EAST-WEST
Journal of **Economics and Business**
Vol. XI – 2008, No 1 & No 2

Switching to the Inflation Targeting Regime: The Case of Egypt

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Abstract

The purpose of this paper is to answer the question of whether Egypt should switch to the inflation targeting (IT) regime or not? Our judgment on adopting IT is based on the practical experience of the inflation targeters and on whether the monetary targeting regime (MTR) currently applied in Egypt is efficient or not. The study concluded that the MTR in Egypt is not efficient enough to tie down individuals' expectations about the future path of inflation. Taking into account that the IT regime is a way of reforming monetary policy and it does not worsen economic performance in practice, it becomes necessary for Egypt to take practical steps toward adopting IT.

Keywords: inflation targeting; demand for money function; monetary policy in Egypt

JEL: E410, E510, E520, E580, E590

Introduction

The economic circumstances in Egypt during the 1990s were very similar to those in the Czech Republic, Poland, and Brazil (hereinafter CPB). The application of an economic reform program at the start of the 1990s and the pegging of the exchange rate for long periods of time are two common aspects between Egypt and CPB. The main difference, however, is the reaction of the Central Bank of Egypt (CBE) to the economic crises encountered the economy in the second half of the 1990s. While the CBs in CPB reacted to such

economic crises by switching their monetary policy regimes to IT immediately after floating the domestic currency, the CBE did not.

A recent IMF staff survey expected the trend toward the adoption of IT by emerging market economies to continue. More than half of the 88 non-industrial countries covered by this survey expressed a desire to move to explicit or implicit quantitative inflation targets, and nearly three quarters of these countries envisaged a shift to full-fledged IT by 2010 (Batini et al., 2006, pp. 7–8).

Egypt, according to the aforementioned survey, is one of the prospective candidates for switching to an IT regime in the near term (1–2 years). Also, the Central Bank of Egypt (CBE) has on several occasions announced its intention to adopt IT as a framework for its monetary policy once the fundamental prerequisites are met (IMF, 2007; CBE, 2005).

To date, the CBE has not matched words with deeds. On the one hand, it has not disclosed with any degree of detail which prerequisites are still unfulfilled. On the other hand, the steps taken by the CBE to apply IT are still unsatisfactory[1]. However, two fundamental questions have to be tackled before any switch to IT in Egypt. Firstly, is the monetary policy regime currently applied in Egypt efficient or not? Secondly, is Egypt ready to apply IT?

The second question is clarified in a previous paper by Awad (2009). The conclusions of his study were as follows: (i) the CBE is not factually independent; although the CBE has been granted legal instrument independence, the existence of government representatives as voting members in the Monetary Policy Committee (MPC) and the coercion of the CBE to extend finance to the government are two elements sufficient to undermine the de facto independence of the CBE; (ii) inflation targets are expected to be missed given the possibility that the behavior of the CBE will be similar to the that of the majority of emerging market economies, i.e. adopting an IT regime while implicitly targeting the FX rate; and (iii) the current level of knowledge about some central issues of designing and implementing IT and the quality of the available data are not sufficient to support the adoption of IT. The study concluded that Egypt was still not ready to apply IT.

[1] The CBE does not yet publicize a precise inflation target and lacks the internal capacity to measure and forecast inflation on a regular basis. There have also been delays by the Central Agency for Public Mobility and Statistics (CAPMAS) in producing a reliable consumer price index (Oxford Analytica, 2005, p. 107).

This paper sets out to answer the first question. I organized this paper as follows. Section 2 discusses definitions, preconditions, and motives for the IT regime. Section 3 describes the evolution of monetary policy regimes in Egypt since the 1990s. Section 4 measures the efficiency of MTR in Egypt. Section 5 concludes.

IT regime: definitions, preconditions, and motives

Definitions of IT

Generally speaking, there is no standard definition of IT[2]. However, we can think of IT as a way of reforming monetary policy by anchoring individuals' expectations about inflation around an announced target. In a flexible IT regime, the short-term interest rate serves as the operational target of monetary policy. The connection between the operational target and the ultimate target(s) is the inflation forecast level, which serves as the intermediate monetary policy target. For this reason, the inflation forecast plays a pivotal role in the targeting process.

IT as a constrained discretion is a way of implementing the optimal policy reaction function[3]. The CB or the government determines the targeted level/range of inflation. On the basis of the forecasted level of inflation, the CB moves the short-term interest rate to drive the expected, and consequently the actual, rate of inflation toward the targeted level. The targeted level of inflation should be publicly announced to serve as an "anchor" for individuals' expectations about the future behavior of inflation. The announced inflation target is expected to play the role of anchoring individuals' expectations as long as the CB's credibility is high. This is why CB credibility represents the cornerstone of a successful IT regime. Accountability, transparency, and independence are the three basic pillars of CB credibility.

Preconditions for IT

There has been much debate among economists about the "preconditions" that

[2] The definitions of IT in the literature differ; see, for example, Debelle et al. (1998, p. 2), Svensson (1998, p. 13), Batini et al. (2005, p. 161), Bernanke and Woodford (2005, p. 1), and King (2005, p. 13).

[3] In fact, most economists regard IT as a constrained discretion. The constraint is the inflation target and the discretion is the scope to take account of short-run economic and financial considerations. For more details, see Truman (2003) and Bernanke and Mishkin (1997).

countries need to meet before applying IT. This debate reflects the fact that there is no generally agreed set of preconditions[4]. The disagreement among economists pertains mainly to the question, 'What are the initial conditions or preconditions that need to be met before applying IT, particularly in an emerging market economy?' In the vast majority of the literature addressing this point, there are three elements that are generally demanded for IT to be applied, especially in developing countries and emerging market economies. They are: (i) factual (de facto) independence of the central bank[5], which comprises three basic pillars: legal instrument independence, the nonexistence of government representatives in the MPC as voting members, and the absence of fiscal dominance, including no obligation for the CB to finance budget deficits; moreover, domestic financial markets should have enough depth to absorb placements of public debt such as treasury bills; (ii) a commitment to price stability, which requires two basic elements: the CB should not target any variables other than the rate of inflation, and the CB should be transparent to the public about the exemptions from its inflation target; such transparency is a practical device to make the CB accountable to the public for achieving the inflation target; and (iii) forecasting capabilities, including a model for inflation forecasting and inflation projections, a clear idea about monetary policy transmission mechanisms and associated lags, and an inclusive and updated database.

Motives for IT

The rapid spread of IT in different countries led to the question of 'Why have some countries decided to switch their monetary policy regimes to IT?' Two factors lie behind this trend: IT is a way of reforming monetary policy, and IT does not worsen economic performance[6].

IT is a way of reforming monetary policy; it is widely accepted today that a monetary policy regime is efficient as long as it is able to achieve the goal of

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

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

[6] Of course there are other factors for the rapid spread of IT, but they are related to the two factors mentioned in the text. Epstein (2007), for instance, thinks that the spread of IT is due to the IMF increasingly using loan conditions and technical assistance to promote the use of IT in developing countries and emerging market economies.

price stability[7]. In this respect, a nominal monetary policy anchor is necessary for price stability, because it ties down individuals' expectations about the price level[8]. Thus, the efficiency of a monetary policy regime is determined, first of all, by the ability of the embedded nominal anchor to send the right message to all practitioners about the potential behavior of the price level. In this context, IT is a way of reforming monetary policy by anchoring individuals' expectations about inflation around an announced inflation target.

One lesson from the experience of some emerging market economies during the second half of the 1990s is that countries such as CPB were forced to float their currencies in the aftermath of economic crises in order not to lose a large part of their foreign exchange reserves. The decision to float came in the wake of speculative attacks on the domestic currency triggered by both economic crises and external imbalances on their current accounts. These current account imbalances emerged as a result of pegging the exchange rate in conjunction with high domestic inflation, with real appreciation thus occurring.

Immediately after floating the domestic currency the CBs in CPB switched their monetary policy regimes to IT. The CPB found that IT was the only available option for achieving the goal of price stability on a forward-looking basis. On the one hand, a monetary policy regime without an explicit nominal anchor, i.e. 'just do it' policy, was not an appropriate alternative for tying down individuals' expectations about the future path of inflation, especially as the CBs in these countries did not have a track record of credibility. On the other hand, a monetary targeting regime was also not an appropriate alternative, especially after the liberalization of capital flows and financial markets, which undermined the relationship between the money supply and the price level (Schaechter et al. 2000; Jonas and Mishkin, 2003; Fraga, 2000; Arestis et al., 2008).

IT does not worsen economic performance; there is no agreement among economists in the literature about the contribution of IT to economic performance. For example, Truman (2003, p. 33) attributes the spread of IT especially during the 1990s to the suitable global macroeconomic environment

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

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

during this period, which gave a good name and a good start to the inflation targeting regime.

However, the disagreement among economists about the contribution of IT to economic performance may be due to the conflicting results of empirical studies. On the one hand, Mishkin and Schmidt-Hebbel (2000) found that IT is beneficial especially as regards reducing the rate of inflation, reducing the sacrifice ratio and output volatility, guiding inflation expectations and dealing better with inflation shocks, reinforcing central bank independence, and mutually reinforcing communications, transparency, and accountability. Neumann and Von Hagen (2002) found similar results regarding the volatility of inflation and output. Also, Landerretche et al. (2001) found similar results about the output sacrifice, the volatility of industrial output, and reducing inflation forecast errors based on country VAR models.

On the other hand, some studies have found that IT does not contribute to economic performance. Bernanke et al. (1999) show that the adoption of IT did not make a difference with regard to the cost and speed of price stabilization. Cecchetti and Ehrmann (1999) find that the degree of inflation aversion and consequently the degree of output volatility in the inflation-targeting countries on average is not higher than those of non-targeters. Comparing 7 inflation targeters to 13 non-targeters, Laurence and Niamh (2003) found that performance improved in both groups after the early 1990s and there was no evidence that IT improved performance.

However, Hu (2003) takes a middle stance based on the results of an empirical study of about 66 countries for the period 1980–2000. The author found limited support for the proposition that the adoption of IT improves the trade-off between inflation and output variability, although IT does play a beneficial role in improving the performance of inflation and output. Nevertheless, the clear point in the empirical studies is that IT does not worsen economic performance in the inflation targeters.

Monetary policy developments in Egypt since the 1990s

FX targets

Economic circumstances in Egypt were very similar to those in CPB during the 1990s. Like CPB, Egypt applied an Economic Reform and Structural Adjustment Program (ERSAP) at the beginning of the 1990s. During this

period, and for long periods of time, the Egyptian pound was pegged against the US dollar (USD).

In the second half of the 1990s, the Egyptian economy encountered a number of external and domestic shocks which negatively affected the performance of the external sector. These shocks included: (i) the East Asian crisis in June 1997; (ii) the Luxor terrorist attack in November 1997; and (iii) the fall in oil prices in 1998 (Abu-Elayoun, 2003; Kamar and Bakardzhieva, 2003). The reaction of the CBE to these shocks was dissimilar to that of CPB, which encountered similar crises during the same period. Unlike CPB, the CBE did not use monetary policy tools to respond to these shocks. According to Panizza (2001) the CBE during this period was unwilling to have a market-determined pegged exchange rate because of some fears of a pass-through effect. Another explanation of the CBE's behavior is that the decision-making circles inside the Egyptian government were not convinced of the idea of the impossible trinity[9]. However, as the CBE insisted on defending an unrealistic value of the Egyptian pound during this period, the problems of foreign exchange shortages in the economy worsened[10], the CBE lost a large part of its international reserves (during 1998–2000 the international reserves decreased from USD 18 billion to USD 14 billion), and the FX black market re-emerged. At the end of 2000, the CBE began moving toward a more flexible exchange rate through a series of step devaluations until 2002. On January 28, 2003, the Prime Minister announced a free float of the Egyptian pound.

According to Rabanal (2005, p. 3), the Egyptian pound experienced a cumulative depreciation of 68 percent against the USD in 2000–2004. The active parallel FX market during this period began to converge to the banking rate in mid-2004, prior to the establishment of a formal interbank market for the exchange rate. In January 2005, the Egyptian pound began to appreciate against the USD. During the second half of 2006, it appreciated by 0.9 percent (CBE, 2006–2007, p. 2). Currently, the exchange rate in Egypt is unified and reasonably flexible.

Monetary policy goals

In the context of the ERSAP, the ultimate objective of monetary policy is to

[9]According to the impossible trinity hypothesis, a country can pick only two out of the following three objectives: (i) a fixed exchange rate, (ii) free capital mobility, (iii) monetary policy independence.

[10] Although commercial banks declared the price of FX, they did not sell dollars to anyone, even in limited amounts.

achieve and maintain price stability in line with the national objectives of spurring economic growth and creating more job opportunities. The intermediate monetary policy target was determined to be net domestic credit and later the rate of growth of M2. The daily operational monetary policy target was banks' excess reserve balances, which had to be set so as to achieve the intermediate target (Abu-Elayoun, 2003).

After the promulgation of a new law governing the CB, the banking sector, and money in 2003, the primary monetary policy objective was changed to focus only on achieving price stability. On June 5, 2005, the CBE introduced a new framework for monetary policy implementation. Instead of banks' excess reserve balances, this framework relies on the use of the overnight interest rate on inter-bank transactions as the operational monetary policy target. The new framework represented the CB's main policy instrument, providing the outer bounds of a corridor within which the ceiling is the overnight interest rate on lending from the CBE, and the floor is the overnight deposit interest rate at the CBE.

Measuring the efficiency of the MTR in the Egyptian economy

MTR involves announcing annual targets for the rate of growth of money, e.g. M1 or M2, on the assumption that controlling the rate of growth of money gives control of inflation. Such assumption finds its origin in the quantity equation by Irving Fisher and recently in Friedman (1968). According to Friedman (1968), monetary policy can affect real economy only during the short run. In the long run, inflation is a monetary phenomenon, and real output is driven by real factors, i.e. money is neutral in the long run. Mishkin, Fredric S. (2000) determine three key elements for MTR; (i) announcement of targets for monetary aggregates, (ii) reliance on information conveyed by a monetary aggregate to conduct monetary policy, and (iii) some accountability mechanism to prevent the deviations from monetary targets.

In the late of 70s many countries, motivated by the monetarists' model, applied monetary targeting regime to fight inflation. In practice no central bank applied monetary targeting in the form of Friedman's rule of constant money growth. Moreover, not all monetary targeters disclose numeric money targets. Batini, Nicoletta et al. (2005, 164) indicate that among 22 countries that declared

themselves as monetary targeters only 9 periodically disclose their numeric money targets[11].

As mentioned above, a monetary policy regime is efficient as long as it is able to achieve the goal of price stability. Therefore, the efficiency of a monetary policy regime is determined by the ability of the embedded nominal anchor to send the right message to all practitioners about the potential behavior of the price level. Thus, we can assess the efficiency of the MTR in the Egyptian economy by measuring whether there is a relationship between money and prices, the stability of the velocity of circulation, and the stability of the demand for money function[12].

The relationship between money and prices in the Egyptian economy

Variables and data; as the CBE targets the rate of growth of M2, I employed

M2 to measure movements in the supply of money in the Egyptian economy. As the measure of the rate of inflation, I used the change in the CPI. The use of the CPI rather than other measurements of inflation is based on two considerations. The first concerns the data, as quarterly CPI data are available for long periods. The second consideration is the wide use of the CPI. Although the CPI may technically involve some bias, it is the most commonly used measure of inflation either in both empirical studies and monetary policy analysis or even for the public. The source of the quarterly data on both M2 and CPI is IFS, CD-R, 2008.

The analysis covers the period 1991Q1–2007Q1. The choice of 1991 as the point of departure for the analysis is based on the fact that the period starting in 1991 is completely different from other previous periods. The Economic Reform and Structural Adjustment Program (ERSAP) endorsed by the IMF and WB in 1991 represents a watershed between two different epochs of economic regimes and consequently economic policy in the Egyptian economy[13].

Stationarity of the M2 and CPI time series; plotting both the CPI and M2 time series against time gives the perception that they are nonstationary. Plotting the

[11]Although the CBE is formally targeting the rate of growth of M2 it rarely discloses numeric money targets. During the fiscal year 2002–2003, the CBE targeted growth of domestic liquidity at a rate of 10%, irrespective of changes in the exchange rate (CBE, 2002–2003, p. 30).

[12] The details about the empirical study are available upon request.

[13] For more details about the ERSAP see Korayem (1997) and Awad (2002).

autocorrelation function (ACF) through the correlogram confirmed our initial suspicion about the nonstationarity of both the CPI and M2, where the first values are close to one.

One of the most popular tests of time series stationarity is the unit root test. Beside the ACF, I used the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to determine the stationary time series of both the *CPI* and *M2*[14]. For a given time series (Y_t), the ADF equation takes the following form:

$$\Delta Y_t = \beta_0 + \beta_{1t} + \lambda Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t \qquad (1)$$

where, $\varepsilon_t \sim iid\ (o, \sigma^2)$, *and* $\lambda = (\rho - 1)$

The ADF test is regularly performed under three assumptions regarding the parameters of the equation *(1)*. In each case the null hypothesis is that the value of λ equals to zero, i.e. ρ equals one, or the process under consideration involves a unite root and consequently it is not stationary.

I performed the unit root test on the two time series CPI and M2. Both are found to include a unit root, but the first differences of both the logarithm of the CPI (*ΔLnCPI*) and the logarithm of M2 (*ΔLnM2*) are found to be stationary processes.

The long-run relationship between money and prices in the Egyptian economy; does a relationship exist in the long run between money and prices in the Egyptian economy? The answer to this question depends on the cointegration relationship between money and prices. According to Granger's representation theorem, if two variables, say Y and X, are individually integrated of order one but the residuals from the cointegrating regression are stationary, then there is a long-run relationship between those two variables. In the light of this, the first differences of the logs of both CPI and M2 are stationary. Therefore, the time series of both *LnCPI* and *LnM2* are integrated of order one, i.e., *LnM2* ~ I (1) and *LnCPI* ~ I (1). To determine whether there is a cointegration relationship between money and prices we can simply regress *LnCPI* on *LnM2* and test the stationarity of the residuals. In other words we can apply the unit root tests to the residuals of the following regression:

[14] The ADF test takes care of the serial correlation by adding the lagged difference terms of the dependent variable whilst, the PP test uses nonparametric statistical methods to take care of the serial correlation.

$$LnCPI = \beta_0 + \beta_1 LnM2 + \varepsilon_{t1} \qquad (2)$$

Testing the residuals of equation (2), the ADF unit root test does not reject the null hypothesis at 5 % level of significance, i.e., the residuals are not stationary, as shown in table 1. Also, the first value of the ACF is found to be close to one, which indicates nonstationarity of the residuals with high probability. Therefore, the residuals of equation (2) exhibit nonstationary behavior.

Table 1: The ADF unit root test on the residuals of equation (2)

Case	ADF Equation			ADF Test	
	β_0	β_1	λ	ADF statistic (t)	ADF Critical values
1	**0**	**0**	**-0.06**	-1.82	1% level -2.605442 5% level -1.946549 10% level -1.613181
2	**0.001**	**0**	**-0.06**	**-1.897**	1% level -3.548208 5% level -2.912631 10% level -2.594027
3	**0.008**	**-0.0001**	**-0.078**	**-2.206**	1% level -4.124265 5% level -3.489228 10% level -3.173114

In the light of this, the variables *LnCPI* and *LnM2* are not cointegrated. Consequently, there is no long-run relationship between money and prices in the Egyptian economy[15].

[15] This result may partly refer to the administrated prices included in the CPI. I also analyzed the relationship between money and prices in the short run by regressing *ΔLnCPI* on ΔLnM2 but positive serial autocorrelation is found according to the low value of the Durbin-Watson statistic. After using a transformed form, $\Delta LnCPIW = \beta_1 + \beta_2 \Delta LnM2W + \varepsilon_{t1}$, the estimation results indicated that there is no short-run relationship between money and prices in the Egyptian economy (the details about this analysis are available upon request).

The causality relationship between money and prices within an unrestricted VAR model; I considered a different method to explore the relationship between money and prices in the Egyptian economy. Detecting a causality relationship between the two variables is an indicator that a relationship exists. I checked the causality relationship between money and prices in the Egyptian economy using an unrestricted VAR model with the following form:

$$LnCPI_t = \beta_0 + \sum_{i=1}^{k} \lambda i\ (LnCPI)_{t-i} + \sum_{i=1}^{m} \alpha i\ (LnM2)_{t-i} + \varepsilon_{1t,} \qquad (3)$$

$$LnM2_t = \eta 0 + \sum_{i=1}^{k} \gamma_i\ (LnCPI)_{t-i} + \sum_{i=1}^{m} \delta_i\ (LnM2)_{t-i} + \varepsilon_{2t} \qquad (4)$$

where, ε_{1t} and $\varepsilon_{2t} \sim iid\ (0, \sigma^2)$.

I estimated the above model for the period 1991:1–2007:1. According to the stability test, the model does not satisfy the stability condition. At least one root is found to be outside the unit circle. One of the possible reasons for such instability in the VAR estimations is the change of economic policy during this period as mentioned above, i.e. floating FX rate in January 2003. Such a change of economic policy might have impacted upon the parameters of the model.

Table 2: Wald Test-Granger Causality

VAR Granger Causality/Block Exogeneity Wald Tests			
Sample: 2002Q4 2007Q1			
Included observations: 18			
Dependent variable: LN_CPI			
Excluded	Chi-sq	df	Prob.
LN_M2	5.830844	2	0.0542
Dependent variable: LN_M2			
Excluded	Chi-sq	df	Prob.
LN_CPI	2.207975	2	0.3315

I estimated the above VAR model for the period 2002:4–2007:1. The model satisfies the stability condition, with all the roots lying inside the unit circle. Also, the model satisfies the normality test of the residuals according to the Jarque-Bera test. Testing for the causality relationship, the Wald test of Granger causality indicated that there is no causality relationship between money and prices in the Egyptian economy as shown in Table 2.

The stability of the velocity of circulation

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

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

$$M.V \equiv P.Q^{16} \qquad (5)$$

[16] The evulotion of the variables in 5 can be written as follow: $rv = [(1+ rp)\ (1+rq) / (1+ rm)] - 1$. where, *rm*, *rv*, *rp*, and *rq* are the rates of growth of money, velocity, prices, and real GDP successively. Therefore, the behavior of *V* depends on the behavior of *rp*, *rq* and *rm*.

If V is found to be stationary, then the variables in the quantity equation are stationary, or are not stationary but cointegrated. By contrast, nonstationarity of V is an indicator not only that the variables in the quantity equation are nonstationary, but also that the long-run relationship between the nominal supply of money and nominal GDP (*NGDP*) (=$P.Q$) has broken down. The relationship between the nominal supply of money and *NGDP* can break down if at least one of the three variables (P, Q, and M) is moving separately from the other two variables (no cointegration relationship). In that case we may also find that the relationship between both M and P, or real GDP (*RGDP*), has broken down[17].

In the light of this I will check the stationarity of V and the cointegration relationship between *M2* (= M) and *NGDP* in the Egyptian economy. Since quarterly *NGDP* data are not available in our source (IFS, CD-R, 2008) I will use the time series available on the website of the CBE[18], which covers the period starting in 2002. Therefore, the analysis in this part will cover the period 2002Q4–2007Q1.

The ADF and PP unit root tests on the variables *V*, *RGDP*, and *NGDP* revealed that these variables are nonstationary. The second difference of the logarithm of *NGDP* ($\Delta^2 LnNGDP$) is stationary, while the first difference of *RGDP* ($\Delta RGDP$) is stationary. The ADF unit root test on the variables *M2* and *CPI* during the current period showed that the first difference of log *M2* is stationary while the second difference of *CPI* ($\Delta^2 CPI$) is stationary.

To test whether there is a cointegration relationship between *NGDP* and *M2* I followed the same procedures as in section 4.1. The residuals of the regression $\Delta LnNGDP/LnM2$ (where both are integrated of order 1) are nonstationary as shown in Table 3.

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

[18] Available at http://www.cbe.org.eg/timeSeries.htm.

Table 3: The ADF unite root test on the residuals from regression *Δ Ln NGDP/LnM2*

Case	ADF Equation			ADF Test	
	β_0	β_1	λ	ADF statistic (t)	ADF Critical values
1	**0**	**0**	**-1.16**	-1.28	1% level -2.754993 5% level -1.970978 10% level -1.603693
2	**-0.027**	**0**	**-5.52**	**-2.51**	1% level -4.297073 5% level -3.212696 10% level -2.747676
3	**-0.09**	**0.005**	**-4.96**	**-2.21**	1% level -5.295384 5% level -4.008157 10% level -3.460791

According to the Johansen cointegration test the variables *LnM2* and *ΔLnNGDP* are not cointegrated. The Granger causality test indicates that there is no (Granger) causality relationship between the two variables as shown in Table 4. In the light of this, we can interpret the nonstationary of *V* in the Egyptian economy as a breakdown of the long-run relationship between *NGDP* and *M2*.

Table 4: Granger Causality test on *Ln M2* and *Δ Ln NGDP*

Sample: 2002Q4 2007Q1			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Probability
LN_M2 does not Granger Cause DIF_LN_GDP_N	15	1.88489	0.20201
DIF_LN_GDP_N does not Granger Cause LN_M2		2.80699	0.10775

To answer the question of why such a long-run relationship between *NGDP* and *M2* does not exist in the Egyptian economy, we can check the cointegration relationship between *M2* and either *P* or *RGDP*[19].

To test whether there is a cointegration relationship between *M2* and *RGDP* I estimated the regression *RGDP/LnM2*, where the two variables are integrated of order 1. The residuals of this regression are stationary as shown in Table 5.

Table 5: The ADF unite root test on the residuals of regression *RGDP/LnM2*

Case	ADF Equation			ADF Test	
	β_0	β_1	λ	ADF statistic (t)	ADF Critical values
1	**0**	**0**	**-1.28**	-5.22	1% level -2.708094 5% level -1.962813 10% level -1.606129
2	**-280.8**	**0**	**-1.28**	**-5.08**	1% level -3.886751 5% level -3.052169 10% level -2.666593
3	**-771.11**	**54.72**	**-1.27**	**-4.85**	1% level -4.616209 5% level -3.710482 10% level -3.297799

[19] The theoretical basis for analyzing the cointegration relationship between *M2* and *P* depends on the monetarists' hypothesis, which implicitly assumes that the economy approaches full employment. In the case of Egypt, where the formal rate of open unemployment has been higher than 11% over the past five years, it will be valid to analyze the cointegration relationship between M2 and real GDP.

Table 6: Granger Causality test on *RGDP* and *Ln M2*

Pairwise Granger Causality Tests			
Sample: 2002Q4 2007Q1			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Probability
LN_M2 does not Granger Cause REAL_GDP	16	4.04210	0.04830
REAL_GDP does not Granger Cause LN_M2		1.01041	0.39550

According to the Johansen cointegration test and the Granger causality test, the variables *LnM2* and *RGDP* are cointegrated, and *LnM2* (Granger) causes *RGDP* (Table 6).

To test whether there is long-run relationship between *M2* and *P* during the current period I estimated the regression *ΔCPI/LnM2* (where the two variables are integrated of order one). The residuals of this regression are found to be nonstationary. According to the Johansen cointegration test, the variables *LnM2* and *ΔCPI* are not cointegrated. The Granger causality test indicated that there is no causality relationship between the two variables[20].

Our conclusion from the above analysis is that while the nonstationary of *V* in the Egyptian economy is interpreted as a breakdown of the long-run relationship between *NGDP* and *M2*, the breakdown of the relationship between *M2* and *NGDP* is interpreted as a breakdown of the relationship between *M2* and *P* in the long run.

The stability of the demand for money function

One of the fundamental assumptions of the MTR is that a stable relationship has to exist between the money supply and prices. Under this assumption, the CB can achieve the goal of price stability by moving the money supply to affect the actual price levels. The other, and related, assumption of the MTR is that the demand for money function has to be stable. Without a stable demand for money function the CB will not be able to predict the demand for money. Consequently, the CB will not be able to determine how much change in the money supply is required to meet the demand for money. As a result, the CB will not be able to achieve the goal of price stability.

[20] The results are available upon request.

The instability of the demand for money can be illustrated by the instability of the velocity of circulation. More frequently, the instability of the demand for money is illustrated in terms of the demand for money function. Anderson (1985) identified three sources of instability in the demand for money: (i) change in the velocity of circulation in response to fluctuations in interest rates as well as to movements in other arguments of the money demand function rather than real income; (ii) the money demand function itself may shift; for instance, financial innovations and deregulation of interest rates may shift the demand for money at the prevailing levels of nominal interest rates; (iii) over shorter periods the money stocks actually held may not correspond to the money balances desired; if the speed of adjustment is low then such discrepancies will induce large and unexpected changes in the velocity of circulation.

In this section our objective is to consider the stability of the demand for money function in terms of its determinants. Besides RGDP, the nominal interest rate (R) affects the real demand for money because of its effect on the opportunity cost of holding money. Hetzel (1984) used a typical equation expressing the public's demand for real money balances (M^*) in the following form:

$$M^* = F(X) = e^k e^{-at} R^{-b} Y^c \qquad (6)$$

M^*, desired real money balances, are a function of the nominal interest rate (R) and real income (Y). k is a constant and at is the trend rate of growth in the income velocity of money. In practice, the stability of the demand for money function is measured by testing the stability of the following regression (Hetzel, 1984; Mehra, 1993):

$$Ln\ (M/P)_t = \beta_1 + \beta_2 LnY_t + \beta_3 Ln\ R_t + \varepsilon_t \qquad (7)$$

Wagner (1981) indicated that once the interest rate appears in the demand for money function, a stable demand for money function no longer implies a stable monetary multiplier. The main defect of equation (7) is that it does not take into account the effect of changes in the price level on the real demand for money. Following Al-Sowaidi and Darrat (2006) I included lagged inflation, $(\pi)_{t-1}$, in the demand for money function.

In the light of this, we can test the stability of the following form of the demand for money function in the Egyptian economy:

$$(M/P)_t = \beta_1 + \beta_2 (RGDP)_t + \beta_3 (R)_t + \beta_4 (\pi)_{t-1} + \varepsilon_t \qquad (8)$$

The period of the study is constrained by the availability of data. As mentioned earlier, quarterly nominal GDP data are only available for the period 2002Q4–2007Q1, therefore our analysis will only cover this period.

Which rate of interest might be used? As the Egyptian economy has become more liberalized, especially after the liberalization of the exchange rate and the deregulation of domestic interest rates, the structure of domestic interest rates is dominated by the directions of international interest rates. Therefore, we can use either the LIBOR rate or an average of domestic interest rates as a measure of the nominal interest rate included in equation (8).

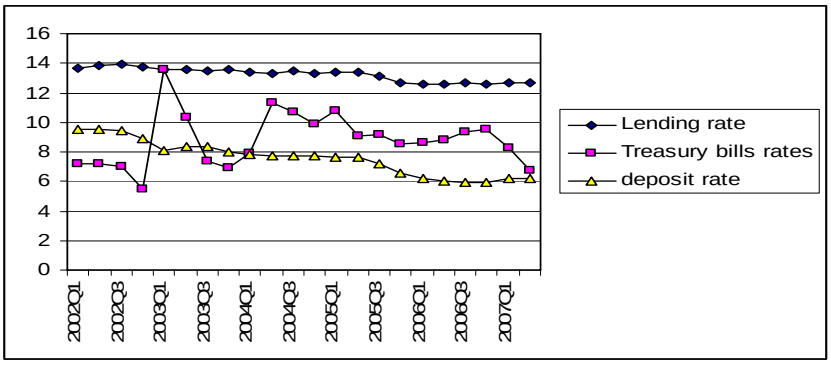
Although the Treasury Bill (TB) rate lies mostly between the lending and deposit rates (Figure 1), the use of the TB rate as a proxy for the nominal interest rate is cancelled where the TB rate, in contrast to the other variables included, seems stationary. According to the ADF unit root test, the TB rate is integrated of order zero. As the time series of the TB rate was found to be stationary, i.e., I~ (0), we could not include it in our analysis to estimate the long-run demand for money function. The time series of both the CPI and LIBOR are integrated of order two, while Ln (M2/P) is integrated of order one. As mentioned earlier, RGDP is integrated of order one.

In the light of the above analysis we can measure the stability of the demand for money function in the Egyptian economy in two steps. The first step is to estimate the long-run demand for money function. The second step is to consider whether this long-run relationship is stable or not.

The long-run demand for money function can be estimated in the Egyptian economy in the following form, where all the variables are integrated of order one:

$$Ln\ (M/P)_t = \beta_1 + \beta_2 RGDP + \beta_3 \Delta\ LIBOR_t + \beta_4 (\Delta\ CPI)_{t-1} + \varepsilon_{t1} \qquad (9)$$

Figure 1: Interest rates in the Egyptian economy during the period 2002-2007



Source: prepared using the data from: IFS, CD-ROM, 2008

Since the individual variables of equation (9) are integrated of order one then the existence of a long-run relationship depends on whether the residuals are stationary or not. According to the ADF unit root test, the PP unit root test, and the Q-statistic test the residuals of equation (9) are stationary as shown in figure 2.

According to the Jarque-Bera normality test, the residuals are normally distributed. Besides, the Johansen cointegration test indicates that a cointegration relationship obviously exists. In the light of these results, we can conclude that equation (9) captures the long-run demand for money in the Egyptian economy.

The second step is to check whether the existing long-run demand for money function is stable or not. Different tests of stability may be used. Specifically, to check the stability of the long-run relationship depicted by (9), I used the Chow breakpoint test, the Chow forecast test, and the recursive residuals test[1].

Using the point 2005:1 to check for a structural change in (9), the Chow tests indicated a structural change. The null hypothesis is rejected in the two tests according to both the F-statistic and the likelihood ratio statistic (Tables 7). According to the recursive residuals test the parameters of equation (9) are not

[1] The details about these tests are available upon request.

stable through time, as shown in Figure 3. Where, the cumulative sum of the recursive residuals (CUSUM) goes outside the area with the 5 % critical value.

Figure 2: The stationary behavior of the residuals in regression (9)

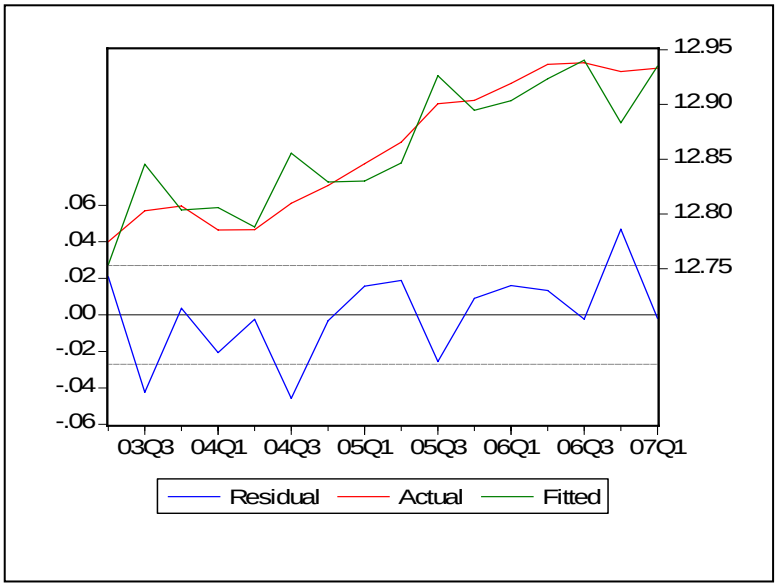


Table 7: Chow Breakpoint Test & Chow Forecast Test

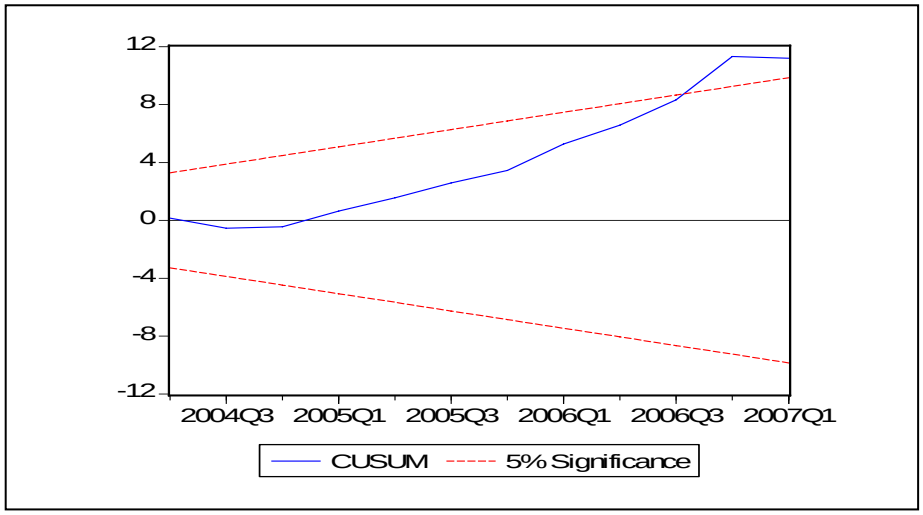
Chow Breakpoint Test: 2005Q1			
F-statistic	11.75096	Prob. F(4,8)	0.001977
Log likelihood ratio	30.84738	Prob. Chi-Square(4)	0.000003
Chow Forecast Test: Forecast from 2005Q1 to 2007Q1			
F-statistic	13.30485	Prob. F(9,3)	0.028165
Log likelihood ratio	59.38377	Prob. Chi-Square(9)	0.000000

Conclusion

This paper set out to answer the question of whether Egypt should switch to the inflation targeting (IT) regime or not? Our judgment on adopting IT is based on the practical experience of the inflation targeters, and on whether the monetary targeting regime (MTR) currently applied in Egypt is efficient or not. Defining the efficiency of a monetary policy regime as the ability of the embedded nominal anchor to send the right message to all practitioners about the potential behavior of the price level, I assessed the efficiency of the MTR in Egypt by measuring whether there is a relationship between money and prices, the stability of the velocity of circulation, and the stability of the demand for money function. The results of the study were as follows: (i) the relationship between money and prices in the Egyptian economy is loose in both the short run and the long run; (ii) the velocity of circulation (V) is found to be nonstationary, and there is no cointegration relationship between the supply of money (M2) and nominal GDP; and (iii) by estimating the demand for money function in the long run and checking its stability, the study found that the demand for money function is not stable in the Egyptian economy.

In the light of the above results the study concludes that the MTR is not efficient enough to tie down individuals' expectations of inflation. Taking into account that the IT regime is a way of reforming monetary policy and it does not worsen economic performance in practice, it becomes necessary for Egypt to take practical steps toward adopting IT.

Figure 3: Recursive residuals of equation (9)



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