in the real demand of money. FX rate, E_t (the price of foreign currency, USD, in terms of domestic currency), is positively related with demand for money. A decrease of FX rate appreciates domestic currency and, ceteris paribus, dampens the demand for domestic cash balances. Domestic nominal interest rate (three-month deposit rates, R_t) is inversely related with the real demand of money. An increase in nominal interest rate raises the opportunity cost of holding money, resulting in a decrease in the real demand for money. The expected rate of inflation is inversely related with the demand for cash balances because of expecting higher prices of assets.

Following Bichaka and Deme (1995) and Al-Sowaidi and Darrat (2006) the lagged value of inflation, $(\pi)_{t-1}$, is included in the demand for money function to mirror the expected rate of inflation¹³.

Using quarterly data covering the period 1995Q1-2007Q4, we can check the stability of the following demand for money function:

$$(M/P)_t = \beta_0 + \beta_1 Y_t + \beta_2 E_t + \beta_3 R_t + \beta_4 \pi_{t-1} + \epsilon_t \quad (4)$$

3.2 Data and estimation procedures

¹³ Under the adaptive expectation hypothesis, expected inflation (π_t^*) takes the following form: $\pi_t^* = \pi_{t-1}^* + (\pi_{t-1} - \pi_{t-1}^*)$ or, $\pi_t^* = \pi_{t-1} + (\lambda) (\pi_{t-1} - \pi_{t-1}^*)$. Under the assumption that the expectations factor (λ) = 1, or equivalently the expectations are instantaneously, the lagged value of inflation, π_{t-1} , can be used as measurement of expected inflation.

The source of the data is IFS, CD-R, 2009. As quarterly data about real GDP for the periods of 1995Q1-2007Q4 is not available for Egypt either in this source or any other source, we used statistical methods to extrapolate quarterly data from the annual data of the period 1995-2007. Lagged inflation series, π_{t-1} , is calculated from the CPI. M2 and CPI were used to calculate real money balances, $(M/P - RM2)$, since quarterly data are available for the two variables in the above source.

We can check the stability of the demand for money function in the Egypt through two steps. The first step is to estimate the long run demand for money function. The second step is to consider whether the long run relationship is stable or not.

All variables included in equation 4 are introduced in the logarithm form except for the nominal interest rate and expected inflation rate. The unit root tests were performed on real money balances, (\ln_RM2_t) , real GDP (\ln_Y_t) , FX rate (\ln_E_t) , three-month deposit rates (R_t) and lagged CPI-inflation rate $(EP_t - \pi_{t-1})$. While \ln_RM2_t , \ln_Y_t and \ln_E_t are integrated of order one, i.e. $I(1)$, both R_t and EP_t are integrated of order zero, i.e., $I(0)$.

To estimate equation 4 whereas integrated variables with different orders are included, a cointegrated relationship has to be existed. That is, π_t has to be stationary¹⁴. According to the Johansen cointegration test, the variables; \ln_RM2_t , \ln_Y_t , \ln_E_t , R_t and EP_t are cointegrated (see appendix 1). In the light of this, we will check the stationarity of π_t from the following regression:

$$\ln_RM2_t = \beta_1 + \beta_2 \ln_Y_t + \beta_3 \ln_E_t + \beta_4 R_t + \beta_5 EP_t + \epsilon_t \quad (5)$$

3.3 Estimation results

The estimation results of equation 5, as shown in Table 1, indicate that all explanatory variables came with proper signs and all of them are strongly significant at 5 % level of significance, except for the expected inflation rate (EP_t) . According to F-statistic, the regression relationship is significant. According to Adjusted R-squared, the

¹⁴ The econometric use of the term ‘equilibrium’ indicates any long run relationship. Any equilibrium relationship among a set of nonstationary variables implies that their stochastic trends must be linked, i.e. the variables cannot move independently of each other. This linkage among stochastic trends necessitates that the variables be cointegrated. Although Engle and Granger’s original definition of cointegration refers to variables that are integrated of the same order, it is possible to find equilibrium relationships among group of variables that are integrated of different orders. This case is known as ‘multicointegration’ (Enders, 2004, PP. 319-323).

variables included in equation 5 explain 99 % of the changes in ln_RM2_t . Unfortunately, the low value of the Durbin-Watson statistic is an indicator of the presence of serial correlation in the residuals. The Breusch-Godfrey serial correlation LM test detected first order serial correlation in the residuals of equation 5. The LM test result suggests that we need to modify equation 5 to take account of the serial correlation. One common method to do that is to include autoregressive and/or a moving average term in equation 5.

Table 1: Estimation results of equation 5

Dependent Variable: LN_RM2			
Method: Least Squares			
Sample (adjusted): 1995Q2 2007Q4			
Included observations: 51 after adjustments			
Variable	Coefficient	t-Statistic	Prob.
C	2.999192	3.116211	0.0032
LN_Y	0.721576	9.903468	0.0000
LN_E	0.449419	13.81152	0.0000
R	-0.034212	-4.540960	0.0000
EP	-0.003646	-1.097930	0.2779
Adjusted R-squared	0.990066	Akaike info criterion	-4.219712
Durbin-Watson stat	1.265010	Schwarz criterion	-4.030318
F-statistic	1246.769	Prob(F-statistic)	0.000000

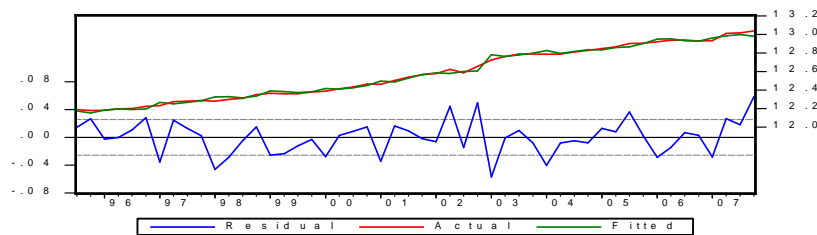
Table 2: Estimation results of equation 5 with AR term

Dependent Variable: LN_RM2			
Method: Least Squares			
Sample (adjusted): 1995Q3 2007Q4			
Included observations: 50 after adjustments			
Convergence achieved after 8 iterations			
Variable	Coefficient	t-Statistic	Prob.
C	3.306511	2.940130	0.0052
LN_Y	0.702352	8.230419	0.0000
LN_E	0.447089	11.20919	0.0000
R	-0.040070	-4.490517	0.0001
EP	-0.010566	-2.376997	0.0219
AR(1)	0.276300	1.902085	0.0637
Adjusted R-squared	0.991511	Akaike info criterion	-4.376875
Durbin-Watson stat	2.031932	Schwarz criterion	-4.147432
F-statistic	1145.690	Prob(F-statistic)	0.000000

By including an autoregressive term and re-estimating equation 5, results, as shown in Table 2, indicate that all explanatory variables are significant with proper signs and the regression relationship is strongly significant. There is no serial correlation and the regression equation captures 99 % of the changes in Ln_RM2_t . According to the AIC and SIC, the later regression with AR term is better than the previous one.

As previously mentioned, the stationary residuals of equation 5, with AR term, is an indicator that the above regression represents the long run, cointegration, relationship of the real demand for money. By estimating the residuals from the above regression and using the ADF unit root test, the residuals are stationary as shown in Figure 2.

Figure 2: The residuals of equation 5 with AR term



The second step is to check whether the long run demand for money function is stable or not. Different tests of stability can be used. Specifically, to check the stability of the above long run demand for money function both the Chow breakpoint test and Chow forecast test will be used.

According to the Chow breakpoint test, the entire sample is divided into two or more sub-samples. Equation 5 with AR term is estimated separately for each sub-sample, and we test whether there are significant differences among the residuals of the estimated equations. A significant difference indicates a structural change in the relationship. Two test statistics for the Chow's breakpoint test are used; the F-statistic, based on the comparison between the restricted and unrestricted residuals sum of squares, and the log-likelihood ratio statistic, based on the comparison between the restricted and unrestricted maximum of the log-likelihood function. The test is performed under the null hypothesis that there is no structural change among the sub-samples.

According to the Chow forecast test, two models are estimated, i.e. one uses the full set of data and the other uses the sub-periods. A significant difference between the

residuals of the two models is indicator for a structural change. Two test statistics for Chow's forecast test are used; the F-statistic, based on the comparison between the restricted and unrestricted sum of squared residuals, and the log-likelihood ratio statistic, based on the comparison between the restricted and unrestricted maximum of the log-likelihood function. Both restricted and unrestricted log-likelihoods are obtained by estimating the regression using the whole sample. While the restricted regression uses the original set of regressors, the unrestricted regression adds a dummy variable for each forecast point. The test is performed under the null hypothesis that there is no structural change between the two models.

Using different points to check whether there is a structural change in the long run demand for money function or not, both the Chow breakpoint test and Chow forecast test, as shown in Tables 3 and 4, indicate a structural change¹⁵. Both of these two tests reject the null hypothesis, of no structural change.

Table 3: The Chow breakpoint test of equation 5

Test' points	2001Q1	2003Q1	2005Q2
F-statistic	3.05	4.6	4.66
Prob. F(6,38)	0.015	0.001	0.001
Log likelihood ratio	19.7	27.26	27.57
Prob. Chi-Square(6)	0.003	0.0001	0.0001

Table 4: The Chow forecast test of equation 5

Test' points	2001Q4	2004Q1	2005Q1
F-statistic	2.24	2.18	2.17
Prob. F	0.037	0.034	0.006
Log likelihood ratio	68.65	40.47	37.43
Prob. Chi-Square	0.000	0.000	0.00

4. Robustness

The study investigates the robustness of the estimated results either by estimating equation 5 using real FX rate instead of nominal FX rate or by measuring whether or not the velocity of circulation of money is stable.

¹⁵ These points were chosen to mirror both policy change and institutional change during the period 2001-2005. For instance, during the period 2001-2002 the CBE applied step devaluations of domestic currency, and in 2003 a free float of domestic currency has been announced. In 2005 the CBE has been granted legal instrument independence according to the new law governing the CBE, the banking sector, and money.

4.1 The real FX rate instead of nominal FX rate

The Real FX rate is calculated from IFS, CD-R 2009 according to the following formula;

$$\text{Real FX rate} = \text{FX rate } (\text{£E per USD}) * \text{CPI}^{USA} / \text{CPI}^{EG} \quad (6)$$

Where, CPI^{USA} and CPI^{EG} are the consumer price index in both USA and Egypt, successively. According to (6), the real FX rate reflects the price of a unit of the USA goods in terms of units of the domestic goods. As the real FX rate is positively related with the nominal FX rate, it has a positive sign with the real demand of money. That is, high real FX rate, depreciates the value of domestic goods, and increases the demand for money.

The real FX rate which introduced in the logarithm form is found to be I~ (1). After treating autocorrelation, all variables, with proper signs, are significant except for lagged CPI-inflation rate, as shown in Table 5¹⁶.

By testing its stability at the same points as in Tables 3 and 4, both the Chow breakpoint test and Chow forecast test indicate that the long run demand for money function in Egypt is not stable as shown in Tables 6 and 7.

Table 5: Estimated results of equation 5 using real FX rate

Dependent Variable: LN_RM2				
Method: Least Squares				
Sample (adjusted): 1995Q3 2007Q4				
Included observations: 50 after adjustments				
Convergence achieved after 14 iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.804186	1.450038	1.933870	0.0596
LN_Y	0.765163	0.108866	7.028464	0.0000
LN_REAL_FX	0.383296	0.052175	7.346310	0.0000
R	-0.062404	0.011653	-5.355345	0.0000
EP	-0.006911	0.004621	-1.495453	0.1419
AR(1)	0.440900	0.144676	3.047492	0.0039
Adjusted R-squared	0.989126	Akaike info criterion	-4.129262	
Durbin-Watson stat	2.033241	Schwarz criterion	-3.899819	
F-statistic	892.4667	Prob(F-statistic)	0.000000	

¹⁶ One reason for this is that LN_CPI^{EG} is actually included in the real FX rate.

Table 6: The Chow breakpoint test of equation 5 with real FX rate

Test' points	2001Q1	2003Q1	2005Q2
F-statistic	2.35	8.6	5.12
Prob. F(6,38)	0.049	0.00	0.00
Log likelihood ratio	15.8	42.96	29.6
Prob. Chi-Square(6)	0.014	0.00	0.00

Table 7: The Chow forecast test of equation 5 with real FX rate

Test' points	2001Q4	2004Q1	2005Q1
F-statistic	2.76	2.95	3.24
Prob. F	0.013	0.005	0.003
Log likelihood ratio	76.64	49.44	39.8
Prob. Chi-Square	0.000	0.000	0.00

4.2 The stability of the velocity of circulation of money

The determinants of the velocity of circulation (V), and consequently its stability, are a subject of controversy among economists. According to the quantity theory of money, the price level (p) is determined only by the nominal supply of money (M). The explicit assumption is that real output ($Y = RGDP$) is constant in the long run, whereas the implied assumption is that individuals' expectations about the price level are stable. If individuals' expectations are adaptive, then a previous change in the price level will lead to direct changes in the velocity of circulation (not because of a change in the supply of money, but because of some other exogenous factors).

Consider the simple quantity theory, which yields the ex post relationship given as;

$$M.V = P.Y^{17} \quad (7),$$

If V is found to be stationary, then the variables in the quantity equation are stationary, or are not stationary but cointegrated. By contrast, a nonstationarity of V is an indicator not only that the variables in the quantity equation are nonstationary, but also that the long-run relationship between the nominal supply of money and nominal GDP ($NGDP = P.Y$)

¹⁷ The evolutions of the variables in 7 can be written as follow: $rv = [(1+rp)(1+rq)/(1+rm)] - 1$. Where, rm , rv , rp , and rq are the rates of growth of money, velocity, prices, and real GDP successively. Therefore, the behavior of V depends on the behavior of rp , rq and rm .

has broken down. The relationship between the nominal supply of money and *NGDP* can break down if at least one of the three variables (*P*, *Y*, and *M*) is moving separately from the other two variables (no cointegration relationship). In that case we may also find that the relationship between both *M* and *P*, or *Y*, has broken down¹⁸.

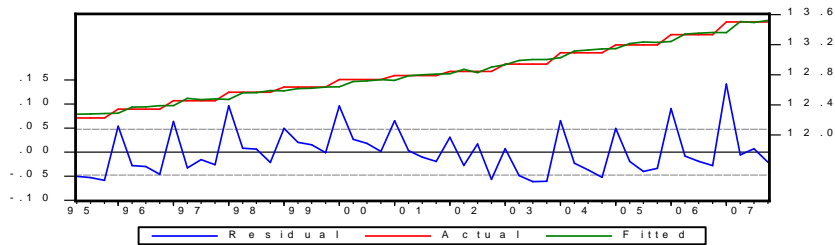
In the light of this, the stability of *V* in the Egyptian economy can be investigated as follows: (i) Test whether or not a long run (cointegration) relationship exists between *NGDP* and nominal *M2*. If such a relationship exists the residuals of *NGDP/M2* have to be stationary. (ii) By testing its stability for structural change we can judge whether or not *V* is stable.

The source of the data for both nominal *M2* and *NGDP* is IFS, CD-R, 2009. A quarterly data about *NGDP* for the periods of 1995Q1-2007Q4 is extrapolated from the annual data using statistical methods included in the E-views 5. Both *M2* and *NGDP* are introduced in the logarithm form.

According to the Johansen cointegration test, the variables, *ln_M2* and *ln_NGDP* are cointegrated (see appendix 2). Thus, the study estimated the following regression:

$$\ln_NGDP_t = \beta_1 + \beta_2 \ln_M2_t \quad (8)$$

Figure 3: The residuals of equation 8 with AR term



The residuals of 8, with AR term, are stationary at 5 % level, as shown in Figure 3. By testing its stability for structural change, both the Chow breakpoint test and Chow forecast test indicate that the long run velocity of circulation of money in Egypt is not stable as shown in Tables 8 and 9.

¹⁸ For empirical analysis of the relationship between money and prices in the context of a mean-reverting velocity of circulation, see: Hollman et al. (1991) and Crowder (1998).

Table 8: The Chow breakpoint test of equation 8

Test' points	2001Q1	2003Q1
F-statistic	3.17	2.55
Prob. F(6,38)	0.03	0.066
Log likelihood ratio	9.7	8.02
Prob. Chi-Square(6)	0.02	0.04

Table 9: The Chow forecast test of equation 8

Test' points	2001Q4	2004Q1
F-statistic	1.9	2.1
Prob. F	0.06	0.03
Log likelihood ratio	57.4	37
Prob. Chi-Square	00	00

5. Conclusions

This paper intends to answer the following question; can the CBE achieve the goal of price stability under the currently applied monetary policy regime? As the CBE is currently applying the monetary targeting regime, the answer depends on whether or not the demand for money function is stable in Egypt. Under a stable demand for money function, the CBE can accurately predict the demand for money and hence control money supply in such a way that achieves the goal of price stability. Conversely, if the demand for money function is not stable, the CBE should move toward adopting IT to achieve price stability, especially after floating the FX rate.

Using quarterly data on the period 1995-2007, the study estimated the long run demand for money function in Egypt. By testing its stability for structural change, both the Chow breakpoint test and Chow forecast test indicated that the long run demand for money function in Egypt is not stable¹⁹.

¹⁹ Empirical studies about the stability of the long run demand for money function in the developing countries are divided. For instance, Al-Sowadi & Darat (2006) found a stable long run demand for money function in Bahrain, Qatar, and United Arab Emirates during the period 1973-2005. Hussain, Zakir, et al (2006) found a stable long run demand for money in Pakistan during the period 1972-2005. Zouhar & Kacemi (2006) found unstable long run demand for money function in Morocco during the period 1982-2005.

For robustness: (i) The study re-estimated the long run demand for money function in Egypt using the real exchange rate rather than the nominal exchange rate. By testing its stability for structural change the results did not include substantial change. (ii) By estimating the long run velocity of circulation of money and testing for structural change, both the Chow breakpoint test and Chow forecast test indicated that the long run velocity of circulation of money in Egypt is not stable.

In the light of this, the study concludes that the CBE cannot achieve price stability under the currently applied monetary targeting regime. As a consequence, the CBE should take steps toward adopting IT.

Appendix 1: The Johansen cointegration test on the variables in the equation 5

Sample: 1995Q1 2007Q4					
Included observations: 49					
Series: LN_RM2 LN_RGDP LN_FXR DR LAGGED_CPIINF					
Lags interval: 1 to 1					
Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	3	1	2	2
Max-Eig	2	2	1	2	2
*Critical values based on MacKinnon-Haug-Michelis (1999)					

Appendix 2: The Johansen cointegration test on the variables in the equation 8

Sample: 1995Q1 2007Q4					
Included observations: 50					
Series: LN_NGDP LN_NM2					
Lags interval: 1 to 1					
Selected (0.05 level*) Number of Cointegrating Relations by Model					
Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	1	2	0	0
Max-Eig	1	1	0	0	0
*Critical values based on MacKinnon-Haug-Michelis (1999)					

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III. Towards Measurement of Political Pressure on Central Banks: The Case of the Central Bank of Egypt

Abstract

This paper assesses whether the legal independence granted to the Central Bank of Egypt (CBE) under the latest legislation promulgated in 2005 is factual. I followed Fry's methodology, which assumes that the level of independence of the central bank is determined by fiscal attributes. In an attempt to develop Fry's method, I used a simple criterion to assess the central bank's independence, namely, that the central bank is factually independent if it can fulfill its target without squeezing private sector. Applying this criterion to the case of the CBE, we find that: the legal independence granted to the CBE under the latest legislation is not factual.

Keywords: central bank independence; fiscal dominance; political pressure

JEL: E51, E59, H75, C23

1. Introduction

With the problem of higher inflation facing the industrialized economies during the 1970s and early 1980s, one important argument pointed to an inherent inflation bias in discretionary monetary policy. Under rational expectations an expansionary monetary policy will not affect real output, but average inflation will be higher. This explanation raises the question 'Why might central banks prefer economic expansions or have output goals that exceed the natural rate of output?' Economists frequently point to political pressures on the Central Bank (CB). Numerous studies have tried to measure politicians' influence on monetary policymakers. The fundamental assumption of these studies is that the CB is more concerned than the elected government with maintaining low and stable rates of inflation. Consequently, if the CB became less subject to political pressure it would be able to deliver lower rates of inflation.

One branch of these studies has tried to measure Central Bank Independence (CBI) by constructing indices for CBI derived from CBs' charters and estimating the relationship between such indices and the rate of inflation. The major defect of these studies is that legal indices may not reflect the relationship between governments and CBs that exists in reality. In countries with a lower degree of democracy and where the rule of law is less strongly embedded in the political culture, as in most developing countries, there can be a wide gap between the formal legal institutional arrangements and the actual practice. Thus, for developing countries, these CBI indices may not be accurate, because legal independence does not mean actual independence.

“Actual independence is impossible to quantify” (Cukierman, 1992, p. 273). Another branch of these studies did not take Cukierman's advice and tried to measure the actual independence of CBs using some indicators of political pressure. The central tenet of this approach is that political pressure on the CB will arise even if the CB is legally independent. Politicians always try to influence the CB to adopt policies compatible with their preferences. The degree of responsiveness of the CB to such political pressure depends on the extent to which the CB is actually independent. Then, by constructing an indicator of political pressure on the CB, we can measure the degree of responsiveness of the CB to such political pressure and consequently judge whether CB independence is *de facto* (factual) or just *de jure*. The major defects of these studies are that the channels through which political pressure might work are not clear and the reaction of the CB to fiscal policy is ambiguous.

Furthermore, some studies give more attention to CBI in the developing countries, relying on the fiscal dominance hypothesis. In the developing countries the fiscal situation will constrain if not dictate the CB's activities and therefore determine the extent of CBI. Fry (1998) tried to measure actual CB independence by estimating the reaction of the CB to the government's demands to increase credit. In fact, domestic credit to the government is a crossing point between the CB and the government. Consequently, the reaction of the CB to such demands (pressure) represents a linkage between political pressure on the CB and the actual independence of the CB.

In this paper I followed Fry's methodology for assessing the legal independence of CBs. I tried to develop Fry's method using a new criterion to assess the legal independence of the Central Bank of Egypt (CBE), namely, that the CB is actually independent if it can fulfill its target without squeezing private sector.

I organized this paper as follows: section 2 presents previous studies of CBI and political pressure on CBs. Section 3 assesses the previous studies. Section 4 focuses on Fry's methodology. Section 5 focuses on our attempt to develop Fry's method. Section 6 assesses the legal independence granted to the CBE under the latest legislation. Section 7 concludes.

2. Previous studies of CB independence and political pressure on CBs

Greater attention has been focused on the relationship between monetary policymakers and politicians. In the literature there are two broad approaches to measuring this relationship. The first consists of studies based on legal attributes and therefore addressing the legal independence of CBs. The second involves studies based on non-legal attributes and therefore addressing political pressure on CBs. Besides these two approaches, there is another branch of studies which addresses the actual independence of CBs based on the fiscal dominance hypothesis. In this part I will briefly present each of these approaches.

2.1 Previous studies of the legal independence of CBs²⁰

The theoretical basis of these studies depends on the notion that CBs in democratic countries are more concerned with maintaining low and stable rates of inflation than the elected government. If a CB becomes free of political pressure it will be able to deliver stable and low rates of inflation. In the theoretical models, CBI is introduced by means of the weight placed on inflation objectives in the loss function. The CB will be more independent if such weight in the loss function exceeds that of the government. The CB in this case is described as a Rogoff-conservative CB.

To measure how independent a CB is, empirical studies have constructed CBI indices based on the CB's legal characteristics. To investigate the relationship between

²⁰ For more details and other subsequent empirical studies, see Arnone et al. (2006a).

CBI and the inflation rate, empirical studies (Eijffinger and Keulen, 1995, p. 57) have used this equation:

$$\text{Average monthly inflation } (\pi) = \alpha_0 + \alpha_1 (\text{CBI}) + \alpha_2 \text{ (1)}$$

Using legal indices for CBI, many studies try to prove the theoretical assumption that higher levels of CBI, as detected by legal indices, will lead to lower rates of inflation. These studies have also used panel data about developing and developed countries to find such a negative correlation/relationship between CBI and the rate of inflation. Finding such a relationship is important to judge whether the legal independence of the CB is factual (de facto) or just formal (de jure).

Bade and Parkin (1977) presented the first empirical study of CBI using an index based on legal attributes. The study comprises twelve industrial countries during the period 1951–1975. They measured the independence of the CB according to the following criteria: (i) the primary objective of the CB according to the law; (ii) the degree of government influence over CB policy (the government’s ability to appoint the members of the board of directors, government representation in the board of directors, and which authority controls monetary policy).

Alesina (1988, 1989) includes monetary financing rules, thus enlarging Bade and Parkin’s index of policy independence to include the following criterion: the obligation of the CB to buy short-term treasury papers, as the monetary financing obligation can seriously harm CBI with respect to monetary policy making. Alesina (1988) examines how the degree of CB autonomy affects the magnitude of political influence over the economy and monetary policy. An independent CB is able to reduce fluctuations in monetary policy brought about by the election cycle.

Grilli, Masciandaro, and Tabellini (1991) built a two-part legal index for CBI. The authors defined “political autonomy” as the ability of the CB to select the final objectives of monetary policy, and defined “economic autonomy” as the ability of the CB to select monetary policy instruments. They constructed an index from eight criteria for each part,

and assigned one point for each criterion if it is satisfied²¹. The overall index, the total sum of the points of the two-part index, is a measurement of CBI.

Cukierman (1992) constructs three indices of CBI. The first index (LVAU-LVAW) contains 16 indicators grouped under four main headings; a heading about the chief executive officer (CEO), a heading about policy formulation (PF), a heading about the objectives of the central bank (OBJ), and a heading about the limitations on the CB for lending to the government (LL). The second index, the turnover rate of the CB's governor (TOR), is based on the assumption that the higher is the TOR the lower is the CB's autonomy. The third index (QVAU-QVAW) is constructed on the basis of responses given to a questionnaire exploring various aspects of the CB's autonomy by focusing not only on the legal aspects, but also on the instruments used by the CB.

Alesina and Summers (1993) constructed another CBI index using the average of Bade and Parkin, expanded by Alesina (1988, 1989) and GMT (1991).

Describing policy independence, like GMT, as the capacity of the CB to choose the final objectives of monetary policy, Eijffinger and Schaling (1993) constructed another legal index for CBI. It comprised the formal responsibility of the CB with regard to monetary policy, the relationship between the CB and the government/parliament in the formulation of monetary policy, and the procedures for the appointment of the board of directors.

Arnone et al. (2006b) presented an update of the GMT index based on the CB legislation as of the end of 2003. The index comprised a set of developing countries, emerging market economics, and OECD countries. The authors presented a reconstruction of the GMT index based on Cukierman (1992) for a smaller set of countries, and evaluated the changes in CB autonomy between 1992 and 2003. Their results point to a significant increase in CB autonomy particularly for developing countries. Improvements in CB autonomy had, in most cases, involved a three-stage process: an initial stage in which the political foundations for CB autonomy were laid, a

²¹ Grilli, Masciandaro, and Tabellini (GMT) (1991) define CB independence as autonomy in setting objectives and autonomy in setting instruments. But the most common terminology for defining CBI is due to DeBelle and Fisher (1994), who defined CBI as "goal independence" and "instrument independence."

stage in which operational autonomy developed, and further political autonomy in terms of policy formulation and the appointment of senior management.

Since the legal indices of CBI may not reflect the real relationship that exists in practice between the government and the CB, another methodology (see Mahadeva and Sterne, 2000) tried to avoid this limitation by asking central bankers directly, using two methods. The first method interprets responses to the general subjective question, ‘How would you define CBI?’ then uses the answers to construct an index of self-assessment of CBI. The second method involves asking central bankers, ‘How independent are your own institutions?’ The answer to this question depends on the answers to a number of objective indicators. Using probit regression, the study attempts to explain which objective indicators of CBI explain the subjective self-assessment. One of the important results of this study is that self-assessment of CBI is strongly associated with both the degree of instrument independence measured and the absence of a deficit finance obligation. Also, the results for developing countries are similar to those of the entire sample. The absence of a deficit finance obligation and instrument independence explain the self-assessment variable. Considering the study group together with developing and transitional economies, the results show that the deficit finance limits have the most important influence on the perception of CB independence.

2.2 Previous studies of political pressure on CBs

The analysis of political pressure under this approach has been established on the background of the political business cycle. Drazen (2002) argues that reconsidering the pre-electoral political monetary cycle as an explanation for political pressure on the CB is important for the following reasons: (i) there may be indirect effects of the electoral cycle on monetary policy; (ii) in countries with independent central banks, pre-electoral monetary cycles are noticeable, with money growth rates rising before elections and the inflation rate rising after elections; (iii) using policy tools other than monetary policy to influence election outcomes may have a significant effect on monetary policy. The nature of this effect depends on the interaction between the CB and politicians.

Drazen presented a theoretical model for political pressure on the CB. Since accommodating monetary policy is worth more to politicians in election years than in

non-election years, the amount of pressure differs over the electoral cycle. This induces an electoral cycle in monetary policy even though the CB is independent and has no electoral motive per se. In equilibrium, the monetary authority accommodates the politicians' desired policies in electoral years, but generally it is free of political influence in non-election years. An electoral cycle in fiscal policy may intensify the political monetary cycle, while an electoral structure that allows the government to call early elections may lessen it.

Empirical studies have tried to construct an indicator for political pressure on CBs. From the point of view of these studies, political pressure on CBs will occur even if the CB is legally independent, as politicians always try to influence the CB to adopt policies compatible with their preferences. But the degree of responsiveness of the CB to such political pressure depends on the extent to which the CB is actually independent. With a higher degree of CBI, such influence will arise only in indirect ways. So, by constructing an indicator for political pressure on the CB we can measure the degree of responsiveness of the CB to such political pressure, and consequently judge whether the independence of the CB is de facto or just de jure.

Havrilesky (1993) constructed an index for political pressure on CBs. This index was based on the number of newspaper reports in which politicians revealed their preferences about a more or less restrictive monetary policy. Any article calling for a monetary easing was assigned the value +1, while any article calling for monetary tightness was assigned the value -1. The final index, as an indicator of the net political pressure, is the net summation of the negatives and positives. Havrilesky applied his study to the Federal Reserve by counting the number of reports in the Wall Street Journal of politicians arguing in favor of more or less restrictive monetary policy. He found that the Federal Reserve's policies responded to this index.

Maier et al. (2002) applied Havrilesky's approach to the Deutsche Bundesbank after extending the analysis to include the pressure arising from other interest groups and analyzing press reports in different newspapers. They concluded that the Bundesbank did not respond to political pressure and its policies were in line with the wishes of the banking sector.

Using the extended version of Havrilesky's approach (1993) by Maier (2002), Gersl (2006) tried to measure and explain the political pressure on the Czech National Bank (CNB). He concluded that the CNB faced considerable political pressure toward a monetary easing in the period 1997–2005, comparable with the pressure on the Federal Reserve and slightly higher than the pressure on the Deutsche Bundesbank. However, the CNB did not succumb to such pressure. Therefore, political pressure did not have any systematic impact on the direction of monetary policy. Hence the legal independence of the CNB was proved to be factual as well.

2.3 Previous studies of the actual independence of CBs based on the fiscal dominance hypothesis

This approach gives more attention to CBs in developing countries, relying on the fiscal dominance hypothesis. In developing countries the fiscal situation will constrain, if not dictate, the CB's activities and therefore determine the extent of the CB's independence. To assess how independent a CB is, Fry (1998) used a simple measure based on an action that all CBs can take: reaction to increased credit demands by the government. Using the change in domestic credit as a proxy for monetary policy, he constructed a monetary policy reaction function. His hypothesis states that the extent of neutralization depends on both the size of the government deficit and the methods by which it is financed. Since governments can finance their deficit in four ways (borrowing at zero cost from the CB, borrowing from domestic commercial banks at below-market interest rates, borrowing abroad in foreign currency, and borrowing at market interest rates from the voluntary domestic private sector), the CB will be less independent if the government deficit is higher and the government uses the first two methods to finance its deficit.

Fry measured the degree of CB independence by the value of the neutralization coefficient, that is, the reaction of the CB to the government's demand for more credit to finance the budget deficit. Since domestic credit plus net foreign assets constitute the assets backing the monetary stock, an increase in net foreign assets must be offset by a decrease in domestic credit to prevent any change in the money stock or to make the CB able to fulfill its money supply target. To examine whether CBs in developing countries

are independent, Fry estimated the neutralization coefficient for a variety of developing countries. His result was that a larger deficit and greater government reliance on the domestic banking system are associated with less neutralization, and consequently less CBI.

3. Assessment of previous studies

The general conclusion found in the literature pertaining to the empirical studies of legal CBI can be summarized as follows (Ferreira de Mendonca, 2005, and Arnone et al., 2006): (i) among industrial economies there is a strong negative correlation between de jure CBI and inflation; (ii) in developing countries there is no evident relationship between legal CBI and inflation; (iii) there is a positive correlation between the political vulnerability of the CB and the variation of inflation; (iv) countries in which the monetary authorities announced their goals for inflation presented lower rates of inflation; (v) legal CBI is not correlated with the average real growth rate; (vi) CBs with a higher degree of independence do not finance deficits.

One of the main defects of the legal indices for CBI is that the concept of independence differs across such indices, even though they deal with the same thing. In other words, there is no homogeneous concept of CBI across the legal indices. Ferreira de Mendonca (2005) examines this point using a correlation analysis for the three indices frequently used in empirical studies of CBI (Alesina and Summers, Cukierman, and GMT). Focusing on 15 industrialized countries and performing the analysis for independence indices and independence rankings, the finding was that there is no relationship between these measures of independence after the most independent countries (Germany, Switzerland, and United States) are omitted from the analysis.

Another defect of the legal indices is that they may not reflect the relationship between the government and the CB that exists in practice. In countries with a lower degree of democracy and where the rule of law is less strongly embedded in the political culture (as in most developing countries), there can be a wide gap between the formal legal institutional arrangements and the actual practice. Thus, for developing countries these CBI indices may not be accurate.

Economists have pointed out other defects in the empirical studies based on the legal indices of CBI (Walsh, 1998, pp. 379–381, and Arnone et al., 2006). (i) Average inflation and the degree of CBI might be jointly determined by the strength of the political constituencies opposed to inflation. In the absence of these constituencies, increasing CBI will not affect inflation. This means that even if the CB is independent, higher political pressure with no equivalent opposite directions may result in inflation. (ii) Another problem with the estimations of the equation 1 is that it fails to correct for country-specific factors that may affect inflation and may also be correlated with the indices of CBI. Correcting for potential bias requires the inclusion of other determinants of inflation in the above equation. (iii) Most economists cast doubt on the relationship between CBI and average inflation. A complete understanding of this relationship requires a better understanding of the factors that have led to the variations in CBI across countries. The best way to understand such differences is to estimate the equation 1 directly for one-country rather than cross-section comparisons. However, this task is not easy. (iv) While CBI raises the issue of subjecting the CB to democratic control, the linkage between CBI and CB accountability is not clear in most of these studies.

Moreover, the political pressure approach is also criticized. Besides the other flaws of Havrilesky's approach (see Gersl, 2006, p. 4) the major defects are as follows. (i) The channels through which political pressure might work are not clear. (ii) The reaction of the CB to fiscal policy is ambiguous. (iii) Without complete coordination between fiscal policy and monetary policy, the CB may be coerced to conduct monetary policy in favor of politicians' interests. Such coordination between monetary and fiscal policy reflects the government's desire, side by side with the CB, to curb inflation. This point is also not clear in this literature.

Some important lessons from the previous studies are as follows. (i) Political pressure on CBs may occur with any degree of CBI. (ii) The degree of inflation resulting from political pressure on CBs depends on whether CBI is factual or only formal. (iii) Since the degree of resulting inflation is the product of the interaction between the political pressure on the CB for a monetary easing and a higher or lower degree of responsiveness of the CB, then we can assess the degree of CBI by the ability of the CB to fulfill its money supply target in the face of political pressure. (iv) One of the crossing

points between fiscal policy and monetary policy, and consequently between the government and the CB, is “domestic credit to the government.” On the one hand, this is one of the sources of political pressure on the CB. On the other hand, it constitutes an essential part of the assets backing the money supply, and so it is important for monetary policy to keep it under control.

The fiscal dominance hypothesis, discussed by Fry, represents a step in that direction. The reaction of the CB to the government’s demands to increase credit represents a linkage between political pressure on the CB and CBI. Such a reaction measures to what extent the CB is actually independent, especially in developing countries. Since CBs in the developed countries may or may not be asked to provide credit to central government, this measure (the reaction of the CB to the government’s demand for higher credit) can be developed into a comprehensive indicator of the actual independence of CBs. In the following two sections I will present Fry’s methodology in more detail and then develop it to serve my purposes.

4. Fry’s methodology

Fry began with this equation:

$$DDCY = f(DNFAY, X_i) \quad (2)$$

Where DDCY represents the change in domestic credit scaled by GDP, DNFAY represents the change in net foreign assets scaled by GDP, and X_i represents the other explanatory variables other than DNFAY (the gap between domestic inflation and inflation in the industrialized economies, the gap between actual and potential output, economic growth...). Complete sterilization of net foreign assets on the supply of money, i.e. M2, implies a coefficient of DNFAY equal to -1 . Since domestic credit equals domestic credit to the government (DCG) plus domestic credit to the private sector (DCP), the above equation might be written as follows:

$$DDCPY = f(DNFAY, X_i) - DDCGY \quad (3)$$

Where DDCPY is the change in domestic credit to the private sector scaled by GDP, and DDCGY is the change in domestic credit to the government scaled by GDP. The last equation represents the monetary policy reaction function that Fry used to estimate the

neutralization coefficient. Complete neutralization of the government's extra borrowing requirements implies a coefficient of -1 for DDCGY. Partial neutralization will produce a coefficient less than zero and higher than -1 , and no neutralization entails a coefficient of zero. Complete neutralization represents the highest level of CBI, while zero neutralization represents, in fact, complete subordination of the CB to the government. Fry argues that,

'a central bank that says to the government "we cannot resist your financing demands, but we shall neutralize them by squeezing the private sector and we shall tell the private sector exactly why we have to squeeze credit" is surely acting more independently than one that simply lets domestic credit rise by the full extent of any extra government borrowing from the banking system.'

Fry used a system of simultaneous equations. He treated the variable change in domestic credit to the government (DDCGY) as exogenous, and the variables the inflation gap (INFGAP) and the change in net foreign assets (DNFAY) as endogenous. He used 3SLS. The instruments are: lagged DNFAY, lagged INFGAP, and lagged money and growth rates, the rate of change in oil prices, the OECD growth rate, and the world interest rate. The estimated monetary policy reaction function was as follows:

$$DDCPY = b_1DNFAY + b_2DNFAY_{t-1} + b_3DDCGY + b_4DDCGY_{t-1} + b_5INFGAP + b_6L.DNFAY + b_7L.DNFAY_{t-1} + b_8L.DDCGY + b_9L.DDCGY_{t-1} + b_{10}L.INFGAP \quad (4)$$

Where, L is a dummy variable taking a value of zero for countries in the high group and one for countries in the low group, i.e. the countries scoring low values upon a particular discriminating variable²².

Fry's method does have some defects. (i) Although the variable DDCGY is treated as exogenous the instruments used for the endogenous variables may affect it. For example, an increase in the inflation rate may increase DDCG. But Fry argues that the effect of the inflation rate on DDCG may be offset by an opposite effect on the economic

²² Fry collected data on 70 developing countries over the period 1972-1995. To select the countries for each estimate, he first ranked them on the basis of various discriminating variables. For most tests, he selected the ten countries with the highest average values of the discriminating variable and the ten countries with the lowest average values of this variable. Finally, he estimated a system of 20 monetary policy reaction functions with appropriate cross-equation restrictions.

growth rate, as economic growth tends to reduce the government's borrowing requirements. (ii) Even if we assumed that the opposite effects of these two variables are equal, the increase in the budget deficit may shift the whole equation if the CB sought to finance it by issuing new money. If this happened (as is the case in the majority of developing countries) overall domestic credit would increase. In such case we may find a positive relationship between DDCPY and DDCGY. Fry's equation does not consider the case that the coefficient of DDCPY/DDCGY might be positive.

5. Developing Fry's methodology

In spite of these limitations in Fry's methodology, the idea is valuable. We may develop it to derive a comprehensive indicator of factual CB independence. The main defect of Fry's methodology is conceptual because it does not make difference between efficiency and independence. If the CB cannot say "no" to the government's demands for higher credit especially when such demands will negatively affect the target which the CB is willing to meet then the CB is not factually independent. But the CB is efficient if it can fulfill its target, despite disability to resist the government's demands for higher credit.

The government's credit requirement is a channel for political pressure on the CB. An increasing public debt and budget deficit lead to increasing government demand for credit. Consequently, political pressure on CB will also increase. Without a budget deficit, the government's credit requirements would vanish and the political pressure on the CB might vanish too. The high contribution of the CB in financing budget deficit indicates that the CB is not factually independent but the CB will be efficient if it can neutralize them. "Neutralizing" means that the CB will not miss its target. If, for instance, the CB applies a sterilized intervention policy (SIP) in which the CB is targeting both money supply and FX rate (FXT) then to fulfill its target, the CB has to neutralize/sterilize changes in DCG (because of financing budget deficit)/NFA on the money supply. By doing so the CB is efficient. Nevertheless, the CB is not factually independent if maintaining its target leads to a discrimination against the private sector in favor the government. Such a discrimination against the private sector occurs if the CB is coerced to finance budget deficit. Thus, the criterion for both efficiency and factual

independence of CB is the ability of CB to fulfill its target without squeezing the private sector.

We assume that: (i) the CB will take an appropriate action to maintain its target; (ii) The CB follows either SIP or FXT. Under these assumptions, the study assesses both efficiency and independence of CB by linking the CB's actions to the influence on both DCG and DCP as indicated by the equation 5²³.

$$DCP = \beta_1 + \beta_2 NFA + \beta_3 DCG \quad (5)^{24}$$

By estimating 5, we can assess both efficiency and independence of CB upon the sign of the coefficients β_2 and β_3 . Where, the sign of the coefficient β_2 indicates efficiency and the sign of the coefficient β_3 indicates independence (i.e. being factual or not factual), as shown in Table 1²⁵.

Table 1: possibilities of the equation 5

possibilities	SIP			FXT		
	Efficient	CBI		Efficient	CBI	
		Factual	Not Factual		Factual	Not Factual
β_2	<i>Negative</i>			<i>Positive</i>		
β_3		<i>Positive</i>	<i>Negative</i>		<i>Positive</i>	<i>Negative</i>

The sign of the coefficient β_2 indicates efficiency because it measures the reaction of the CB to maintain its target. Such a reaction includes a change in M0 thereby total DCG and DCP is changed. Under SIT, the sign of β_2 is negative because the CB sterilizes changes in NFA (inside the CB balance-sheet) on the money supply by decreasing total

²³ To achieve its target, the CB moves M0 (either the NFA or the government bonds inside the CB balance-sheet), which represents the monetary base or the high-powered money. By moving M0, the monetary supply (e.g. M2) is changed by M0 multiple by the monetary multiplier.

²⁴ Because the equation 5 represents a linkage between the CB's actions and the influence on both DCG and DCP (see also Figures 1 and 2, Appendix 1) the NFA should be extracted from the CB balance-sheet, whereas both DCG and DCP should be extracted from the broad money supply, in which DCG includes both DCG inside the CB balance-sheet and DCG inside the commercial banks balance-sheet. Despite the use of the NFA included in the broad money supply (which includes the NFA inside the CB balance-sheet and the NFA inside the commercial banks balance-sheet) can detect the direction of the relationship depicted by the equation 5, the coefficient β_2 may not be significant in such a case.

²⁵ Practically, we do not have assurance about the monetary policy regime which is factually applied by the CB, because what has been stated does not necessarily be the case in the reality. Nevertheless, under the assumption that the CB will take an appropriate action to maintain its target, the sign of the coefficient β_2 can be used to detect the monetary policy regime which is factually applied by the CB.

domestic credit. Under FXT, the sign of β_2 is positive because a change in NFA does not require a compensatory action by the CB to sterilize the effect on the money supply.

The sign of the coefficient β_3 indicates independence of CB because it measures the impact of the action taken by the CB on both DCG and DCP. If such an impact is symmetric for both private sector and government, i.e. there is no discrimination in such a case, the two variables (DCP and DCG) will move in the same direction, thus the sign will be positive and so the CB is factually independent. On the contrary, if the two variables are moving in opposite directions (DCG is increasing in the whole economy and as a result DCP is decreasing), the sign will be negative, thus the CB independence is not factual, i.e. the action taken by the CB comes at the expense of the private sector in favor of the government (see appendix 1 for details).

The limitation in this method, however, is that it does not fit the case in which the CB follows the inflation targeting (IT) regime. There are many reasons for this. (i) Under IT the CB is supposed to be uninvolved in financing budget deficit. (ii) Under IT, the CB will take an action to achieve the target but it is not necessarily to hit it during the short run either because of the monetary policy lags or because of the supply shocks. As a result, this method is not appropriate for assessing the efficiency of the CB under IT. (iii) Under IT the CB manages monetary policy on forward-looking bases whereas this method addresses the case in which the CB takes actions upon the past changes in money supply and FX rate.

6. Assessing the legal independence of the Central Bank of Egypt (CBE)

6.1 The legal relationship between the government and the CBE

At the beginning of the 1990s, Egypt – acting in agreement with the IMF and WB – implemented an “Economic Reform and Structural Adjustment Program” (ERSAP). The purpose was to reform the country’s macroeconomic policies and increase the role of the private sector in the economy. Under the ERSAP, Egypt liberalized its interest rate in 1991 and applied an active privatization program starting from this date. During this period the CBE was targeting the exchange rate. In January 2003, Egypt floated its exchange rate. The CBE changed its policy from exchange rate targeting to monetary growth targeting as an intermediate objective for monetary policy. New legislation was

promulgated. Law No. 88 of 2003, as amended by Law No. 162 of 2004 and Law No. 93 of 2005, is a comprehensive law governing the CB, the banking sector, and money²⁶.

Under the current new legislation, the final objective of monetary policy is to achieve price stability. The CBE acts as a financial advisor and agent for the government. Consequently, the CBE executes banking transactions pertaining to the government and public legal persons, as well as internal and external finance, with banks according to the conditions set by the BoD. The BoD consists of fourteen members including; two deputy governors, the chairman of capital market authority, three members representing the ministries of finance, planning and foreign trade and eight experts in monetary, financial, banking, legal and economic affairs designated by the president of the republic for a renewable term of four years. The CBE extends financing to the government, upon its request, to cover the seasonal deficit on the general budget, provided that the amount of such finance does not exceed 10% of the average revenues of the general budget in the three previous years. The term of such finance is three months renewable for other similar periods, with a maximum of twelve months. The conditions concerning this finance are determined upon agreement between the ministry of finance and the ECB²⁷.

6.2 The methodology and the data

The main objective is to assess whether the legal independence granted to the CBE under the latest legislation promulgated in 2005 is factual. As mentioned, the CBE, formally, applied two different monetary policy regimes during the period 1991-2007. Before 2003 the applied monetary policy regime was “the exchange rate targeting regime”. In the beginning of 2003 the CBE liberalized the exchange rate and switched to the monetary targeting regime. To achieve our purpose, the equation 5 will be estimated for the period 1991-2007 and test whether the latest legislation involved significant change on the CBE independence.

²⁶ Article 1 of this Law repeals the following former laws: (i) the banks and credit law promulgated by Law No. 163 of 1957, (ii) Law No. 120 of 1975 concerning the central bank of Egypt and the banking sector, (iii) Law No. 205 of 1990 concerning the secrecy of bank accounts, (iv) Law No. 38 of 1994 regulating dealing in foreign exchange, and (v) Law No. 155 of 1998 regulating the private sector’s contribution to the capital of public sector banks. See: www.cbe.org.eg/.

²⁷ Articles 26–27.

The study uses quarterly data from the IFS, CD-R 2008. The data about the variables in the equation 5 is extracted from the assets backing money supply, i.e. M2. Because the quarterly data of GDP are not available for Egypt, the variables in the equation 5 are used in the level-form.

6.3 Estimation results

The unit root test revealed that the variables in the equation 5 are not stationary during the period 1991Q1-2007Q1. According to AIC (20 lags) the first difference of the logarithmic value of the variables DCP and NFA are stationary. Whereas the first difference of the DCG is stationary at level 5 %, but according to SIC (20 lags) it is stationary at level 1%.

In the light of this, the equation 5 can be estimated from the following form, where all the variables are stationary;

$$\ln DCP = \beta_1 + \beta_2 \ln NFA + \beta_3 DCG \quad (6)$$

Table 2: Estimation results of the equation 6

Dependent Variable: DIF_LN_DCP				
Sample (adjusted): 1991Q2 2007Q1				
Included observations: 64 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.047747	0.004046	11.80229	0.0000
DIF_LN_NFA	-0.055529	0.014781	-3.756837	0.0004
DIF_DCG	-1.75E-06	6.39E-07	-2.743002	0.0080
Adjusted R-squared	0.212529	Akaike info criterion		-4.363801
Schwarz criterion	-4.262603	F-statistic		9.501464
Durbin-Watson stat	1.624221	Prob(F-statistic)		0.000256

Table 2 shows the estimation results of the equation 6. As these results suggest, the statistical value of Durbin-Watson is undetermined. The LM test revealed that the regression in the table 1 includes positive serial autocorrelation. Using the value $[1 - (D-W)/2 = 0.19]$ as approximation for the autocorrelation coefficient, I transformed the equation 6 to the following form;

$$\ln DCPW = \beta_{11} + \beta_{21} \ln NFAW + \beta_{31} DCGW \quad (7)$$

Where, $\text{Ln DCPW} = \text{Ln DCP} - 0.19 (\text{lag Ln DCP})$, $\text{Ln NFAW} = \text{Ln NFA} - 0.19 (\text{lag Ln NFA})$, and $\text{DCGW} = \text{DCG} - 0.19 (\text{lag DCG})$.

Table 3 shows the estimation results of the equation 7. According to the statistical value of Durbin-Watson there is no serial autocorrelation. The estimated parameters and regression relationship are significant. According to the unite root test and the ACF the residuals from the equation 7 are stationary.

Table 3: Estimation results of the of the equation 7

Dependent Variable: DIF_LN_DCPW				
Sample (adjusted): 1991Q3 2007Q1				
Included observations: 63 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.038430	0.003886	9.888195	0.0000
DIF_LN_NFAW	-0.073245	0.031604	-2.317572	0.0240
DIF_DCGW	-1.39E-06	6.57E-07	-2.121778	0.0381
Adjusted R-squared	0.114092	F-statistic		4.927960
Durbin-Watson stat	1.872994	Prob(F-statistic)		0.010492
Schwarz criterion	-4.305573	Akaike info criterion		-4.408499

In the light of the descriptive analysis of the study in section 5, the negative sign of the coefficients β_2 and β_3 as shown in Table 3 indicates that the CBE applies SIT, i.e. the CBE maintains an implicit target for the FX rate. In addition, the CBE is not factually independent.

As the Egyptian government claims that the latest legislation gives the CBE higher level of independence, I used the Chow test to explore whether there is significant change after the latest legislation, 2005. The Chow test did not detect any significant change of the CBE independence after the new legislation promulgated in 2005.

6.4 Robustness

For robustness, the study estimated the equation 5 using monthly data (IFS, CD-R 2009) on the period 2001M12-2009M6. The variables DCP and DCG are calculated from the assets backing M2, and the variable NFA is calculated either from the assets backing M0 or from the assets backing M2. According to the unit root tests, all variables are found stationary after taking the first difference of the logarithmic value. In the case of the NFA is calculated from M0, results are significant at 5 % level as shown in Table 4,

whereas results are significant at 10 % level in the case of the NFA is calculated from M2 as shown in Table 5. In both, the results assert the above conclusions of the study, where the CBE is not factually independent and the CBE applies the SIP.

Table 4: Estimation results when the NFA is extracted from M0

Dependent Variable: DIF_LN_DCP_BS				
Method: Least Squares				
Sample (adjusted): 2002M01 2009M06				
Included observations: 90 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009579	0.001269	7.547311	0.0000
DIF_LN_NFA_CB	-0.036220	0.008774	-4.128321	0.0001
DIF_LN_DCG_BS	-0.106183	0.031240	-3.398959	0.0010
Adjusted R-squared	0.171103	F-statistic		10.18582
Durbin-Watson stat	1.941339	Prob(F-statistic)		0.000106
Akaike info criterion	-6.144332	Schwarz criterion		-6.061005

Table 5: Estimation results when the NFA is extracted from M2

Dependent Variable: DIF_LN_DCP_BS				
Method: Least Squares				
Sample (adjusted): 2002M01 2009M06				
Included observations: 90 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DIF_LN_NFA_BS	-0.043333	0.025807	-1.679151	0.0967
DIF_LN_DCG_BS	-0.082895	0.035702	-2.321888	0.0226
C	0.009494	0.001596	5.950479	0.0000
Adjusted R-squared	0.039842	F-statistic		2.846551
Durbin-Watson stat	2.045234	Prob(F-statistic)		0.063464
Schwarz criterion	-5.914003	Akaike info criterion		-5.997330

7. Conclusion

To assess whether the legal independence granted to the Central Bank of Egypt, (CBE) under the latest legislation is factual, I followed Fry's methodology, which assumes that the level of independence of the central bank is determined by fiscal

attributes. In an attempt to develop Fry's method, I used a simple criterion to assess the central bank's independence, namely, that the central bank is factually independent if it can fulfill its target without squeezing private sector.

Under the assumptions that the CB will take an appropriate action to maintain its target and the CB applies either the sterilized intervention policy or the FX targeting, the study assesses both efficiency and independence of CB by linking the CB's actions to the influence on both DCG and DCP. In other words, the study assesses both efficiency and independence of CB upon the sign of the coefficients β_2 and β_3 included in the equation 5. Where, the sign of the coefficient β_2 indicates efficiency, and the sign of the coefficient β_3 indicates independence.

Applying this criterion to the case of the CBE, the study estimated the equation 5 using quarterly data on the period 1991Q1-2007Q1. The results of the study are as follow: (i) the legal independence granted to the CBE under the latest legislation is not factual. (ii) The Chow test did not detect any significant change of the CBE independence after the latest legislation. (iii) The CBE is factually applying the sterilized intervention policy.

For robustness, the study re-estimated the equation 5 using monthly data on the period 2001M12-2009M6. The estimation has been run under calculating the NFA either from M0 or from M2. In both, the results assert the above conclusions of the study, where the CBE is not factually independent and the CBE applies the sterilized intervention policy.

Appendix 1: Assessing the efficiency and factual independence of CB

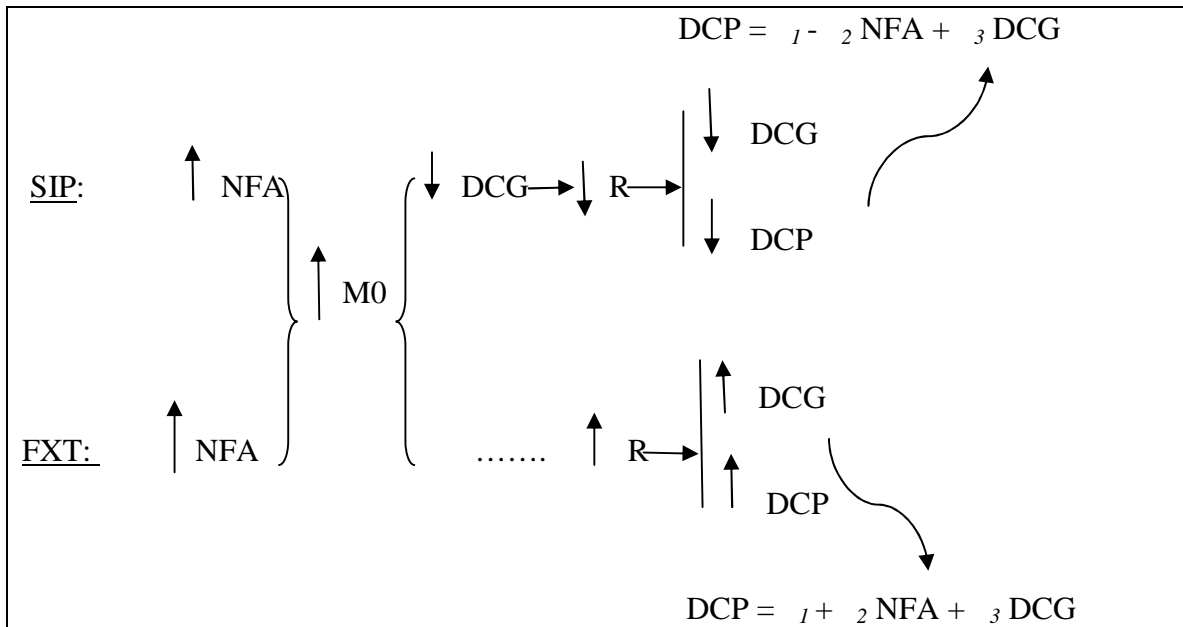
1. The increase of NFA

Figure 1 depicts the behavior of NFA, DCP, and DCG in the case of the increase of NFA, under both the sterilized intervention policy (SIP) and the FX rate targeting (FXT).

1.1 Under the SIP

Assume that the CB has intervened in the FX market because of a depreciation of the foreign currency in the domestic market (i.e. an appreciation of the domestic currency) and so the NFA in the CB balance-sheet (M0) is increased thereby M2 became higher.

Figure 1: The increase of NFA under the SIP and the FXT



As a result, the CB has to sterilize the increase of NFA to maintain its target of M2. The CB will sell government bonds through the open market operations (OMO), thereby banks' reserves (R) will be reduced by the same value²⁸. The decrease of R will decrease domestic credit of both the government and the private sector. Thus, the sign of the coefficient α_2 will be negative and the sign of the coefficient α_3 will be positive. The negative sign of α_2 indicate efficiency because the CB could achieve its target under the SIT. The positive sign of the coefficient α_3 indicates factual independence of CB, because the action taken by the CB to achieve the target did not discriminate against the private sector, where both DCG and DCP are moving in the same direction²⁹.

1.2 Under the FXT

²⁸ Notice that we are focusing on DCG in a whole economy (inside the CB balance-sheet and the commercial banks balance-sheet). When the CB sells government's bonds through OMO, the total DCG in the whole economy will not change because the government bonds are, simply, transferred from the CB's assets side to the commercial banks' assets side. As a consequence, banks' reserves will decrease thereby both the government and the private sector will not be able to get the same amount of credit as before because nominal interest rate now is higher. In other words, the action taken by the CB, in this case, penalizes both the government and the private sector.

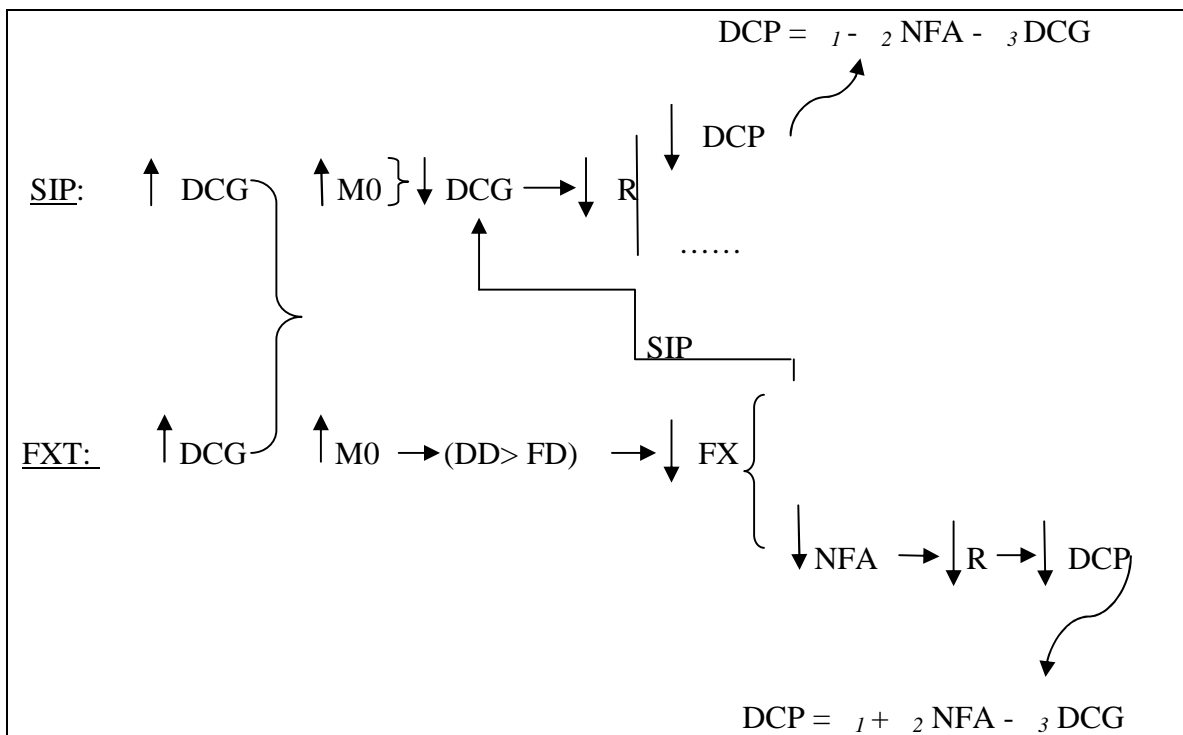
²⁹ The sign of the coefficient α_3 also will be positive in the case of R is constant and both the government and the private sector are competing to get a higher amount of credit. Such a competition, will lead to increasing nominal interest rate, which reduces both DCG and DCP. Obviously, this case reflects a competition in the credit market and it does not include any discrimination by the CB.

Under the FX rate targeting, the CB is basically caring about maintaining the FX rate target. So, the increase in R because of an increase of NFA will increase both DCG and DCP. In this case, the sign of α_2 is positive, which indicates efficiency under the FXT, and the sign of α_3 is positive, which indicates factual independence of CB.

2. The increase of DCG

Figure 2 highlights the behavior of NFA, DCP, and DCG in the case of an increase of DCG, under both the SIP and the FXT.

Figure 2: The increase of DCG under the SIP and the FXT



2.1 Under the SIP

Assume that the CB is coerced to finance budget deficit by accepting the government bonds, thereby M0, and consequently M2, became higher [notice that, in this case, the total DCG in the whole economy became higher]. To maintain its target for the money supply, the CB has two options. The first is to sell foreign assets, thereby NFA, and M0 will be reduced. The second is to resell the government's bonds to the commercial banks through OMO. The first option is not valid because the CB is also targeting the FX rate. Under the second option, R will decrease and DCP, not DCG, will

decrease. Here, the decrease in R is mainly caused by the increase in total DCG in the whole economy, thereby DCP is decreased. Indeed, the behavior of CB in this case is not independent because the action taken by the CB represents a discrimination against the private sector. Under this case, the sign of α_2 is negative, thus the CB is efficient because it could achieve its target under the SIP, and the sign of α_3 is negative, which indicates that the CB is not factually independent.

2.2 Under the FXT

Under the FXT the CB is basically caring about maintaining its target for the FX rate. The increase in DCG makes total deposits denominated in domestic currency (DD) higher than the foreign deposits (FD), thereby domestic currency will depreciate. As the CB knows this information in advance, the CB will neutralize the impact of the increase in DCG on the FX rate. The CB has to decrease $M0$ either by reselling the governments bonds through OMO or by selling foreign assets thereby NFA will decrease. The former option follows the SIP, as mentioned above. By selling foreign assets, R will be reduced, and DCP will decrease. Thus, the sign of α_2 is positive, which indicates efficiency of the CB under the FXT, and the sign of α_3 is negative, which indicates that the CB independence is not factual.

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IV. The Monetary Transmission Mechanism in a Small Open Economy:

The Case of Egypt

Abstract

By treating the Egyptian economy as a small open economy, the current study attempts to fill a gap in studies about monetary transmission mechanisms (MTMs) in the Egyptian economy. The purpose of this study is to answer the following questions: Does the CBE maintain an implicit target for the FX rate? Does the CBE follow an independent monetary policy? Which variables have priority in the reaction function of the CBE? How far can foreign economic shocks explain the behavior of real GDP and price level in the Egyptian economy compared with domestic economic shocks? And which monetary transmission mechanism channels play a dominant role in the Egyptian economy?

The results of the study are as follows: (i) The CBE is factually applying the sterilized intervention policy, which indicates that the CBE is (implicitly) maintaining a target for the FX rate. (ii) The high variance of domestic interest rate caused by either the federal funds rate or the FX rate, indicates that the CBE does not apply an independent monetary policy. (iii) The federal funds rate and the FX rate, respectively, play the most important role among the foreign and domestic variables that influence the reaction of the CBE. (iv) Foreign economic shocks play a dominant role in explaining the behavior of real domestic growth, whereas domestic economic shocks play a dominant role in explaining the behavior of domestic inflation, especially in the short run. (iv) The interest rate channel explains the MTMs in the Egyptian economy, where changes in domestic interest rate have significant impact on both the rate of growth of real GDP and inflation.

Keywords: Monetary Policy; VAR Model; Monetary Transmission Mechanism in Egypt

JEL: E40, E50, E52

1. Introduction

Monetary transmission mechanisms (MTMs) are the channels through which monetary policy actions are transmitted to changes in real output and the price level. One implication of the Phillips model of inflation is that, because of stickiness of wages and prices, the government can ensure a low level of unemployment in the face of a downward shift in demand by intervening to boost demand through a cheap money policy. In his article about the role of monetary policy, Friedman (1968) avers that monetary policy cannot peg either interest rates or the unemployment rate at their equilibrium rates, through cheap money policy, for more than very limited periods. Unemployment cannot be maintained away from its natural rate without accepting a positive and finite rate of inflation. Thus, monetary policy can affect the real economy only in the short run. In the long run, inflation is a monetary phenomenon, and real output is driven by real factors.

A review of previous studies about MTMs in the Egyptian economy indicates that these studies, on the one hand, are very limited and, on the other hand, do not give much attention to foreign shocks that may control the behavior of macroeconomic variables in the Egyptian economy, especially when the Egyptian economy is assessed on the basis of being a small open economy.

In his study about MTMs in the Egyptian economy, Hassan (2003) used a structural VAR model to address the following two questions: How significant is the effect of the interest rate on domestic credit to the private sector (construction sector)? Does a reduction in the nominal interest rate cause international reserves to deteriorate? The study uses monthly data covering the period 1992–2002. The short-term interest rate is used as a measure of the monetary policy stance, whereas international reserves, real domestic credit to the private sector, and the real effective exchange rate are the other variables in the model. The study concludes that investors seem to have been operating under a soft budget constraint, which has made changes in the interest rate less important for investment decisions. Thus, the nominal interest rate does not have a significant impact on the level of real domestic credit to the private sector. In addition, it is real domestic credit, rather than the interest rate, that affects the international reserves.

Emphasizing the role of the credit channel in MTMs, Noureldin (2005) used a five-variable structural VAR model to analyze MTMs in the Egyptian economy during the

period 1980:4–2002:4. The rate of growth of M0 or M2 is used as a proxy for the monetary policy stance, whereas real GDP, the CPI, the real effective exchange rate, and commercial bank credit are the other variables of the model. The results of his study indicated that the credit channel has a greater impact on both real output and inflation during the period of study.

Moursi et al. (2007) examined the features and development of monetary policy structure in the Egyptian economy during the period 1990–2005. Their study uses analytical models introduced by Bernanke and Mihov (1998) and Uhlig (2005) to measure the monetary stance and to identify the effects of policy shocks on the economy. The results of their study show that monetary policy shocks have recently had virtually no real effect on output, thereby providing evidence in support of the long-run neutrality of money. They concluded that the effect of monetary policy on the level and the growth rate of real output in the long run is limited by its capacity to achieve long-run price stability. Employing an estimated interest rate targeting rule, historical and counterfactual policy simulations indicated that during 2001–2006, the central bank of Egypt (CBE) gave precedence to reducing interest rate variances rather than to the stabilization of inflation.

Al-Mashat and Billmeier (2007) examined MTMs in the Egyptian economy from January 1996 to June 2005, when an overnight corridor was introduced in the CBE. Their baseline VAR model includes exogenous and endogenous variables with monthly frequency data. The exogenous variables include oil prices and the federal funds rate. The endogenous variables include real GDP, the WPI, the 3-month deposit rate, and different measures of the exchange rate. One of the results of this study is that the exchange rate channel plays a strong role in propagating monetary shocks to output and prices in the Egyptian economy.

By treating the Egyptian economy as a small open economy, the current study attempts to fill a gap in studies about MTMs in the Egyptian economy. The purpose of this study is to answer the following questions: Does the CBE maintain an implicit target for the FX rate? Does the CBE follow an independent monetary policy? which variables have priority in the reaction function of the CBE? How far can foreign economic shocks explain the behavior of real GDP and price level in the Egyptian economy compared with

domestic economic shocks? And which monetary transmission mechanism channels play a dominant role in the Egyptian economy?

The paper is organized as follows. Section 2 presents the theoretical basis of MTMs. Section 3 specifies a structural VAR model in a small open economy. Section 4 presents the estimation results of the study. Section 5 concludes.

2. Description of Monetary Transmission Mechanisms

Although the vast majority of economists agree with Friedman's view about the role of monetary policy, economists are divided regarding the question of how monetary policy actions can affect the real economy in the short run.

Taylor (1995) thinks that a complete story on MTMs should include a description of a central bank (CB) reaction function showing how the CB adjusts the short-term interest rate in response to various factors in the economy. He believes that the conventional story that the short-term interest rate is determined by the demand for and the supply of money suffers from two inadequacies: (i) the demand for money function appears to be too unstable to yield a reliable estimated effect of a given change in the supply of money, and (ii) the behavior of the CB in the money market through monetary policy actions cannot be described as a one-time action. Instead, the CB always attempts to guide the short-term interest rate to a certain desired rate through successive actions affecting the supply of high-powered money.

Generally speaking, four MTM channels have been highlighted in the literature:³⁰ the interest rate channel, the exchange rate channel, the asset price channel, and the credit channel (Taylor, 1995; Mishkin, 1995, 2004; Bernanke and Gertler, 1995; Mohanty and Turner, 2008).

2.1 The interest rate channel

The interest rate channel exhibits the traditional Keynesian view about MTMs. It emphasizes the role of the real interest rate in both investors' and consumers' decisions. As it reflects the marginal cost of borrowing, the real interest rate is expected to play an important role in both investment and consumer spending on residential structures and durables. An increase in the nominal interest rate will bring about an increase in the real

³⁰ There is also an expectation channel, which has considerable effect on the effectiveness of the other channels mentioned in the text. See Mohanty and Turner (2008).

interest rate if the rationally expected inflation rate does not increase by the same amount. That can happen because of slow adjustment of goods prices, therefore the rational expectations of change in goods prices over short time horizons will also adjust slowly. It follows that a change in the nominal interest rate that reflects inflation expectations, so that real interest rates remain constant, will not affect the marginal cost of borrowing and hence total spending.

In the light of that, a change in the short-term nominal interest rate, given inflation expectations, will affect both the real interest rate and the long-term interest rate, given the risk premium. As a result, both real investment and consumption will change and real output will change accordingly.

The emphasis of this channel on the real rather than the nominal interest rate is because the real interest rate not only is an important factor that affects demand, but also expresses the real stance of monetary policy much better than the nominal interest rate. With a zero nominal interest rate, the real interest rate is negative as long as the change in the nominal price level is expected to be positive. Thus, both nominal and real interest rates reflect the real stance of monetary policy, i.e., monetary policy is described as being expansionary in such case. Instead, when the rate of change in the price level is expected to be negative, particularly during times of recession, a zero nominal interest rate does not express the real stance of monetary policy. Monetary policy in the latter case is not expansionary as might be inferred from the zero nominal interest rate. Because the real interest rate is positive in the latter case, monetary policy is described as being contractionary (Mishkin, 2004, p. 617).

The interest rate channel can be precluded because of several impediments that reduce the pass-through of the policy rate to bank deposit and lending interest rates. These impediments include: (i) the lack of well-developed money and bond markets and frequent shifts in the risk premium emanating from economic instability; (ii) the dependence of firms on self-financing resources, which lower the response of investment spending to a change in the nominal interest rate, and the limited access of households to credit banking (Mohanty and Turner, 2008, p. 10).

2.2 The exchange rate channel

The exchange rate channel explains how monetary policy actions can affect the nominal exchange rate, thereby causing net exports and the domestic value of imports to change. A key assumption underpinning the relationship between the short-term nominal interest rate and the nominal exchange rate is the interest rate parity condition, which states that under a floating exchange rate, the exchange rate is expected to appreciate by the interest rate differential between the domestic and foreign currency. Because of slow adjustment of wages and prices in the short run, an increase in the short-term nominal interest rate leads to both nominal and real appreciation, causing exports and total demand to decrease. In the long run, however, the real exchange rate will converge to its equilibrium level when the adjustment of wages and prices becomes complete.

The effectiveness of the exchange rate channel depends on the extent of the exchange rate pass-through effect and the extent of capital flows. With a high level of both exchange rate pass-through and capital flows, the CB may find it difficult to encourage the economy through this channel.

However, the exchange rate channel is expected to play an important role in the emerging market economies. FX rate changes affect individuals' expectations about the future path of inflation. In addition, FX rate changes produce balance sheet effects when foreign assets and liabilities constitute a large share of firms and households balance sheet (Mohanty and Turner, 2008, p. 15).

2.3 The financial asset price channel

The financial asset price channel describes how monetary policy actions can affect both investment and consumption via affecting equity prices through open market operations. A change in the short-term nominal interest rate that leads to changes in the prices of bonds will influence the prices of equities as well. For instance, cutting the short-term nominal interest rate on bonds will increase the price of equities either because the return on equities relative to that on bonds becomes higher or because of high spending induced by excess liquidity in the economy resulting from the monetary expansion.

A change in asset prices affects total demand via two sub-channels: Tobin's q and the effect of wealth on consumption. Tobin's q is defined as the market value of firms relative to the replacement cost of capital. The higher the q , the higher the market value

of the firm and thus the higher the amount of investment that firms can execute. Therefore, monetary policy actions that affect the value of equities will have a subsequent effect on investment spending and hence on total demand.

As for the effect of wealth on consumption, this channel is established on the life-cycle hypothesis, in which wealth, including stocks, real estate, and any other assets, has a decisive impact on both consumption and saving. Consequently, monetary policy that stimulates the prices of assets and increases household wealth will also stimulate household consumption and hence total demand (Mishkin, 2004, 2007).

One limit of the asset channel is that the decision whether to add new plant or not depends on many other factors, such as expectations of both growth and the real long-term interest rate. Consequently, soaring equity value does not necessarily lead to higher investment. Mohanty and Turner (2008, pp. 13–14) believe that identifying the true impact of asset prices on aggregate demand is difficult. One reason for that is the two-way causality between change in asset prices and the level of macroeconomic performance. In addition, the sensitivity of the long-term nominal interest rate to movements of the short-term nominal interest rate is difficult to discern, especially when the term premium itself undergoes change.³¹ If the behavior of the long-term interest rate, which presumably has the greatest effect on investment decisions, does not precisely follow changes in the short-term nominal interest rate, monetary policy has less power to affect purchases of long-lived assets. Empirical studies reported in Bernanke and Gertler (1995, pp. 27–28) found a weak relationship between the cost of capital and spending. Moreover, empirical studies do not support the neoclassical model in its equivalent “Tobin’s q” formulation. Mishkin (2007, pp. 10–11) thinks that the diversification of household wealth portfolios by itself may encourage or discourage the effect of asset prices on household consumption.

2.4 The credit channel

This channel emphasizes the role of the short-term nominal interest rate instead of the real and long-term interest rate. It explains how monetary policy actions can create problems for agents in the financial market and hence negatively affect real output, given

³¹ According to the liquidity premium theory the interest rate on the long-term bond equals the average of expected short-term interest rates over the life of the bond plus a term premium.

asymmetric information or costly enforcement of contracts. The main instrument of this channel is the external finance premium, which is the difference between the cost of funds raised externally, e.g., by issuing bonds, and the opportunity cost of funds generated internally by retaining earnings. The advocates of the credit channel think that monetary policy actions affect not only the general level of interest rates, but also the size of the external finance premium. Monetary policy actions leading to an increase in the short-term nominal interest rate will move the external finance premium up, thereby magnifying the cost of borrowing. This complementary movement in the external finance premium helps to explain why monetary policy actions still affect the economy even after a monetary policy shock vanishes (Bernanke and Gertler, 1995, and Mishkin, 1995, 2004). Monetary policy actions can affect the external finance premium through two possible linkages, namely, the balance-sheet channel and the bank-lending channel.

2.4.1 The balance-sheet channel

According to the balance-sheet channel, the level of the external finance premium facing borrowers depends on their financial position, reflected in the level of their net worth. Accordingly, monetary policy actions that affect borrowers' net worth, and hence their financial position, will magnify the cost of finance because of the increase in the external finance premium.³² The higher external finance premium in such case is because of the high risk related to the problems of adverse selection and moral hazard. The lower net worth of business firms, on the one hand, means that lenders have less collateral for their loans, which raises the problem of adverse selection. On the other hand, the lower net worth of business firms means that owners have a lower equity stake in their firms, which gives them the incentive to engage in risky projects and so raises the problem of moral hazard. Monetary policy actions can affect firms' balance sheet and hence the level of the external finance premium in many ways: (i) because many firms rely on short-term debt to finance working capital and inventories, a rising short-term interest rate increases interest payments, reduces net cash flows, and thereby weakens borrowers' financial position; (ii) a rising short-term interest rate negatively affects the price of assets, increases the real value of debt, shrinks net worth, and worsens the financial position of

³² Bernanke and Gertler (1995, p. 35) define net worth, operationally, as the sum of liquid assets and marketable collateral.

borrowers; (iii) a rising short-term interest rate reduces demand, widens the gap in the financial resources of firms, and weakens their financial position.

2.4.2 The bank-lending channel

The bank-lending channel explains how monetary policy actions can affect the external finance premium and hence the real economy by influencing the supply of loans. This channel stems from the fact that borrowers do not have equal access to the credit market. Small firms are more dependent on bank loans, while big firms have the ability to access the credit market through the stock and bond markets. Since big firms have more options to finance their investments, the bank-lending channel deals primarily with the problems of asymmetric information related to small firms.

Under the principles of a free market economy, monetary policy can affect commercial banks' reserves and hence loanable funds through open market operations. A reduction in the supply of loanable funds by commercial banks increases the external finance premium especially for small firms because of the higher costs associated with finding a new lender and establishing a new credit relationship. The higher external finance premium associated with the reduction in loanable funds will increase the cost of finance and hence negatively affect real activity. Bernanke and Gertler (1995, p. 41) agree with the view that the existence of a bank-lending channel does not necessarily require banks to be incapable of replacing lost deposits resulting from open-market sales by the CB. It is sufficient that banks do not face a perfectly elastic demand for their open-market liabilities, so that open-market sales by the CB will increase banks' relative cost of funds.

Mishkin (2004, pp. 623–624) thinks that the credit view should apply equally to consumer spending, particularly on consumer durables and housing. When consumers have a large amount of financial assets relative to their debts, their estimation of the probability of financial distress is low and they will be more willing to purchase consumer durables. An expansionary monetary policy will encourage purchases of durables and housing either because of the availability of credit or because of the consumers' balance sheet. Li (2000) evaluated the importance of credit in the transmission of monetary policy. The finding of his study is that monetary injections which occur through the financial sector can generate a liquidity effect that positively

influences the availability of household credit services and overall real activity. Furthermore, the liquidity effect lowers the real costs associated with consumption and can quantitatively dominate the anticipated inflation effect.

Mohanty and Turner (2008, pp. 18–19) reported that bank credit appears to have a significant influence on investment in emerging market economies. In addition, this result does not change even after controlling for several demand factors (such as output, exports, and the real interest rate), suggesting that the supply of bank credit does play a role in influencing fluctuations in investment spending.

3. VAR Model Specifications in a Small Open Economy

In the case of a small open economy, the main focus basically falls on the effect of a big foreign economy on the domestic economy. Using a structural VAR model, Cushman and Zha (1995) specified and estimated a monetary reaction function for the Canadian economy as a small open economy relative to the USA economy. In their opinion, the imposition of ‘block exogeneity’ seems a reasonable way to help identify foreign shocks.

As for the Egyptian economy, it is quite open regarding the ratios of both exports and imports to GDP. The ratios of exports and imports to GDP (on average for the period 1990–2006) are 22.4% and 27.7%, respectively, and the degree of openness (trade, % of GDP) equals 50% during the same period.³³ The EU and the USA are the main traders with Egypt. During the period 1990/91–2006/07, 66.5% of Egyptian exports went to the USA and the EU (32.5% and 34%, respectively) and 60% of Egyptian imports came from the USA and the EU (22.4% and 37.5%, respectively).³⁴ In this study, the main focus will be on the Egyptian economy as a small open economy relative to the US economy. The EU case will be left to another separate study.

Following Zellner and Palm (1974), Cushman and Zha (1995), and Zha (1998), a structural linear, stochastic dynamic VAR model can take the following representation:

$$A(L)Z(t) = \varepsilon(t), \quad (1)$$

where $Z(t)$ is an $(m \times 1)$ vector of variables, $A(L)$ is an $(m \times m)$ matrix polynomial in the lag operator (L) with non-negative power, and $\varepsilon(t)$ is an $(m \times 1)$ vector of structural disturbances.

³³ Calculated from WDI, CD-R, 2008.

³⁴ Calculated from data available on the CBE website: <http://www.cbe.org.eg/>.

Equation (1) can be divided into two blocks of variables: endogenous variables, $Y(t)$, and exogenous variables, $X(t)$, as follows:

$$\begin{bmatrix} A_{11}(L) & A_{12}(L) \\ A_{21}(L) & A_{22}(L) \end{bmatrix} \begin{bmatrix} Y(t) \\ X(t) \end{bmatrix} = \begin{bmatrix} \varepsilon_1(t) \\ \varepsilon_2(t) \end{bmatrix}, \quad (2)$$

where $A_{11}(L)$ is $(m_1 \times m_1)$, $A_{12}(L)$ is $(m_1 \times m_2)$, $A_{21}(L)$ is $(m_2 \times m_1)$, $A_{22}(L)$ is $(m_2 \times m_2)$, $Y(t)$ is $(m_1 \times 1)$, $X(t)$ is $(m_2 \times 1)$, $\varepsilon_1(t)$ is $(m_1 \times 1)$, and $\varepsilon_2(t)$ is $(m_2 \times 1)$, where $m_1 + m_2 = m$. The assumptions of system 2 are that the coefficient matrix of L^0 , A_0 , is non-singular and that $\varepsilon(t)$ is uncorrelated with the past $y(t-s)$ for $s > 0$, and $E[\varepsilon(t) \varepsilon(t-s)'] | y(t-s), s > 0] = I$, $E[\varepsilon(t) | y(t-s), s > 0] = 0$.

Under the prior information that the elements of $X(t)$ are exogenous, the matrix $A_{21}(L)$ elements have to be restricted, i.e., $A_{21}(L) = 0$. Therefore, system (2) will yield:

$$A_{11}(L) Y(t) + A_{12}(L) X(t) = \varepsilon_1(t) \quad (3)$$

$$A_{22}(L) X(t) = \varepsilon_2(t) \quad (4)$$

Accordingly, the elements of $\varepsilon_1(t)$ do not affect the elements of $X(t)$, whereas the elements of $\varepsilon_2(t)$ affect the elements of $Y(t)$ only through the elements of $X(t)$.

A reduced form of (1), which expresses the current values of endogenous variables as a function of lagged endogenous and current and lagged exogenous variables can be derived from (3) as follows.

Define $A_{11}(L) = A_{10} + A_1(L)$, where A_{10} is the contemporaneous coefficient matrix on L^0 in $A_{11}(L)$, and $A_1(L)$ is the coefficient matrix in $A_{11}(L)$ without contemporaneous coefficient A_{10} . We can rewrite (3) as follows:

$$A_{10} Y(t) + A_1(L) Y(t) + A_{12}(L) X(t) = \varepsilon_1(t) \quad (5)$$

Rearranging and pre-multiplying (5) by A_{10}^{-1} we get:

$$\varepsilon_1(t) = -A_{10}^{-1} A_1(L) Y(t) - A_{10}^{-1} A_{12}(L) X(t) + A_{10}^{-1} \varepsilon_1(t), \quad (6)$$

or, equivalently:

$$\varepsilon_1(t) = -a(L) Y(t) - b(L) X(t) + V_1(t), \quad (7)$$

Where $a = A_{10}^{-1} A_1$, $b = A_{10}^{-1} A_{12}$, and $V_1(t) = A_{10}^{-1} \varepsilon_1(t)$.

In general, a reduced form of $Z(t)$ can be derived directly from the structural model, (1), as follows:

$$\text{Define } A(L) = A_0 + A^0(L), \quad (8)$$

Where A_0 is the contemporaneous coefficient matrix on L^0 in $A(L)$, and $A^0(L)$ is the coefficient matrix in $A(L)$ without contemporaneous coefficient A_0 . By substituting (8) in (1) and rearranging, we get:

$$Z(t) = -B(L)Z(t) + V(t), \quad (9)$$

Where $B = A_0^{-1}A^0$ and $V(t) = A_0^{-1} \epsilon(t)$.

To identify structural shocks $\epsilon(t)$ from reduced form residuals $V(t)$, a problem of identification has to be solved. That is, unless we appropriately restrict the structural model it will not be possible to identify structural shocks from the estimated reduced form (9). Restrictions equal to $(n^2 - n)/2$ have to be imposed on A_0 to make the system identifiable (Enders and Walter, 2004, pp. 291–293).³⁵ Christiano et al. (1999) and Enders and Walter (2004) reported different strategies for identifying monetary policy shocks. One of these strategies is to make identifying assumptions about the parameters included in the feedback rule besides the functional form of the feedback rule itself. The assumption that a policy shock is orthogonal to variables in the feedback rule along with the linearity assumption of the feedback rule justify estimating the dynamic response of variables to a monetary policy shock by regressing current and lagged values of the variables on the fitted residuals.

The recursiveness assumption based on the Choleski decomposition is used to identify the structural shocks $\epsilon(t)$ from a vector of residuals $V(t)$, where $\epsilon(t) = A_0 V(t)$. A straightforward way to impose such restrictions is to impose A_0 as a lower triangular matrix. The order of the variables reflects our prior assumptions about the variables that the CB looks at when setting its operating instrument and the interaction of a monetary policy shock with the variables in the feedback rule.

In the course of assessing whether the monetary policy stance is expansionary or contractionary, empirical studies use different specifications of monetary policy instruments. These specifications abandon the traditional approach of measuring the stance of monetary policy using the rate of growth of monetary aggregates. The reasons for that are as follows.

³⁵ Given that the diagonal elements of A_0 are all unity, A_0 contains $n^2 - n$ unknowns. In addition, there are n unknown values $\text{var}(\epsilon_t)$, thus the total unknown values equal n^2 . To identify n^2 unknowns from the estimated variance/covariance matrix with $(n^2 + n)/2$ known independent elements, it is necessary to impose an additional $n^2 - [(n^2 + n)/2] = (n^2 - n)/2$ restrictions on the system.

(i) The use of monetary aggregates to measure the monetary policy stance delivers anomalous results, especially when the nominal interest rate is included in the model.

(ii) Disturbances in monetary aggregates do not completely reflect the policy stance, as it can be affected by other non-policy factors such as money demand disturbances. For instance, higher demand for money will cause the reserves of commercial banks to fall. If the operating procedures of the CB involve smoothing the short-term interest rate, the CB will react by allowing the money supply to increase in order to accommodate the money demand. In reality, growth in the money supply reflects both growth in money demand and changes in policy. Therefore, we cannot use change in the money supply as a pure measure of the monetary policy stance. Besides, if we decided to use innovations in the total reserves of commercial banks as a measure of the monetary policy stance, we would have to separate changes in reserves that pertain to money demand innovations from those that pertain to money supply innovations, as the latter can be used to reflect the monetary policy stance (Bernanke and Mihov, 1998, and Strongin and Steven, 1995).

(iii) Strongin and Steven (1995) argue that the demand for total reserves is inelastic with respect to the nominal interest rate in the short run, so that a monetary policy shock will initially rearrange the structure of total reserves between non-borrowed and borrowed reserves. As a result, the monetary policy shock should be measured as an innovation to the ratio of non-borrowed reserves to total reserves.

Following Christiano et al. (1999, p. 83), three measures can be used for the monetary policy stance (S_t). These measures, as indicated by (10), are the short-term nominal interest rate (DR_t), non-borrowed reserves (NBR_t), and the ratio of non-borrowed reserves to total reserves (NBR/TR).

$$S_t \left(DR_t, NBR_t, NBR/TR \right) \quad (10)$$

One interesting result of the study by Christiano et al. (1999, p. 89) is that although all three measures of the monetary policy shock, S_t , lead to similar inferences about the qualitative effects of a disturbance to monetary policy, the bivariate correlations between them is less than one. That is, at least two of them must be confounded by limited non-policy shocks.

In the case of Egypt, three benchmark identification schemes will be tested with each element of S_t . In the first benchmark, (11), we assume that the CBE does not anchor

monetary policy, changes in the monetary policy instrument (S_t), either to the money supply or to the FX rate.

$$Y(t) = [y_t \quad P_t \quad S_t \quad M2_t \quad E_t] \quad (11)$$

Where, $Y(t)$ represents a vector of endogenous variables including real GDP (y_t), a measure of the price level (P_t), the monetary policy instrument (S_t), the nominal money supply ($M2_t$), and the nominal FX rate (E_t).

In the second benchmark scheme, (12), we assume that the CBE anchor monetary policy to changes in the money supply, $M2$, i.e. the money supply represents the intermediate target of monetary policy. In other words, the CBE applies the monetary targeting regime.

$$Y(t) = [y_t \quad P_t \quad M2_t \quad S_t \quad E_t] \quad (12)$$

In the third benchmark, (13), we assume that the CBE anchor monetary policy to changes in the FX rate, i.e. the FX rate represents the intermediate target of monetary policy under the FX rate targeting regime³⁶.

$$Y(t) = [y_t \quad P_t \quad E_t \quad S_t \quad M2_t] \quad (13)$$

As the USA economy is one of the main traders with Egypt, the above three schemes of domestic variables will be augmented by foreign variables for the USA economy. As mentioned above, domestic variables are assumed to be affected by foreign variables without feedback. Variables that represent the USA economy include real GDP, y_t^{USA} , the general price level measured by CPI_t^{USA} , and the short-term nominal interest rate measured by the federal funds rate (FFR_t^{USA}).

Following Christiano et al. (1999), Peersman and Smets (2001), and Mojon and Peersman (2001), the exogenous variables (USA economy variables) and endogenous variables (domestic variables) take the following order:

First scheme:

$$Z_t = [y_t^{USA} \quad CPI_t^{USA} \quad FFR_t^{USA} \quad y_t^{EG} \quad P_t^{EG} \quad S_t^{EG} \quad M2_t^{EG} \quad E_t^{EG}] \quad (14)$$

Second scheme:

³⁶ Notice that, the final goal of monetary policy in the three schemes is to achieve price stability thereby growth rate will be higher.

$$Z_t = \begin{bmatrix} y_t^{USA} & CPI_t^{USA} & FFR_t^{USA} & y_t^{EG} & P_t^{EG} & M2_t^{EG} & S_t^{EG} & E_t^{EG} \end{bmatrix} \quad (15)$$

Third scheme:

$$Z_t = \begin{bmatrix} y_t^{USA} & CPI_t^{USA} & FFR_t^{USA} & y_t^{EG} & P_t^{EG} & E_t^{EG} & S_t^{EG} & M2_t^{EG} \end{bmatrix} \quad (16)$$

In the light of this, the three recursive schemes will be as follows:

$$\begin{bmatrix} \mathcal{E}_t^{y_t^{USA}} \\ \mathcal{E}_t^{CPI_t^{USA}} \\ \mathcal{E}_t^{FFR_t^{USA}} \\ \mathcal{E}_t^{y_t^{EG}} \\ \mathcal{E}_t^{P_t^{EG}} \\ \mathcal{E}_t^{S_t^{EG}} \\ \mathcal{E}_t^{M2_t^{EG}} \\ \mathcal{E}_t^{E_t^{EG}} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & 0 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & 0 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & a_{77} & 0 \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & a_{88} \end{bmatrix} \begin{bmatrix} V_t^{y_t^{USA}} \\ V_t^{CPI_t^{USA}} \\ V_t^{FFR_t^{USA}} \\ V_t^{y_t^{EG}} \\ V_t^{P_t^{EG}} \\ V_t^{S_t^{EG}} \\ V_t^{M2_t^{EG}} \\ V_t^{E_t^{EG}} \end{bmatrix} \quad (17)$$

$$\begin{bmatrix} \mathcal{E}_t^{y_t^{USA}} \\ \mathcal{E}_t^{CPI_t^{USA}} \\ \mathcal{E}_t^{FFR_t^{USA}} \\ \mathcal{E}_t^{y_t^{EG}} \\ \mathcal{E}_t^{P_t^{EG}} \\ \mathcal{E}_t^{M2_t^{EG}} \\ \mathcal{E}_t^{S_t^{EG}} \\ \mathcal{E}_t^{E_t^{EG}} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & 0 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & 0 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & a_{77} & 0 \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & a_{88} \end{bmatrix} \begin{bmatrix} V_t^{y_t^{USA}} \\ V_t^{CPI_t^{USA}} \\ V_t^{FFR_t^{USA}} \\ V_t^{y_t^{EG}} \\ V_t^{P_t^{EG}} \\ V_t^{M2_t^{EG}} \\ V_t^{S_t^{EG}} \\ V_t^{E_t^{EG}} \end{bmatrix} \quad (18)$$

$$\begin{bmatrix} \mathcal{E}_t^{y_t^{USA}} \\ \mathcal{E}_t^{CPI_t^{USA}} \\ \mathcal{E}_t^{FFR_t^{USA}} \\ \mathcal{E}_t^{y_t^{EG}} \\ \mathcal{E}_t^{P_t^{EG}} \\ \mathcal{E}_t^{E_t^{EG}} \\ \mathcal{E}_t^{S_t^{EG}} \\ \mathcal{E}_t^{M2_t^{EG}} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 & 0 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & 0 & 0 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & 0 & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & a_{76} & a_{77} & 0 \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & a_{88} \end{bmatrix} \begin{bmatrix} V_t^{y_t^{USA}} \\ V_t^{CPI_t^{USA}} \\ V_t^{FFR_t^{USA}} \\ V_t^{y_t^{EG}} \\ V_t^{P_t^{EG}} \\ V_t^{E_t^{EG}} \\ V_t^{S_t^{EG}} \\ V_t^{M2_t^{EG}} \end{bmatrix} \quad (19)$$

The three recursive schemes, (17)–(19), summarize our assumptions about the variables included in (9), the operating instrument, the variables that the CBE looks at when setting its operating instrument and the interaction of a monetary policy shock with the variables in the feedback rule. A monetary policy shock is identified through a standard Choleski decomposition with the variables ordered as in (17)–(19). The zero block(s) corresponding to a monetary policy shock (S_t) in the instruments' rows indicates that the CBE does not see the subsequent variables E_t or/and $M2_t$ when setting its monetary policy instruments. The other zero blocks reflect the recursiveness assumption. In other words, while the CBE contemporaneously reacts to changes in the foreign and domestic variables preceding a monetary policy instrument, the change in the monetary policy instrument S_t , does not affect the preceding variables of S_t but instead it has a contemporaneous effect on the following variables of S_t .

4. Estimation Results

4.1 Results of measurement of the price index and the monetary policy stance in Egypt

The three-benchmark VAR model is estimated on the period 1995Q1–2007Q4. The source of the data is the IFS (CD-R 2008). As quarterly data on real GDP is not available for Egypt either in the IFS or in any other source during the period of the study, I used statistical methods included in E-views 5 to extrapolate quarterly data on real GDP from the annual data. Because the data are quarterly, the variables are seasonally adjusted using seasonal dummies. All variables are expressed in logs, except for nominal interest rates, i.e., FFR_t^{USA} and DR_t^{EG} ³⁷.

Using unit root tests (the Augmented Dickey-Fuller unit root test and the Phillips-Perron unit root test), all variables are found to be non-stationary, $I \sim (1)$, except for FFR_t^{USA} and DR_t^{USA} , $I \sim (0)$. Thus, nonstationary variables are introduced using first differences after taking logs. By estimating the model, all roots are found to be inside the unit root circle. The Akaike information criterion (AIC) and the likelihood ratio test (LR) are used to determine the appropriate lag length, which turns out to be one lag.

As the measure of the price level in Egypt, the study experimented with both the CPI and the wholesale price index (WPI). Although the directions of causality, as indicated by

³⁷ The correlation coefficient between the three-month deposit rate and the discount rate during the period of the study is 93%. As an alternative to the three-month deposit rates, discount rates were used in the three schemes. The results, however, did not change substantially.

block exogeneity Wald tests, were similar using both the CPI and the WPI, the CPI is excluded from the analysis because it does not reflect changes in the money supply, M2. According to Granger causality tests, the rate of growth of M2 does not Granger cause CPI inflation. Indeed, this result agrees with the results of a study by Awad (2008), which found no relationship between the money supply and CPI-inflation in Egypt either in the short run or in the long run. In addition, by estimating the exchange rate pass-through effect in Egypt to both the WPI and CPI during the period 2000–2004, Rabanal (2005) found that while the pass-through effect to the WPI was higher (from 30% to 60%) and statistically significant, it was lower and insignificant if measured by the CPI. The weak relationship between exchange rate shocks or money supply shocks and changes in the CPI can be attributed to the relatively large share of goods with administered prices included in the CPI series that was used until July 2003 (roughly one third to one half of the CPI items).

As for the measure of the monetary policy stance in Egypt, S_t , both NBR^{EG} and NBR/TR^{EG} are excluded from the analysis, thus DR_t^{EG} is used to estimate the three-benchmark VAR model. The reasons for excluding both NBR^{EG} and NBR/TR^{EG} are as follows.

(i) In the light of the aforementioned description of the three-benchmark VAR model, the relationship between a small open economy and a large open economy is unidirectional, i.e., the large open economy affects the small open economy and not the opposite. Taking into account that the causality relationships among the macroeconomic variables should come outside econometrics, block exogeneity tests delivered results that conflict with our prior descriptions. For instance, when we estimated the model using either NBR^{EG} or NBR/TR^{EG} , block exogeneity Wald tests (available upon request) indicated that the Federal Reserve Bank set its FFR to react to both the rate of change in real GDP^{EG} and the rate of change in NBR^{EG} . Rather, when we used DR_t^{EG} as a measure of the monetary policy stance, the Granger causality directions were in accordance with our prior descriptive of the relationship between a small open economy and a large open economy.

(ii) Both NBR^{EG} and NBR/TR^{EG} do not reflect the stance of the CBE on changes in the FX rate, as neither NBR or NBR/TR nor the FX rate Granger cause each other. One

reason for this is that the CBE adopted inconsistent objectives for monetary policy after the introduction of the economic reform and structural adjustment program (ERSAP) at the start of the 1990s (Moursi et al., 2007, Kamar and Bakardzhieva, 2005, and Panizza, 2001). After the introduction of the ERSAP in 1990, the ultimate objective of monetary policy was determined to be achieving both internal and external stability of the domestic currency in line with the national objectives of spurring economic growth and creating more job opportunities. During this period, the intermediate target of monetary policy was determined to be net domestic credit and later the rate of growth of the money supply (M2). The daily operational target of monetary policy was determined to be banks' excess reserves, which had to be set in such a way as to achieve the intermediate target (Abu-Elayoun, 2003). During the period from 1990 until the start of 2003 the CBE was targeting the FX rate. Taking into account that the CBE liberalized domestic interest rates on both loans and deposits in 1991,³⁸ one may thus ask how the CBE can maintain the FX rate target and, at the same time, achieve the goal of price stability through maintaining an implicit M2 target. A sterilized intervention policy may give the answer. Under the sterilized intervention policy, the CB will accommodate capital flows by sterilizing their effect on the money supply. Thus, the CBE has to satisfy the net demand for foreign exchange at the prevailing FX rate using sterilized foreign exchange intervention. For instance, if the CB is faced by capital outflows that negatively affect the supply of money, it can maintain its money supply target by purchasing securities with the same amount of capital outflows (Goodfriend, 2008). In such a case, changes in either NBR^{EG} or NBR/TR^{EG} will be isolated from changes in the FX rate. As a result, Granger causality tests will not detect any causality relationship between these variables.

4.2 Estimation results using WPI and DR

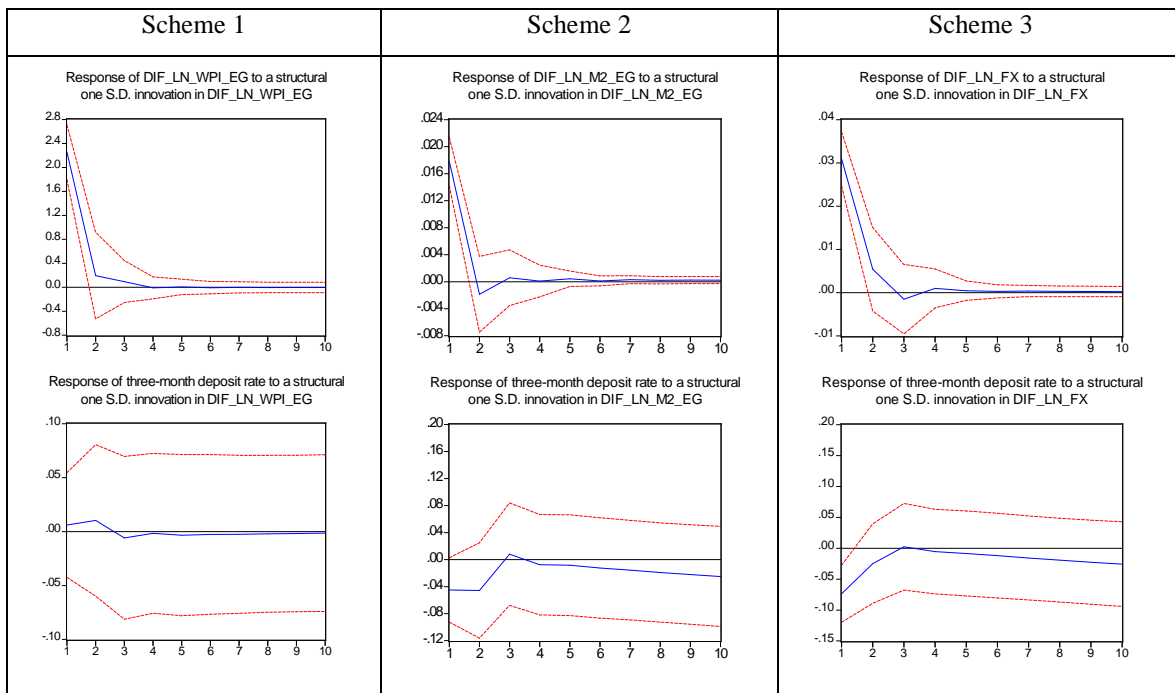
4.2.1 Results of the intermediate target of monetary policy in Egypt

Figure 1 highlights the response of domestic monetary policy, DR^{EG} , to structural one standard deviation innovation in the rate of change in WPI^{EG} , the rate of change in

³⁸ By January 1991, the CBE had liberalized interest rates on loans and deposits. Accordingly, banks were given the freedom to set their loan and deposit interest rates subject to the restriction that the 3-month interest rate on deposits should not fall below 12% per annum. This restriction was cancelled in 1993/1994 (Moursi et al., 2007, pp. 6–7).

$M2^{EG}$ and the rate of change in FX^{EG} . The only significant response of monetary policy (at 5 % level) is the response to the FX rate shock as shown in Scheme 3. It tells us that the CBE cuts domestic interest rate when domestic currency depreciates (USD appreciate). This result seems anomalous if it will be assessed on the basis of the FX rate targeting, where the CB should react to a depreciation of domestic currency by increasing domestic interest rate. Indeed, this result is quite normal if it will be assessed on the basis of the sterilized intervention policy mentioned in the second essay. Figure 1 in the Appendix 1 of the second essay indicates that domestic interest rate goes up when domestic currency appreciates under the sterilized intervention policy, and vice versa. Under the FX rate targeting, however, the appreciation of domestic currency leads to cutting domestic interest rate.

Figure 1: The response of domestic monetary policy to a structural shock in domestic prices, money supply, and FX rate.



In addition, the estimation results of the equation 5 in the second essay, detect a negative sign of β_2 , which indicates that the CBE applies the sterilized intervention policy. Moreover, this result comes in line with the aforementioned study by Al-Mashat and Billmeier (2007), which asserts the dominant role of the FX rate despite the fact that

the CBE (formally) no longer uses the nominal exchange rate as a nominal anchor for its monetary policy.

In the light of this, the significant and positive response of monetary policy to the FX rate shocks as shown in Scheme 3 indicates that the CBE is factually applying the sterilized intervention policy.

4.2.2 The impact of foreign economic shocks on real GDP and inflation

Figure 2: The impact of foreign economic shocks on domestic variables (real GDP and prices)

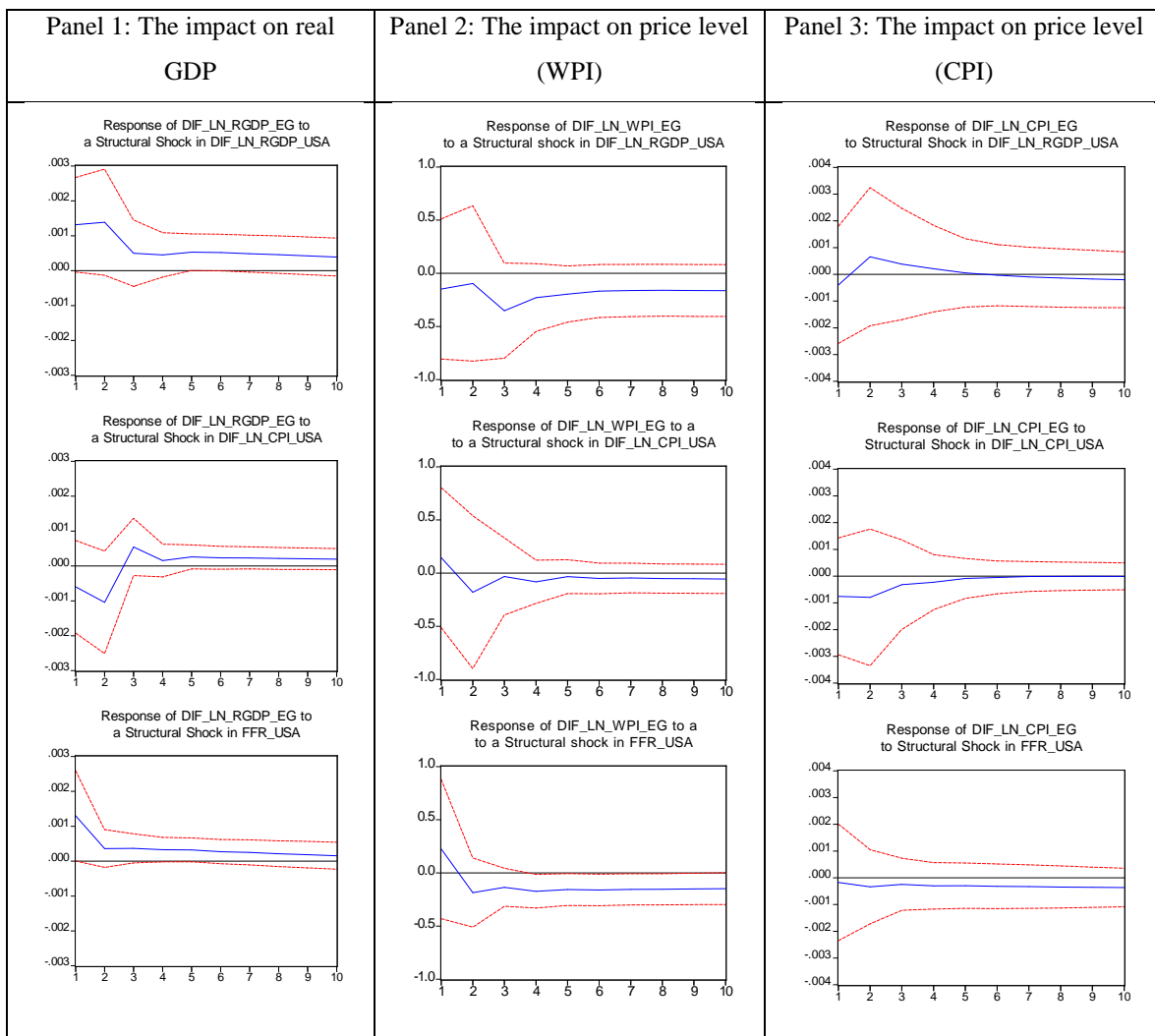


Figure 2 reports the impact of foreign economic shocks on the rate of growth of real GDP^{EG} and the rate of inflation in Egypt. Panel 1 depicts the response of the rate of

growth of real GDP^{EG} to structural one standard deviation innovation in the rate of growth of real GDP^{USA} , the rate of change in the CPI^{USA} , and the FFR^{USA} . It indicates that a shock in the rate of growth of real GDP^{USA} has significant impact (at 10 % level) on the rate of growth of real GDP^{EG} for two quarters. In addition, a shock in the FFR^{USA} has significant impact on the rate of growth of real GDP^{EG} (at 10 % level) for one quarter. A shock in the rate of change in the CPI^{USA} , however, does not have significant impact on the rate of growth of real GDP^{EG} (see appendix 1). While the expansion of real GDP^{EG} induced by a positive shock in real GDP^{USA} can be attributed to the demand effect, the expansion of real GDP^{EG} induced by a positive shock in FFR^{USA} can be attributed to a depreciation of the domestic currency vis-à-vis the US dollar, which stimulates domestic exports.

Panels 2 and 3, Figure 2, mirror the impact of foreign economic shocks on domestic inflation measured by the rate of change in WPI^{EG} and, for robustness, the rate of change in CPI^{EG} . While CPI -inflation does not indicate any significant impact of foreign shocks, WPI -inflation detects significant impact of FFR^{USA} , at 5 % level, beginning of quarter 4 (see appendix 1).

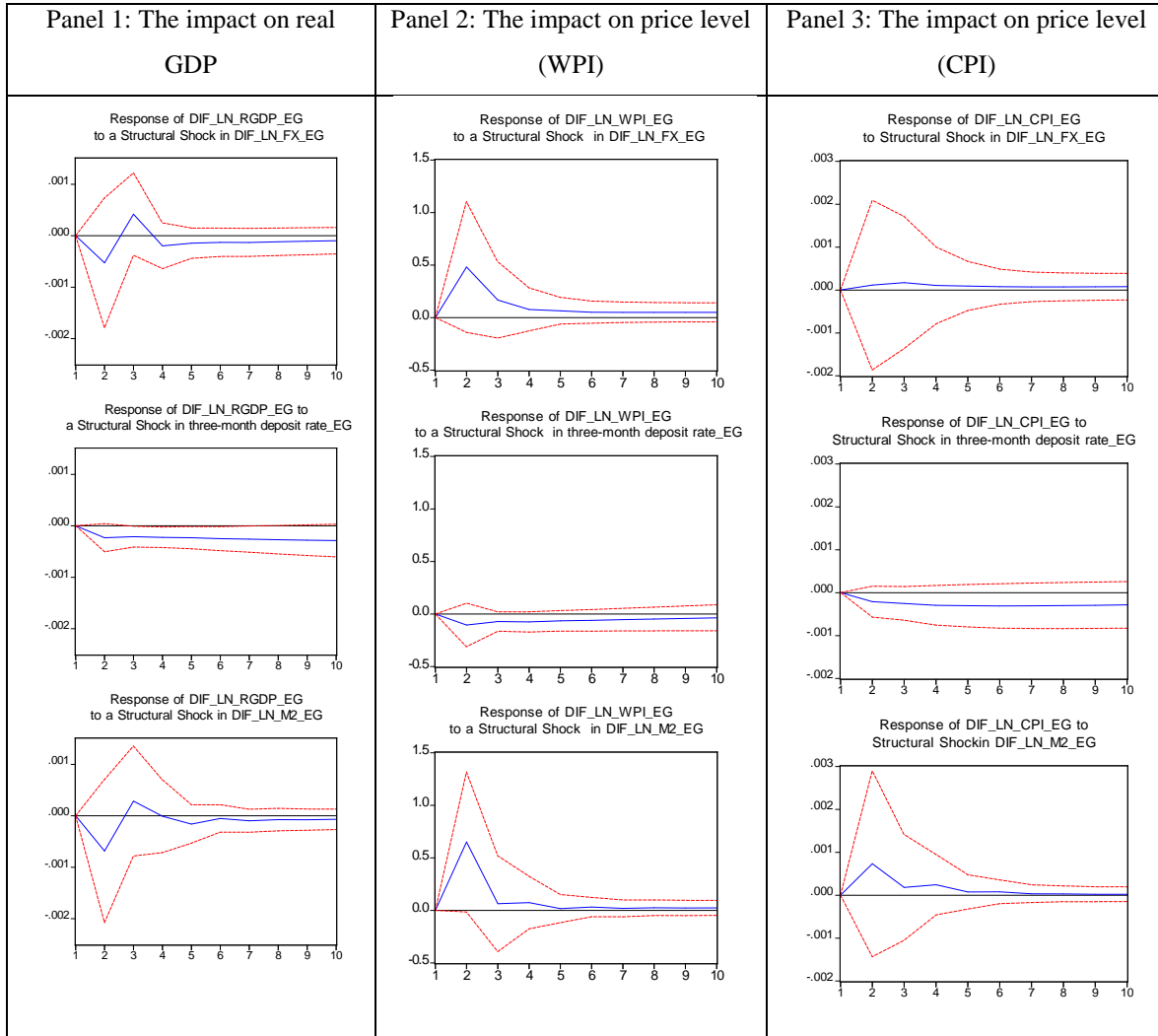
4.2.3 The impact of domestic economic shocks on real GDP and inflation

Figure 3 reports the responses of both the rate of growth of real GDP^{EG} and inflation to shocks in other domestic variables (a structural shock in the rate of change in FX^{EG} , DR^{EG} , and the rate of growth of $M2^{EG}$).

As shown in panel 1, DR^{EG} is the domestic variable that has significant impact on the rate of growth of real GDP^{EG} (see appendix 1). As DR^{EG} comes after real GDP^{EG} , a shock in DR^{EG} does not have a contemporaneous effect on the rate of growth of real GDP^{EG} . The significant impact of a shock in DR^{EG} on the rate of growth of real GDP^{EG} (at 5 % level) begins from the third quarter. In the light of a descriptive analysis of MTMs in section 2, the negative impact of a positive shock in short-term interest rate on real GDP can be explained by the interest rate channel³⁹.

³⁹ We focus on the direct effect of changes in short-term interest rate on real GDP, i.e. changes in short-term interest rate affect the marginal cost of borrowing thereby real investment and real GDP change.

Figure 3: The impact of domestic economic shocks on domestic variables (real GDP and prices)



Panels 2 and 3 depict the response of domestic inflation, measured by the rate of change of both WPI and (for robustness) CPI, to domestic shocks. Panel 2 tells us that the rate of change in M2 has significant influence at 5 % (or 10 %) level, in the second quarter, on the inflation rate measured by the rate of change in WPI (see appendix 1). The influence of the rate of change in M2 on domestic inflation is not significant when the rate of inflation is measured by the change in CPI as shown in panel 3. Indeed, this result

agrees with the aforementioned studies by Awad (2008) and Rabanal (2005). In addition, it justifies the use of WPI rather than CPI in analyzing the MTMs in Egypt⁴⁰.

Other domestic variables, in Panel 2, seem to have significant influence, at 10 % level, on domestic inflation measured by the change in WPI^{EG}. As both FX^{EG} and DR^{EG} come after the rate of change in WPI^{EG} they do not have a contemporaneous effect on WPI^{EG}. While the rate of change in FX^{EG} has significant impact on domestic inflation in quarter 2, DR^{EG} has significant impact on domestic inflation beginning of quarter 3 (see appendix 1).

4.2.4 Variance decomposition of domestic variables to foreign and domestic shocks

Table 1: Forecasting variance decomposition of domestic variables (%)

External Shocks					Domestic shocks					
Variance decomposition of the rate of growth of real GDP										
period	RGDP ^{USA}	CPI ^{USA}	FFR ^{USA}	Sum.	RGDP	WPI	DR	M2	FX rate	Sum.
6 months	13.2	5	5.2	23.4	-	0.02	0.001	2.6	0.2	2.82
1 year	14.3	6	5.6	25.9	-	0.02	0.5	3	0.44	3.96
4 years	19.2	7.3	6	32.2	-	0.03	2.06	3.4	1.22	6.71
Variance decomposition of the rate of inflation (WPI)										
6 months	0.51	0.9	1.4	2	2.4	-	1.5	9.3	0.1	11
1 year	3.2	0.95	2	6.25	2.3	-	1.9	9.2	0.2	11.3
4 years	7.6	1.4	5.4	14.4	2.2	-	2.2	8.5	0.25	12
Variance decomposition of the three-month deposit rate										
6 months	1.1	9.1	9.5	19.7	2	0.2	-	0.08	3.72	6
1 year	2.4	9.45	12.5	24.35	2.2	0.1	-	2.2	6	10.5
4 years	7.93	3.48	35.9	47.31	1.1	0.04	-	0.94	3.5	5.6
Variance decomposition of the rate of growth of M2										
6 months	7.2	1.4	2.8	11.4	2	2	5.8	-	0.19	10
1 year	7.49	1.9	3.11	12.5	2.35	2	5.79	-	0.31	10.45
4 years	9.2	2.12	4.38	15.7	2.3	1.9	5.68	-	0.34	10.22
Variance decomposition of the rate of change in the FX rate										
6 months	21.78	1.16	1.1	24.04	0.06	4	10.7	23.7	-	38.46
1 year	23.84	1.24	1.15	26.23	0.29	4.12	10.08	24.45	-	38.94
4 years	24.49	1.54	1.2	27.23	0.36	4.03	10.24	23.97	-	38.6

Table 1 summarizes the forecasting variance decomposition of the domestic variables as follows:

⁴⁰ Notice also that the CPI-inflation did not detect any significant impact of foreign economic shocks, as mentioned above.

(i) External shocks explain roughly 25% of the variances in real GDP^{EG} in the short run and 32% in the long run. A shock in the rate of growth of real GDP^{USA} takes priority among the foreign shocks that affect the variances of real GDP^{EG} either in the short run or in the long run.

(ii) Domestic inflation is controlled by domestic shocks in the short run. The rate of growth of M2 takes priority among the domestic and foreign variables that influence domestic inflation in the short run. In the long run, the rate of growth of $M2^{EG}$ and the rate of growth in real GDP^{USA} , respectively, play an important role among the domestic and foreign variables that affect domestic inflation.

(iii) The variance decomposition of the three-month deposit rate shows that the FFR^{USA} , among foreign variables, explains 36% of variances in DR^{EG} in the long run. In the short run, domestic variables, especially FX^{EG} play a role in explaining variances of DR^{EG} .

(iv) The rate of growth of $M2^{EG}$ is driven by domestic and foreign shocks. While the rate of growth of real GDP^{USA} takes priority among the foreign shocks that affect the rate of growth of $M2^{EG}$, DR^{EG} takes priority among the domestic variables that affect the rate of growth of $M2^{EG}$.

(v) As for the rate of change in the FX^{EG} , domestic shocks take higher priority than foreign shocks either in the short run or in the long run. The rate of growth of M2 and changes in short-term interest rates, respectively, are the two domestic factors that represent the main source of variances in the FX rate, whereas the rate of growth of real GDP^{USA} represents the main source of foreign shocks that influence variances in the FX rate.

To summarize:

(i) The CBE is factually applying the sterilized intervention policy. This result is corroborated through positive and significant response of monetary policy to structural shock in the rate of change in FX^{EG} (Figure 1). In addition, this result comes in line with both descriptive analysis and estimation results in the second. Taking into account that the CBE is (formally) applying the monetary targeting regime, this result indicates that the CBE is (implicitly) maintaining a target for the FX rate.

(ii) The high variance of DR^{EG} caused by either FFR^{USA} , among foreign variables, or FX^{EG} , among domestic variables, indicates that the CBE does not apply an independent monetary policy, given the result that the CBE is factually applying the sterilized intervention policy.

(iii) The FFR^{USA} and FX^{EG} , respectively, play the most important role among the foreign and domestic variables that influence the reaction of the CBE (Table 1).

(iv) Foreign economic shocks, particularly shocks in both the rate of growth in real GDP^{USA} and FFR^{USA} , play a dominant role in explaining the behavior of the rate of growth of real GDP^{EG} . Domestic interest rate, DR^{EG} , is the domestic variable that has significant impact on the rate of growth of real GDP^{EG} . This result is corroborated through impulse responses (Figures 2 and 3) and variance decomposition analysis (Table 1).

(v) Foreign economic shocks do not have significant impact on the rate of inflation in Egypt during the short run. The rate of inflation in Egypt, in the short run, is controlled by domestic variables. The rate of growth of $M2^{EG}$ takes priority among domestic and foreign variables that influence domestic inflation either in the short run or in the long run. Changes in DR^{EG} take the second priority among domestic variables that affect the rate of inflation in Egypt. The rate of change in FX^{EG} affects domestic inflation in the short run. This result is derived from impulse responses (Figures 2 and 3) and variance decomposition analysis (Table 1).

(vi) Given results (iv) and (v), the interest rate channel explains the MTMs in the Egyptian economy, where changes in DR^{EG} have significant impact on both the rate of growth of real GDP^{EG} and domestic inflation (Figure3).

5. Conclusions

Monetary transmission mechanisms (MTMs) are the channels through which monetary policy actions are transmitted to changes in real output and the price level. Empirical studies about the MTMs in the Egyptian economy are limited and do not give much attention to foreign shocks that may control the behavior of macroeconomic variables. Thus, this study does attempt to fill a gap in studies by estimating MTMs in the Egyptian economy using a structural VAR model in which the Egyptian economy is treated as a small-open economy.

The purpose of this study is to answer the following questions: Does the CBE maintain an implicit target for the FX rate? Does the CBE follow an independent monetary policy? Which variables have priority in the reaction function of the CBE? How far can foreign economic shocks explain the behavior of real GDP and price level in the Egyptian economy compared with domestic economic shocks? And which monetary transmission mechanism channels play a dominant role in the Egyptian economy?

The results of the study are as follows:

(i) The CBE is factually applying the sterilized intervention policy. Taking into account that the CBE is (formally) applying the monetary targeting regime, this result indicates that the CBE is (implicitly) maintaining a target for the FX rate.

(ii) The high variance of domestic interest rate caused by either the federal funds rate or the FX rate, indicates that the CBE does not apply an independent monetary policy.

(iii) The federal funds rate and the FX rate, respectively, play the most important role among the foreign and domestic variables that influence the reaction of the CBE.

(iv) Foreign economic shocks play a dominant role in explaining the behavior of real domestic growth, whereas domestic economic shocks play a dominant role in explaining the behavior of domestic inflation, especially in the short run.

(v) The interest rate channel explains the MTMs in the Egyptian economy, where changes in domestic interest rate have significant impact on both the rate of growth of real GDP and inflation.

Appendix 1: Impulse responses for 4 quarters calculated from scheme 3

Response of DIF_LN_RGDP_EG:								
Period	RGDP_USA	CPI_USA	FFR_USA	RGDP_EG	WPI_EG	FX_EG	DR-EG	M2_EG
1	0.001290	-0.000530	0.001179	0.004534	-1.07E-19	1.28E-18	5.29E-20	0.000000
	(0.00069)	(0.00067)	(0.00066)	(0.00046)	(7.4E-19)	(6.4E-19)	(6.4E-20)	(0.00000)
2	0.001459	-0.001071	0.000307	-0.000769	7.33E-05	-0.000528	-0.000232	-0.000685
	(0.00078)	(0.00074)	(0.00029)	(0.00070)	(0.00073)	(0.00063)	(0.00014)	(0.00070)
3	0.000566	0.000596	0.000376	0.000452	2.08E-05	0.000421	-0.000210	0.000286
	(0.00049)	(0.00043)	(0.00021)	(0.00038)	(0.00039)	(0.00040)	(0.00010)	(0.00053)
4	0.000484	0.000219	0.000304	9.74E-05	-2.03E-05	-0.000196	-0.000224	-8.39E-06
	(0.00034)	(0.00025)	(0.00017)	(0.00023)	(0.00022)	(0.00022)	(9.9E-05)	(0.00035)
Response of DIF_LN_WPI_EG:								
1	-0.148051	0.144595	0.224708	-0.379887	2.255076	-1.80E-16	1.33E-17	0.000000
	(0.32926)	(0.32859)	(0.32748)	(0.32443)	(0.22780)	(3.0E-16)	(3.2E-17)	(0.00000)
2	-0.096248	-0.179490	-0.185360	0.019370	0.194762	0.481964	-0.104105	0.650837
	(0.36522)	(0.35855)	(0.16276)	(0.34637)	(0.36088)	(0.31151)	(0.10317)	(0.33303)
3	-0.351734	-0.031463	-0.135932	0.047820	0.094846	0.167970	-0.071968	0.063467
	(0.22384)	(0.18126)	(0.08936)	(0.14649)	(0.17473)	(0.18140)	(0.04586)	(0.22764)
4	-0.228831	-0.081978	-0.172794	-0.041300	-0.009840	0.077909	-0.075240	0.074666
	(0.15920)	(0.10117)	(0.07873)	(0.07098)	(0.09156)	(0.10214)	(0.04825)	(0.12465)
Response of DIF_LN_E_EG:								
1	-0.010691	0.003702	-0.001784	0.000705	-0.004079	0.030948	3.16E-18	0.000000
	(0.00463)	(0.00448)	(0.00446)	(0.00446)	(0.00444)	(0.00313)	(6.7E-19)	(0.00000)
2	-0.016186	-0.002516	-0.004005	0.000780	-0.007322	0.005406	0.000167	0.015916
	(0.00587)	(0.00555)	(0.00308)	(0.00537)	(0.00552)	(0.00483)	(0.00236)	(0.00497)
3	-0.007944	-0.000359	1.69E-05	-0.001556	0.002225	-0.001511	0.001184	-0.006495
	(0.00494)	(0.00418)	(0.00193)	(0.00346)	(0.00433)	(0.00402)	(0.00126)	(0.00413)
4	-0.002291	-0.001737	-0.001509	-0.001388	-0.001294	0.000995	0.000666	0.002450
	(0.00318)	(0.00221)	(0.00149)	(0.00188)	(0.00198)	(0.00225)	(0.00092)	(0.00272)

Appendix 1: Impulse responses for 4 quarters calculated from scheme 3 (continued)

Response of DR3M_EG_SA:								
Period	RGDP_USA	CPI_USA	FFR_USA	RGDP_EG	WPI_EG	FX_EG	DR-EG	M2_EG
1	0.027815	-0.039754	0.052004	-0.007967	0.006115	-0.073660	0.152959	0.000000
	(0.02618)	(0.02572)	(0.02486)	(0.02428)	(0.02426)	(0.02308)	(0.01545)	(0.00000)
2	-0.001179	-0.067828	0.061327	-0.036366	0.010309	-0.024848	0.150330	-0.027758
	(0.03794)	(0.03694)	(0.02514)	(0.03434)	(0.03511)	(0.03211)	(0.01607)	(0.02624)
3	-0.030626	-0.058981	0.064778	-0.027228	-0.005858	0.002314	0.147081	0.018403
	(0.04283)	(0.03755)	(0.02521)	(0.03029)	(0.03772)	(0.03507)	(0.01624)	(0.02422)
4	-0.038621	-0.052432	0.076409	-0.027819	-0.001656	-0.005518	0.145911	0.004815
	(0.04554)	(0.03738)	(0.02701)	(0.03030)	(0.03705)	(0.03419)	(0.01709)	(0.02449)
Response of DIF_LN_M2_EG:								
1	-0.001423	0.001605	-0.003238	-0.002318	-0.001887	0.008522	-0.001120	0.015574
	(0.00263)	(0.00262)	(0.00260)	(0.00257)	(0.00255)	(0.00239)	(0.00223)	(0.00157)
2	-0.005011	0.001687	0.000108	0.001500	0.001965	-4.68E-05	-5.67E-06	-0.002095
	(0.00284)	(0.00273)	(0.00098)	(0.00264)	(0.00275)	(0.00236)	(0.00046)	(0.00262)
3	-0.000799	-0.001372	-0.001151	-0.001198	-0.000478	-0.000134	-0.000386	0.000721
	(0.00155)	(0.00136)	(0.00066)	(0.00126)	(0.00117)	(0.00130)	(0.00033)	(0.00193)
4	-0.001102	0.000219	-0.000646	0.000221	0.000237	0.000534	-0.000228	-0.000202
	(0.00098)	(0.00069)	(0.00053)	(0.00060)	(0.00057)	(0.00065)	(0.00032)	(0.00111)
Factorization: Structural								
Standard Errors: Analytic								

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V. Summary and Concluding Remarks

1. Summary

This dissertation comprises three empirical essays on adopting the IT regime in Egypt. It sets out to investigate the following two questions: (i) Can the CBE achieve the goal of price stability under the currently applied monetary policy regime? The answer to this question is important from the point of view of the study because it can guide us to determine whether the CBE should move toward adopting IT. (ii) If the CBE should move toward adopting IT, is it qualified to apply IT?

The first essay addresses the first question, i.e. can the CBE achieve the goal of price stability under the currently applied monetary policy regime? As the CBE is currently applying the monetary targeting regime, the answer depends on whether or not the demand for money function is stable in Egypt. Under a stable demand for money function, the CBE can predict the demand for money and hence control money supply in such a way that achieves the goal of price stability. Conversely, if the demand for money function is not stable, the CBE should move toward adopting IT to achieve price stability, especially after floating the FX rate. By reviewing relevant literature, the study specified the explanatory variables and the steps for investigating the stability of the demand for money function. Using quarterly data on the period 1995-2007, the study estimated the long run demand for money function in Egypt. The estimation results indicate that all explanatory variables are significant with proper signs and the regression relationship is strongly significant. Using different points to check whether there is a structural change in the long run demand for money function or not, both the Chow breakpoint test and Chow forecast test reject the null hypothesis, of no structural change. For robustness: (i) The study re-estimated the long run demand for money function in Egypt using the real exchange rate rather than the nominal exchange rate. By testing its stability for structural change the results did not include substantial change. (ii) By estimating the long run velocity of circulation of money and testing its stability for structural change, both the Chow breakpoint test and Chow forecast test indicate that the long run velocity of circulation of money in Egypt is not stable. In the light of this, the study concludes that

the CBE cannot achieve price stability under the currently applied monetary targeting regime. As a consequence, the CBE should take steps toward adopting IT.

The second and third essays are devoted to answer the second question, i.e. is the CBE qualified to apply IT? As mentioned in the introduction part, there are three prerequisites for IT to be successfully applied. They are; factual independence of CB, the CB should not target any variables other than the rate of inflation, and forecasting capabilities. The second and third essays empirically investigate some specific points related to prerequisites for IT. They are: factual independence of CB, the CB should not maintain an implicit target for the FX rate, the impact of foreign economic shocks on both inflation and real growth rates in the domestic economy, and the channels through which monetary policy actions are transmitted to changes in real output and price level.

The second essay empirically investigates the first point, i.e. factual independence of the CBE. In literature there are three methodologies for assessing factual independence of CB: (i) legal indices for the CB independence, which are constructed from the CB charter. To investigate whether legal independence of CB is factual or not, empirical studies test the causality relationship between legal indices for the CB independence and inflation. If such causality is found then legal independence of CB is factual, and vice versa. (ii) The second methodology is to construct an indicator for political pressure on CB and then to test whether or not the CB responds for political pressure. If CB is responding for political pressure then CB is not factually independent. (iii) The third methodology for assessing factual independence of CB is based on the fiscal dominance hypothesis. This methodology is followed by Fry who assesses independence of CB by the reaction of CB to the government's demands for higher credit. The CB is factually independent if it could achieve its target of money supply despite disability to resist the government's demands for credit. Because of some limitations in the first two methodologies, especially in the developing countries the study followed Fry's methodology for assessing factual independence of the CBE. In an attempt to develop Fry's method, the study used simple criterion to assess the CB independence, namely, that the CB is factually independent if it can fulfill its target without squeezing private sector. Under the assumptions that the CB will take an appropriate action to maintain its target and the CB applies either SIP or FXT, the study assesses both efficiency and

independence of CB by linking the CB's actions to the influence on both DCG and DCP. In other words, the study assesses both efficiency and independence of CB upon the sign of the coefficients β_2 and β_3 included in the equation 5. Where, the sign of the coefficient β_2 indicates efficiency, and the sign of the coefficient β_3 indicates independence of CB. Applying this criterion to the case of the CBE, the study estimated the equation 5 using quarterly data on the period 1991Q1-2007Q1. The estimation results were as follow: (i) the legal independence granted to the CBE under the latest legislation is not factual. (ii) The Chow test did not detect any significant change of the CBE independence after the latest legislation promulgated in 2005. (iii) The CBE is factually applying the sterilized intervention policy. For robustness, the study re-estimated the equation 5 using monthly data on the period 2001M12-2009M6. The estimation has been run by calculating NFA either from M0 or from M2. In both, the results assert the above conclusions of the study, where the CBE is not factually independent and the CBE applies the sterilized intervention policy.

The third essay empirically investigates the rest of the aforementioned points related to prerequisites for IT, i.e. the CB should not maintain an implicit target for the FX rate, the impact of foreign economic shocks on both inflation and real growth rates in the domestic economy, and the channels through which monetary policy actions are transmitted to changes in real output and the price level. Thus, the third essay investigates the following questions; does the CBE maintain an implicit target for the FX rate? Does the CBE follow an independent monetary policy? Which variables have priority in the reaction function of the CBE? How far can foreign economic shocks explain the behavior of real GDP and price level compared with domestic economic shocks? And which monetary transmission mechanism channels play a dominant role? To do so, the study estimates MTMs using a structural VAR model in which the Egyptian economy is treated as a small open economy relative to the USA economy. The study, firstly, presented descriptive analysis about potential channels through which monetary policy actions can affect both real output and price level. A descriptive analysis about MTMs is important because it helps to discern the reaction of economic variables to monetary policy actions. In addition, it guides us to assess which MTM channels exist in reality. Secondly, by reviewing relevant literatures, the study specified a structural VAR model. The model is

estimated under three identification schemes which summarize our assumptions about the domestic and foreign variables, the operating instrument, the variables that the CBE looks at when setting its operating instrument and the interaction of a monetary policy shock with the variables in the feedback rule. By estimating the three-benchmark VAR model and analyzing both impulse responses and variance decomposition of domestic variables, results of the study were as follows:

(i) The CBE is factually applying the sterilized intervention policy. This result is corroborated through positive and significant response of monetary policy to structural shock in the rate of change in FX rate. In addition, this result comes in line with both descriptive analysis and estimation results in the second essay. Taking into account that the CBE is (formally) applying the monetary targeting regime, this result indicates that the CBE is (implicitly) maintaining a target for the FX rate.

(ii) The high variance of domestic interest rate caused by either federal funds rate, among foreign variables, or FX rate, among domestic variables, indicates that the CBE does not apply an independent monetary policy.

(iii) The most important variables that take priority in the reaction function of the CBE, among domestic and foreign variables, are the federal funds rate and FX rate, in succession.

(iv) Foreign economic shocks, particularly shocks in both the rate of growth in real GDP^{USA} and federal funds rate, play a dominant role in explaining the behavior of the rate of growth of real GDP in Egypt. Domestic interest rate has significant impact on the rate of growth of real GDP in Egypt.

(v) Foreign economic shocks do not have significant impact on the rate of inflation in Egypt during the short run. The rate of inflation in Egypt, in the short run, is controlled by domestic variables. The rate of growth of M2 takes priority among domestic and foreign variables that influence domestic inflation either in the short run or in the long run. Changes in domestic interest rate take the second priority among domestic variables that affect the rate of inflation in Egypt. The rate of change in FX affects domestic inflation in the short run.

(vi) The interest rate channel explains the MTMs in Egypt, where changes in domestic interest rate affect both the rate of growth of real GDP and domestic inflation.

2. Concluding remarks

The results of the study bear important implications on adopting IT in Egypt as follows:

(i) The result of the study in the first essay about both unstable the demand for money function and the velocity of circulation of money means that the CBE cannot achieve price stability under the current monetary targeting regime. Taking into account that the CBE has formally floated the FX rate, thus the study concludes that the CBE should take steps toward adopting IT. This conclusion is supported by practical experience of many countries such as Czech Republic, Poland, and Brazil. As mentioned, these countries adopted IT immediately after floating the domestic currency. Other options for achieving price stability were not appropriate. The 'just do it' policy was not an appropriate alternative either because of economic turbulences or because the CB did not have a track record of credibility. In addition, the monetary targeting regime was also not an appropriate alternative because of unstable demand for money function, especially after the liberalization of capital flows and financial markets.

(ii) The results of the study in both second and third essays underscore the need for satisfying preconditions for IT otherwise adopting IT under the current conditions will not be successful. The reasons for that are:

(1) According to empirical results of second essay, the CBE is not factually independent because of systematic contribution in financing budget deficit, where the sign of β_3 is negative and significant. As mentioned, factual independence of CB is one of the most preconditions needed for adopting IT. The CB should be free to choose the appropriate tools and change them whenever it is necessary without any pressure from the government. Thus, factual independence of CB includes three elements; legal instrument independence, nonexistence of government representatives in the Monetary Policy Committee (MPC) as voting members, and no obligation for the CB to finance budget deficit. In the light of this, granting the CBE a legal instrument independence becomes meaningless if the decision making process inside the MPC (or the BoD) is dominated by the government representatives, and the CBE is obliged to finance budget deficit (see; the second essay, section 6.1).

(2) According to empirical results of both second and third essays, the CBE is maintaining an implicit target for the FX rate. Indeed, maintaining an implicit target for the FX rate contradicts with the successful application of IT. A monetary policy under the commitment to other targets, e.g. exchange rate, will be confined by those targets and as a result, the monetary authority is more likely to fail in hitting the announced target of inflation. In addition, the public will have no assurance that the monetary authorities will give a priority to the inflation targets. Such a situation is likely to deteriorate individuals' expectations about inflation because of uncertainty about the credibility of the announced target. Thus, as a prerequisite for adopting IT, the CBE should not target any other variables.

(iii) After satisfying prerequisites for IT, adopting IT by the CBE can be successful, where domestic price level is determined by domestic factors, and short-term interest rate (monetary policy tool) has significant impact on both domestic prices and real GDP.