Effectiveness of Monetary Policy In Economies in Democratic Transition: Evidence from Tunisia

Guizani, Brahim

Tunis Business School Univesity of Tunis, Tunisia

20 March 2015

Effectiveness of Monetary Policy In Economies in Democratic Transition: Evidence from Tunisia

Brahim Guizani†

Tunis Business School
University of Tunis

Abstract

This paper aims to contribute to the meager literature on monetary policy effectiveness in Tunisia especially after the revolution of January 2011; a period during which the country entered a delicate democratization transition. On the basis of a monthly data of several macroeconomic variables during the period from 2000 through 2013 a Vector Error Correction (VEC) model is estimated. The VEC-generated impulse response functions show that the monetary policy stance, as measured by the short-term interest rate, has become increasingly more effective on real output and prices during the post-revolution period; i.e., (2011 – 2013) than the previous period; i.e., (2000 – 2010). The variance decomposition analysis not only confirms these findings but also it points out an increasing role to the real output in price variation during the political transitional period. This might be attributed to the increasing volatile environment that characterized this period, which perturbed the aggregate supply and exacerbated the aggregate demand. Another no less important finding uncovered by the model is the amplification and acceleration of the exchange rate pass-through during the transitional period with respect the pre-revolution period.

Keywords: monetary policy, Vector Error Correction Model, impulse response function, variance decomposition, Exchange rate Pass-Through.

JEL classification: E52, E58

---

† Lecturer in Tunis Business School at the University of Tunis.
Address: Tunis Business School, Mourouj, 2074, Tunis, Tunisia
Phone: 216- 53-258-525; 216-71-476-600; *Fax*: 216-71-477-555; *E-mail:* brahim.guizani@tbs.rnu.tn

Introduction

Monetary policy actions are transmitted to the economy through several mechanism channels. The relative importance of the different channels, how they change through time and how these actions impact key variables are crucial for monetary policy decision-making.

The impact of monetary policy depends on the context in which it operates such as transitional contexts of turbulent political process and volatile environment. During transition, the institutions, which are important for monetary transmission, are to certain extent weakened, the political pressure on central banks is likely to intensify. Moreover economic difficulties like budgetary deficits, the collapse of the financial system, and inflationary expectations linked to exchange rate movements could hamper the transmission mechanisms of monetary policy. In such an environment the monetary policy can behave differently than normal period.

Lang and Krznar (2004) and BIS (1998) argue that in an instable environment a loosening of the monetary policy can result in supply-side shock when a depreciation of the exchange rate increases import prices and hence induce firms to raise their domestic producer prices even in absence of any expansion of aggregate demand. On the other hand, wages and prices could move even before movements in import costs find their way through the cost structure, affecting aggregate demand and finally output. So in countries experiencing increasing uncertainties a loosening of monetary policy can have contractionary effect rather than the expected expansionary effects.

BIS (1998) study argues that monetary policy channels, even if they are stable and well understood, the increasing uncertainty of the environment and the volatility of financial market conjoined with macroeconomic performance volatility may diminish the linkage between the monetary policy impulses and future economic outcomes.

The rest of the paper is organized as follows. Section 1 presents the monetary policy framework of the central bank of Tunisia. The literature review is presented in Section 2. The following section 3 provides the model to be used in this empirical research. Sections 4 and 5 describe the data and the Johansen coinegration test. Then

section 6 presents the results of the empirical estimations. This section is detailed as follows: Impulse response functions, the variance decomposition analysis and the exchange rate pass-through analysis. The final section concludes.

1. Monetary Policy Framework

Under the Central Bank Law, the priority objective of the monetary policy in Tunisia is to safeguard the price stability. The central bank of Tunisia's (henceforth, the BCT) operational framework as detailed in Chailloux et al. (2009) derives annual and monthly targets for M3 and base money growth in accordance with the government financial program. On the basis of these targets, the BCT then calibrates its monetary operations and aims at keeping short-term interest rates within a targeted range. The main short-term interbank rate is the overnight rate (henceforth the TMM). According the Chailloux et al. (2009), around eighty percent of Tunisian banks' loans, irrespective of their duration, are indexed on the TMM. Consequently, any change in central bank's policy rate would have an immediate impact on the cost of most loans; new and old ones.

2. Literature Review

Although monetary policy is neutral in the long run, the IS-LM model explains, in the short and medium term, that this policy can influence the economic activity such as offsetting the effects of the disturbances on inflation.

Ireland (2006) argues that the transmission mechanism of monetary policy can be broadly defined as the way in which policy-induced changes in short-term interest rates or the money stock affect economic activity and inflation. In other words, the transmission mechanism is the link between the monetary policy instrument and the aggregate demand. The monetary policy affects the economy through several channels. The smoothness of these channels depends on the country's economic openness, financial system development, inflation history, central bank's independence, etc.

Mishkin (1996) elaborates on the following transmission mechanisms of monetary policy:

- Traditional interest rate channel: according to this model, a change in policy rate by a central bank is likely to spread to bank lending, bond and deposit interest rates which directly affect business and households expenditure thereby leading to an increase in aggregate demand and a rise in output. Mohanty and Turner (in BIS paper 2008) points out that the interest rate channel plays an important in industrial countries but it faces several impediments in emerging countries such as the lack of well developed money and bond markets.
- Other asset price channels: macro models build by Keynesians such as Franco Modigliani emphasize the critical effects of other assets prices the monetary policy transmission. Besides bonds the literature recognize two key assets; i.e., foreign exchange and equities. The exchange rate channel gained importance with the growing internationalization of the world economies. According to this channel a change in the domestic real interest rate would affect the exchange rate of the local currency and consequently net exports. The equities channel can work through the effect of monetary policy on equity prices (including housing and land prices), which would affect firms' investment and consumption spending and then output.
- Credit channels: These channels arise from the asymmetric information problem that characterizes financial markets. Through its effects on bank deposits[1] and firms' net worth[2], monetary policy can affect, the amount of loans available for investments expenditure and therefore aggregate demand.

In this section rather than providing an exhaustive review, we highlight a sample of the literature on monetary policy in the world and Tunisia.

There is a rich literature on monetary policy transmission mechanisms. This can be explained by the importance of accurately understanding how monetary policy is influencing the economy; output and inflation. In the following literature review we will present an overview, though not complete, of the literature focusing on the Tunisian literature.

[1] Bank lending channel.

[2] Balance sheet channels.

Since the seminal paper by Sims (1980) the vector autoregressive model has been the major tool in studying transmission channels of the monetary policy. Autoregressive models are commonly used statistical methods to obtain a broad picture of the monetary transmission mechanism. Many papers have employed autoregressive methodology to gauge the responsiveness of macroeconomic variables to changes in monetary policy; Sims (1992), Bernanke et al. (1998), Bernanke et al. (2005), Eichenbaum, Eichenbaum and Evans. (1995).

Christiano, Eichenbaum and Evans (1996a) argue that after a rise in Federal Fund rate – a contractionary policy, unemployment raises after a delay of two quarters. Using a monthly data, Bernanke and Blinder (1992) confirm the previous results and advocate that monetary policy has no instantaneous impact on output and inflation.[3] They point out that monetary tightening drains liquidity from the banks. Fisher (1997) argues that all components of investments decline after a tightening monetary shock; residential investments incur the sharpest decline. Gertler and Gilchrist (1994b) find that there is a disproportionate response of inventories in large and small firms to a monetary policy shock.

CEE (1997a) and Sims and Zha (1995), though they use different identification approaches, find similar qualitatively results in the sense that a monetary policy shock lead to a decline in both wages and profits though with different magnitudes.

Bernanke and Blinder (1992) study the effects of a monetary contractionary shock on bank deposits, securities and loans. They found that such a shock would lead to an immediate and persistent decline in the volume of deposits and a delayed decline in loans. The decline in loans is accompanied by a return of security holdings to their pre-shock level.

Gertler and Gilchrist (1994a and 1994b) refine further the previous study and argue that a monetary policy contractionary shock affects differently bank credits; they argue that commercial and industrial loans unlike other credits do not decline. In addition they point out that loans to small firms decrease relative to large firms after a monetary tightening.

[3] This is the popular identification (restriction) used in the literature.

Bernanke and Blinder (1992) advocate that monetary policy has no instantaneous impact on output and inflation.[4] A monetary tightening drains liquidity from the banks. CEE (1999) using a US quarterly data between 1965:3 and 1995:2 have found that the three monetary policy shocks measures[5] they employed have given almost the same inferences; i.e., after a contractionary monetary policy, output declines rapidly whereas the fall in the price level is more delayed and persistent.

Carolino and DeFina (1998) examines whether monetary policy has similar effects across regions in the United States. The impulse response function determined from a structural VAR model estimation reveals that noncore regions in the US respond differently to a monetary policy change than core regions. The noncore response is, depending on the region, more or less sensitive to a monetary policy shock than the other regions.

As emphasized by many authors such as Mishra and Montiel (2013), who made a survey of empirical literature on monetary policy effectiveness in low-income countries, the issue of the effectiveness of monetary policy becomes more complicated in the context of developing countries with respect to developed countries. These authors argue that the transmission of monetary policy shocks to bank lending rates is weaker in developing countries than in developed countries. They point out that we should expect interest rate, asset and exchange rate channels to be weak when examining monetary policy channels in developing economies. This monetary policy ineffectiveness is attributed largely to the fact that developing countries face weak financial markets and institutions and low economic openness that make monetary transmission channels weak or functionless.

Chailloux et al. (2009) estimate a VAR model using a monthly data of several macroeconomic variables between January 2001 and September 2006 and argue that the interest rate has a very weak effect on the economy even though its role as a monetary policy instrument remains relatively stronger than money supply. Also Neaime (2008) using the same VAR approach, on a quarterly data from 1990 until 2006, investigated the transmission channels in several countries in the MENA region

[4] This is the popular identification (restriction) used in the literature.
[5] Federal fund rate, FF, the nonborrowed reserves plus extended credits, NBR, and NBR/TR, where is total reserves. The last monetary shock measure was proposed by Strongin (1995).

and found that the interest rate played a dominant role in the transmission of monetary policy in Tunisia.

Lajmi and Khadhraoui (2013) use a quarterly macroeconomic data between 2000 and 2012 and find that a monetary policy tightening slows down the economy during the first year and appreciates the real exchange rate. Moreover they build a short-run forecasting model of the GDP growth rate and inflation in Tunisia. Their work reveals that interest rate has a limited effect on inflation. Khadhraoui and Ghattassi (2012) point out the increasing importance of the real interest rate on the economy after the revolution of January 2011.

Using both quarterly and monthly data during the period (2000 – 2011) and using a VAR model, a research conducted by the central bank of Tunisia (i.e., Rapport Final 2014)[6] shows that an unanticipated increase in the short-term interest rate induces a decline, though limited, of the CPI[7] and the manufacturing production remains unaffected. The Rapport points out the existence of an exchange rate pass-through even though. However, it does not exclude the aggregate demand decline on prices.

Even though this paper, like ours, tried to compare the effectiveness of monetary policy transmission mechanisms before and after the revolution, it should be noticed that it lack of sufficient data prevented it from providing clear, consistent and elaborate results. Moreover, the data and the methodology are not similar.

Boughrara (2008) using a VAR system, in which the money market rate was ordered last, studies monetary policy transmission in Tunisia and Morocco. He argues that the lending channel in Tunisia is stronger than the traditional interest rate channel and it is more effective than in Morocco. Boughrara (2002) uses a quarterly data covering the period (1987 – 2000) argues that M2 is not perfectly controllable in the short run making it less reliable as a monetary policy instrument to control inflation in Tunisia. Benbouziane and Benamar (2004) examine the relationship between money supply and price in the Maghreb using a data ranging from 1975 to

[6] This research is conducted by the BCT staff in collaboration with researchers from the Banque de France and the National Bank of Poland.
[7] Notice that the CPI used in this research does not include food and energy prices.

2004 and argue that money supply can be an effective instrument to influence and control inflation in Tunisia.

Zghidi (2012) using a non-linear VAR model argues that monetary shocks have asymmetric effects on the economic aggregates, depending on the initial state of the economy. Sghaier (2013) using the forward-looking monetary policy reaction function for a quarterly data from 1993 through 2011 shows that the central bank of Tunisia followed the Taylor rule in its interest setting behavior and points out the prevalence of inflation over the output as an objective of the monetary policy in Tunisia.

Moursi et al. (2007) using a semi-structural VAR approach to examine the monetary policy in Egypt argue that monetary policy shocks have no significant effect neither on the real economy nor the prices. Al Mashat and Billmeier (2007), introducing the international oil price and the US Federal Funds rate as exogenous variables in their VAR model, found consistent results with those of Moursi et al. (2007). Poddar et al. (2007), working on Jordanian data, found no evidence in favor of any standard monetary policy transmission channel.

There were few researches on the monetary transmission mechanism have been scarce in Tunisia. However, to the best of our knowledge, this paper is the first to investigate monetary policy effectiveness after the political upheaval with respect the previous period; a period of political stability under dictatorship.

3. Model

Monetary policy mistakes can cause serious economic damage. Central banks and their worldwide observers must strive to understand the transmission mechanism of monetary policy so that they know what monetary policy can do and what it should do to stabilize inflation and output--however imprecise that understanding may be.

Mishkin (1996) has concisely elaborated that in order to be successful in their increasingly important responsibility, monetary authorities must have an accurate assessment of the timing and effect of their policies on the economy. This enterprise requires an understanding of the mechanisms through which monetary policy influences the economy.

Since the seminal work Sims (1980), Vector Autoregressive (VAR) models have been broadly by researchers to address the relationship between monetary policy and macroeconomic variables. The VAR methodology allows making accurate assessment of the effects of monetary policy on price stability and economic activity, as well as those of the timing of policy implementation. Though VAR models are a-theoretical,[8] they are suitable for monetary transmission mechanisms because they come with a number of useful tools such as impulse response functions and variance decomposition that are useful in studying the effects of the shocks and their role and importance in specific historical periods. As we will explain later, this study will compare the effectiveness of monetary policy in Tunisia during two sub-periods between which an important political upheaval has taken place.

According to Mahadeva and Sinclair (2002), Kandil (2006) and Chailloux et al. (2009) in emerging countries like Tunisia it is more appropriate to use short-term econometric models such as vector autoregressive model to study the effect of monetary shocks on macroeconomic variables because unlike long-term relationships they ensure maximum flexibility in the dynamics of the variables.

The structural VAR model can be written as follows

$$Y_t = A(L)Y_{t-1} + \xi_t \qquad (1)$$

Where:
A(L) the matrix lag polynomial
Yt is the vector of endogenous variables
Xt is the vector of exogenous variables
ξ is the residuals vector

The structural VAR model (1) can be rewritten as follows:

$$Y_t = B(L)\varepsilon_t$$

[8] In the sense that they are not bound by precise theoretical economic relationships.

Where:

B(L) is the matrix lag polynomial

ε_t is the vector of the underlying of structural shocks

In this paper we use the same variables and ordering as in Chailloux et al. (2009) model; i.e., the endogenous variables are the real GDP, *y*, the consumer price index, *p,* the short-term interest rate, *tmm*, and the nominal exchange rate of the Euro against the Tunisian dinar, x^{eur}.

$$Y'_t = [y_t, p_t, tmm_t, x^{eur}_t]$$

The implicit identification assumption is that the monetary policy shock affects, the real economy, and the prices with lags but contemporaneously the exchange rate.

Following the empirical literature such as Bernanke and Blinder (1992), Forni et al. (2010) Bernnake et al. (2005), Bjornland (2008) and Holtemoller (2004), this study assumes a recursive structure of ordering in which policy variables are ordered so as the real output and the price level do not respond contemporaneously to monetary policy innovations. [9] [10]

Despite a large amount of literature on the monetary policy, there is no consensus among economists on the measure of monetary policy. We chose the short-term interest rate, *tmm*, as the monetary policy stance measure. In fact, while monetary aggregates[11] can be used as measures of the stance of monetary policy, they are subject in practice to a wide variety of disturbances, including shifts in the demand for money, which often dominate the information they contain about changes in the state of the policy. Such disturbances do not affect the interest rate.

Moreover, as suggested by Eichenbaum et al. (1995) in a small open economy, like Tunisia, the exchange rate should be placed last in the order of variables. It ensures a lagged response of monetary policy towards any change to exchange rate shocks.

[9] In another well-known application, Bernanke and Gertler (1995) ordered variables as Y, P, CP, and R. The assumption was again that the Fed observed all of (Y, P and CP) in making its policy decisions, but the federal funds rate R did not affect these variables within the period.

[10] Monetary policy might react towards any news from macro aggregates within the period. This is consistent with the transmission mechanism of monetary policy as highlighted by empirical studies such as Svensson (1997).

[11] Monetary aggregates used in the literature are usually M1, M2 and M3.

On the other hand, many empirical studies that have extended the closed economy VAR model so as to make it an open economy model.[12] This extension typically involved the addition of some foreign variables, such as commodities price index and foreign interest rate.

In the light of these theoretical suggestions, the structural VAR model (1) will include a vector X_t of exogenous variables that comprises the commodity price, *oil*, the European Union's GDP, y^{eur}, and the short-term interest rate in the European Union, s^{eur}.

$$X'_t = [oil_t, y^{eur}_t, s^{eur}_t, s^{eur}_{t-1}]$$

These exogenous variables, such as the commodity price, were among several solutions proposed by researchers to surmount the price puzzle (Sims, 1992; Christiano et al., 1999; Kim and Roubini, 2000).[13] Note that to conserve degrees of freedom, standard VARs rarely employ more than six to eight variables

We estimate two versions of the VAR: a benchmark VAR that uses aggregate data and another that uses sub-sample sub-period data.

4. Data

To estimate the above mentioned VAR model a monthly data of all macroeconomic variables is collected. The data to be used spans from January 2000 through December 2013. This period will be divided into two sub-periods; a pre-revolution period that is from January 2000 until December 2010 and a post-revolution that is from January 2011 until December 2013. The latter will be called the transitional period in what follows. All data is available in monthly frequency except for the real GDP level, which is only available in quarterly frequency. As in Chailloux et al. (2009) the industrial production index to extrapolate the missing GDP time series. This method is supported by the high correlation between the GDP and the Industrial production growth rates.

[12] Such studies are the following: Eichenbaum and Evans (1995); Cushman and Zha (1997); Kim and Roubini (2000); Kim (2003); Fung (2002).
[13] Kim and Roubini (2000) suggest the world oil price (WOP) as a proxy for expected inflation, to surmount the problems of price puzzles and endogeneity

The data was expressed in natural logarithms and seasonally adjusted except for both domestic and foreign short term interest rates, which were expressed solely in terms of levels and not seasonally adjusted.[14]

5. Stationarity and Johansen Cointegration tests

Before estimating the VAR model there are several standard econometric procedures that should be fulfilled first. Unlike Chailloux et al. (2009) who do not conduct unit root test, we applied the augmented Dickey-Fuller (ADF) to test variables stationarity.

Table 1 provides a summary of the results. The variables in level form are non-stationary, i.e., the null hypothesis of a unit root cannot be rejected. However, all the variables are stationary (no unit roots are present) in their first difference form, that is, they are integrated of order 1.

Moreover the existence of long-run stationary linear combinations of these series levels should not be ignored. Hence, the Johansen cointegration test is conducted to check the existence of cointegrating relationship.

Tables 2 and 3 show the tests results. Trace test indicate that in both sub-periods the monetary policy variables have stable, long run relationships with real output, prices, and the exchange rate. Then the dynamic system must be specified as a Vector Error Correction model (VEC) rather than an unrestricted VAR model.

6. Results

6.1. Impulse Response Functions

We turn now to the results analysis that are stemming from the estimates of the VEC model discussed above. The analysis is organized as follows; Firstly, we use the impulse response functions to examine the reactions, in both sub-periods, of the output, the prices and the exchange rate to monetary policy shocks. Secondly, the relative importance of different shocks using variance decomposition. Thirdly, we discuss the exchange rate pass-through.

[14] The X11 method was employed to convert the gross time series into seasonally adjusted series.

Figures 1, 2 and 3 show the estimated responses of the level of real GDP, the consumer price level and the exchange rate level to one Cholesky standard deviation in the short-term interest rate in both sub-periods.

In both sub-periods, as suggested by the theory, the increase in the TMM depresses the economy. However, in the transitional period the monetary policy effect is larger and quite abrupt; almost after a quarter a monetary shock reduces output by almost 0.12 percent, which represents six times the magnitude of the effect of the same shock before the revolution. In both sub-periods it takes almost the same period; ten months to output to stabilize and the effect is undone. Overall, the economic activity in Tunisia contracts more sharply during the transitional period.

Figure 2 represents the reaction of the price level to one unit innovation in the short-term interest rate. In both sub-periods, and in accordance with the theory, prices react negatively to a monetary policy tightening. Our empirical results do not show a *price puzzle* phenomenon, which is a sign that support our identification scheme.[15] In the transitional period the monetary policy's impact has become faster and more effective in reducing inflation; in fact during this period a one standard deviation increase in the short-term interest rate has a longer and larger impact on the CPI; in the post-revolution period, a quarter after the tightening shock prices decrease as twice as the corresponding quarter in pre-revolution period. Another no less important finding shown by the figure 2 is that while before the revolution the general price level stabilizes during the second quarter following the policy shock, in the transitional period it continues to decrease for at least four quarters.

Figure 3 shows the nominal exchange rate response to an interest rate innovation. In accordance with the theory, there is an appreciation of the Tunisian dinar after a tightening in monetary policy, although this effect is clearly sharper and faster in the transitional period; six months after the interest rate shock the dinar appreciates by almost twenty one times its appreciation before the revolution. Nevertheless, this empirical results should be taken with caution; in fact since the capital account is not fully liberalized in Tunisia it is not expected that the interest rate channel of monetary policy would play an important role in influencing significantly the capital inflows to, and outflows from, the domestic economy. Indeed, like the

[15] The Cholesky ordering and the exogenous variables.

interest rate, the nominal exchange rate is almost determined by the main player in market; i.e., the Tunisian central bank rather than investors looking for higher returns.

The figure 3 and the data show that the central bank has to certain extent changed its exchange rate policy after the revolution. Before the revolution the central bank's policy was aiming at keeping the nominal exchange rate varying within narrow boundaries. However, in the transitional period the central bank allowed the exchange rate to be more flexible ranging across wider boundaries. Note that the since January 2011 the BCT has been implementing several reforms on the foreign exchange operational framework that favored this flexibility. This can explain the larger depreciation of the exchange rate when the interest rate increases by one standard deviation.

As revealed by figures 4 and 5, the results qualitatively do not change for the output and the price level when broad money aggregate M3 is used as a monetary policy stance variable instead of the short-term interest rate. However the response of the exchange rate to broad money shock, as shown by figure 6, is not completely similar to the short-term interest rate shock.

6.2. Variance Decomposition

The variance decomposition analysis is an important tool in examining the importance of each variable in explaining variances. Figures 7, 8, 9 and 10 show a comparison between the two sub-periods and confirm the results given by the impulse response analysis when pointing out the growing importance of the monetary policy role in shaping the main macroeconomic variables, i.e., the GDP and the general price level in the transitional period with respect to the pre-revolution period. During the transitional period, one quarter following the monetary tightening shock the short run interest rate explains 15 percent of the real GDP variance and continues to grow to account almost the third of this variance by the seventh quarter. Likewise, by the end of the first quarter that follows the monetary innovation the interest rate accounts for 11 percent of the price variance and continues to grow to reach 36 percent by the end of the seventh quarter. Before the revolution this monetary policy instrument was almost mute in explaining the real output and the CPI.

Also the comparison of figures 7 and 8 shows that the exchange rate has become quicker in influencing the real output in the transitional period accounting for approximately 15 percent of its variance by the end of the first quarter following the monetary tightening while before the revolution it took almost the double of this period to reach the same variance contribution.

An important finding revealed by figure 8 that uncover a new factor in explaining inflation that did not exist before the revolution. This new factor is the increasing importance of the real GDP in explaining price variation during the transitional period. In just two months following the monetary shock real output rises to account for almost 11 percent in the CPI variance. This percentage starts to decrease later on, though it does not fade and becomes accounting for approximately 6 percent at the end of the twentieth month. This new and important finding is likely attributed to the perturbations in the aggregate demand and supply, the disruption in distribution channels, weak regulatory institutions, the positive demand shock from neighboring upheaved Libya and the increasing uncertainty that featured the transitional period. Such instability, most likely, has exacerbated inflation in the transitional period.

6.3. Exchange Rate Pass-Through

The exchange rate pass-through as was defined by Goldberg and Knetter (1997) is "the percentage change, in local currency, of import prices resulting from a one percent change in the exchange rate between the exporting and importing countries". When this exchange rate pass-through is large, there is more cross-border transmission of inflation.

In this section we will investigate how a shock in exchange rate between the Tunisian dinar and the Euro affects inflation in Tunisia; i.e., the CPI, which represents the consumer prices that are expected to be directly and importantly affected by, changes in import prices.

Figure 11 depicts the exchange rate pass-through to domestic CPI after a positive shock in the euro/dinar exchange rate for the two sub-periods. In accordance with the theory, an unanticipated depreciation shock of the Tunisian dinar against the

euro causes an increase in price level. The figure shows a faster and larger exchange rate pass-through during the transitional period. An exchange rate innovation causes a hike in inflation that keeps operating throughout the following year before it is undone.

This amplification of the exchange rate pass-through is likely attributed to the loss of exports competitiveness and the increasing flexibility introduced by the CBT in its exchange rate policy.

The intensification of the exchange rate pass-through after the revolution can explain to certain extent the increase in inflation during this period. In light of Mihaljek and Klau (2008) this finding shows that after the revolution importers/distributors could not absorb sufficiently the effects of exchange rate changes by varying their mark-ups, so the pass-through would be incomplete which points out the low competitiveness in the domestic markets. Also this finding shows, according to Taylor (2000), that monetary policy after the revolution was not as credible as before in pursuing a goal of low and stable inflation. In fact Taylor suggests that by tying up inflation expectations, a central bank can increase the readiness of firms to absorb exchange rate fluctuations in their profit margins.

Nevertheless, it is clear that before the revolution the exchange rate pass-through was low in Tunisian and that in accordance with emerging countries literature. The lesson we can suggest here is that when a small open economy passes through a period of uncertainty and instability related to an important political transition the exchange rate pass-through intensifies and would surely have an impact on domestic rate of inflation.

We should notice that investigating the exchange rate pass-through for import prices would be a good exercise for future researches.

Conclusion

After the January 14th 2011 upheaval, it has become very clear that the country should change strategy and look for the implementation a new economic development model after the previous one, which was started by the early 1970s, has showed its drawbacks and incapacity to create sufficient amount of wealth to absorb the

alarmingly and frustrating high unemployment rate among educated youth and the increasing economic marginalization of the inner regions of the country.

In addition to that, increasing political, economical and even social pressures on the Tunisian central bank marked the post-revolution period. Also, the monetary authority seems to have acquired further freedom from the political pressure it used to incur during the previous autocratic regime. With the new transitional constitution, the BCT governor has become accountable only to the elected National Constitutional Assembly.

This additional independence in conjunction with the events described early have brought the idea to examine the central bank's monetary policy effectiveness throughout the transitional post-revolution period with respect to the previous period, which we can even describe as "normal" period.

On the basis of a vector error correction model the estimation results show a clear enhancement in the interest rate channel during the transitional period; in fact throughout this period monetary policy has a stronger and faster impact on both real GDP and general price level than the pre-revolution period. An unanticipated increase in the short-term interest rate has a more depressing effect on the real economy and has a more controlling effect on inflation.

Variance decomposition analysis shows an important finding featuring the economy during the political transitional period; this analysis points out the role of the perturbations in the aggregate supply and demand in exacerbating inflation.

Another no less important finding is given by the exchange rate pass-through analysis. In fact, during throughout the transitional period an unanticipated depreciation of the Tunisian dinar results in a hike in inflation that keeps taking place throughout almost one year before it is undone. This finding reveals the weak competitiveness in the Tunisian domestic market.

Table 1. The Augmented Dickey-Fuller test statistic.

	ADF	
Series	Level	First difference
Log real GDP	-0.933950	-3.504842***
Log Price	3.836693	-5.517919***
TMM	-1.810996	-6.657436***
Log Exchange Rate	-0.749842	-4.131449***

Null Hypothesis: The variable x_i has a unit root
, ** and * indicate that Null Hypothesis is rejected at a significant statistical level of ten percent, five percent and one percent significance levels, respectively.*

Table 2. Johansen cointegration test of the endogenous variables for the sub-period (January 2000 – December 2010).

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.367494	72.02581	47.85613	0.0001
At most 1	0.076784	13.39338	29.79707	0.8728
At most 2	0.022890	3.167206	15.49471	0.9588
At most 3	0.001586	0.203175	3.841466	0.6522

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 3. Johansen cointegration test of the endogenous variables for the sub-period (January 2011 – December 2013).

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.738899	75.23568	47.85613	0.0000
At most 1	0.452538	29.57886	29.79707	0.0530
At most 2	0.225291	9.095127	15.49471	0.3567
At most 3	0.012162	0.416033	3.841466	0.5189

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Figure 1- Real GDP impulse response function to a short-term interest rate shock

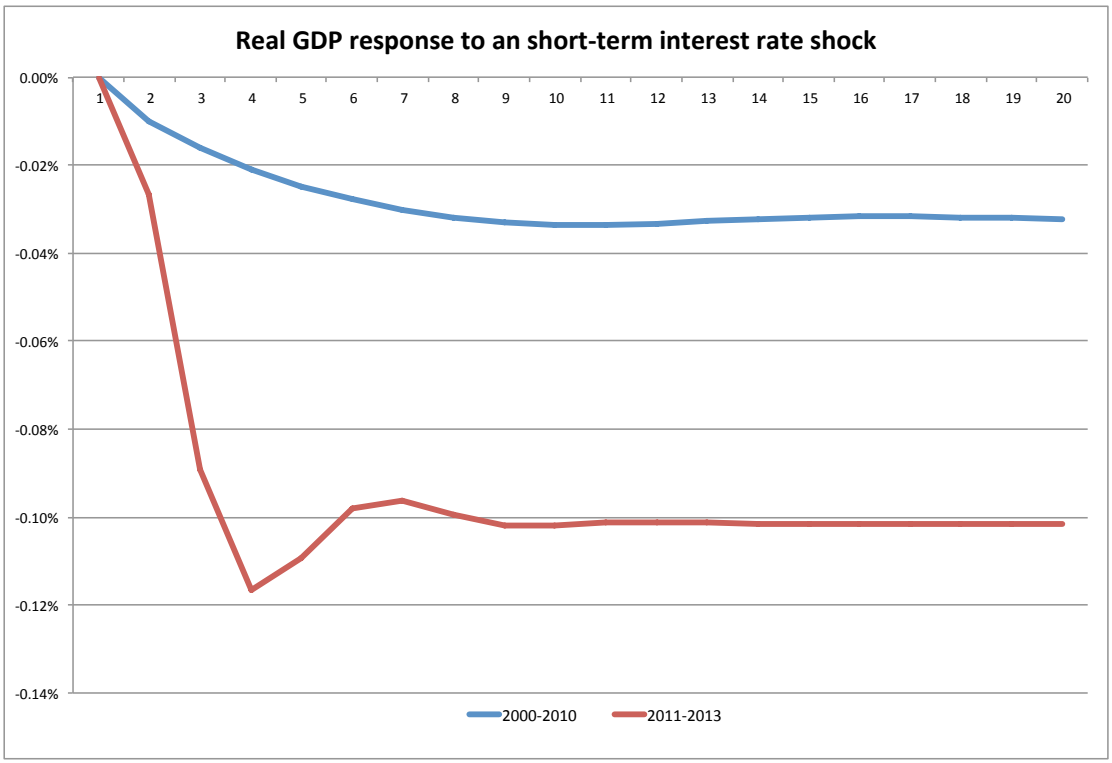


Figure 2- Price impulse response function to a short-term interest rate shock

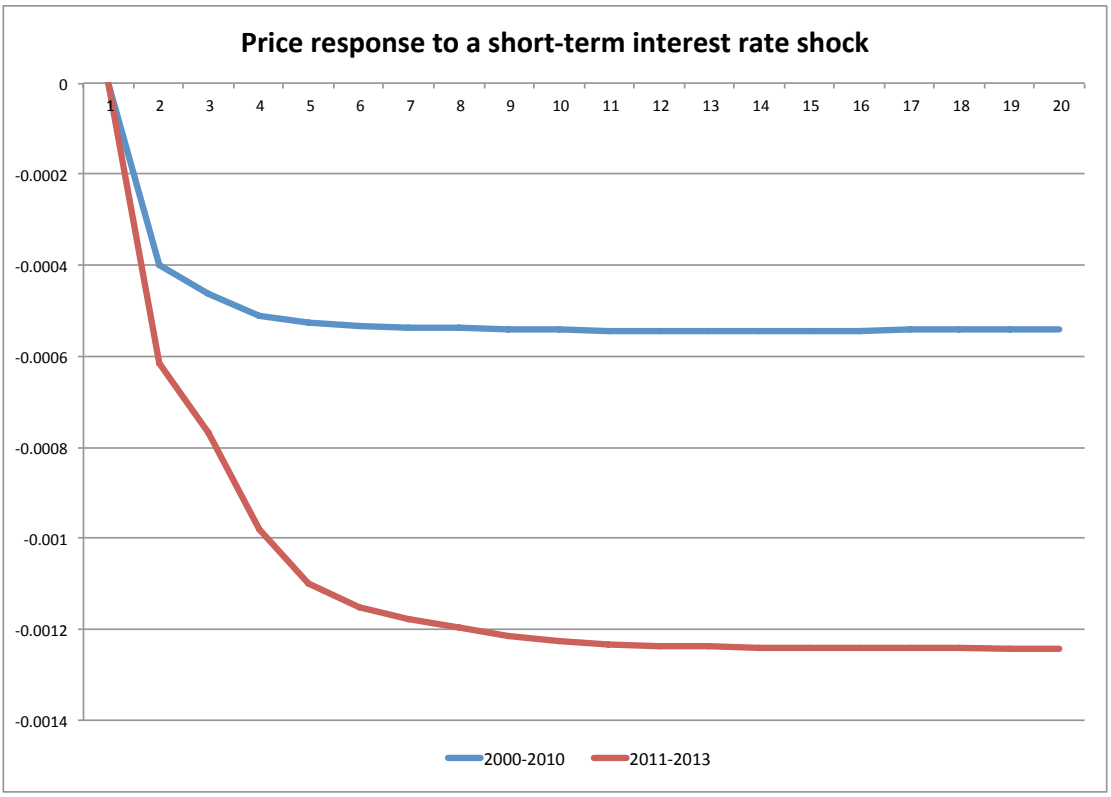


Figure 3- Exchange rate impulse response function to a short-term interest rate shock

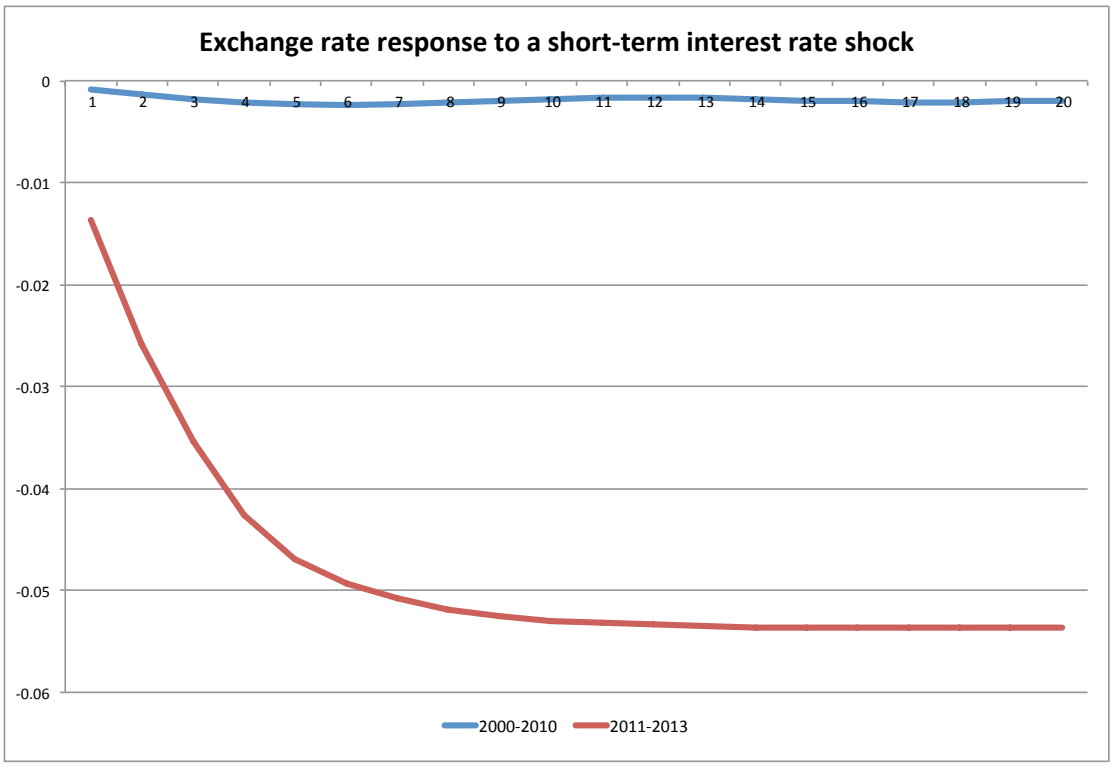


Figure 4- Real GDP impulse response function to an aggregate money supply M3 shock

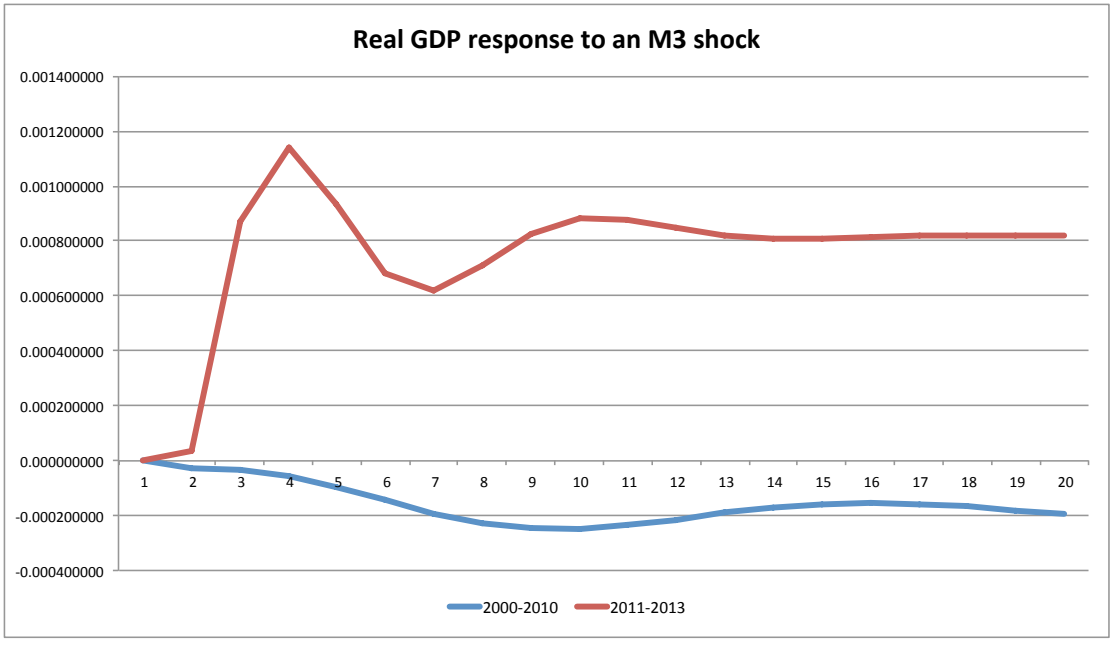


Figure 5- Price impulse response function to an aggregate money supply M3 shock

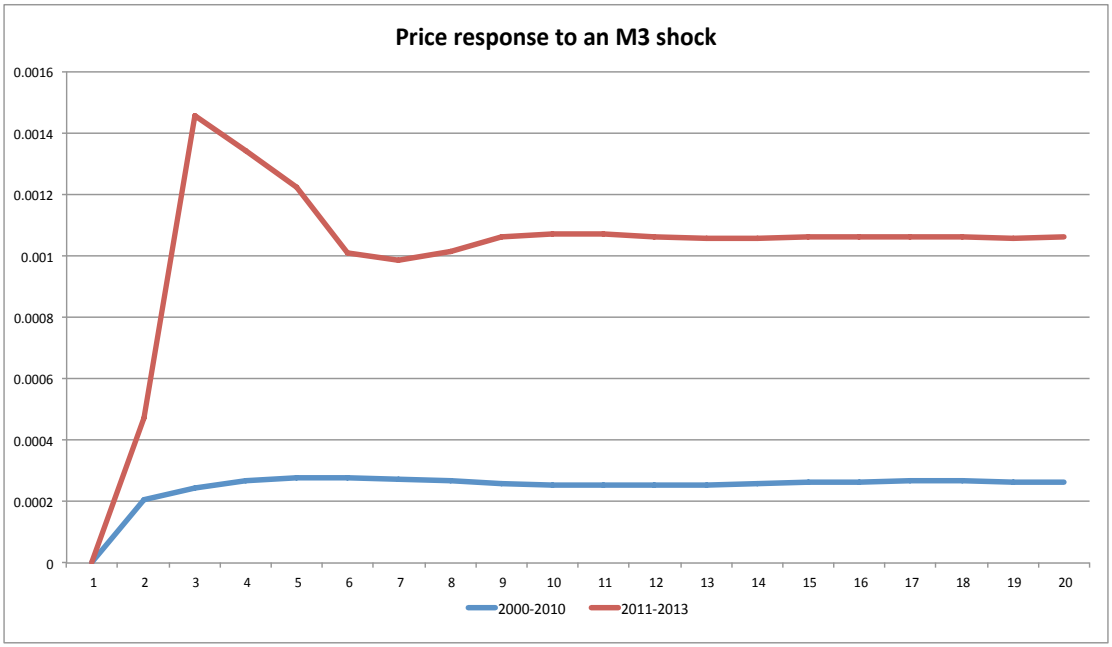


Figure 6- Exchange rate impulse response function to an aggregate money supply M3 shock

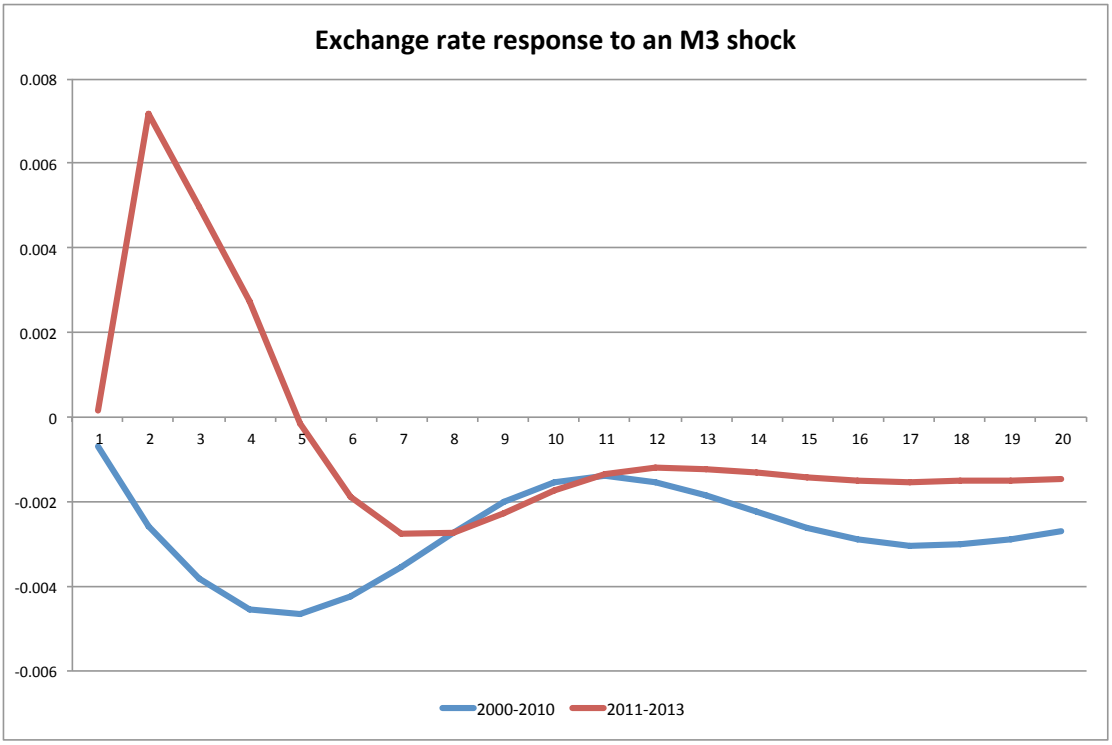


Figure 7- Variance decomposition of the real GDP for the period (2000 – 2010)

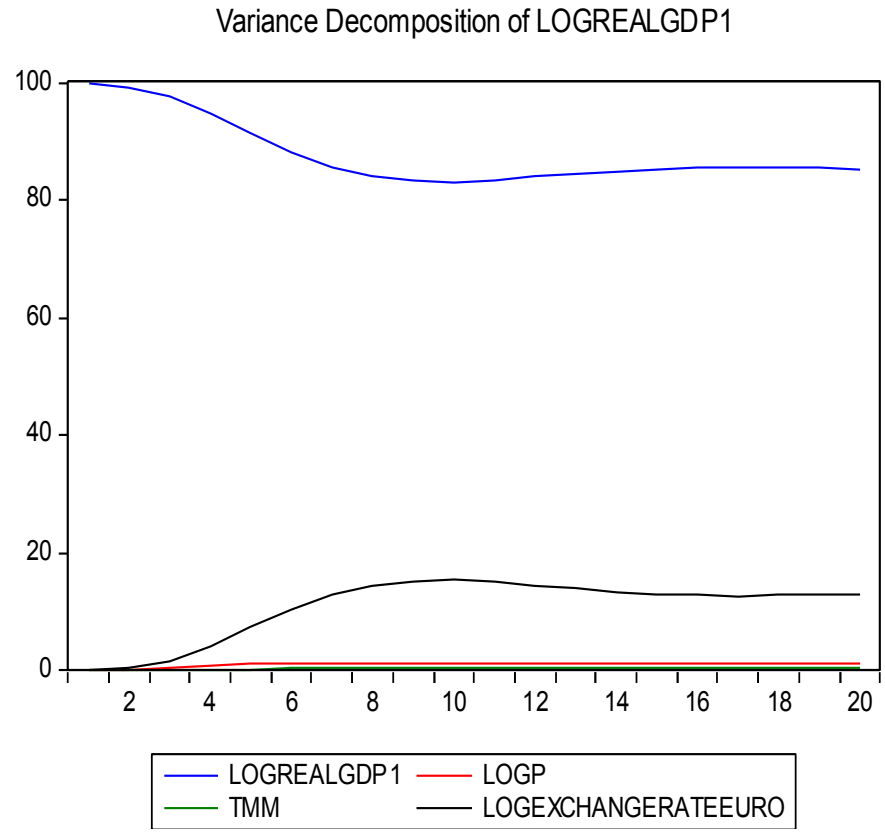


Figure 8- Variance decomposition of the real GDP for the period (2011 – 2013)

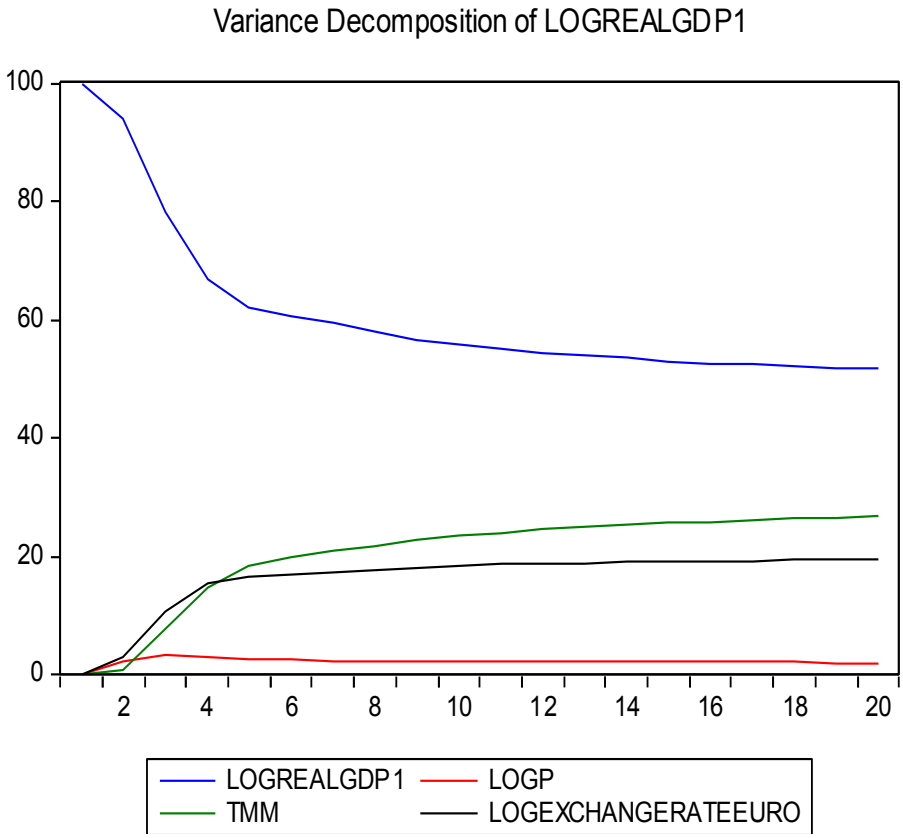


Figure 9- Variance decomposition of the price level for the period (2000 – 2010)

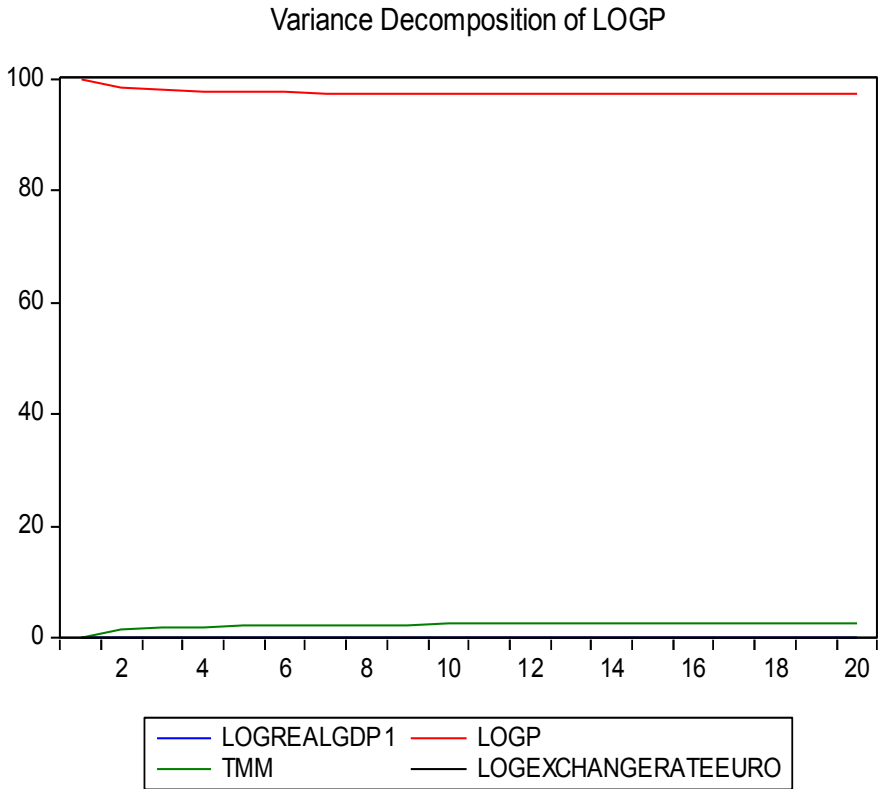


Figure 10- Variance decomposition of the price level for the period (2011 – 2013)

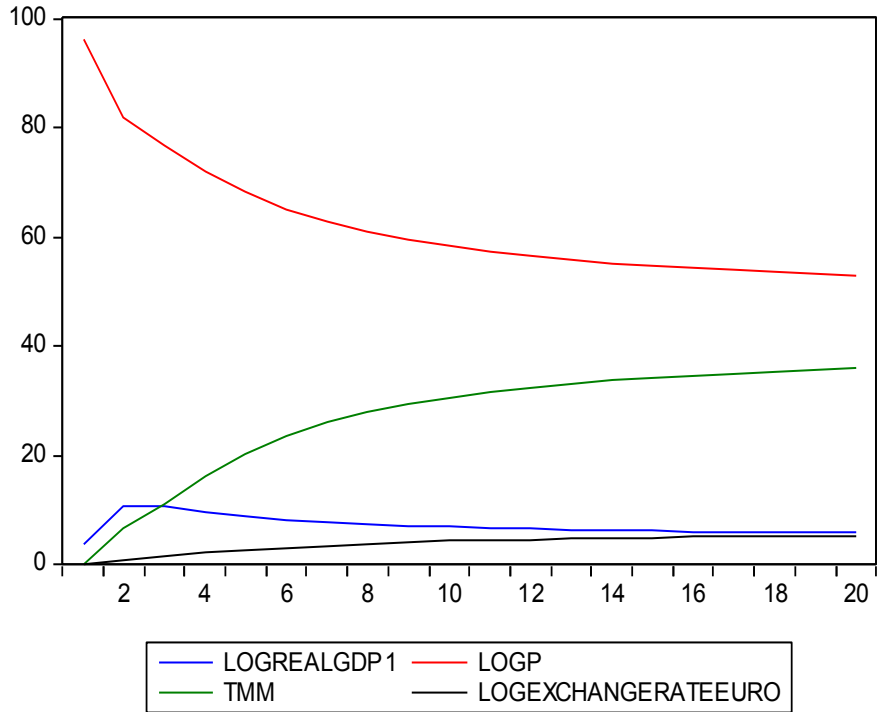
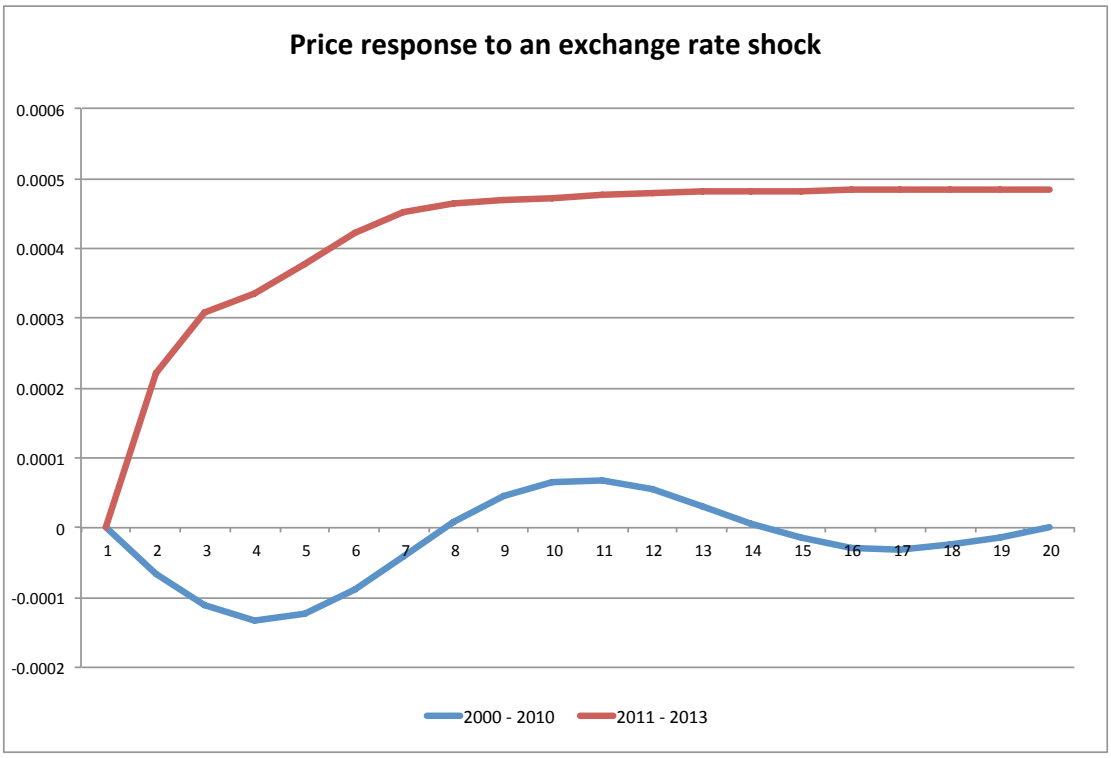


Figure 11- Price impulse response function to an exchange rate shock



References

Al-Mashat, R., & Billmeier, A. (2008). "The monetary transmission mechanism in Egypt" *Review of Middle East Economics and Finance*, 4(3), 32-82.

Benbouziane, M., and Benamar, A. (2004). "The relationship between money and prices in the maghreb countries: a cointegration analysis", Universite de Tlemcen, mimeo.

Bernanke, B and A Blinder (1992): "The federal funds rate and the channels of monetary transmission", *American Economic Review*, 82(4): 901–921.

Bernanke, B. S., and Gertler, M. (1995). "*Inside the black box: the credit channel of monetary policy transmission*" National bureau of economic research, No. w5146.

Bernanke, B. S., and Mihov, I. (1995). "Measuring monetary policy" *National Bureau of Economic Research,* Paper Number 5145.

Bernanke, B. S., Gertler, M., and Gilchrist, S. (1998). "The Financial Accelerator in a Quantitative Business Cycle Framework" *NBER Working Paper* W6455.

BIS (1998)

Bjørnland, H. C. (2008). "Monetary policy and exchange rate interactions in a small open economy" *Scandinavian Journal of Economics*, 110 (1), 197-221.

Boughrara, A. (2002). "The monetary policy of the central bank of Tunisia: an assessment" *In 9th Annual Conference of Economic Research Forum (ERF*), Al-Sharja, United Arab Emirates.

Boughrara, A. (2008) "Monetary Transmission Mechanisms in Morocco and Tunisia" *Workshop Monetary Policy and Inflation Targeting, Economic Research Forum*.

Chailloux, A., Durré, A., and Laurens, B. (2009). "Requirements for using interest rates as an operating target for monetary policy: The case of Tunisia" *IMF Working Papers*, 1-45.

Christiano, L. J., and Eichenbaum, M. (1995). "Liquidity effects, monetary policy, and the business cycle" *Journal of Money, Credit and Banking*, 1113-1136.

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1996a). "The effects of monetary policy shocks: Evidence from the Flow of Funds" *Review of Economics and Statistics* vol 78, No 1, 16:34.

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1996b). "Identification and the effects of monetary policy shocks*" in Mario Blejer, Zvi Eckstein, Zvi Hercowitz and Leonardo Leiderman*, *Financial factors in Economics Stabilization and Growth,* Cambridge, Cambridge University Press, 36:74.

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1997). "Sticky price and limited participation models of money: A comparison" *European Economic Review*, 41(6), 1201-1249.

Christiano, L. J., Eichenbaum, M., and Evans, C. L. (1999). "Monetary policy shocks: What have we learned and to what end?" *Handbook of macroeconomics*, 1, 65-148.

Cushman, D. O., and Zha, T. (1997). "Identifying monetary policy in a small open economy under flexible exchange rates" *Journal of monetary economics*, 39(3), 433-448.

Eichenbaum, M., & Evans, C. L (1995) "Some empirical evidence on the effects of shocks to monetary policy shocks on exchange rates" *Quarterly Journal of Economics*, Vol. 110, No. 4, 975:1010.

El Khadhraoui, S., and Ghattassi, I. (2012) "Construction d'un indicateur des conditions monetaires pour la Tunisie" (Construction of a monetary policy index for Tunisia), *central bank of Tunisia working paper* 1-2012.

Fisher, J. (1997) "Monetary policy and investment" *manuscript, Federal Reserve Bank of Chicago.*

Forni, M., and Gambetti, L. (2010). "The dynamic effects of monetary policy: A structural factor model approach" *Journal of Monetary Economics*, 57(2), 203-216.

Fung, B. S. C. (2002). "A VAR analysis of the effects of monetary policy in East Asia" *BIS Working Papers* No 119.

Gertler, M., and Gilchrist, S. (1994). "Monetary policy, business cycles, and the behavior of small manufacturing firms" *Quarterly Journal of Economics*, Vol. 109, No. 2, 309:340.

Gertler, M., and Gilchrist, S. (1994). "The role of credit market imperfections in the monetary transmission mechanism: Arguments and evidence" *Scandinavian Journal of Economics*, Vol. 95, No. 1, 43:64.

Goldberg, P.K., and Knetter, M. M (1997) "Goods Prices and Exchange Rates: What Have We Learned?" *Journal of Economic Literature* 35 (3), 1243-1272.

Holtemöller, O. (2004). "A monetary vector error correction model of the euro area and implications for monetary policy" *Empirical Economics*, 29(3), 553-574.

Kandil, M. (2006). "On the transmission mechanism of policy shocks in developing countries" *Oxford Development Studies*, *34*(2), 117-149.

Kim, S. (2003). "Monetary policy, foreign exchange intervention, and the exchange rate in a unifying framework" *Journal of International Economics*, 60(2), 355-386.

Kim, S., and Roubini, N. (2000). "Exchange rate anomalies in the industrial countries: A solution with a structural VAR approach" *Journal of Monetary Economics*, 45(3), 561-586.

Lajmi, M., and El Khadhraoui, S. (2013). "Modèle de Prévision à Moyen Terme pour la Tunisie" (A model of middle term forcasting for Tunisia), *mimeo of Central Bank of Tunisia*.

Lang, M., and Krznar, I. (2004). "Transmission mechanism of monetary policy in Croatia" *The 10th Dubrovnik Economic Conference*.

Mahadeva, L., and Sinclair, P. (Eds.). (2002). "Monetary transmission in diverse economies" *Cambridge University Press*.

Mihaljek, D., and Klau, M. (2008). "Exchange rate pass-through in emerging market economies: what has changed and why?" *BIS Papers*, 35, 103-130.

Mishkin, F. S. (1996). "The channels of monetary transmission: lessons for monetary policy" *National Bureau of Economic Research* No. w5464,.

Mishra, P., and Montiel, P. (2013). "How effective is monetary transmission in low-income countries? A survey of the empirical evidence" *Economic Systems* 37(2), 187-216.

Mishra, P., Montiel, P. J., and Spilimbergo, A. (2010). "Monetary transmission in low income countries" *IMF Working Papers*, 1-42.

Mohanty, M., and Turner, P. (2008) "Monetary policy transmission in emerging market economies: what is new?" *BIS Papers*, no 35, Bank for International Settlements.

Moursi, T. A., Mosallamy, M.E., and Zakareya, E, (2007). "Effect of some recent changes in Egyptian monetary policy: Measurement and evaluation" *ECES working paper* No. 122, Egyptian Center For Economic Studies.

Neaime, S. (2008). "Monetary policy transmission and targeting mechanisms in the MENA region" *Economic Research Forum* Working Paper Series, Vol. 395.

Poddar, T., Sab, R., and Khachatryan, H. (2007). "The monetary transmission mechanism in Jordan" *IMF working paper* 06/48.

Rapport Final (2014). "Les mecanismes de transmission de la politique monetaire en Tunisie" *mimeo Banque Centrale de Tunisie*.

Sghaier, I. M. (2013). "Taylor Rule and Monetary Policy in Tunisia" *Journal of Finance* and *Economics*, 1(4), 30-41.

Sims, C. A. (1980). "Macroeconomics and reality" *Econometrica*: *Journal of the Econometric Society*, 1-48.

Sims, C. A. (1992). "Interpreting the macroeconomic time series facts: The effects of monetary policy" *European Economic Review*, 36(5), 975-1000.

Sims, C., and Zha, T. (1995). "Does Monetary Policy Cause Recessions?" Manuscript, Yale University.

Strongin, S. (1995). "The identification of monetary policy disturbances explaining the liquidity puzzle" *Journal of Monetary Economics*, 35(3), 463-497.

Svensson, L. E. (1997). "Inflation forecast targeting: Implementing and monitoring inflation targets" *European Economic Review*, 41(6), 1111-1146.

Taylor, J. (2000) "Low inflation, pass through and the pricing power of firms" *European Economic Review*, Vol 44, 1389–1408.

Zghidi, N. (2012). "The asymmetric effects of Tunisian monetary policy: a threshold vector autoregressive approach" *International Journal of Economics and Business Research*, 4(4), 363-373.