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What is the Central Bank of Egypt's Implicit Inflation Target?

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Abstract The Central Bank of Egypt (CBE) announced its intention to move toward a fully-fledged inflation targeting regime once the fundamental prerequisites are met. The purpose of this paper is to estimate the CBE's (implicit) inflation target over the period 2002M1-2012M12. Using a backward-looking Taylor rule, the inflation target is estimated to be in the range of 9.1-9.2% while actual inflation was 9.1% over the entire period. We also employ a time-varying parameter methodology in a state-space framework to estimate the CBE's implicit inflation target. Results indicate significant time variation in the estimate of the inflation target, and hold under a number of robustness checks.

Keywords: Monetary policy rules, Egypt, time-varying parameters, inflation targeting
JEL Classification: E5

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1. Introduction

The monetary policy objective of the Central Bank of Egypt (CBE) is achieving low rates of inflation essential for sustaining high investment and growth rates as well as maintaining confidence in the Egyptian economy. Law no. 88 of 2003 of the "Central Bank, Banking Sector and Monetary System" entrusts the CBE with the formulation and implementation of monetary policy, with price stability being the primary objective. According to the CBE website, the monetary policy framework adopted by the CBE's Monetary Policy Committee (MPC) currently intends to move toward a fully-fledged formal inflation targeting (IT) regime once the fundamental prerequisites are met. In the transition period, the CBE uses its main monetary policy instrument, the overnight inter-bank rate introduced in 2005M7, to manage inflation in the short-run (see CBE multiple issues).

This current monetary policy framework in Egypt motivates our research question. Particularly, we are interested in estimating the CBE's (implicit) inflation target. As mentioned above, the CBE is currently moving toward a formal IT regime making sure that all the required fundamentals are first in place. This implies that the CBE must be implicitly targeting a certain rate of inflation when deciding upon its monetary policy. Our objective in this paper is to estimate this implicit (time-varying) inflation target using a simple Taylor rule over the period 2002M1-2012M12.

Using a backward-looking Taylor rule, we are able to estimate the CBE's implicit inflation target for the period under investigation. This allows an examination of how the CBE changes its monetary policy tool, the overnight interbank rate, in response to lagged inflation and output gap. We also take the effect of the exchange rate, interest rate smoothing and the Egyptian revolution of January 25, 2011 into consideration. We do so using two approaches; namely OLS and a time-varying parameter (TVP) methodology. The first approach, OLS, delivers a single estimate of the inflation target over the entire period. Our results indicate that the estimated inflation target is 9.1% which is exactly equal to the actual inflation rate over the 2003M2-2012M12 period. The second approach, the TVP methodology, uses a state-space approach to estimate the CBE's implicit inflation target over time. We are able to estimate a time-varying inflation target over the period under investigation that closely follows the actual inflation rate in Egypt.

The paper is structured as follows. Following this introduction, section 2 presents the model and data. Section 3 presents the econometric methodologies and results. Finally, section 4 concludes.

2. The Model and Data

A number of papers have used simple Taylor rule models to estimate an implicit target rate of inflation. Taylor rules, following Taylor (1993), are simple monetary policy rules that describe how a central bank should adjust its interest rate policy instrument in response to developments in inflation and macroeconomic activity. Orphanides (2007) reviews the development and characteristics of Taylor rules versus alternative monetary policy guides. The basic structure and parameters of the Taylor rule are well known and are as follows:

$$i_t = r^n + \pi^*_t + 1.5\,(\pi_t - \pi^*_t) + 0.5\;\tilde{y}_t \qquad (1)$$

where i_t is the short-term nominal interest rate that is the central bank's monetary policy instrument. It is expressed as a function of r^n_t, the natural rate of interest, π^*_t the inflation target, π_t the inflation rate, $\tilde{y}_t$ the output gap. After Taylor (1993) showed that the above parameters hold for the case of the USA, a proliferation of studies have emerged testing the above simple model under different specifications, samples and countries, and using different econometric techniques.

More recent papers have argued for the important roles of interest rate smoothing (see equation (2)), and exchange rates especially in small open economies (see equation (3)). Selim (2012) has argued for including both when estimating a monetary policy rule for Egypt. The model used in this paper is defined as follows:

$$i_t = (1-\rho)\, i^*_t + \rho\, i_{t-1} + \varepsilon_t \qquad (2)$$

$$i^*_t = r^n + \beta\,(\pi_{t-1} - \pi^*_t) + \gamma\;\tilde{y}_{t-1} + \eta\,\Delta x_t \qquad (3)$$

where i^*_t is the target interest rate and is expressed as a function of r^n_t, the natural rate of interest, π_{t-1} the lagged inflation rate, $\tilde{y}_{t-1}$ the lagged output gap, π^*_t the inflation target and the Δxt exchange rate. It is worth mentioning that we use year-on-year (y-o-y) changes when calculation the inflation rate in Egypt. The reason is that we believe that the policymaker tends to consider yearly rates of inflation when formulating decisions about monetary policy rather than looking at monthly changes. Indeed, according to the monetary policy statements released by the CBE, it is evident that the Monetary Policy Committee at the CBE has been reacting to (y-o-y) inflation changes when deciding upon any changes in their short-term monetary policy instrument.

An important discussion in the literature has been about a central bank's choice between backward versus forward-looking monetary policy rules. On one hand, papers by Clarida, Gali and Gertler (1998, 2000) and Qin and Enders (2008) argue that empirical studies on industrial countries usually show that forward-looking models have better fit than backward ones. On the other hand, a number of other studies claimed that backward-looking Taylor rules are more appropriate in the case of developing and emerging economies (see Moura and de Carvalho (2010), Hammond, Kanbur and Prasad (2009) and Mohanty and Klau (2004)). We, therefore, decide to use a backward-looking Taylor rule for Egypt in this paper since it is among small open emerging economies. Furthermore, almost all monetary policy statements published by the CBE's Monetary Policy Committee indicate that the CBE has been mostly reacting ex-post to past inflation changes rather than ex-ante to future expected changes or developments (see CBE, multiple issues).[ii]

Putting equation (3) into equation (2) delivers the following set of equations:

$$i_t = (1-\rho)\,\alpha + (1-\rho)\,\beta\,\pi_{t-1} + (1-\rho)\,\gamma\,\tilde{y}_{t-1} + (1-\rho)\,\eta\,\Delta x_t + \rho\, i_{t-1} + \varepsilon_t \qquad (4)$$

$$\text{where}\ \ \pi^*_t = (r^n - \alpha)\,/\,\beta\text{-}1 \qquad (5)$$

Thus, an estimate of the CBE's (implicit) inflation target is possible once we find an empirical estimate of the relevant coefficients from equation (4).

An Initial Look at the Data

We use monthly observations over the period 2002M2-2012M12 to estimate the above model. Data sources are the Central Bank of Egypt (CBE) as well as the International Financial Statistics (IFS) of the International Monetary Fund (IMF). All variables are seasonally adjusted and all variables, except the overnight interbank rate, are expressed in logs.

Figure (1) below shows the development of the inflation rate in Egypt versus the overnight interbank rate. It is evident that the overnight rate was more volatile during the beginning of the period up to 2005M7 when it was announced as the CBE's formal short-term monetary policy instrument.

The output gap variable is usually calculated as follows:

$$\tilde{y}_t = GDP_t - \overline{GDP}_t \qquad (6)$$

The output gap ($\tilde{y}_t$) is the difference between the actual GDP series and its long-run trend $\overline{GDP}_t$ calculated using the Hodrick-Prescott filter. In this paper, we use the monthly total production index (TPI), published by the Ministry of Economic Development of Egypt, as a proxy to (GDP_t) since GDP is only available on quarterly basis. The correlation between both series is 0.941 and serves as a close approximation to actual GDP. Figure (2) shows a regression of quarterly TPI on quarterly GDP.

Table (1) presents summary statistics for the variables of our model.

Table (2) presents the time-series properties of the variables. We use the Augmented Dickey Fuller (ADF) and Elliott, Rothenberg and Stock (ERS) unit root tests to establish stationarity of the variables in the empirical analysis.[iii]

It is clear that the CBE's overnight interbank rate and that the output gap are stationary variables, while the consumer price index and the exchange rate are non-stationary in levels but become *I(0)* in their first difference. The time series properties of the variables reported in Table (2) above are taken into consideration when performing the econometric analysis in the following section.

3. Econometric Methodologies and Results

This section presents the econometric techniques used to estimate the CBE's implicit inflation target under the period under consideration. Specifically, this paper employs two methodologies; OLS and time-varying parameter approaches.

3.1. The OLS Approach

A number of studies have estimated a country's implicit inflation target using OLS in a backward-looking Taylor rule framework. These include Moura and de Carvalho (2010) for a sample of Latin American countries among others.

The OLS results for the backward-looking Taylor rule for Egypt are presented in Table (3). Our estimate of the implicit inflation target in Egypt versus actual inflation is presented in the last two columns of the table.

Results from Table (3) point to a significant interest rate smoothing effect. We can also see that the choice of a backward looking Taylor rule seems appropriate in the case of Egypt, as evident by the statistically significant coefficient attached to the lagged inflation. Results also indicate that a depreciation of the Egyptian pound versus the US dollar is associated with an increase in the overnight interbank rate as expected. Moreover, it seems that the Egyptian revolution of January 25, 2011 had no significant impact on the formulation of monetary policy in Egypt.[iv] Hosny (2014) provides more details about the conduct of monetary policy in Egypt and the effects of different macroeconomic variables on the CBE's overnight interbank rate in a similar context.

Finally, the last two columns present our estimate of the inflation target in Egypt versus the actual average inflation rate over the periods under consideration. The average value of the real interest rate over the period under consideration is taken to represent the long-run equilibrium value, r^n, the natural rate interest. We estimate an inflation target of 9.1 or 9.2% depending on whether we include the revolution dummy or not. Actual inflation during the period was 9.1%. Our estimate of the inflation target is statistically significant and the standard errors are calculated using the Delta method.[v]

3.2. The Time-Varying Methodology

We now turn to estimating the backward-looking Taylor rule for Egypt, but using a time-varying parameter methodology. Such an attempt has been made in Jalil (2004) for the USA, and Kuzin

(2006) for Germany among others. A survey of the relevant literature is offered in Yüksel, Ozcan and Hatipoğlu (2012).[vi] In what follows, we first present the motivation behind using this methodology in the case of Egypt and then we discuss the econometric model and results.

3.2.1. The Motivation

The motivation is that monetary policy in Egypt has gone through a number of changes over the period under investigation 2002M1-2012M12. Specific to our context is the fact that the CBE officially announced the overnight interbank rate as its main monetary policy tool in 2005M7. Furthermore, the CBE has undertaken a series of successful improvements in the monetary and financial market in Egypt since 2002. These include two phases of the CBE's Financial Sector Reform Program (FSRP). Phase I (2004-2008) aimed at increasing the efficiency of the banking sector and strengthening the overall regulatory and supervisory framework. This phase included measures such as privatization of state-owned banks, settling non-performing loans, restructuring of large public banks as well as the establishment of a private sector credit bureau. New legislations in the financial market have been introduced including the establishment of the Egyptian Financial Supervisory Authority with the aim of regulating the growing non-bank financial markets and instruments. Such measures, in addition to the formal introduction of the overnight interbank rate in 2005, have certainly had a sizeable effect on the conduct of monetary policy in Egypt. An effective monetary policy regime requires not only a clear operational policy rate, but also a set of regulatory and financial prerequisites to be able to successfully attain the objectives of a central bank.

Phase II (2009-2011) of the CBE's FSRF aimed at increasing access to financing, modernizing prudential oversight and spurring more competition. A key element in this regard was the careful implementation of Basel II standards along with comprehensive measures to reduce risk and removing structural impediments to ensure sound financial intermediation.

A number of external events have also taken place during our sample period. The unexpected rise in global commodity prices starting 2008 has certainly had an effect on inflation in Egypt and has definitely influenced the ability of the CBE to exercise its policies using domestic tools, i.e.: the effectiveness of the overnight interbank rate may have decreased following this exogenous shock.

In light of such developments in the overall monetary environment in Egypt, due to both internal and external factors, we hypothesize that the CBE's implicit inflation target has likely varied over time during the sample period used in our analysis. Although results using the OLS approach have given us a picture of the CBE's implicit inflation target, it only delivers an *average* effect over the entire sample period as we simply calculate the inflation target using single point estimates from the OLS regression. This observation motivates our effort to conduct a *time-varying* parameter methodology to more accurately understand the conduct of monetary policy in Egypt and how the CBE targeted different rates of inflation over time.

3.2.2. The TVP Model

Building on the above motivation, we allow the parameters of our model to vary with time following the procedure developed by Kalman (1960) and explained in Kim and Nelson (1998).

Time-varying parameter models were first applied by Kim and Nelson (1989) to model a time-varying monetary reaction function of the Federal Reserve. We apply MLE and the Kalman filter within the context of a state-space approach to model the dynamic time-series in the equations below and estimate the time-variation in the parameters. A Kalman filter, as will be explained below, basically uses a recursive procedure for computing the optimal estimates of the time-varying coefficients using all available information up to time t. In our context, this mounts to estimating equation (7), our equation of interest, and equations (8) which model the dynamics of the time-varying parameters. Notice that equation (7) is equivalent to equation (4) but after adding a subscript t to all coefficients.

$$i_t = a_t + b_t \pi_{t-1} + c_t \tilde{y}_{t-1} + d_t \Delta x_t + p_t i_{t-1} + \varepsilon_t \tag{7}$$

$$a_t = a_{t-1} + v_t,\ b_t = b_{t-1} + u_t,\ c_t = c_{t-1} + \eta_t,\ d_t = d_{t-1} + \zeta_t \text{ and } p_t = p_{t-1} + \mu_t \tag{8}$$

The state-space representation of the above system could be written as follows:

$$i_t = \begin{bmatrix} 1 & \pi_{t-1} & \tilde{y}_{t-1} & \Delta x_{t-1} & i_{t-1} \end{bmatrix} \begin{bmatrix} a_t \\ b_t \\ c_t \\ d_t \\ p_t \end{bmatrix} \tag{9}$$

$$\begin{bmatrix} a_t \\ b_t \\ c_t \\ d_t \\ p_t \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a_{t-1} \\ b_{t-1} \\ c_{t-1} \\ d_{t-1} \\ p_{t-1} \end{bmatrix} + \begin{bmatrix} v_t \\ u_t \\ \eta_t \\ \zeta_t \\ \mu_t \end{bmatrix} \tag{10}$$

In matrix notation, the above equations can be more compactly written as

$$\underset{(n\times 1)}{i_t} = \underset{(n\times m)}{X_{t-1}} \underset{(m\times 1)}{\beta_t} + \underset{(n\times 1)}{e_t} \tag{11}$$

$$\beta_t = F \beta_{t-1} + v_t \text{ with } F = I_m \tag{12}$$

$$e_t \sim iid\ N(0, \sigma_e^2),\ v_t \sim iid\ N(0, \sigma_v^2) \text{ and } E[e_t v_s'] = 0 \tag{13}$$

A *state space* model for an $n-$dimensional time series (in our case i_t) consists of a measurement equation (11) relating the observed data to an $m-$dimensional state vector (β_t), and a transition equation (12) describing the dynamics of the state vector over time. The transition equation, as shown above, takes the form of a first-order difference equation in the state vector. The X_{t-1} vector contains the right-hand-side variables from the inflation equation. The last set of equations (13) defines the errors as *iid* and assumes that the measurement equation errors are independent of the transition equation errors for all $s=t$.

The *Kalman filter* is the tool that deals with state-space models. A Kalman filter uses a recursive procedure for computing the optimal estimates of the state vector (β_t), using all available information up to time t. The filter consists of two sets of equations as described in Kim and Nelson (1998). The first is the *prediction equations* at the beginning of time t which are used to predict an optimal estimate of the $n-$dimensional time series (i_t) defined above using all available information up to time $t\text{-}1$, $\Delta R_{t|t-1}$. This requires the estimation of the state vector (β_t) using information up to $t\text{-}1$, $\beta_{t|t-1}$. In the second step, once (i_t) is realized at the end of time t, we can form a more accurate inference about our state vector, $\beta_{t|t}$, through a set of *updating equations* after calculating a prediction error. Specifically, $\beta_{t|t}$ is now our updated estimate of β_t based on the appropriate weights assigned to the new information, contained in the prediction error, up to time t. These weights, or the Kalman gain, are a function of the prediction error variance due to uncertainty in $\beta_{t|t-1}$ and shocks to the measurement equation error, e_t.

Figure (3) presents the estimated inflation target of the CBE over the 2003M2-2012M12 period using our backward-looking Taylor rule.[vii] The solid line presents actual (y-o-y) inflation, while the dotted line presents the estimated inflation target.

Looking at Figure (3), one can notice the higher volatility in the estimated inflation target during the beginning of the period. This volatility decreases starting 2005M7, which is when the CBE officially announced the overnight interbank rate as its main operational monetary policy tool. The estimate of the inflation target became more stable after 2005M7 and onwards. One can also notice how the estimated inflation target was not so close to actual inflation from 2005M7 till the end of 2008. This may be due to the fact that inflation was more volatile during this period than afterwards. The estimated inflation target and actual inflation start to converge and seem to move closely starting in 2009 and remain so till the end of the period in 2012M12.

Our results from Figure (3) also show that the estimated inflation target is above actual inflation during 2005 and most of 2007. Our hypothesis is that the CBE was targeting a high rate of inflation in an attempt to support economic growth during these periods. In fact, economic growth rates were the highest as compared to earlier or later years in our sample. It could be that the CBE was aiming at easing monetary policy during this period to stimulate aggregate demand at the expense of higher prices, and that could offer an explanation as to why its inflation target was relatively high.

A closer comparison of the estimated inflation target and actual inflation during 2008-2009 as compared to 2009-2012 period reveals further interesting information. We can notice a bigger discrepancy between the two series during the first period, while this discrepancy decreases in the second. Inflation in 2008-2009 could be mostly explained by the unfavorable exogenous shocks due to increases in prices of global commodities, while inflation during 2009-2012 was driven mostly by internal as opposed to external factors. It seems that the CBE has been more successful at targeting an inflation rate and achieving it when inflationary pressures originate from internal rather than external factors.

We perform a number of robustness checks to our baseline TVP model. Specifically, we re-estimate the time-varying inflation target after adding the revolution dummy as discussed above. We experiment by restricting the coefficient attached to this dummy to be fixed as well as allowing it to be time-varying. Results (not reported for space considerations) are unchanged.

Another robustness check involves using the Kalman smoother, as opposed to the Kalman filter, to estimate the time-varying implicit inflation target in Egypt. Results are reported in Figure (4). The difference is that estimates based on the filter (Figure 3) used data only up to time *t*, while those based on the smoother (Figure 4) use data from the entire sample (see Kim and Nelson (1998) for more details).

Results using the Kalman smoother are quite similar to those using the Kalman filter. Again, adding the revolution dummy using the Kalman smoother does not change the results.

In sum, using the time-varying parameter methodology has indeed improved our understanding of the dynamics of inflation in Egypt during the period under investigation. We can conclude that the CBE targeted different rates of inflation over time, adjusting it as needed with overall economy developments over time or to cope with inflationary pressures arising from internal-driven factors and/or external shocks.

4. Conclusion and Policy Implications

The CBE has been implicitly targeting inflation since it announced its intention to move toward a fully-fledged inflation targeting regime once all required fundamentals are in place. The CBE's main operational monetary policy instrument is its overnight interbank rate. In this paper, our objective is to use a simple monetary policy rule to estimate the CBE's implicit inflation target over the period 2002M1-2012M12. We do so by estimating a backward-looking Taylor rule for Egypt that explains how the CBE sets its short-term interest rate; the overnight interbank rate, in response to lagged inflation and macroeconomic developments.

Using a simple OLS approach, our estimate of the inflation target is 9.1% which is equal to actual inflation over the 2003M2-2012M12 period. We then argue that the CBE might have targeted different rates of inflation over time as financial markets and the overall economy developed. Using a TVP methodology in a state-space framework, we are able to estimate a time-varying inflation target over the period under investigation that closely follows the actual inflation rate in Egypt. We are able to show how the CBE targeted different rates of inflation over time, adjusting it as needed with overall macroeconomic and inflationary developments. Our results hold under a number of robustness checks.

These findings deliver some important policy messages to the policymakers in Egypt. A number of studies in the literature have advocated the implementation of a set of "initial preconditions" for the success of an inflation targeting regime. Carare et al (2002) grouped such pre-conditions into four categories; namely a clear mandate for the support of an IT regime, well developed financial systems, overall macroeconomic stability and effective policy implementation tools. Freedman and Otker-Robe (2009) present evidence that such preparations need to be coordinated with other economic policies and reforms. This implies that the successful implementation of an IT regime not only requires efforts from the part of monetary policymakers but also requires a cohesive set of supporting policies from the fiscal, external and institutional sides.

In our context, our findings imply that monetary policymakers in Egypt, represented by the CBE, are successfully managing the transition to a fully-fledged IT regime. The CBE has the required institutional framework in terms of its independence and clear mandate of achieving price stability. The CBE has also introduced a clear monetary policy operational tool, its overnight interbank rate, and our results indicate that it has been successfully getting inflation on target during the period under consideration in this study. This, however, does not mean that all other required fundamentals and pre-requisites are in place. Our findings simply praise the actions of monetary policy in Egypt but say little about other pre-conditions such as a supportive fiscal policy, and accommodating external and institutional environments. On the part of fiscal policy, issues of fiscal dominance and huge budget deficits need to be avoided as they may exert pressure on the conduct of monetary policy in Egypt. Pressures from the external sectors such as a depreciating currency or consistent trade deficits may also hamper the independence and focus of the CBE in maintaining its mandate of price stability. Indeed, our results indicate that a weaker currency often induces a raise in the CBE's short-term interest rate. Freedman and Otker-Robe (2010) argue that the issue of exchange rates can be troublesome for an effective IT regime in the case of emerging small open economies. Therefore, the CBE needs to be clear on whether exchange rate stability may in certain times be preferred over price stability.

In sum, findings from this paper commend the actions of monetary policymakers in Egypt and their successful efforts in getting the inflation rate on target, but more still needs to be done in the areas of fiscal, external and institutional environments to ensure an effective move towards a fully-fledged inflation targeting regime in Egypt.

Endnotes

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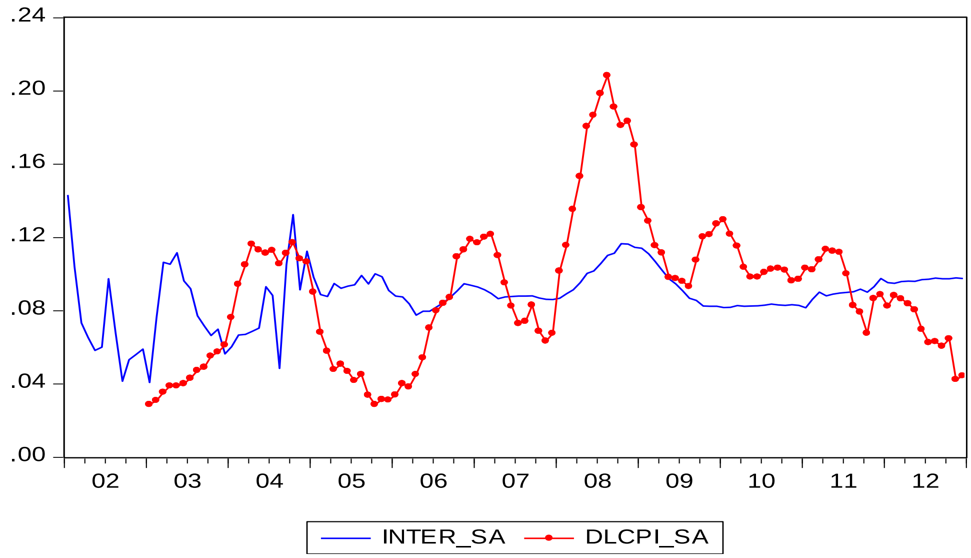
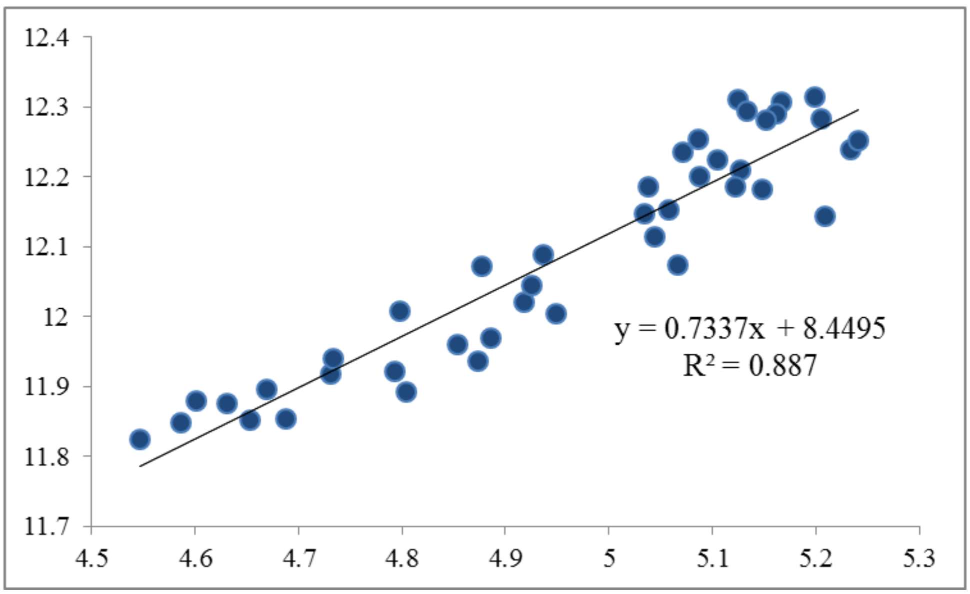
Figure 1: Inflation and Interest rates in Egypt 2002M1-2012M12



Solid line: overnight interbank rate, dotted line: inflation rate
Source: Central Bank of Egypt and International Financial Statistics

Figure 2: GDP versus TPI: 2002Q1-2012Q2



Source: Ministry of Economic Development

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Table 1: Summary Statistics

	Mean	*Std. Dev.*	*Min*	*Max*
Inflation	0.091	0.039	0.028	0.208
Overnight rate	0.088	0.015	0.040	0.143
Exchange rate	1.732	0.083	1.493	1.841
Output gap	-0.000	0.053	-0.248	0.187

Variables, except overnight rate, are expressed in logs

Table 2: Unit Root Tests

variable	*Description*	*Level*		*First Difference*	
		ADF	ERS	ADF	ERS
cpi	Consumer price index	0.474	981.162	-2.899**	3.627**
int	Overnight interbank rate	-3.744***	2.362***	-7.785***	0.017***
gap	Output gap	-6.917***	1.300***	-11.127***	0.127***
exr	Exchange rate	-2.429	19.785	-6.777***	0.940***

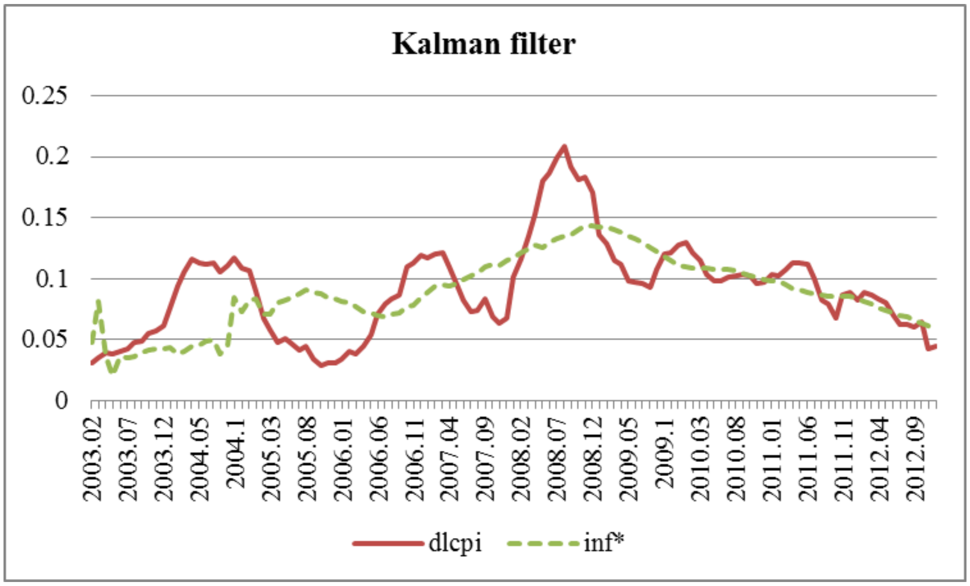
*** Significant at the 1% significance level, ** Significant at 5%, * Significant at 10%
Numbers reported are the computed t-statistics for ADF tests, and p-statistic for ERS test. The null hypothesis in both tests is the series contains a unit root.

Table 3: Backward Looking Taylor Rule: OLS 2003M2-2012M12

cons	**lagint**	**lagdlcpi**	**laglgap**	**dlexr**	**rev**	**inf***	**avg(inf)**
0.031	0.611	0.046	-0.008	0.105		0.092	0.091
(0.006)***	(0.067)***	(0.023)**	(0.018)	(0.062)*		(3.51)* $^{\Psi}$	
0.031	0.606	0.047	-0.007	0.102	0.002	0.091	0.091
(0.006)***	(0.068)***	(0.023)**	(0.018)	(0.063)*	(0.002)	(3.68)* $^{\Psi}$	

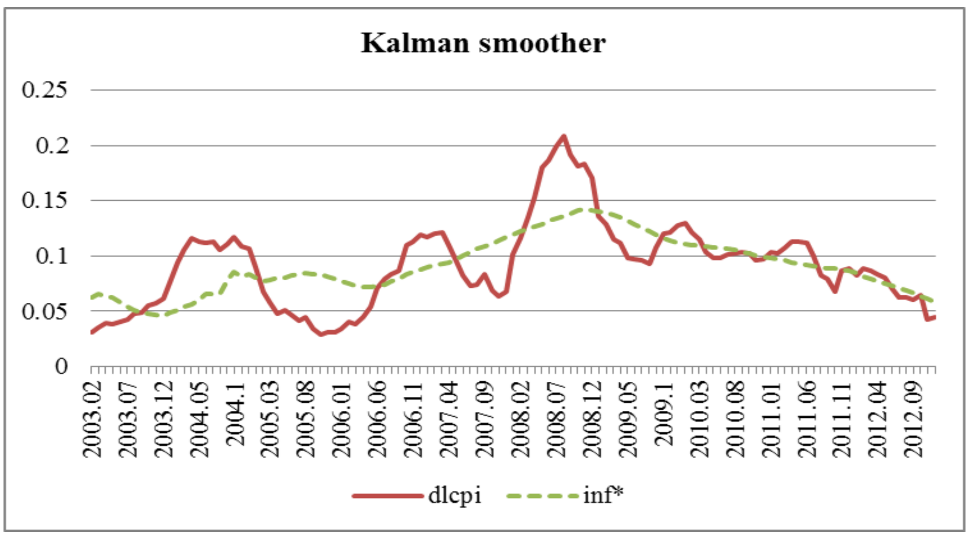
Robust standard errors are in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%
$^{\Psi}$ Chi-square is reported in parenthesis for the estimated inflation target using the Delta method

Figure 3: Backward Looking Taylor Rule: Kalman filter 2003M2-2012M12



Solid line: Actual inflation, dotted line: Estimated inflation target

Figure 4: Backward Looking Taylor Rule: Kalman smoother 2003M2-2012M12



Solid line: Actual inflation, dotted line: Estimated inflation target

[i] The views expressed in this paper are those of the author and do not necessarily represent those of the IMF or IMF policy.
[ii] A study by Hosny (2014) is dedicated to testing whether monetary policy in Egypt is backward or forward-looking.
[iii] It has been argued in the literature that one should use the test proposed by Elliott, Rothenberg and Stock (1996) for maximum power against very persistent alternatives, i.e.: series that are very close to being non-stationary.
[iv] We add a dummy variable that takes the value of one from 2011M1 onwards, and zero otherwise to account for the effect of the revolution.
[v] See Greene (1997), Theorems 4.15 and 4.16.
[vi] A number of studies have estimated time-varying inflation targets in the context of a *forward-looking* Taylor rule. These include Leigh (2004) and (2008) for the cases of Japan and USA. Klein (2012) estimated South Africa's implicit inflation target.
[vii] The natural rate of interest is obtained using the HP filter to calculate the long-run trend of the real overnight interbank rate. This series is then used to calculate the implicit inflation target after obtaining the time-varying coefficients.