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Estimation of Monetary Policy Reaction Function and Inflation Function under Fiscal Dominance in Egypt

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Abstract

The Egyptian economy has been suffering from a high and persistent budget deficit as a percentage of GDP over the past decades. The need to finance this deficit emerged through the inflationary monetary financing of the Central Bank of Egypt or by purchasing government debt. This resulted in the accumulation of public debt from internal and external sources. The purpose of this study is twofold: The first is to test the extent of fiscal dominance over monetary policy in Egypt and assess the dynamic behavior of inflation, considering the impact of real, monetary and financial factors under the fiscal dominance. The second is to prioritize monetary policy by estimating the CBE's response function. The results of the study showed that the dominance of the monetary policy is deeply rooted in the Egyptian economy through monetary financing of the budget deficit and the government's absorption of a large part of the net domestic credit of the Central Bank. The results of assessing the reaction of the central bank confirmed the existence of multiple and conflicting monetary policy objectives to target the stability of the exchange rate, stabilize the inflation rate and increase the real output growth rate; but the highest priority was to maintain the exchange rate stability more than targeting inflation.

ملخص

لقد عانى الاقتصاد المصري من عجز مرتفع ومستمر في الميزانية كنسبة من الناتج المحلي الإجمالي على مدى العقود الماضية. وظهرت الحاجة إلى تمويل هذا العجز من خلال قيام البنك المركزي المصري بالتمويل النقدي التضخمي أو عن طريق شراء الديون الحكومية. ونتج عن ذلك تراكم الدين العام من مصادر داخلية وخارجية. الغرض من هذه الدراسة ذو شقين: الأول، هو اختبار مدى وجود لهيمنة السياسة المالية على السياسة النقدية في مصر وتقدير السلوك الديناميكي للتضخم في مصر مع مراعاة تأثير العوامل الحقيقية والنقدية والمالية في ظل هذه الهيمنة. والثاني هو تحديد

أولوية السياسة النقدية من خلال تقدير دالة رد فعل البنك المركزي المصري. ولقد أظهرت نتائج الدراسة أن هيمنة السياسة المالية للسياسة النقدية متجذرة بعمق في الاقتصاد المصري خلال التمويل النقدي لعجز الميزانية واستيعاب الحكومة لجزء كبير من صافي الائتمان المحلي للبنك المركزي. ولقد أكدت نتائج تقدير دالة رد فعل لبنك المركزي وجود أهداف متعدد ومتضاربة للسياسة النقدية لاستهداف استقرار سعر الصرف واستقرار معدل التضخم وزيادة معدل نمو الناتج الحقيقي، ولكن الاولوية القصوى كانت للحفاظ على استقرار سعر الصرف أكثر من استهداف التضخم.

Introduction

Egyptian economy has been suffering from a high and persistent budget deficit as a ratio of GDP over the last decades that reached 12% in 2016. Needs for financing such deficit buy CBE through direct monetization or by buying the government's liabilities are clear symptoms of fiscal dominance. The accumulation of huge public debt from domestic and foreign sources, which reached 90% and 35% of GDP, respectively; limited the ability of monetary policy to use its tools, especially domestic interest rates, in controlling inflation. In this case, any increase in interest rate would increase the cost of servicing the domestic public debt and raising the budget deficit as a percentage of GDP and threatens the public debt sustainability.

The purpose of this study is two-fold: the first, is to test for the existence of fiscal dominance in Egypt and estimate the dynamic behavior of inflation in Egypt taking into consideration the impact of real, monetary, and fiscal factors under the fiscal dominance of monetary policy; the second, is to identify the monetary policy targeting priority of nominal anchor(s) by estimating the CBE's reaction function during the period of the study 1974-2018. The importance of this study comes from its attempt to uncover the ambiguity surrounding the monetary policy's choice of its nominal anchor(s) in Egypt and determine empirically their priorities in the case of multiple

anchors. Estimating an accurate inflation dynamics in Egypt will support any attempt to implement successful inflation targeting.

The remainder of this paper is divided into six parts. In the first part, I will review the previous studies concerning the impact of fiscal dominance on monetary policy in emerging countries and Egypt. The second part will analyze the monetary policy choice of nominal anchor in developing and emerging countries. In the third part, I will present stylized facts about inflation dynamics under fiscal dominance and the monetary policy stance in Egypt during the period of the study 1974-2018. In the fourth part, I will build two models, the first one is to explain the reaction function of the CBE in response to changes in real GDP, inflation, foreign exchange rate and budget deficit, and the second model is to analyze the inflation dynamics under fiscal dominance. The empirical analysis and the results will be presented in the fifth part. Concluding remarks are given in the last part.

1. Literature review

After the successful implementation of the inflation-targeting (IT) framework in industrial countries since its first application in 1990 in New Zealand, a strong tendency has started in emerging and developing countries to apply this framework to control inflation in their countries. Targeting exchange rate (EXT) or monetary aggregates (MT) or both used to be the guidance of monetary policy to maintain inflation under control in emerging (EME) and developing countries (LDC). With high foreign exchange rate path-through to inflation in these countries, monetary policymakers preferred using the foreign exchange rate as a nominal anchor or directly targeting it to maintain stability in their price level. In this part, I will first review the cases in EME and LDC then turn to the Egyptian case.

(Ersel and Azatay, 2008) explained why Turkey decided to implement an implicit inflation-targeting regime in 2002, instead of a full-fledged IT,

because of the severe fiscal dominance caused by high and unsustainable domestic debt which was coupled with high pass-through of the foreign exchange rate. This implicit IT regime implied a monetary targeting to limit the base money and net domestic and foreign assets of the central bank of Turkey. In such circumstances, raising the policy rate by the central bank to deal with any expected inflationary pressure would danger the sustainability of public debt, especially if the higher interest rate is perceived by the market as a sign of high risk.

(Sanusi and Enisan, 2016) investigated the presence of fiscal dominance in Nigeria during the period of 1986-2013 by testing of unidirectional causality, running from fiscal deficits to growth of monetary base. [1] They argue that in the case of fiscal dominance, governments make pressure to keep interest rate low, relative to inflation rate, to reduce the cost of financing the budget deficit. Based on the empirical results, the study could not confirm the existence of fiscal dominance in Nigeria during the period of the study. One should take into consideration that the study depended on a narrow aspect of fiscal dominance which is the monetization of the budget deficit.

Using multivariate cointegration analysis and vector error-correction modeling, Nachega (2005) examined the fiscal dominance hypothesis in the Democratic Republic of the Congo during 1981-2003. In this paper, inflation was modeled as a fiscally driven monetary phenomenon. The degree of fiscal dominance was measured by the evolution of the sum of seigniorage and inflation tax as a percentage of GDP. The fiscal dominance hypothesis implies that budget deficit affects inflation through its effect on money growth rate or seigniorage. The empirical results confirmed strong and statistically significant long-run relationships between budget deficits and seigniorage, and between money creation and inflation. The budget deficits had a long-run

inflationary impact during the 1980s and 1990s. Disinflation was achieved in the early 2000s mainly after the restraining of fiscal deficits and the reduction in the rate of monetary expansion.

In his seminal study about inflation targeting in Brazil during the period 2002-2003, (Blanchard, 2004) has established the link between real interest rates, real exchange rate, and the probability of default on government debt, within a high-risk-aversion market. In a standard open economy model, the transmission from a high real interest rate to lower inflation is going through two channels. The first is through the negative impact of higher interest rate on aggregate demand and output and thereby decreases inflation. The second, higher interest rate will cause a real appreciation of the domestic currency and this in turn will decrease inflation. (Blanchard, 2004: p. 5) argued that in the case of fiscal dominance raising domestic real interest rate in response to high inflationary pressures would increase the probability of default on government debt, especially the dollar-denominated part, and leads to a real depreciation and thus increase inflation rather than decrease it. In this case, fiscal policy would be the right tool, instead of monetary policy, to decrease inflationary pressures.

Following the fiscal theory of the price level of proposed by (Woodford, 2001)[2], (Kumhof, et al., 2008) tried in their study to find out whether an aggressive monetary policy response to inflation is feasible in countries that suffer from fiscal dominance. He found that eliminating fiscal dominance would be better than following aggressive monetary policy by raising nominal interest rates in response to high inflation. Higher nominal interest rate, even if central banks included in their monetary rules fiscal variables, would result in extremely volatile inflation (Kumhof, *et al.*, 2008: p.17). The study concluded by giving clear advice to central banks in

developing countries that achieving fiscal discipline is extremely important before any attempt to implement inflation targeting.

(Edda, 2005) analyzed how fiscal policy affects monetary policy in six emerging economies, Argentina, Brazil, Colombia, Mexico, Poland, and Thailand. First, following the approach proposed by (Canzoneri et al., 2001) and (Tanner and Ramos, 2002), he conducted a test for fiscal dominance, and found evidence to confirm the existence of fiscal dominance in the case of Argentina and Brazil during the 1990s and early 2000s, mixed results were found for the other countries in the sample.[3] Second, he also examined whether monetary policy accommodates fiscal policy, by assessing whether the fiscal variable (changes in real primary balance) enter significantly in the central bank's reaction function for seven emerging countries Brazil, Chile, Colombia, Mexico, Poland, South Africa, and Thailand. The findings suggested that monetary policy in the selected emerging markets were not directly affected by changes in real primary balance. We can conclude from reviewing these studies that fiscal dominance is considered a tough challenge to efforts in EME and LDC to control inflation and removing fiscal dominance is a prerequisite for successful IT. In the following studies related to Egypt.

(Al-Mashat, 2008) reviewed the development of monetary policy in Egypt, during 1996-2005 and highlighted the replacement of quantitative monetary instrument with price instruments as an important step towards the adoption of formal inflation targeting over the medium term. Following (Domaç, 2003), she examined the inflation dynamics by estimating a money-gap model based on domestic liquidity. Despite the simplicity of the money-gap model, it depends only on the deviation of the actual real money supply from its trend value to explain inflation behavior and ignores important variables that directly affect inflation dynamics in Egypt, such as real GDP,

nominal exchange rate, and other variables that reflect the existence of fiscal dominance. To examine the readiness of the Egyptian economy for the implementation of inflation targeting, the author compared the macroeconomic indicators of some emerging countries of previous inflation targeters with those of Egypt. [4] She concluded that despite the improvement in Egypt's readiness to implement inflation targeting, this will be conditional on its ability to curb the sever fiscal dominance by consolidating the fiscal position.

To check whether the Egyptian economy suffers from fiscal dominance or not, (Youssef, 2011) used an error correction model to test the impact of CBE lending to the government to finance its budget deficit on inflation during 1960-2007. The model included also two more explanatory variables; i.e., real GDP and M2 as a ratio of GDP. The empirical results confirmed the existence of fiscal dominance through a statistically significant long-run relationship between the price level in Egypt and net claims on the government, M2/GDP, and real GDP. Although, no short-run relationship could be found as the coefficients of independent variables in the short-run were found insignificant and the error correction term showed a very slow adjustment towards the long-run. Despite the empirical confirmation of the fiscal dominance during the period of the study, the estimated model ignored the effect of foreign exchange rate on the behavior of price level and inflation in Egypt. Including foreign exchange rate in the model, given its high pass-through effect on inflation, would have improved its performance.

(Helmy, 2008), investigated the short-run dynamics and long-run relationship between the budget deficit and its sources of financing and inflation in Egypt during 1981-2006. Using Johansen cointegration analysis, the empirical results suggested that there is a long-run and positive relationship between inflation, the budget deficit, net credit to the

government, and money supply M2; and negative relationship with real output growth and the nominal foreign exchange rate (LE/$). The later negative relationship between inflation and nominal foreign exchange rate contradicts with the fact that depreciation of the Egyptian pound against the U.S. dollar always creates inflationary pressures. The paper concluded that budget deficit and its sources of financing are important factors causing inflationary pressures in Egypt and making targeting price stability challenges.

To answer the question of whether the switching to the inflation targeting regime is necessary for the Egyptian economy or not, (Awad, 2008) tried to measure the efficiency of monetary targeting regime by testing the stability of the velocity of circulation, and the stability of the demand for money function during 1991Q1-2007Q1. The study found that there was neither a short-run nor long-run relationship between the price level (CPI) and money supply (M2); even using a non-causality test showed no directional relationship between the two variables over the selected time period. With respect to the stability of the velocity of circulation and the demand for money, the empirical results pointed to the instability of both during a shorter period 2002Q1-2007Q1. [5] In the light of these results, the study concluded that "*it becomes necessary for Egypt to switch to the IT regime once its prerequisites have been met.*" [6] All these tests indicated the inefficiency of using monetary targeting regime in Egypt, but they could not necessarily advocate using inflation targeting; especially that none of which dealt with the problems related to the fiscal dominance or the targeting of foreign exchange rate that contradict with implementing inflation targeting framework.

(Selim, H., 2010), tried to assess whether monetary policy significantly changed after the float of the Egyptian pound in 2003. The

author used a cointegration model to test for the long-run relationship between the foreign exchange rate and monetary fundamentals during the period 1981-2008. A vector error-correction model showed a slow speed of adjustment of the exchange rate to its long-run equilibrium suggesting that misalignments of exchange rate are persistent. The empirical results showed no significant change in exchange rate determination after the float. Accordingly, irrespective of the *de-jure* classification of float, the *de-facto* for the Egyptian exchange rate system could not be classified as a floating one. The author highlighted the conflict between foreign exchange rate stability and controlling inflation, especially as CBE decided to avoid appreciation of the pound (despite the float) and tried to sterilize partially the high foreign capital inflows during 2005-2007; so, the unsterilized part of capital inflows raised money supply and increased inflation.

Motivated by the CBE's intention to apply inflation targeting framework (Noureldin, 2005) evaluated the robustness of three alternative approaches to forecasting inflation in Egypt during the period 1980Q1-2002Q4. These models were *the Output-gap* model, a *Money-gap* model, and a Vector Autoregressive (VAR) model. The empirical results showed that the Money-gap model outperforms the other models and its ability to capture the dynamics of inflation in Egypt during the selected period. However, the three models showed poor forecast performance. Given that CBE's inflation target is always unknown, the author depended on a very restricted assumption that the implicit inflation target depended on actual inflation in the U.S., simply because CBE maintains a fixed exchange rate over the period of the study. It is hard to believe that the monetary policy of CBE is maintaining this nominal parity between the domestic price level and price level in the U.S., such claim needs rather to be tested empirically.

The review of the studies related to Egypt, except for (Youssef, 2011) and (Selim, 2010), included attempts to estimate inflation dynamics using simple models such as the money-gap that does not take into consideration the role of the foreign exchange rate and its high pass-through nor the severe fiscal dominance. These studies also ignored the obscurity surrounding the monetary-policy targets and the possible contradictions between these targets that reduces its performance in controlling inflation. These issues are the motivations behind this study and its novelty is in the attempt to uncover empirically the monetary-policy targeting priorities by estimating CBE reaction function and explaining the behavior of inflation dynamics under fiscal dominance and the preference of foreign exchange rate stability.

2. Monetary Policy and the Choice of Nominal Anchor

There is a general agreement between economists and policymakers about the main goal of monetary policy is to maintain law and a stable inflation rate. To achieve this goal, monetary policy should have a nominal anchor, which is an intermediate target that helps economic agents to form their expectations about inflation. Conducting monetary policy without a nominal anchor is risky because it may cause public expectations about inflation to drift into recession or inflation as explained by (Bemanke et al., 1999). There are three main regimes of nominal anchors for monetary policy; i.e., exchange rate targeting (EXT), monetary targeting (MOT), and inflation targeting (IT). [7]

For small developing countries with a simple financial system and controlled foreign capital flows, exchange rate targeting is an easy nominal anchor that can be applied either by pegging their currencies to a strong foreign currency (hard peg) or limiting changes in the foreign exchange rate (soft peg). EXT regime is more effective in maintaining price level stability in developing countries with a high pass-through of foreign exchange rates.

Liberalization of capital account in developing countries or emerging economies will make targeting the exchange rate problematic. On one hand, monetary policy needs to sterilize capital inflows to maintain foreign exchange stability and absorb domestic liquidity to avoid inflationary pressures. On the other hand, keeping the exchange rate target would encourage speculative attacks with very high cost in terms of losing foreign international reserves. [8] As explained by (Panizza, 2000), in the environment of free foreign capital flows fixed exchange rate becomes one of the main causes of severe currency and financial crises.

To deal with such crises, more economists advise developing and emerging countries to follow a more flexible exchange rate regime (Mishkin, 2000), (Sachs and Larraine, 1999) and (Velasco, 2000). The IMF also advocates applying a flexible exchange rate system as part of its conditionality for supporting member countries, so targeting foreign exchange lost its popularity. Practically, the choice for monetary policy of its nominal anchor is becoming limited between monetary targeting or inflating targeting.

Concerning monetary targeting, monetary policy will simply limit the growth rates of one or more of monetary aggregates. The growth rate of the chosen monetary aggregate should be consistent with a low and stable level of inflation. The choice of an appropriate monetary variable depends on its effects on inflation and inflation expectations. Under the IMF' supporting programs, monetary aggregates are chosen from the components of central-banks' balance sheet; e.g., base money, net domestic assets, or net foreign assets. For monetary targeting to be a true nominal anchor, central banks should also be announced for the public to try to tie down their inflation expectations. The information impact of money target is generally limited compared with those of exchange rate and inflation rate targets, as the public

is more familiar with these two variables than the limits imposed on the growth of money supply.

The credibility of the central banks is considered as a prerequisite for the efficiency of monetary targeting regime; therefore, it is only suitable to developed countries with efficient financial markets and flexible exchange rate system (e.g., United States, Japan, and Germany). [9] The rationale of monetary targeting assumes a stable relationship between monetary aggregate (e.g., money supply) and inflation; this entails a constant velocity of circulation. In LDC and EME, the relationship between monetary aggregates and inflation is found unstable and their central banks have less control over their monetary aggregates; therefore, monetary targeting is considered as inefficient for these countries (Mishkin and Savastano, 2001). In addition, frequent exceeding of the pre-announced monetary target in LCD and EME would be perceived by the public as an expansionary monetary policy that raises inflation expectations and endanger the efforts of monetary policy to reduce inflation. [10]

The third possible nominal anchor for countries opt for a flexible exchange rate is the inflation targeting regime (IT). This regime consists of four components Masson, et al. (1997):

1. Explicit numerical target for inflation rate in the future.
2. Targeting inflation is the overriding objective of monetary policy.
3. A model to forecast future inflation rate.
4. An operating procedure to adjust monetary instruments in case of the forecasts of the inflation rate differs from the targeted rate.

The prerequisites for successful implementation of IT include the independence of the central bank from any fiscal dominance and any commitments to other nominal anchors (EXT or MT) other than the inflation target. A slightly different prerequisite of IT adds an institutional commitment

to price stability, policy instrument independence, and policy transparency and accountability (Mishkin and Hebbel, 2001). Central banks should have instrument independence rather than target independence because the former helps to avoid fiscal policy interference in the conduct of inflation targeting. In the comparison between targeting headline or core inflation, central banks should target the later to avoid overreacting to transitory supply shocks or sudden changes in food and energy prices. The disadvantage of targeting core inflation is its measurement is less transparent and unclear to the public compared with the headline, which is based on changes in CPI, (Bernanke, et.al, 1999).

Inflation should be the overriding target means that the central bank can also target other nominal anchors such as exchange rate or monetary aggregate, but if there is any conflict inflation should override the other targets. In the case targeting different nominal anchors, central banks could assign one target for the short-run and the other for the long-run, and in the case of conflict central bank can overshoot or undershoot the subordinate target. [11] High path-through effect of foreign exchange, there will be a need for a transition period for central banks in LDC and EME to have more than one target EXT and IT, in this period using discretion to decide which target to have the higher priority.

LCD and EME countries with a high inflation rate should approach IT gradually this would help to reduce the cost of restrictive monetary policy in terms of output stabilization. Coordination between monetary policy and fiscal policy should not be limited to reducing the burden of fiscal dominance and removing the administrative control over domestic prices, which are the main fiscal problems that reduce the efficiency of IT, it should include the end of pro-cyclical behavior of the fiscal policy. In this respect, (Taylor, 2000) divides government budget into two parts the first is the structural

government budget and the second is cyclical budget. The government should limit the later to the automatic stabilizers and extremely limit the former. He stresses the importance of reducing the pro-cyclical behavior of the fiscal policy and try to make enough surplus in the booming time to help to finance the need for expansionary policy in the recession period. This will alleviate the burden on the monetary policy to create enough seigniorage by issuing money.

The main disadvantage of IT is caused by its extreme emphasis on inflation stabilization that would create high cost in the form of large output variability.[12] This is called Strict inflation targeting in which reducing inflation is the only objective of the monetary policy irrespective of any other targets such as economic growth or foreign exchange rate stability.[13] Flexible inflation targeting entails a gradual approach to get inflation target with considering output and foreign exchange rate stabilization. Accordingly, LDC and EME with multiple targets should implement a flexible inflation targeting to lessen the cost of large fluctuations in both foreign exchange rate output.

3. Stylized Facts about Inflation Dynamics and Monetary Stance in Egypt

3.1 Inflation Dynamics and Fiscal Dominance in Egypt

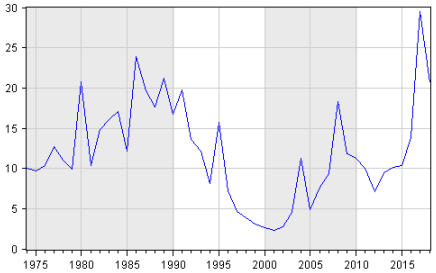
Egyptian economy has witnessed an unstable record of the annual inflation rate over the last four decades. The period of the study (1974-2018) will be classified into four distinct sub-periods according to different structural changes, the first is (1974-1991), the second is (1992-2003) the third is (2004-2010) and the fourth is (2011-2018).

In the **first period (1974-1991)**, the inflation rate was at a low level during the early 1970s, but shifted to a moderate level after the first oil-prices shock in the mid-1980s. In the second half of the 1980s to the early 1990s,

the annual inflation rate took a faster track and averaged about 19% annually, see Figure (1). The Egyptian government recoded a high level of budget deficit during the second half of the 1970s and the 1980s and an average of 22% and 21.5% of GDP; respectively, see Figure (2). To finance such a large deficit, the government was able to derive a high level of total finance of an average of 8% of GDP by creating seigniorage and inflation tax of an average of 5% of GDP and 3%; respectively. With a peak of total finance of 21% of GDP in 1980, this was a clear sign of fiscal dominance, see Figure (3).

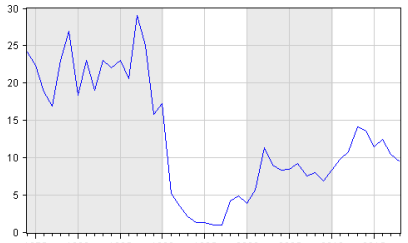
In the **second period (1992-2003)**, included the successful implementation of the Economic Reform and Structural Adjustment Program (ERSAP) with the IMF and WB during 1992-1997, inflation was put under control and continued to decrease to the lowest level of 4% in 1997. The ERSAP comprised strong restrictive monetary and fiscal measures. The monetary measures included the devaluation of the pound, rising domestic interest rates above the inflation rate, and limiting credit to public and private sector. More details will be given in the next section of the monetary policy stance. The fiscal measures included the introduction of sales-tax to support government revenue side and the issue of T-bills to finance budget deficit from real rather than monetary resources. All these measures and others helped the Egyptian government in reducing its budget deficit to only 1% of GDP in 1997. Accordingly, the total finance from seigniorage and inflation tax continued to decrease from 11% of GDP in 1990 to 3.5% of GDP in 1997.

Figure (1) Inflation Rate in Egypt (1974-2018)



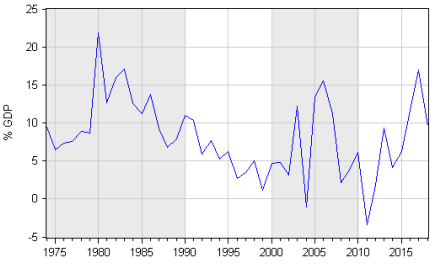
Source: Author's calculation based on CPI, IFS, IMF.

Figure (2) Budget Deficit Ratio to GDP in Egypt (1974-2018)



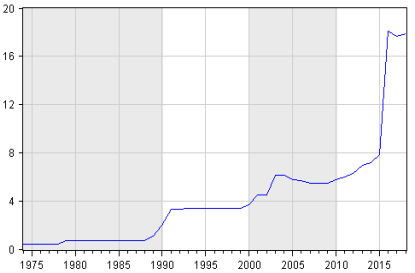
Source: CBE, Several Issues.

Figure (3) Total Financeof the Egyptian Government (1974-2018)



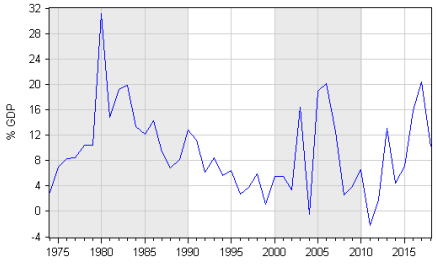
Total Finance = Seiniorage + Inflation Tax
Source: Authors's Calculation.

Figure (4) Foreign Exchange Rate in Egypt (1974-2018)



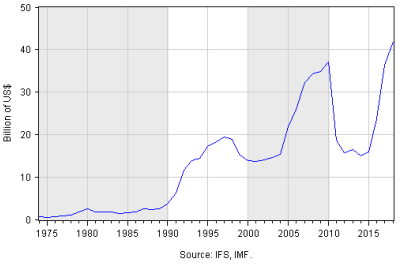
source: IFC, IMF.

Figure (8) Total Finance/GDP in Egypt (1974-2018)



Total Finance = Seiniorage + Inftion Tax
Source: Author's Calculations.

Figure (10) Egyptian International Reserves (1974-2018)



Source: IFS, IMF.

In the **third period (2003-2010)**, monetary authority abandoned the use of foreign exchange rate as a nominal anchor, several devaluations of the Egyptian pound against the U.S. Dollar in the early 2000s caused the inflation rate to jump to 11%. As can be seen in Figure (1) and Figure (2), the frequent devaluations of the Egyptian pound during the first half of the 2000s was reflected in a higher level of inflation which confirms that the foreign

exchange rate has high pass-through on inflation. A high budget deficit of an average of 7.8% of GDP (with a peak of 11.25% of GDP in 2002) had also contributed to the increase in inflation during the same period. Concurrently, total finance from seigniorage and inflation tax recorded an average of more than 8% of GDP (with a peak of 13.5% of GDP in 2005) which indicates the resurgence of the monetary pressure of the fiscal dominance on inflation, see Figure (8).

Interestingly, in the second half of the 2000s, the inflation rate continued to hike to reach 18.3%, although the foreign exchange rate was maintained stable by the monetary authority. The question is what was the reason then behind the sharp increase in inflation? Referring to Figure (8), the answer is clear, high inflation was essentially caused by a sharp increase in government's total finance of 15.5% of GDP in 2006 created by seigniorage of 12.1% of GDP and inflation tax of 3.4% of GDP. Although, the budget deficit was 9% of GDP in that year the domestic debt service was 7% of GDP in 2006, see Table (2) in the appendix.

By targeting the stability of foreign exchange rate, monetary policy could not prevent fiscal dominance from causing high inflation in Egypt. Apparently, maintaining inflation stability was not the overriding target of monetary policy during the 2000s, even after the CBE's revelation in 2005 of his intention to implement a full-fledged inflation-targeting regime if the fundamental prerequisites are met, see (CBE, 2005). No further details were mentioned about these fundamentals, whether they are institutional, technical, or even legal issues.

In the **fourth period (2011-2018)**, the foreign exchange market was put under substantial pressure after the revolution in the 25th of January 2011. During the five years that followed the revolution, the Egyptian economy suffered from external and internal imbalances caused by political and

economic instability. Therefore, international reserves were depleted quickly by more than $20 billion over the period 2010-2015, the Egyptian pound was devalued several times and lost 31% of its value which was also reflected in imported inflation of an average of 9.5%. A high budget deficit of an average of 12% of GDP contributed to the inflationary pressure through a total finance of an average of 3.6% of GDP.

In November 2016, the Egyptian government decided to implement a three-year comprehensive program with an IMF-support of $12 billion. [14] Applying a floating exchange rate system to determine the market value of the U.S. dollar was one of the main components of the new program to correct external imbalances and restore competitiveness. Unfortunately, the market value of the U.S. dollar overshot to LE18 and created a new wave of imported inflation to an all-time high of over 30% in 2017.

To reduce the budget deficit of 12.5% of GDP, the program entailed measures to narrow the gap between government revenues and government expenditures to make a primary surplus of 2% of GDP to restore public debt sustainability. This is very hard to achieve, given that the government suffered from a high primary deficit of an average of 4% of GDP during the fourth period, see Table (3) in the appendix. Replacing Sales-Tax by Value-Added Tax (VAT) and raising its rate to 14% to increase government revenue and restraining wages and reducing energy subsidy to decrease government expenditures. All these measures contributed to the inflationary pressures created by foreign exchange rate pass-through.

Additionally, after one year of the implementation of the new free-floating regime, the foreign exchange rate exhibits a clear lack of flexibility which is necessary for cushioning external shocks.[15] According to the IMF's fourth review of the EFF program, the Egyptian pound has remained stable against the U.S. dollar despite a significant share of portfolio

investment outflows; these outflows have been absorbed by CBE's repatriation mechanism without any effect on the exchange rate or the international reserves.[16] Maintaining stability of the foreign exchange rate is an indication of a third possible nominal anchor that could be the international reserves targeting or the foreign exchange targeting. The ambiguity surrounding the choice of monetary policy's nominal anchor or the priority of each anchor in the case of multiple anchors need to be cleared to build CBE's transparency and accountability.

The accumulation of huge public debt from domestic and foreign sources, which reached in 2016 95% and 16% of GDP, respectively, see Table (1) in the appendix. This high debt ratio limited the ability of monetary policy to use its tools, especially domestic interest rates, in controlling inflation. In this case, any increase in domestic interest rate would increase the cost of servicing the domestic public debt and raising the budget deficit as a percentage of GDP in the same time threatens the public debt sustainability. Given the high cost of domestic interest rate relative to foreign rate, the Egyptian government expand its borrowing from foreign sources which increased from 16% of GDP in 2016 to 31.5% in 2018.

After reviewing the inflation dynamics in Egypt over the period of the study we can conclude that the pattern didn't change much. The trigger is always caused by external or internal shocks, then inflation is sustained by the fiscal dominance of monetary policy in the form of financing the budget deficit through seigniorage and inflation tax. After the 2011's revolution, the nature of fiscal dominance has changed to take the form of high CBE's net credit to the government (NCG) that continued to increase from 35% of GDP in 2011 to 69% of GDP in 2016, see Figure (10). NCG is becoming a major component of net domestic assets that the CBE depends on, along with net

foreign assets, to supply money. Therefore, it is important to remove fiscal dominance to support monetary policy in targeting inflation.

3.2 Monetary Policy Stance

During the first period (1974-1991), monetary policy in Egypt did not have clear objectives, although it was responsible for providing enough seigniorage revenues to the government to finance its budget deficit and maintain low-interest rates for cheap lending to public enterprises.[17] A high reserve requirement of 25% was used as a basis for creating resources from the inflation tax to finance the budget deficit.[18] During this period, the exchange rate was pegged to the U.S. dollar but with multiple exchange rates applied to different international transactions that created a great distortion in the pricing system.

In the **second period (1992-2003)**, the ERSAP program mandated a serious restrictive monetary policy that included a high-interest rate and credit ceiling on lending to private and public sector. After the devaluation of the foreign exchange rate in 1992, CBE decided to use it as a nominal anchor of the monetary policy. This was the first time that monetary policy has an explicit nominal anchor to maintain the stability of price level and reduce inflation expectations. The foreign exchange regime became a strong pegged system at LE 3.33 per U.S. $, see Figure (4).

The negative impact of such a contractionary policy on economic growth created a conflict for monetary policy between maintaining a lower inflation rate and stimulating economic growth; whereas the later needs decreasing domestic interest rate the former requires raising it. This conflict became more problematic because of the liberalization of foreign capital flows in the late 1990s; maintaining the stability of foreign exchange rate contradicted with keeping a lower inflation rate. During this period, the monetary policy was active in sterilizing the foreign capital inflows to prevent

Egyptian pound from appreciation. Sterilization policy was mainly implemented through the issuance of T-bills and T-bonds beyond the need for financing the budget deficit, which in turn contributed to the accumulation of domestic debt.

Raising interest rates to lower inflation encouraged the inflows of foreign capital and thereby increased the pressure on the domestic currency to appreciate. Meanwhile, CBE changed some monetary policy instruments from direct to indirect measures e.g., introducing T-bills as non-inflationary tools to finance the budget deficit (at positive real interest rate), and used repo operations to provide enough liquidity to support economic growth.

As the Egyptian economy was hit by the Asian crises in 1997 and the Luxor's terrorist attack in 1998 that created an overall balance of payments deficits and shortage in international reserves, maintaining the stability of the foreign exchange rate was a very difficult task. With further pressure on Egyptian pound to devaluate, CBE tried to add some flexibility to the exchange rate system by following a *crawling peg* during 2001-2002; but the system failed, and the Egyptian pound lost 30% of its value. [19] In January 2003, CBE abolished *the crawling peg* system and allowed the Egyptian pound to float.

In the **third period (2004-2010)**, despite the de-jure floatation of 2004 which was reclassified into de-facto managed floating, monetary policy did not have an explicit nominal anchor anymore, rather implicitly targeted money growth of about 10% annually to keep price stability. To control money growth, CBE used excess reserves of banks as its operational instrument, and M2 as its intermediate target given its strong linkage with inflation. Such targets could not be maintained especially in the period of excessive capital inflows (2005-2007) during which the money growth rate was higher than the target of 10%. As a result, the inflation rate hiked to 20%.

This complication occurred because monetary policy tried to target both inflation and exchange rate. [20]

CBE added more indirect monetary instruments, such as the reverse repos of T-bills, the introduction of CDs with one-year maturity in 2004, and CBE's notes with maturities of one to two years in 2005. The discount rate was used as the policy rate up to 2005, after that CBE decided to use the overnight deposits and lending rates on CBE' standing facilities as the policy rate. These two rates represented the minimum and the maximum of a corridor within which the market overnight rate can fluctuate. Although this new short-run policy rate was considered an important indirect instrument, its value was negative in real terms and thereby perceived as expansionary policy, especially in time of high inflation rate. [21]

While the price stability became a formal goal of monetary policy in the banking law of 2003, it was not always the overriding objective, as CBE is also committed to achieving the government's target of economic growth. [22] On the contrary, the 2003 law allowed explicitly the CBE to give an overdraft to the government with a cap of 10% of the average annual budget revenue during the previous three years. In fact, the CBE's net credit extended to the government frequently exceeded this cap. [23]

In the **fourth period (2011-2018)**, especially after the announcement of the monetary policy of its first inflation target of 13% of the headline with (± 3%) range in May 2017, CBE decided to maintain a strong tight monetary policy stance, included the following measures: [24]

- Raising the overnight deposit and lending rates by 200 basis points to 18.75 percent and 19.75 percent, respectively.
- Increasing the required reserve ratio for banks at the CBE from 10% to 14%.

- Absorbing excess liquidity from the banking system by using deposits acceptance operations with maturities of 28 to 210 days, at variable rates linked to the corridor rate.

The implementation of this tight monetary policy succeeded in containing inflationary pressures as the annual headline inflation rate retreated to 14.4 percent at the end of June 2018 (from 30 percent at the end of June 2017). As soon as the inflation rate reached the level within the range of the target, MPC decided to lower overnight deposit and lending rates twice on February 15, 2018, and on March 29, 2018, by 200 basis points in total to 16.75 percent and 17.75 percent; respectively. [25] This abrupt return to expansionary monetary policy to support economic growth is a clear indication that monetary policy in Egypt in the fourth period had dual targets; i.e., inflation and economic growth.

4. Taylor Rule and Central Bank Reaction Function and Inflation Dynamics

The main component of IT is the central bank reaction function called Taylor Rule presented by (Taylor, 1993). A Taylor Rule is a policy rule that explains the short-term nominal interest rate as a function of the deviation of inflation from a target and the deviation of real GDP from potential GDP. A Taylor rule may take the following form:

$$i_t = r + \pi_t + a(\pi_t - \pi^*) + \beta(y_t - y^*). \qquad (1)$$

a and β specify the response of nominal interest rate if actual inflation deviates from its target and actual real GDP from its potential; respectively. Both parameters are expected to be positive, which means that central bank is going to raise i_t if $\pi_t > \pi^*$ or $y_t > y^*$. [26]

Taking into consideration the fact that the monetary policy in Egypt did not reveal any inflation target over most of the period of the study 1974-2016; and only in the year 2017 MPC announced the targeting of 13% of the

headline inflation. It would be unrealistic to restrict the value of the target to this level for the whole period. It would be more convenient to assume that π^* is the trend of inflation rather than the targeted inflation, this means that the policy rate is supposed to respond positively to any deviation of current inflation π_t from its trend π^*.

Taylor rule in eq. (1) was built on the assumption of a closed economy, (Ball, 1999) builds a simple open-economy model and shows a higher impact of changes in the domestic interest rate on inflation in an open economy than in closed one. In close economy adjustment in interest rate will be transmitted to inflation only through output channel, but in an open economy, the transmission will be through both output and foreign exchange channels.

For Egypt and most of EME that suffer from high pass-through of foreign exchange rate to inflation, eq. (1) should be modified to include the effect of the changes in foreign exchange rate on monetary policy reaction function. To measure the impact of fiscal dominance on the monetary policy we need to add a fiscal variable to eq. (1). Accordingly, eq. (1) will be modified to include changes in nominal foreign exchange rate (ΔE) and changes in budget deficit as a ratio of GDP (ΔB) as follows: [27]

$$i_t = r + \pi_t + a(\pi_t - \pi^*) + \beta(y_t - y^*) + \theta\Delta E + \gamma\Delta B \qquad (2)$$

θ and γ specify the response of nominal interest rate to changes in foreign exchange rate and changes in budget deficit ratio; respectively. In eq. (2) θ is expected to be positive; so, if there is a depreciation (appreciation) of domestic currency $\Delta E > 0$ ($\Delta E < 0$), central banks will increase (decrease) i_t to keep the stability of foreign exchange market.

With respect to the sign of γ, if monetary policy accommodates fiscal policy, γ will be positive. As claimed by (Sargent and Wallace, 1981) in the case of fiscal dominance, monetary policy will tend be expansionary in response to an increase in fiscal deficit to GDP. If γ is negative, this will be

an indication of the absence of fiscal dominance as monetary policy will be contractionary in response to an increase in fiscal deficit to GDP.

Given the delay that monetary policy takes to have its full impact, (Svensson, 1999) proposes the central bank should generate conditional forecasts of inflation and use these conditional forecasts as an intermediate target. Inflation targeting in fact turns into inflation-forecasts targeting. The difference between the conditional forecasts and inflation targets will guide the changes in policy variables (nominal interest rate). If the level of forecasted inflation is higher than the pre-announced inflation target, the policy rate should increase to lower expected inflation towards the target. Therefore, it is important for the central bank to build a robust econometric model that fits the domestic inflation dynamics with high forecasting capability.

Based on the stylized facts about inflation dynamics in Egypt presented in part 3 of this paper, fiscal dominance has played a major role in the sustainability of inflation despite the change in its form. Therefore, a fiscal variable, as a proxy of fiscal dominance, should be included as an explanatory variable in inflation function. Given the high pass-through of the foreign exchange rate to domestic inflation, it should also be included in the inflation function to explain the behavior of imported inflation. Lax Monetary policy is also contributed to the resistance of inflation whether this lag of action was caused by the necessity for avoiding appreciation of the domestic currency, to serve the target of maintaining foreign exchange rate stability, or the need for preventing the higher burden of servicing domestic debt, as another symptom of fiscal dominance. Thus, the policy rate should also be included in the inflation function to explain the impacts of other conflicting targets of monetary policy on the behavior of inflation. Accordingly, I propose a specification of inflation function for Egypt that takes into consideration the

impact of real, monetary, fiscal, and external factors. The inflation function is specified as follows:

$$\pi_t = f(y_t, i_t, E_t\ N_t), \qquad (3)$$

(-) (-) (+) (+)

Based to this function, inflation is expected to be negatively related to real GDP and nominal interest rate and positively related to nominal exchange rate and net credit to the government (N_t). The increase in N_t is considered as an indicator of fiscal dominance, simply because it is usually used in financing the budget deficit and as a major part of the net domestic assets it contributes to the creation of money. Testing for the existence of FD is difficult, given the changing nature of fiscal dominance in Egypt over the period of the study from concentration on the creation of seigniorage and monetization of the deficit to the absorption of a large part of net domestic assets. Rather than generally including the change in money supply, this proposed inflation function includes a major cause of the increase in supply of money initiated by the fiscal dominance.

1. Empirical Analysis

5.1 Data and Estimation Methodology

The data set in this study covered the period (1974-2018) with 45 annual observations of CPI-inflation (*linfc*), budget deficit ratio to GDP (*bdr*), real gdp (*rgdp*), nominal foreign exchange rate (*dexr*), discount rate (*disr*), CBE's net credit on the government (*ncgv*). The small letter (*l*) is indicating logarithmic value of the variable. All these variables are from *IFS*, IMF, except *bdr* the data is from Egyptian Ministry of Finance. The inflation gap (*ginfc*) and real GDP gap (*grgdp*) are calculated as the difference between current value of inflation and real GDP and their trends; respectively. The trend in both cases is measured using Hodrick-Prescott (HP)-filter.

To decide the appropriate econometric procedure for the estimation of the inflation function and the monetary policy reaction function, it is important to test for the stationarity of all variables involved. With respect to inflation function:

(-) (-) (+) (+) (3)`

linfc = f (lrgdp, disr, lexr, lncgv),

the results of stationarity test in Table (6a), using traditional ADF-test, and (7a), using Zivot-Andrews unit-root test with break, in the appendix show that all variables are integrated of order one I(1), except *lrgdp* is integrated of order zero I(0). Whereas the results of stationarity test of monetary policy reaction function:

(+) (+) (+) (+)

disr = f (ginfc, grgdp, dexr, dbdr), (2)`

in Table (6b) and (7b) in the appendix show that all variables are integrated of order zero I(0), except *disr* is integrated of order one I(1).

In this case of having a mix of I(0) and I(1), conventional cointegration methods; e.g., (Johansen-Juslius, 1990) and (Engle-Granger, 1987), are not applicable as they require that all variables should have the same integration order either I(0) or I(1). Accordingly, the best econometric method to estimate the long-run relationship is the Autoregressive Distribution Lag (ARDL) developed by (Pesaran and Shin, 1999) and (Pesaran, Shin, and Smith, 2001).[28]

ARDL method has several advantages of simplicity and high performance. Whereas the conventional cointegration methods estimate the long-run relationships using a system of equations, ARDL is using only one single equation for cointegration. For better dynamic performance, ARDL allows for having different lags for dependent and explanatory variables, which is impossible for conventional methods. ARDL method is also found

more robust and performs better for a small sample size of data; therefore, it is suitable for our data of 45 observations.

The general specification of ARDL(p,q) is as follows:

$$y_t = a_0 + \sum_{i=1}^{p} a_{1i} y_{t-i} + \sum_{j=1}^{q} \gamma_j X_{t-j} + \varepsilon_t, \quad (4)$$

where y_t is the dependent variable, X_t is a vector of the dynamic explanatory variables which and ε_t is the error term that should be normally distributed with zero mean and constant variance $\varepsilon_t \sim N(0, \sigma^2)$, p and q are the number of lags for dependent and explanatory variables; respectively.

To test for whether there is long-run relationship (cointegration) between y_t and X_t we need to perform the "Bounds Testing" using the following equation:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta y_{t-i} + \sum_{j=1}^{q} \omega_j \Delta X_{t-j} + \theta_0 y_{t-1} + \theta_1 X_{t-1} + \vartheta_t, \quad (5)$$

where β_1, and ω are the parameters of the short-run relationship; θ_0 and θ_1 are the parameters of long-run relationship. There will be cointegration between y_t and X_t if the null hypothesis,

H_0: $\theta_0 = \theta_1 = 0$ is rejected against the alternative H_1: $\theta_0 \neq \theta_1 \neq 0$.

(Pesaran et al., 2001) provide lower and upper bounds on the critical values for the asymptotic distribution of the F-statistic.[29] There are three possibilities of the cointegration test; first, there will be no cointegration if the computed F-statistic lays below the lower bound. Second, if the F-statistic exceeds the upper bound, there will be cointegration. Third, the test will be inconclusive if the F-statistic lays between the lower and upper bounds.

If the cointegration between y_t and X_t is confirmed, we can estimate the error correction model using the following equation:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta y_{t-i} + \sum_{j=1}^{q} \omega_j \Delta X_{t-j} + \varphi_0 \, ECM_{t-1} + \vartheta_t, \quad (6)$$

where, ECM_{t-1} is derived from the lagged value of the error term (μ_{t-1}) of the flowing long-run relationship:

$$y_t = a_0 + \sum_{j=1}^{q} \gamma_j X_t + \mu_t, \qquad (7)$$

$$ECM_{t-1} = \mu_{t-1} = y_{t-1} - \sum_{j=1}^{q} \gamma_j X_{t-1}, \qquad (8)$$

and $\varphi_0 < 0$ is the parameter of the error correction model ECM_{t-1} that measures the speed of adjustment from any shocks in the short-run back towards the long-run.

5.2 The empirical results of the ARDL inflation model:

The ARDL equation to be estimated for inflation model is specified as:

$$linfc_t = a_0 + \sum_{i=1}^{p} a_{1i} linfc_{t-i} + \sum_{j=1}^{q1} \gamma_{1j} lrgdp_{t-j} + \sum_{j=1}^{q2} \gamma_{2j} disr_{t-j} + \sum_{j=1}^{q3} \gamma_{3j} lexr_{t-j} + \sum_{j=1}^{q4} \gamma_{4j} lncgv + \varepsilon_t \qquad (9)$$

The first step in estimating ARDL model is lag selection using different information criteria. Table (7a) shows the best number of lags according to majority of criteria is 5, but 1 lag according to Schwarz information criterion SIC.

Table (7a) Lag selection for *linfc*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-25.22331	NA	0.276223	1.549913	1.763190	1.626435
1	-14.59570	17.98519	0.168769	1.056190	1.312122*	1.148016
2	-13.59326	1.645029	0.168996	1.056064	1.354652	1.163195
3	-13.58738	0.009335	0.178186	1.107045	1.448289	1.229481
4	-13.47710	0.169664	0.186983	1.152672	1.536571	1.290412
5	-9.354061	6.131702*	0.159828*	0.992516*	1.419070	1.145560*
6	-8.583443	1.106529	0.162369	1.004279	1.473489	1.172628

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error
AIC: Akaike information criterion
SIC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The estimates of ARDL inflation model are reported in Table (8a) it shows that with a maximum of 5 lags, the selected model according to SIC method is ARDL (1, 4, 1, 0, 1), the lag structure assigned for the variables *linfc*, *lncgv*, *lexr*, *lrgdp*, and *disr*; respectively. It also indicates the high explanatory power of the model as the adjusted R-Square equals 0.87. Table (9a) shows that the null hypothesis of no-cointegration between inflation and its determents can be rejected at 1% significant level as the value of F-statistic (8.63) is higher than the upper critical value bounds (5.06), which means that there is a long-run relationship between inflation an all the dynamic regressors.

Table (8a) Estimation of ARDL Mode for *LINFC*

Dependent Variable: LINFC
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (4 lags, automatic): LNCGV LEXR LRGDP DISR
Fixed regressors: BREAK (2004) C
Selected Model: ARDL (1, 4, 1, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LINFC(-1)	0.309339	0.128106	2.414704	0.0225 **
LNCGV	0.407367	0.340082	1.197849	0.2410
LNCGV(-1)	-0.120913	0.417492	-0.289618	0.7742
LNCGV(-2)	-0.030924	0.429286	-0.072036	0.9431
LNCGV(-3)	-0.682391	0.387313	-1.761860	0.0890 ***
LNCGV(-4)	2.378935	0.404551	5.880432	0.0000 *
LEXR	-0.568395	0.234049	-2.428527	0.0218 **
LEXR(-1)	0.730315	0.241526	3.023752	0.0053 *
LRGDP	-0.177785	0.062834	-2.829448	0.0085 **
DISR	0.075454	0.024856	3.035683	0.0051 *
DISR(-1)	-0.139631	0.024296	-5.747072	0.0000 *
BREAK (2004)	0.760094	0.110358	6.887528	0.0000 *
C	-4.522796	0.824205	-5.487464	0.0000 *

R-squared	0.907162	Mean dependent var	2.324150
Adjusted R-squared	0.867374	S.D. dependent var	0.644654
S.E. of regression	0.234769	Akaike info criterion	0.192349
Sum squared resid	1.543261	Schwarz criterion	0.735677
Log likelihood	9.056846	Hannan-Quinn criter.	0.390199
F-statistic	22.80006	Durbin-Watson stat	2.442931
Prob (F-statistic)	0.000000		

*1% significant, **5% significant, ***10% significant

The estimated parameters of the long-run relationship are shown in Table (10a), all parameters are found significant at 1% level and have the right signs, as inflation is found positively related to changes in CBE's net credit to the government and foreign exchange rate, and negatively related to changes in real GDP and discount rate. The long-run estimated equation is as follows:

$$linfc = -6.5485 + 2.8264*lncgv + 0.2344*lexr - 0.2574*lrgdp - 0.0929*disr + 1.1005*break \quad (9)`$$

Table (9a) ARDL Bounds Test for Cointegration

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	k
F-statistic	8.627	4
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Table (10a) Estimation of Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCGV	2.826384	0.320849	8.809085	0.0000 *
LEXR	0.234443	0.062465	3.753174	0.0008 *
LRGDP	-0.257413	0.073555	-3.499587	0.0016 *
DISR	-0.092922	0.029509	-3.148939	0.0039 *
BREAK (2004)	1.100531	0.282595	3.894376	0.0006 *
C	-6.548501	0.964139	-6.792074	0.0000 *

*1% significant, **5% significant, ***10% significant

Table (11a) Estimation of Error Correction Model of *linfc*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCGV)	0.407367	0.340082	1.197849	0.2410
D(LNCGV(-1))	0.030924	0.429286	0.072036	0.9431
D(LNCGV(-2))	0.682391	0.387313	1.761860	0.0890 ***
D(LNCGV(-3))	-2.378935	0.404551	-5.880432	0.0000 *
D(LEXR)	-0.568395	0.234049	-2.428527	0.0218 **
D(LRGDP)	-0.177785	0.062834	-2.829448	0.0085 **
D(DISR)	0.075454	0.024856	3.035683	0.0051 *
D(BREAK)	0.760094	0.110358	6.887528	0.0000 *
CointEq (-1)	-0.690661	0.128106	-5.391317	0.0000 *

*1% significant, **5% significant, ***10% significant

The highest impact on inflation is exerted by the increase in government's overdraft from CBE which is measuring the fiscal dominance. Based on the estimated long-run parameters, a 1% increase in the net credit to the government is expected to raise inflation by 2,83%, whereas a 1% increase in the foreign exchange rate (devaluation of the Egyptian pound) is expected to raise inflation by 0.23%. On the other hand, to decrease the inflation rate by 1% real GDP should increase by about 4%, whereas the same effect would need to raise the policy rate by 11%.

The estimation of ECM and the short-run relationship between inflation and its determinants are presented in Table (11a). It indicated that the estimated short-run regressors are found statically significant at different lags. The error correction parameter is found significant at a 1% level and its value is negative (- 0,69), which means that about 70% any short-run shock will be corrected with relatively high speed of adjustment in one year.

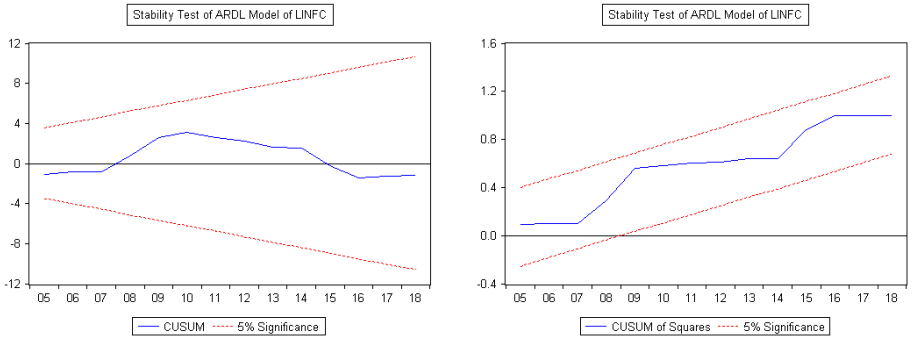
Table (12a) Post Estimation Diagnostic Tests

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.996597	Prob. F(4,24)	0.4286
Obs*R-squared	5.840049	Prob. Chi-Square(4)	0.2114
Breusch-Pagan-Godfrey Heteroskedasticity Test:			
F-statistic	0.944813	Prob. F(12,28)	0.5195
Obs*R-squared	11.81684	Prob. Chi-Square(12)	0.4605
Scaled explained SS	4.383025	Prob. Chi-Square(12)	0.9755
Jarque-Bera Normality Test:			
Statistic	0.689636		0.7084

Table (12a) shows the results of post regression diagnostic tests of the residuals of the estimated ARDL (1,4,1,0,1). Using Breusch-Godfrey Serial Correlation LM-test statistic for the problem of serial correlation revealed that the null hypnosis of no-serial correlation cannot be rejected with the p-value of 0.4286 indicates that the residuals are not serially correlated. The results of testing for heteroscedasticity of the residuals showed that the null hypnosis of no-heteroscedasticity cannot be rejected with the p-value of 0.5195 which

indicates that the distribution of the errors is homoscedastic. The Jarque-Bera test of normality indicated that the residuals of the estimated model are normally distributed as the null hypnosis cannot be rejected at the p-value of 0.7083.

Figure (11a) Stability Test of ARDL Model of LINFC



Results of testing for parameter stability using the cumulative sum of the recursive residuals CUSUM test are shown in Figure (11a), indicates that the cumulative sum and cumulative sum of squares are located between the 5% critical values which means no structure breaks in the regression model and the parameters of the model are stable over time.

Two important points deserve to be emphasized; first, inflation may be initiated by a sharp devaluation in the Egyptian pound but this is eventually a one shock with high pass-through but the fiscal shock has a continuous nature, so it is responsible for the sustainability of inflation. Second, with the relatively lower impact of changes in policy rate on inflation, trying to control it will have a very high cost through its negative impact on growth rate real GDP, whereas lowering net credit to the government will be more efficient than depending mainly on restrictive monetary policy.

5.3 Empirical Results of ARDL Model of the Monetary Policy Reaction Function

The ARDL equation to be estimated for monetary policy reaction function model is specified as:

$$disr_t = a_0 + \sum_{i=1}^{p} a_{1i} ginfc_{t-i} + \sum_{j=1}^{q1} \gamma_{1j} grgdp_{t-j} + \sum_{j=1}^{q2} \gamma_{2j} dexr_{t-j} + \sum_{j=1}^{q3} \gamma_{3j} dbdr_{t-j} + \varepsilon_t, \qquad (10)$$

where $ginfc$ and $grgdp$ are inflation gap and real GDP gap; respectively.

The first step in estimating ARDL model is lag selection using different information criteria. In Table (7b), the best number of lags according to majority of criteria is 2, but 1 lag according to Schwarz information criterion (SIC).

Table (7b) Lag selection for *DISR*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-90.10013	NA	8.372584	4.955006	5.335004	5.092402
1	-45.95945	66.21102	0.971340	2.797972	3.220192	2.950634
2	-36.45663	13.77908*	0.637299*	2.372832*	2.837273*	2.540759*
3	-36.25717	0.279251	0.666324	2.412858	2.919522	2.596052
4	-35.87189	0.520126	0.690853	2.443594	2.992480	2.642054
5	-35.87100	0.001152	0.730929	2.493550	3.084658	2.707276

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

FPE: Final prediction error
AIC: Akaike information criterion
SIC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The estimates of ARDL inflation model are reported in Table (7b). With a maximum of 2 lags, the selected model according to SIC is ARDL (2, 0, 2, 0, 0), the lag structure assigned for the variables *disf*, *ginfc*, *dexr*, *grgdp*, and *dbdr(-1)*; respectively. It also indicates high explanatory power of the model as the adjusted R-Square equals 0.97. Table (8b) shows that the null hypothesis of no-cointegration between the policy rate and its determents can be rejected at 1% significant level as the value of F-statistic (20.98) is higher

than the upper critical value bounds (5.06), which means that there is a long-run relationship between the policy rate and all the dynamic regressors.

The estimated parameters of the long-run relationship are shown in Table (10b), parameters for *ginfc* and *dexr* are found significant at 1% level and 5% level for *grgdp* and *dbdr*; respectively.

Table (8b) Estimation of ARDL Mode for *DISR*

Dependent Variable: DISR
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (2 lags, automatic): GINFC DEXR GRGDP DBDRL
Fixed regressors: BREAK0 BREAK2 BREAK5 BREAK1 C
Selected Model: ARDL(2, 0, 2, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DISR(-1)	1.101829	0.085459	12.89314	0.0000 *
DISR(-2)	-0.299746	0.077685	-3.858467	0.0006 *
GINFC	0.141839	0.028040	5.058494	0.0000 *
DEXR	0.530771	0.056852	9.336055	0.0000 *
DEXR(-1)	0.156451	0.078310	1.997833	0.0549 ***
DEXR(-2)	-0.161839	0.068705	-2.355566	0.0252 **
GRGDP	0.126106	0.054374	2.319221	0.0274 **
DBDRL	0.070160	0.027930	2.511953	0.0176 **
BREAK0	5.178915	0.599463	8.639256	0.0000 *
BREAK2	-4.100652	0.617028	-6.645809	0.0000 *
BREAK5	2.096709	0.659358	3.179924	0.0034 *
BREAK1	-1.464526	0.581239	-2.519662	0.0173 **
C	2.264229	0.379279	5.969828	0.0000 *

R-squared	0.977478	Mean dependent var	11.91047
Adjusted R-squared	0.968469	S.D. dependent var	3.153995
S.E. of regression	0.560051	Akaike info criterion	1.923071
Sum squared resid	9.409715	Schwarz criterion	2.455527
Log likelihood	-28.34602	Hannan-Quinn criter.	2.119424
F-statistic	108.5030	Durbin-Watson stat	2.418509
Prob (F-statistic)	0.000000		

*1% significant, **5% significant, ***10% significant

Table (9b) ARDL Bounds Test for Cointegration

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	k
F-statistic	20.99	4
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Table (10b) Estimation of Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GINFC	0.716658	0.190709	3.757857	0.0007*
DEXR	2.654568	0.671461	3.953423	0.0004 *
GRGDP	0.637169	0.290719	2.191703	0.0363 **
DBDRL	0.354491	0.169271	2.094228	0.0448 **
C	11.440310	0.515082	22.210638	0.0000 *

*1% significant, **5% significant, ***10% significant

The long-run estimated equation is as follows:

$$disr = 0.7167*ginfc + 2.6546*dexr + 0.6372*grgdp + 0.3545*dbdr(-1). \quad (10)`$$

All the explanatory variables in eq. (10)` have the right signs, as policy rate is found positively related to changes inflation gap, foreign exchange rate, real GDP gap, and budget deficit ratio. The highest impact on the policy rate is brought about by the changes in the nominal exchange rate with the largest coefficient of 2.66 which is 3.7 times and 4 times the coefficients of inflation gap and real-GDP gap; respectively. This means that despite the multiple targets of the monetary policy over the period of the study the highest priority was given to maintaining the stability of foreign exchange rate.

Targeting inflation was one of the targets but not the overriding one, but it had more priority than targeting real GDP. Positive and statistically significant long-run coefficient of changes in budget deficit ratio in the reaction function of the CBE confirms that monetary policy was

accommodating loose fiscal policy during the period of the study. This means that the fiscal dominance is deeply rooted in the Egyptian economy.

Table (11b) Estimation of Error Correction Model of *disr*

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.264229	0.210079	10.77801	0.0000 *
D(DISR(-1))	0.299746	0.054331	5.516977	0.0000 *
D(DEXR)	0.530771	0.047503	11.17335	0.0000 *
D(DEXR(-1))	0.161839	0.050238	3.221421	0.0031 *
BREAK0	5.178915	0.534392	9.691229	0.0000 *
BREAK2	-4.100652	0.546983	-7.496850	0.0000 *
BREAK5	2.096709	0.564262	3.715843	0.0008 *
BREAK1	-1.464526	0.533934	-2.742896	0.0102 **
CointEq(-1)*	-0.197917	0.018148	-10.90574	0.0000 *

*1% significant, **5% significant, ***10% significant

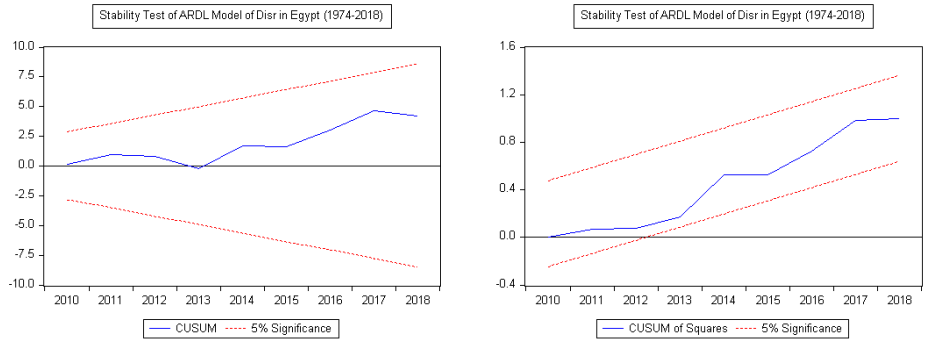
The estimation of ECM and the coefficients of the short-run dynamic relationship between the policy rate and its determinants are presented in Table (11b), in which the error correction parameter is found statistically significant at 1% level and its value is negative and equals (-0.198). This means a slow adjustment rate as only 20% of any short-run shock will be corrected annually and it needs about 3 years for the halve life of the disequilibrium to be corrected. With respect to short-run dynamic regressors, the results show that changes in the nominal foreign exchange rate are the only explanatory variable to have a positive and statistically significant impact on the policy rate. These results emphasize the importance of the foreign exchange rate in the dynamic behavior of monetary policy from the short-run to the long-run.

Table (12b) Post Estimation Diagnostic Tests of DISR Model

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.906620	Prob. F(2,28)	0.4154
Obs*Rsquared	2.615259	Prob. Chi-Square(2)	0.2705
Breusch-Pagan-Godfrey Heteroskedasticity Test:			
F-statistic	0.464926	Prob. F(12,30)	0.9196
Obs*R-squared	6.742774	Prob. Chi-Square(12)	0.8741
Jarque-Bera Normality Test:			
Statistic	0.340594		0.3406

Table (12b) shows the results of post regression diagnostic tests of the residuals of the estimated ARDL (2, 0, 2, 0, 0). The LM-test statistic for the problem of serial correlation revealed that the null hypnosis of no-serial correlation cannot be rejected with the p-value of 0.4154 which indicates that the residuals are not serially correlated. The results of testing for heteroscedasticity of the residuals showed that the null hypnosis of no-heteroscedasticity cannot be rejected with the p-value of 0.9196 which indicates that the distribution of the errors is homoscedastic. The null hypnosis of Jarque-Bera test of normality cannot be rejected at the p-value of (0.3406), which indicates that the residuals of the estimated model are normally distributed.

Figure (11b) Stability Test of ARDL Model of DISR



Results of testing for parameter stability using the cumulative sum of the recursive residuals CUSUM test are shown in Figure (11b), that indicates that the cumulative sum and cumulative sum of squares are located between the 5% critical values which means no structure breaks in the regression model and the parameters of the model are stable over time.

These results are consistent with those of the first model of inflation dynamics and the analytical review of the stylized facts about the monetary policy preferences of using the foreign exchange rate as a nominal anchor during the 1990s. Despite the de jure of floating exchange rate during the

2003-2010 and 2016-2018, monetary policy preferred stability over flexibility of foreign exchange rate. The higher response of policy rates to the foreign exchange rate in Egypt supports the hypothesis of the "fear-of-float" in emerging economies as established by (Calvo and Reinhart, 2002) and confirmed by (Mohanty and Klau, 2004).

2. Concluding Remarks

Despite the ambiguity surrounding the choice of monetary policy's nominal anchor in Egypt, the empirical results reveal the existence of conflicting multiple targets, for foreign exchange rate, inflation rate, and real GDP growth rate. The higher priority was clearly given to foreign exchange rate stability even with the two major attempts by the CBE to implement a flexible exchange rate system in 2003 and 2016. Inflation and real GDP were implicitly targeted but frequently overridden by the target of foreign exchange rate stability.

Fiscal dominance was found deeply rooted in the Egyptian economy despite the change in its nature over the period of the study from the creation of seigniorage and monetization of the budget deficit to the absorption of a large part of net domestic assets. The empirical results of the inflation function confirmed that the highest long-run impact on inflation was exerted by the increase in government's overdraft from CBE as a measure of the fiscal dominance. In addition, the empirical results of CBE's reaction function confirmed that monetary policy was accommodating loose fiscal policy during the period of the study.

These results have four critical policy implications for CBE. First, giving high priority to foreign exchange rate stability did not prevent inflation rate from hiking to double digits, therefore priority should be given to inflation as the overriding target. Second, giving the relatively lower impact of policy rate on inflation, reducing CBE's net credit to the government would

be more efficient in reducing inflation than depending mainly on restrictive monetary policy with its potential negative impact on real GDP. Third, CBE should allow more flexibility to exchange rate to help in absorbing external shocks and reducing the conflicts with targeting inflation. Fourth, all forms of fiscal dominance should be eliminated before targeting inflation.

Endnotes

[1] The study followed the formal testing of fiscal dominance as proposed by (Fratianni and Spinnelli, 2001).

[2] According to (Woodford, 2001), an economy with non-explosive nominal government debt with fiscal dominance can only be guaranteed by ensuring that real interest falls in response to higher inflation. This analysis contradicts with the one presented by (Taylor, 1993), in which the stabilization of inflation requires raising real interest rates to control high inflation.

[3] Colombia and Mexico exhibit clear evidence of FD only for the pre-inflation-targeting period.

[4] These countries are Chile, Czech Republic, Turkey, Poland, South Africa, Israel, Mexico, and Brazil.

[5] This is because quarter data are not available for nominal and real GDP before 2002.

[6] (Awad, 2008) depended on the experience of three inflation targeters (Czech Republic, Poland, and Brazil) to support his conclusion, but in fact, it is difficult to find similarity between Egyptian economy and these emerging economies; except that they all have maintained pegged exchange rate system and suffered high inflation and real appreciation of their currencies.

[7] There is another nominal anchor for monetary policy is called nominal income targeting; see (Taylor, 1985) and (Hall and Mankiw, 1994).

[8] See (Hochreiter, 1999: pp. 24-25).

[9] See (Hochreiter, 1999).

[10] See (Mussa, et al., 2000) and (de Mello, Luiz, 2008).

[11] Turkey started its experience of inflation targeting by maintained monetary target and implicit inflation target before applying full-fledged inflation targeting in 2006, see (Ersel and Azatay, 2008). Chile, Hungary, Israel, and Poland, combined inflation and exchange rate targets during an initial phase of disinflation, see (IMF, 2006).

[12] Empirical studies reveal that output variability increases in inflation targeters in developing and emerging countries, see (Cecchetti and Ehrmann, 2002) and (Minella et al., 2003).

[13] For more details about the difference between strict and flexible inflation targeting and their welfare impacts, see (Parrado, 2004).

[14] This was an Extended Fund Facility (EFF), (IMF, 2017).

[15] AREAER reclassified the Egyptian foreign exchange system from *floating* in 2017 to *stabilized arrangement* in 2018, see (IMF, 2018: p.4).

[16] See (IMF, 2019: p.8).

[17] Interest rate was even negative in the real term, see (Dailami and Dinh, l99l).

[18] This reserve ratio was above 10% decided by the Basel agreement.

[19] For more details about the foreign exchange rate system in Egypt during the period, see (Mekheimar, 2013: pp.10-13).

[20] See, (IMF, 2007: pp.14-15).

[21] See (Selim, 2011: pp. 67-68)

[22] See (CBE, 2018).

[23] Therefore, one of the IMF's performance criteria in December 2017 was to reduce the stock of the government overdrafts to EGP 75 billion by converting EGP 250 billion into securities with two objectives, improving

liquidity management and reducing fiscal dominance, (IMF, 2017: p. 60).

[24] See (CBE, 2018: p. I).

[25] See (CBE 2018: pp. 2-4).

[26] (Taylor, 1993) suggests that a rule with r = 2%, a = 0.5, and B = 0.5 fits well the behavior of the US Federal Reserve.

[27] Following the methodology of (Edda, 2005: pp. 8-10) who added change in the real primary balance to the reaction function to test for fiscal dominance in seven emerging countries; i.e., Brazil, Chile, Colombia, Mexico, Poland, South Africa and Thailand.

[28] Although, ARDL does not allow for I(2) variable to be included in the model, Pesaran et al., (2001).

[29] The lower bound and upper bound are based on the assumption that all variables are I(0) and I(1); respectively.

References

- Al-Mashat, R. (2008) "Monetary Policy in Egypt: A Retrospective and Preparedness for Inflation Targeting," Egyptian Center for Economic Studies, *ECES Working Paper* No. 134.
- Al-Mashat, R., and Billmeier, A. (2007), "Monetary Transmission Mechanism in Egypt", *IMF Working Paper*, 07/285.
- Awad, Ibrahim L. (2008), "Switching to the inflation targeting regime: Does it necessary for the case of Egypt?" *IES Working Paper*, No. 34/2008.
- Ball, Laurence (1999) "Policy Rules for Open Economies", in John Taylor (ed.) Monetary Policy Rules, University of Chicago Press, Chicago.
- Brandao, Marques, Luis, Gelos, R. Gaston, Harjes, Thomas, Sahay, Ratna and Xue, Yi, (2020), "Monetary Policy Transmission in Emerging Markets and Developing Economies," *IMF Working Papers* No. 20/035, International Monetary Fund.

- Cecchetti, Stephen G. and Michael Ehrmann, (2002), "Does Inflation Targeting Increase Output Volatility? An International Comparison of Policymakers' Preferences and Outcomes," in: Norman Loayza and Klaus Schmidt-Hebbel and Norman Loayza (ed.), Monetary Policy: Rules and Transmission Mechanisms, edition 1, volume 4, chapter 9, pages 247-274, Central Bank of Chile.
- Central Bank of Egypt, Annual Report, 2017/2018.
- de Mello, Luiz, (2008), "*Monetary Policies and Inflation Targeting in Emerging Economies*," OECD Publishing, Paris, https://doi.org/10.1787/9789264044630-en
- Domaç, I., (2003), "Explaining and forecasting inflation in Turkey," *Working Paper*, No. 0306, Research and Monetary Policy Department, Central Bank of the Republic of Turkey.
- Edda, Zoli (2005), "How Does Fiscal Policy Affect Monetary Policy in Emerging Market Countries?," *BIS Working Paper*, No. 174, Bank for International Settlements.
- El-Refaie, Faika. 2002. "The Coordination of Monetary and Fiscal Policies in Egypt", in E. Cardoso and A. Galal (eds.), Monetary Policy and Exchange Rate Regimes: Options for the Middle East. Cairo: The Egyptian Center for Economic Studies.
- Ersel, H. and Ãzatay, F. (2008), "Fiscal Dominance and Inflation Targeting: Lessons from Turkey". *Emerging Markets Finance and Trade,* 44(6).
- Frankel, J.A. (2010), "Monetary Policy in Emerging Markets: A Survey." National Bureau of Economic Research, *NBER Working Paper,* No. 16125.

- Fratianni, Michele and Spinelli, Franco, (2001) "Fiscal Dominance and Money Growth in Italy: The Long Record." *Explorations in Economic History*, 38, 252–272.
- Helmy, O. (2008), "The impact of budget deficit on inflation in Egypt", Egyptian Centre for Economic Studies, Cairo, *ECES Working Paper* 141.
- Hochreiter, Eduard (1999), "The case for hard currency strategies for emerging market economies," in "Exchange-rate policies for emerging market economies" eds., Sweeney, Richard J., Routledge, New York, pp. 23-44.
- International Monetary Fund (2006), "Inflation Targeting and the IMF", Monetary and Financial Systems Department, *IMF Policy Paper*, vol. 006.
- International Monetary Fund (2017), First Review under the Extended Fund Facility (EFF) with the Arab Republic of Egypt, IMF Country Report No. 17/290.
- International Monetary Fund (2019), Fourth Review under the Extended Arrangement under the Extended Fund Facility (EFF) with the Arab Republic of Egypt, IMF Country Report No. 19/98.
- Kaltenbrunner, Annina and Juan Pablo Painceira, (2017) "The Impossible Trinity: Inflation Targeting, Exchange Rate Management and Open Capital Accounts in Emerging Economies," *Development and Change*, International Institute of Social Studies, vol. 48(3), pp. 452-480, May.
- Kumhof Michael, Ricardo Nunes and Irina Yakadina, (2008) "Simple Monetary Rules Under Fiscal Dominance," *International Finance Discussion Papers*, Number 937, July 2008.
- Lee, Junsoo and Mark C. Strazicich (2003), "Minimum LM Unit Root Test with Two Structural Breaks." *Review of Economics and Statistics*, 85(4), pp.1082-1089.

- Leiderman, Leonardo and Hadas Bar-Or, (1999), "Monetary Policy Rules and Transmission Mechanism Under Inflation Targeting," *Working Paper* 71, Central Bank of Chile.
- Masson, Paul R. and Savastano, Miguel A. and Sharma, Sunil, (1997), "The Scope for Inflation Targeting in Developing Countries," *IMF Working Paper* No. 97/130.
- Masson, Paul R., Miguel A. Savastano, and Senil Sharma, (1997), "The Scope for Inflation Targeting in Developing Countries," *IMF Working Paper* 97/130 (Washington: International Monetary Fund).
- Minella, A. and Paulo Springer de Freitas and Ilan Goldfajn and Marcelo Kfoury Muinhos (2003) "Inflation Targeting in Brazil: Constructing Credibility under Exchange Rate Volatility,"
- Mishkin, Frederic and Schmidt-Hebbel (2001), "One Decade of Inflation Targeting in the World: What do We Know and What Do We Need to Know?", *NBER Working Paper* No. 8397.
- Mishkin, Frederic S. (1996) "The Channels of Monetary Transmission: Lessons for Monetary Policy". *NBER Working Paper* No. 5464
- Mishkin, Frederic S. and Savastano, Miguel A. (2001), "Monetary policy strategies for Latin America," *Journal of Development Economics*, Elsevier, vol. 66(2), pp. 415-444, December.
- Mishkin, Frederic S., (2000), "Inflation Targeting in Emerging Market Countries," National Bureau of Economic Research, *NBER Working Paper* No. 7618 (March).
- Mohanty, M. S. and Marc Klau, (2004), "Monetary Policy Rules in Emerging Market Economies: Issues and Evidence," *BIS Working Paper*, No. 149, Bank for International Settlements.

- Mukherjee, Sanchita and Bhattacharya, Rina, (2011), "Inflation Targeting and Monetary Policy Transmission Mechanisms in Emerging Market Economies,", *IMF Working Papers* No 11/229, International Monetary Fund.
- Mussa, Michael, Paul Masson, Alexander Swoboda, Esteban Jadresic, Paolo Mauro, and Andy Berg (2000), Exchange Rate Regimes in an Increasingly Integrated World Economy, International Monetary Fund, Washington DC.
- Nachega, Jean-Claude (2005) "Fiscal Dominance and Inflation in the Democratic Republic of the Congo, *IMF working paper*: WP/05/22.
- Neaime, Simon, (2008), "Monetary Policy Transmission and Targeting Mechanisms in the MENA Region, Economic Research Forum, *ERF Working Papers* No 395.
- Noureldin, D. (2005), "Alternative Approaches to Forecasting Inflation in the Case of Egypt," paper presented at the 12th Annual conference of Economic Research Forum, Cairo.
- Oliver Blanchard (2004), "Fiscal Dominance and Inflation Targeting: Lessons from Brazil," *NBER Working Paper* 10389.
- Panizza, Ugo. (2000), "Monetary and Fiscal Policies in Emerging Markets", Egyptian Centre for Economic Studies, *ECES Working Paper* 61.
- Parrado, Eric (2004), "Inflation Targeting and Exchange Rate Rules in an Open Economy", International Monetary Fund, *IMF Working Paper WP/04/21*.
- Parrado, Eric (1999), "Inflation Targeting and Exchange rate Rules in the Open Economy," mimeo, New York University.
- Policy". *NBER Working Paper* No. 5464 (February)

- Sanusi, Kazeem Abimbola and Akinlo Anthony Enisan (2016), "Investigating Fiscal Dominance in Nigeria," *Journal of Sustainable Development*; Vol. 9, No. 1; 2016.
- Selim, Hoda (2010), "Has Egypt's Monetary Policy Changed after the Float?" Economic Research Forum, *ERF Working Paper*, 543.
- Selim, Hoda (2011). "The Evolution of the Monetary Policy Framework in Egypt and the Elusive Goal of Price Stability." in David Cobham and Ghassan Dibeh, eds., *MENA Money: Monetary Policy Frameworks and Strategies in the Middle East and North Africa*. London: Routledge Political Economy of the Middle East series.
- Taylor, John B., (1993), "Discretion versus Policy Rules in Practice,", Carnegie- Rochester Conference Series on Public Policy Vol. 39, pp. 195-214.
- Taylor, John B. (1995), "The Monetary Transmission Mechanism: An Empirical Framework," Journal of Economic Perspectives Vol. 9, pp. 11-26.
- Taylor, John B. (2001), "The Role of the Exchange Rate in Monetary-Policy Rules", *American Economic Review Papers and Proceedings*, 91, pp 263-67.
- Woodford, M. (2001), "Fiscal Requirements for Price Stability", *NBER Working Paper*, No. 8072.
- *Working Papers Series* 77, Central Bank of Brazil, Research Department.
- Wyplosz, Charles, (1999), "Economic Policy Coordination in EMU: Strategies and Institutions," Financial supervision and policy coordination in the EMU, *Working Paper, No. B 11-1999*, pp. 36-60, Center for European Integration Studies, University of Bonn.

- Youssef, Hoda A. G., (2011) "Fiscal dominance: An obstacle to inflation targeting in Egypt", In *Money in the Middle East and North Africa: Monetary Policy Frameworks and Strategies*, eds. Cobham, D., and Dibeh, G., Routledge London, pp. 218-237.
- Zivot, Eric and Andrews, Donald W. K. (1992), "Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis," *Journal of Business & Economic Statistics*, American Statistical Association, Vol. 10 (3), pp. 251-70, July.

Appendix

Table (1) Egyptian Total Debt to GDP ratio (2001-2018)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total Debt %GDP	103%	116%	126%	131%	133%	117%	104%	86%	84%	82%	84%	81%	93%	92%	98%	111%	118%	110%
Domestic Debt %GDP	76%	85%	91%	94%	101%	90%	79%	67%	67%	67%	71%	70%	78%	80%	85%	95%	90%	78%
Foreign Debt %GDP	27%	31%	34%	37%	32%	27%	25%	19%	17%	15%	13%	11%	15%	12%	13%	16%	28%	32%
Source: WDI, World Bank																		

Table (2) Egyptian Domestic Debt and Debt Service to GDP ratio (2001-2018)

(billion LE)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Domestic Debt	273	323	381	456	544	555	591	600	700	808	967	1,155	1,444	1,698	2,083	2,571	3,124	3,471
Domestic Debt Service	32	37	45	45	60	55	60	71	99	117	141	218	281	429	494	590	705	776
% of GDP	8%	9%	9%	8%	10%	7%	7%	7%	8%	9%	9%	12%	13%	18%	18%	17%	16%	15%
% of Gov. Expenditure	28%	29%	31%	28%	29%	25%	21%	20%	27%	29%	30%	37%	40%	59%	60%	57%	57%	57%
Source: CBE Annual Report, Several Issues																		

Table (3) Egyptian Overall Balance and Primary Balance to GDP ratio (2001-2018)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Overall Balance /GDP	10%	11%	10%	10%	8%	7%	7%	7%	8%	10%	10%	13%	-12%	-11%	-13%	-11%	-10%	-8%
Primary Balance / GDP	-4%	-4%	-3%	-4%	-2%	-1%	-1%	-2%	-2%	-4%	-4%	-5%	-4%	-4%	-4%	-2%	0%	2%
Gov. Revenues/ GDP	21%	21%	21%	21%	25%	24%	25%	27%	22%	19%	18%	19%	21%	19%	18%	19%	19%	18%
Gov. Expenditure/ GDP	31%	31%	30%	30%	34%	30%	32%	34%	30%	29%	28%	32%	33%	30%	30%	30%	28%	26%
Source: CBE Annual Report, Several Issues																		

Table (6a) Augmented Dickey-Fuller Unit-root Test								
Augmented Dickey-Fuller Test								
	level				First Difference			
Exogenous	Constant		Constant & Trend		Constant		Constant & Trend	
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-2.1534	0.2257	-2.0798	0.5423	-8.7891*	0.0000	-8.7478*	0.0000
1% level	-3.5885		-4.1809		-3.5925		-4.1865	
5% level	-2.9297		-3.5155		-2.9314		-3.5181	
10% level	-2.6031		-3.1883		-2.6039		-3.1897	
Null Hypothesis: **LINFC** has a unit root, Result of Integration Order **I(1)**								
Augmented Dickey-Fuller Test								
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-1.927877	0.3168	-1.840869	0.6668	-5.7209*	0.0001	-5.7209*	0.0001
1% level	-3.596616		-4.1923		-4.1865		-4.1865	
5% level	-2.933158		-3.5208		-3.5181		-3.5181	
10% level	-2.604867		-3.1913		-3.1897		-3.1897	
Null Hypothesis: **LNCGV** has a unit root, Result of Integration Order **I(1)**								
Augmented Dickey-Fuller Test								
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-0.3630	0.9065	-2.6061	0.2797	-5.2955*	0.0001	-5.2955*	0.0001
1% level	-3.5885		-4.1865		-3.5925		-3.5925	
5% level	-2.9297		-3.5181		-2.9314		-2.9314	
10% level	-2.6031		-3.1897		-2.6039		-2.6039	
Null Hypothesis: **LEXR** has a unit root, Result of Integration Order **I(1)**								
Augmented Dickey-Fuller Test								
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-3.8186*	0.0054	-3.8281**	0.0242	-9.0713*	0.0000	-9.0154*	0.0000
1% level	-3.5885		-4.1809		-3.5925		-4.1865	
5% level	-2.9297		-3.5155		-2.9314		-3.5181	
10% level	-2.6031		-3.1882		-2.6039		-3.1897	
Null Hypothesis: **LRGDP** has a unit root, Result of Integration Order **I(0)**								

•MacKinnon (1996) one-sided p-values.
*1% significant, **5% significant, ***10% significant

Table (6b) Augmented Dickey-Fuller Unit-root Test								
	level				First Difference			
Exogenous	Constant		Constant & Trend		Constant		Constant & Trend	
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-1.9167	0.3219	-1.8898	-1.8898	-5.7344*	0.0000	-5.7344*	0.0000
1% level	-3.5885		-4.1809	-4.1809	-3.5925		-3.5925	
5% level	-2.9297		-3.5155	-3.5155	-2.9314		-2.9314	
10% level	-2.6031		-3.1883	-3.1883	-2.6039		-2.6039	
Null Hypothesis: **DISR** has a unit root, Result of Integration Order **I(1)**								
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-6.5418*	0.0000	-6.4633*	0.0000	-2.4216	0.1433	-2.3815	0.3822
1% level	-3.5885		-4.1809		-3.6329		-4.2436	
5% level	-2.9297		-3.5155		-2.9484		-3.5443	
10% level	-2.6031		-3.1883		-2.6129		-3.2047	
Null Hypothesis: **GINFC** has a unit root, Result of Integration Order **I(0)**								
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-6.5552*	0.0000	-6.4484*	0.0000	-11.644*	0.0000	-11.6438*	0.0000
1% level	-3.6010		-4.1985		-3.5925		-3.5925	
5% level	-2.9350		-3.5236		-2.9314		-2.9314	
10% level	-2.6058		-3.1929		-2.6039		-2.6039	
Null Hypothesis: **GRGDP** has a unit root, Result of Integration Order **I(0)**								
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-6.5558*	0.0000	-6.9505*	0.0000	-8.7079*	0.0000	-8.8613*	0.0000
1% level	-3.5925		-4.1865		-3.5966		-4.1923	
5% level	-2.9314		-3.5180		-2.9332		-3.5208	
10% level	-2.6039		-3.1897		-2.6049		-3.1913	
Null Hypothesis: **DEXR** has a unit root, Result of Integration Order **I(0)**								
ADF test statistic	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
critical values	-7.7992*	0.0000	-7.7643*	0.0000	-8.9916*	0.0000	-8.9916*	0.0000
1% level	-3.5925		-4.1865		-3.5966		-3.5966	
5% level	-2.9314		-3.5181		-2.9332		-2.9332	
10% level	-2.6039		-3.1897		-2.6049		-2.6049	
Null Hypothesis: **DBDR** has a unit root, Result of Integration Order **I(0)**								

•MacKinnon (1996) one-sided p-values.
*1% significant, **5% significant, ***10% significant

Table (7a) Zivot and Andrews Unit-root Test with Structural Break						
	Break in the Intercept		Break in the Trend		Break in the Intercept & Trend	
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-3.0474	0.005313	-2.5582	0.004101	-3.847982	0.004034
1% level	-5.34		-4.80		-5.57	
5% level	-4.93		-4.42		-5.08	
10% level	-4.58		-4.11		-4.82	
Chosen break Point	1996		2002		1996	
Null Hypothesis: **LINFC** has a unit root with a structural break, **I (1)**						
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-3.592326	0.003609	-3.4399	0.0008	-3.5303	0.0584
1% level	-5.34		-4.80		-5.57	
5% level	-4.93		-4.42		-5.08	
10% level	-4.58		-4.11		-4.82	
Chosen break Point	2011		2000		1992	
Null Hypothesis: **LNCGV** has a unit root with a structural break, **I (1)**						
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-4.5757	0.0007	-3.1307	0.0427	-4.553808	0.002123
1% level	-5.34		-4.80		-5.57	
5% level	-4.93		-4.42		-5.08	
10% level	-4.58		-4.11		-4.82	
Chosen break Point	1989		1994		1988	
Null Hypothesis: **LEXR** has a unit root with a structural break, **I (1)**						
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-4.3004	0.1341	-4.2581	0.1786	-5.0196***	0.0144
1% level	-5.34		-4.80		-5.57	
5% level	-4.93		-4.42		-5.08	
10% level	-4.58		-4.11		-4.82	
Chosen break Point	1994		1991		1994	
Null Hypothesis: **LRGDP** has a unit root with a structural break **I (0)**						

Table (7b) Zivot and Andrews Unit-root Test with Structural Break						
	Break in the Intercept		Break in the Trend		Break in the Intercept & Trend	
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-3.0045	0.0827	-2.4390	0.0072	-3.0045	0.0827
1% level	-5.34		-4.80		-5.34	
5% level	-4.93		-4.42		-4.93	
10% level	-4.58		-4.11		-4.58	
Chosen break Point	1997		2011		1997	
Null Hypothesis: **DISR** has a unit root with a structural break, **I (1)**						
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-6.6891	0.1286	-6.4284	0.2436	-6.9896**	0.0432
1% level	-5.34		-4.80		-5.57	
5% level	-4.93		-4.42		-5.08	
10% level	-4.58		-4.11		-4.82	
Chosen break Point	1996		1988		2011	
Null Hypothesis: **GINFC** has a unit root with a structural break, **I(0)**						
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-6.6891	0.1286	-6.5086	0.4874	-6.9571	0.251833
1% level	-5.34		-4.80		-5.57	
5% level	-4.93		-4.42		-5.08	
10% level	-4.58		-4.11		-4.82	
Chosen break Point	1997		1987		1989	
Null Hypothesis: **GRGDP** has a unit root with a structural break, **I (1)**						
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-7.1806	0.2266	-7.7386**	0.0333	-7.6934	0.1384
1% level	-5.34		-4.80		-5.57	
5% level	-4.93		-4.42		-5.08	
10% level	-4.58		-4.11		-4.82	
Chosen break Point	2010		2010		2005	
Null Hypothesis: **DEXR** has a unit root with a structural break, **I(0)**						
	t-Statistic	Prob.•	t-Statistic	Prob.•	t-Statistic	Prob.•
Z-A Statistic	-8.5247	0.0114**	-7.9237	0.0948	-8.4875	0.0245**
1% level	-5.34		-4.80		-5.57	
5% level	-4.93		-4.42		-5.08	
10% level	-4.58		-4.11		-4.82	
Chosen break Point	1988		1992		1988	
Null Hypothesis: **DBDR** has a unit root with a structural break, **I(0)**						

*1% significant, **5% significant, ***10% significant