Targeting Inflation and Exchange Rate Management in Tunisia Before and After the Revolution

Yousra Ben Romdhane, Sahar Loukil, Souhaila Kammoun

University of Sfax, Tunisia

Corresponding author: Yousra Ben Romdhane; youssrabenromdhane776@hotmail.fr

Abstract

This paper investigates the dynamic links between the exchange rate and inflation in Tunisia, using annual data during the 1984/2016 period. First, we implement a unit root analysis to test stationarity. This study makes use of both primary and secondary data and VAR Granger Causality/Block Erogeneity Wald Tests were adopted as estimation techniques. Granger causality results revealed that there is a unidirectional causal link between inflation and the exchange rates running from inflation to the exchange rates and that these exchange rates have no impact on inflation. This study provides some implications regarding potential constraints on the monetary policy. A policy of inflation targeting, as an alternative monetary policy, combined with a compatible regime of flexible exchange rates could provide a solution to this dilemma.

Keywords: _Inflation, Exchange rates, Revolution, Granger causality._

1. Introduction

The underlying root causes of financial and macroeconomic imbalances lie not only in the disequilibrium in current account balances, but also in financial recession that has shaken some Arab world countries as a result to political events, Obstfeld (2012). The January 2011 revolution marked the beginning of a historical era for Tunisia. It liberated the economy from stifling governance inefficiencies. In fact, Tunisia achieved some advances at the political level with the consensual adoption of a new constitution and the emergence of a very dynamic civil society. However, the political and social post-revolution instability and the variety of external shocks, especially the war in Libya, affected the Tunisian economy and led to financial crises. Jeribi et al. (2015) and Fakhfekh et al. (2015) studied this parameter during the Tunisian revolution. They found that the market capitalization of Tunisian companies increased after the Tunisian revolution the high number of new IPOs after 2011. Moreover, the local capital market is small and banks' access to external funding is restricted and concentrated primarily on Tunisian expatriate deposits or long-term loans from multilateral lending institutions. The African's Development Bank Group report in 2012 suggested that structural challenges are needed to move up the value chain through structural shift of the manufacturing sector and the liberalization of the domestic private sector from the dual economy.

After January 2011, the date of the Tunisian revolution, the flagrant depreciation of the dinar impeded the different policies of the Central Bank and threatened its credibility (inflation targeting[1] as monetary policy), Chtourou and Hammami (2014). To fight against economic destabilization, the Central Bank attempted to implement reforms and new policies in order to establish a stable, efficient and reliable financial system. According to the International Monetary Fund, this will first require supporting the economic recovery in the short term with an investment-oriented fiscal expansion while preserving macroeconomic and financial stability against a difficult external environment and a still-volatile political and social domestic situation. Monetary and financial sector policies should aim at containing inflation, preserving foreign reserves, and strengthening the banking sector. In fact, Siklos (2014) argues that the Central Bank's credibility, which was badly compromised after the crash of classical gold standard around 1914, has been enhanced in recent decades because of the adoption of inflation targeting.

In a flexible regime, inflation cannot be easily controlled by the monetary authorities in contrast to hard fixers. There may also be a lag time between policy and inflation outcomes. Therefore, inflation targets (IT) does not provide immediate signals of monetary policy to the households or the markets about the stance.

However, in Tunisia, the de facto trend towards more closely directed regimes has taken place without a declared the de jure[2] change in exchange rate policies. The The1990s were marked by a certain stability of the financial and economic environment after the Central Bank of Tunisia (CBT) had adjusted the nominal effective exchange rates[3] (NEER) from time to time to compensate for the inflation gap compared to Tunisia's commercial partners, Simon and al. (2013).

The African Development Bank Group suggested that structural challenges are needed to move up the value chain through

structural shift of the manufacturing sector and the liberalization of the domestic private sector from the dual economy. However, the exchange rates and capital accounts are still under the strict control of the Central Bank, even though exceptions are intended to export-related activities. In fact, the public sector dominates all the strategic sectors in the economy (e.g., energy, transport, telecommunications, pharmacy, collection and trade of basic food, etc.) and basic commodity prices are controlled by the government, which represent one third of the CPI. Therefore, it is crucial to assess the response of the domestic prices to the exchange rate pass-through,[4] given its important implications for the monetary policy. The pass-through measures the effect of a nominal exchange rate change on prices across fluctuations in the prices of imported products.[5] According to Dahem and Guermasi (2016), the total exchange rate pass-through in Tunisia was about 20% after the revolution. Specifically, 10% of pass-through on the administered prices, which contradicts the prevailing theory that admits the inexistence of pass-through for administered prices.

Several researchers, such as Goldfajn and Werlang (2000), Taylor (2000), Haussmann (2001), Mihaljck and Klau (2001); Darvas (2001) Devereux and al (2001, 2002), Bailliu and al (2004), Gagnon and Ihrig (2004), Campa and Goldberg (2006), Barhoumi and al (2006, 2008), Ito & Sato (2006), Campa and al. (2005, 2006), Miguel and Reginaldo (2010), Delatte and Villavicencio (2012) and recently Jimborean (2013) investigated the relationship between the exchange rates and inflation. The aim of this paper is to answer the following question: What is the relationship between inflation and the exchange rates and whether there is a causal relationship duplex or unidirectional relationship between them? In this regard, the relationship between inflation and the exchange rates over a period of 32 years (1984- 2016) was examined on the basis of FMI data base. Next, in the second section we started by clarifying the cartography of economic repercussions of the global financial crisis combined transition factors associated with the post-revolutionary period on the Tunisian monetary policy in terms of inflation and exchange rates. In the third section, details of the methodological procedure are explained. The result of the causality analysis is given in the fourth section then, the fifth section concludes the paper.

2. The financial and economic context of Tunisia

The principal mission of the Central Bank is to maintain general price stability. For this purpose, it is particularly responsible for overseeing the monetary policy and preserving the stability and security of the financial system. In Tunisia, the monetary policy has been supportive of banking credit although it decelerated. The Central Bank of Tunisia (BCT) launched a monetary policy aiming to preserve the value of the currency by controlling the rate of inflation at a level close to the one observed in the partner countries and competitors. The role of this exchange rate policy is to defend the internal and external value of the currency and maintain its stability and support the government's economic policy, Mustapha and al. (2004).

2.1. Exchange rate regime in Tunisia: Perception and Reality in a Context of Transition

An exchange rate policy is the set of rules that determine the intervention of the monetary authorities on the exchange market and therefore the behavior of the exchange rates. The choice of the exchange rate regime and its effect on economic performance is among the most contentious issues in the economic policy, which depends crucially on the specificities and characteristics of the economy. In fact, the key issue in monetary policy making is the time inconsistency problem confronting the Central Bank.

The compensation hypothesis supposes that open trade exposes a nation to a greater social and economic inequality which is the social cost of an international integration and leads to political crises. To deal with case, governments respond by providing more social spending to ensure economic parity. This social compensation stimulates higher consumer's spending and creates more inflation (Kaufman and Segura-Ubiergo, 2001). Moreover, open trade increases importation and causes more inflation (Daniels and Van Hoose, 2006).

Before the revolution, as in many dictatorships, the Tunisian regime was based on the authoritarian bargain: obligatory loyalty to the regime in exchange for political stability and the distribution of jobs and other benefits. The exchange rate regime adopted is flexible, however, this flexibility is limited. Currently, it is a managed float without preliminary announcement of the exchange rate trajectory, (Boujelbene and Chriguia (2015)).

The early eighties were marked by the drop of the income transfers from Tunisian workers abroad and of agricultural production due to the drought as well as the production and prices of hydrocarbons. After participating in the structural adjustment program (SAP) in 1987, the Tunisian Central Bank (TCB) introduced the constant real effective exchange rate rule (CRECR) in order to preserve Tunisia's competitiveness. In fact, the real exchange rate depreciated sharply over the 1986/1988 period. Moreover, the 1990s were characterized by prudent monetary and fiscal policies, with a stability of the international environment, which ensured a macroeconomic stability. Until the late 1990s, the TCB had rigorously applied the CRECR rule, while combining it with strong monetary and fiscal discipline and control of capital flows. This policy resulted in the growth of the Tunisian economy (7.32%) and the decrease of inflation by more than 5% in 2004.

In fact, compliance with this rule made the Tunisian monetary authorities periodically adjust the nominal exchange rate. At the end of 1999, the adoption of this rule relaxed and tempered the responses of the nominal exchange rate to exogenous shocks, Calvo and Reinhart, (2000). However, since 2000, domestic currency has been depreciated to support exportations. The total depreciation of the nominal effective exchange rate between 2000-2010 was around 30% and between 2011-2015 it was around 15% (inflation increase between 2011-2015 was about 40%).

On the hand, during this period (2000-2010), the exchange rate regime for Tunisia was a "managed floating" one aiming at the equilibrium's path. Then, after the 2011 revolution, the TCB followed a more flexible exchange rate policy (impure floating) after the flagrant depreciation of the Dinar in order to preserve competitiveness and avoid depleting exchange reserves. In fact, compared to the end of 2010 and through December 2011, the Dinar exchange rate on the interbank market fell by 4.1% with respect to the US Dollar and 0.8% against the Euro. This monetary deterioration caused a price increase. In fact, the inflation rate rose in May 2014 standing at 5.4% against 5.2% in April and 5% in March.[6]

In 2016, Tunisia recorded an inflation rate of 4.2%.[7] In comparison with the 2010 base year, inflation was 4.1% in 2015,

4.8% in 2014 and 5.7% in 2013. The national institute of statistics (NIS) explains this rise of the inflation rate by the price increase of the food and beverages compared to 2015, see figure 1.
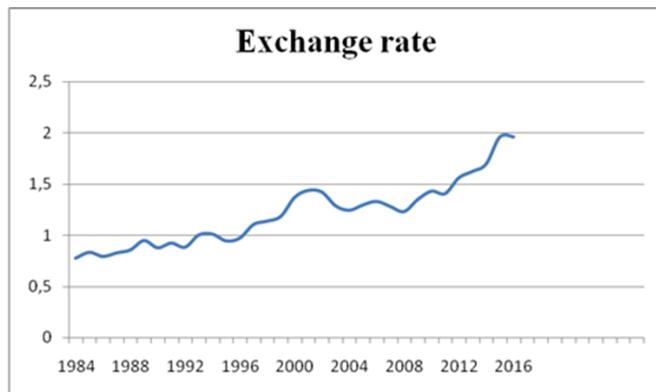
Source: IMF data

Figure1: Real Effective Exchange Rate in Tunisia (1984-2016)

Globally, after revolution, the interim government managed to prevent the economy from collapsing, preserve a decent level of foreign exchange reserves, and control inflation. The TCB de facto exchange rate regime differs from the TCB de jure exchange rate regimes, or officially announced, defined as what a countries' governments 'claim' to do. In fact, this is usually associated with a 'fear of floating' and seen as intermediate exchange rate regimes.

According to the TCB report in 2015, the exchange rate is determined on the interbank market where the TCB intervenes to regulate the liquidity of the market according to its own prices, which makes it the main market maker. The exchange rate was used to protect the competitiveness of the real sector. The TCB allowed the exchange rate to depreciate in real terms because it kept in mind the rise the unit labor costs relative to those of the main partner countries and competitors. In some cases, when the national currency risks losing value, the TCB intervenes by offering the currency in order to support the Dinar. This is the case of the depreciation of the national currency after the statements of the finance minister in April 2017. Then, the TCB announced the support of the Tunisian Dinar by offering foreign currency to banks.

2.2. The inflation regime
The monetary policy framework is based on the monetary aggregates, on credit and on a diverse range of indicators (import prices, the output gap, core inflation...) closely linked to inflation. To ensure price stability, the TCB supervised the banks' liquidity and steered the interest rates in the short term through a number of instruments (required reserves, operations at the initiative of the TCB, operations at the initiative of banks). The TCB used the open market operations in terms of banking liquidity regulation in order to contain the interest rate in a channel marked by the rate bidding (the minimum rate) and the reverse repurchase rate (the maximum rate). Therefore, "the monetary policy conducted by the TCB can be described as neutral with a certain rigidity of interest rates", Kadria and Ben Aissa (2014).[8] The problem is that the TCB announced objectives that were not always reached. These results should incite to install a device that helped a better evaluation of the authorities' initiatives.

However, the TCB made great efforts in inflation forecasting at the short and medium terms, which might serve as a reference for decision making in monetary policy and a means of

communication with the public by providing a means to assess and strengthen its policy and, therefore, its credibility. For a more flexible context, the TCB is expected to further clarify its strategy, to explain more frequently the slippages of intermediate targets and further clarify the role of the interest rates. According to the regulation, the TCB is required to coordinate and give its support to the economic policy of the State. With the revolution of January 2011, it was expected that the TCB will perform its function and will be independent in its decision making.

However, the governor of the Central Bank remains a guarantee of its autonomy. In fact, there had been 12 changes in fifty-five years. Hence, one must say that the term of office of the CBT's Governor is six years renewable. It seems that Tunisia is not now floating de jure and manages de facto. In what follows, we will try to understand the changes of the inflation rate on the last four decades. Which made us consider it curbed, and identify the rampant inflation that tends to rise from one period to another. On the other hand, Tunisia had known a period characterized by a relatively weak rhythm of inflation, which was between 1963 and 1972. Indeed, all over this period, the middle rate measured by the indication of the consumer price maintained itself at 3.4 %. It was only from the first oil shock of 1973 that inflation accelerated, reaching 4.1% following the increase of the price of oil. From 1974, the authorities undertook a policy of raising the demand to stimulate economic growth. Actually, they increased the wages by increasing the currency offer. Unfortunately, this measure aggravated inflation that reached 5.5% in 1975. During the following period (1976 -1978), inflation decreased substantially and the GDP continued to grow following the enhancement of the exports and the intervention of the General Case of Compensation (CGC). Then, the 1979/1982 period coincided with the second oil shock, which explains the acceleration of inflation from 1979 to reach 10.2% per year on average on this period. This acceleration of inflation was accompanied by an unfavorable economic conjuncture. However, the 1982-1986 was an active period characterized by a light deceleration during which the inflation rate varied between 4.1% in 1982 and 6.3% in 1986. Moreover, the years 1984, 1985 and 1986 were characterized by a slowdown of the inflation rate. This evolution could be explained by the resumption of economic growth during this period, with the exception of the year 1986, following the improvement of the productivity and to the compression of the interior demand what succeeded in 1986 to an unbearable deficit of the current payments (yearly Reports of the central bank (1981 -1988)). To deal with the crisis of the balance of payments, the TCB devalued the Dinar strongly, modified its monetary policy and started a program of liberalization of prices by setting general economic reforms along this period. Then, the 1987/1990 period was characterized by a stabilization of the inflation rate at around 7.4% on average. This result is attributable to a policy of management of the interior demand based on a reduction of the public expenses and the inflation level. On the other hand, the 1991/1994 period was characterized by a decrease of the inflation rate to around 5.7% per year on average as a result of the pursuit of the restraining budgetary and monetary policies. Then, from the second half of 1994 up to 1995, it increased to 6.3% as a result of circumstantial factors, such as the increase of the prices of most of the imported products, and the decrease of the prices of some agricultural products (Study economic of the World Bank on the Middle East and North Africa (1996, p 1 -5)). However, the 1996/2002 period had seen an important deceleration of the inflation rate, which was located between -1.7% in 1996 and 2.8% in 2002.

This reduction of inflation observed in the recent years has contributed to the creation of a favorable and stimulating climate for private investments and helped reduce the interest rates, which enhanced the dynamics of the economic activity, created jobs and increased exports (Report of the Tunisian Central Bank 2000, p97 - 101)). Using a Markov-switching approach, Khemiri and Ben Ali (2012) identified two main regimes for inflation in Tunisia over the period 2001–2009: a low and stable inflation regime associated with a low pass-through level, and a high inflation regime associated with a high pass-through level. Their empirical results showed that the industrial production index and the imports have a high pass-through level, whereas exports increase the probability of staying at a low inflation regime and a low pass-through level. The next figure number 2 displays the evolution of inflation during the last two decades in Tunisia.
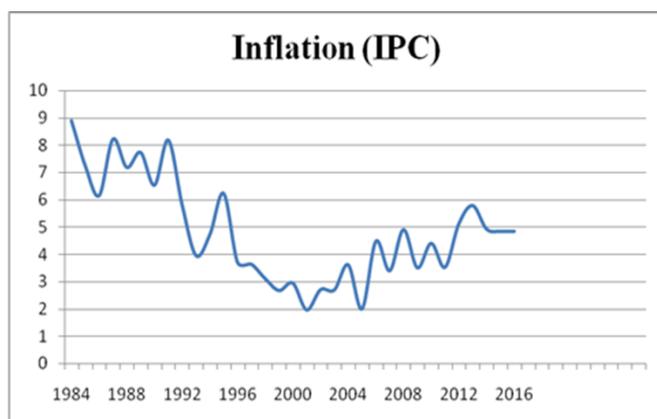
Source: IMF data

Figure 2: The evolution of inflation (1984-2016)

However, between 2009 and 2010, inflation increased slightly and slowly then remained moderate. Indeed, it was measured by the total IPC (average of the period) at 3.7% in 2009 then increased to 4.5% in May 2010. This increase was largely due to the growth of the prices of the food products.

The annual average inflation rate reached 5.6% in 2012, compared to 3.5% in 2011, due primarily to the rise of prices of the entire product, in particular, foodstuffs the prices of which had risen by 8.4% by the end of the preceding year. On the other hand, since June 2012, inflationary pressure has become inertial. This inflation increase can also be due to the rise of internal demand. The output gap[9] was negative during the post-revolutionary period, going from +1.82 in 2010 to -2.31 in 2011 and -1.95 in 2012. Nonetheless, there was an increase of 0.36 points between 2011 and the third quarter of 2012 which means an overall upward trend in aggregate demand. In addition, the pass-through effects associated with inflation imported through effective nominal explain the depreciation of the exchange rates. Nevertheless, the TCB made undeniable efforts to support the exchange rates through its intervention in the foreign exchange market to adjust the inflation differential relative to partners.

After ending its policy of full liquidity allocation in 2011, the TCB continued in 2013 with the policy initiated in 2012 based on a neutral intervention strategy in line with the evolution of autonomous liquidity factors. This direction is justified by the fact that inflation is not based solely on monetary factors in Tunisia. Then, in December 2013, the TCB decided to introduce swap accords as a new monetary policy tool in order to broaden its range

of tools for the regulation of banking liquidity and better steer the interbank interest rates. In fact, the objective of the BCT was to reinforce the efficiency of its monetary policy in terms of price stability. Inflation was fed notably by increased food prices, the depreciation of the Dinar against the Euro and smuggling and insufficient control of distribution circuits.[10] In 2014, the inflation rate reached 5.5% then declined to 4.9% in 2015. In fact, a study carried by Mhamdi and al. (2014)[11] concluded that the administered prices constitute a major obstacle to measure, interpret and forecast inflation. In fact, the TCB had no control over 30% of the CPI basket. This is a sign of weakness of the economic system, which implies that the monetary authorities should continue their efforts to liberalize the prices.

We can conclude that inflation in Tunisia has been increasing in recent years for various reasons (lack of supply, continued depreciation of the Dinar, the current account deficit...). This is damning the purchasing power of the Tunisians. The transition to a more flexible monetary regime which is IT remains a challenge in itself. In fact, the TCB became more transparent towards the public and more or less independent from the political power and there are great efforts being made within the TCB in order to make an analysis and forecasting of inflation in the short and medium term, but, this is not sufficient since IT requires restructuring and adjustments at all levels.

3. Data and method specification

Some empirical studies explained the relationship between the exchange rates and inflation by a simple regression equation (Olivei, 2002, Campa and Golberg, 2005, Campa, Goldberg and Gonzáles-Mínguez, 2005). We will follow McCarthy (2000), Hahn (2003), Faruqee (2004), and Ito and Sato (2006) who used the VAR approach to analyze the unidirectional or bidirectional relationship between the real effective exchange rates[12] and the inflation rate, which is measured by the average consumer price in Tunisia. Our data were collected from the IMF statistics for the 1984-2016 periods.

Our empirical study is based on annual observations in which we applied the vector autoregressive (VAR) model to examine the relationship between inflation and the real effective exchange rates. This technique was popularized by Sims (1980). In fact, the VAR model was developed in the macroeconomics literature as an attempt to characterize the joint time-series of a set (vector) of variables without making restrictive (and perhaps false) assumptions that would allow the identification of structural dynamic models. It provides a multivariate framework where the changes in a particular variable are related to changes in their own lags and the lags of other variables. This is a reduced-form of the VAR since the dependent variable is expressed in terms of predetermined lagged variables. The advantage of the VAR approach is that unknown relationships between the variables are considered as endogenous in the system as the variables relationship is simultaneously determined. The VAR model could be simplified as follows:

$$Y_t = \beta + A_1 Y_t + \ldots + A_p Y_{tp-1} + B Z_t + \varepsilon_t (1).$$

Where (Y_t) is a vector of endogenous variables, (β) is an intercept, (Z) is a vector of exogenous variables, (A) and (B) are coefficient matrices, (p) is the lag length and (ε_t) is an unobservable zero-mean white noise, see table 1.

Table 1: Summary statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
INFLATION	33	4.852173	1.891221	1.983333	8.9
EXCHANGE RATE	33	1.212054	0.32065	0.7768334	1.961625

These results show that the mean inflation is around 5% with a minimum of 1.9% in 2001 and a maximum of 8.9% a very high value recorded in 1984. We see that the exchange rates were on average around 1.2 and reached a minimum value of 0.77 in1984 and a maximum value of 1.9 in 2015 and 2016. The analysis of the evolution of inflation before and after the Tunisian revolution revealed that between 1984 and 2010 inflation averaged 4.8% before it declined in 2011, the year of the Tunisian revolution, to 3.5%, then rose to 5.13% in 2012 and slightly decreased to reach 4.8% during the 2013-/2015 period. This was explained by the NIS and BTC[13] by the price increase of food and beverages. Regarding the exchange rates, their average value was about 1.1 during the pre-revolutionary period. In fact, in 2011, it reached 1.4 but it kept nearly the values of 2010 and 2009.

Before starting a VAR estimation model, it is crucial to test for the stationarity of the time series data. Unit root tests are generally employed in order to identify the variables that belong to a stationary series. This is particularly essential as the stationarity of the macroeconomic series are generally limited (Pedroni, 1996; Froot and Rogoff, 1994; Chinn and Johnston, 1996). For this

purpose we used the Augmented Dickey Fuller (1979) and Phillips–Perron (1988)[14] stationarity test. Under the unit root null hypothesis, the variables have a unit root. The autoregressive unit root tests are based on the null hypothesis that $\varphi = 1$ (difference stationary) against the alternative hypothesis that $\varphi < 1$ (trend stationary). They are called unit root tests because under the null hypothesis, the autoregressive polynomial of zt, $\varphi (z) = (1 − \varphi z) = 0$, has a root equal to the unity while stationarity tests take the null hypothesis that yt is a stationary trend.

To test the unit root hypothesis, the following regressions of the ADF test and Phillips-Perron's tests (PP) were utilized:

ADF regression test: $\Delta x_t = (p-1) x_{t-1} + \sum_i^n \varphi_i \Delta x_{t-1} + u_t$

Phillips-Perron test regression : $\Delta x_t = \beta' D_t + \pi x_{t-1} + u_t$

We conduct these two different unit root tests,[15] and the ADF and PP tests which suggest a stationarity at a 1 % significance level. Consequently, it was assumed that all the time series are stationary after one differentiation. The results in the table show that for all the variables, we cannot reject the unit root test, see table 2.

Table 2.a: Unit root test (Augmented Dickey-Fuller test)

Variables	Level			1st difference		
	(i)	(ii)	(iii)	(i)	(ii)	(iii)
INFLATION	-1.457	-2.596	-2.761***	-9.264***	-9.379***	-9.195***
EXCHANGE RATE	2.630	-1.381	0.628	-4.489***	-5.373***	-5.153***

*(i): Without intercept, (ii) : with an intercept, and (iii) : with an intercept and trend. ***, ** and *: asterisks mean a p-value less than 1%, 5% and 10%. Critical levels in the model are (i), -2.649, (1%), -1.950, (5%), -1.603, (10%) (ii), -4.316, (1%), -3.572, (5%), -3.223, (10%), (iii), -2.457, (1%), -1.697, (5%), -1.310, (10%).*

Following these results, we can run the Johansen tests for cointegration. Testing for the order of integration is a standard in an applied econometric work. The Johansen tests are called the maximum eigenvalue test and the trace test. To test for the existence of Cointegration using the trace test, we set $K_0 = 0$ (no cointegration), and examine whether the null hypothesis can be rejected. If this is the case, then we conclude that there is at least one cointegration relationship. In this case, we need to reject the

null hypothesis to establish the presence of cointegration between the variables. It is crucial to know the order of integration to choose whether to set up a VAR model or a VEC model. The null hypothesis of no cointegration is accepted since the trace statistics is inferior to the critical value. Then, in our case, the two variables are not co-integrated; therefore, we can use the VAR model, which deals the short-term relationship, see table 3.

Table 3: Johansen tests for cointegration

Trend: constant			Number of obs = 31		
Sample: 1986 - 2016			Lags = 2		
maximum rank	Parms	LL	eigenvalue	trace statistic	critical value
0	6	-12.326338	.	6.7372*	15.41
1	9	-9.8234491	0.14911	1.7314	3.76
2	10	-8.9577585	0.05432		

The optimal lag length of the VAR model was examined using the information criterion of final prediction error (FPE), Akaike's information criterion (AIC), Schwarz's Bayesian information

criterion (SBIC), and the Hannan and Quinn information criterion (HQIC). In our case, the lag order selection statistics is equal to two according to the four criterions, see table 4.

Table 4: Selection-order criteria

Sample: 1988 - 2016					Number of obs = 29			
lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-59.253				0.234253	4.22435	4.25388	4.31864
1	-13.3763	91.754	4	0	0.013063	1.33629	1.42489	1.61918
2	-6.25862	14.235*	4	0.007	.010594*	1.12128*	1.26895*	1.59277*
3	-5.14939	2.2185	4	0.696	0.013093	1.32065	1.52737	1.98072
4	-2.91051	4.4778	4	0.345	0.015126	1.4421	1.7079	2.29077

4. Interpretation

There are few empirical studies concerning the effect of inflation regimes on the exchange rate volatility, Ouyang, Rajan and Lie (2016). First, it is necessary to define the inflation targeting regime under its different types. Inflation targeting is a central banking policy that revolves around meeting preset publicly displayed targets for the annual rate of inflation.[16] Berganza and Broto (2012), classified inflation target IT regimes into "strict IT" as IT with pure floating regime and "flexible IT" as IT with a managed floating regime. IT adoption may lead to a higher exchange rate instability. However, the authors argue that IT adoption is benefic for the control the exchange rate volatility. In fact, foreign exchange interventions in IT countries seem to be more effective in containing the exchange rate volatility than in non-IT countries. This suggests that the exchange rate volatility under IT countries with "managed" regimes tend to be lower than those with flexible regimes.

Like with Neely (2010) and Charef and Aycyech (2015), our results confirm that the inflation rate variations are followed by significant exchange rate impact responses. The positive and significant coefficient of the inflation and exchange rates suggest that increased inflation causes increased demand for domestic currency leading to its appreciation.

On the other hand, Edwards (2006) concluded that the phenomenon of volatility rising with IT regimes is mainly due to

floating exchange rate regimes since the result is overturned after controlling for exchange rate regimes. As for Rose (2007), he explored this issue and found that IT regimes tend to have lower exchange rate volatility. In a credible inflation target regime, Arghyrou and Pourpourides (2015) argued that positive (negative) inflation surprises trigger increases (reductions) of the short-term domestic interest rates leading to increased (reduced) real returns on the domestic currency (see Clarida and Waldman, 2008; Neely, 2010 and Conrad and Lamla, 2010). These, in turn, cause increased (reduced) demand for domestic currency leading to its appreciation (depreciation).This response goes against the predictions of the textbook Purchasing Power Parity (PPP) hypothesis under which increasing (decreasing) inflation rates causes currency depreciation (appreciation). This appears paradoxical but it can be explained by the inflation-targeting monetary policy. According to Ouyang, Rajan and Li (2016), inflation targeting (IT) regimes seem to have experienced greater real effective exchange regime volatility, largely driven by external prices in the developed countries, while for the developing countries, IT regimes show no difference in REER[17] volatility, though there is some evidence that they have lower volatility in internal prices.

Therefore, the relationship between the inflation rate and the exchange rate regime is non monotonous. In fact, this relationship is based on monetary policy considerations and, in particular, asymmetric monetary policy preferences see table .5

Table 5: VAR model results

		Coef.	Std.error	z	P>|z|	[95% Conf.Interval]	
INFLATION							
	INFLATION						
	L1.	0.3997838**	0.1627743	2.46	0.014	0.0807521	0.7188155
	L2.	0.4253781***	0.1613102	2.64	0.008	0.1092159	0.7415403
EXCHANGE							
	L1.	-1.277009	2.341394	-0.55	0.585	-5.866057	3.312038
	L2.	1.838487	2.684341	0.68	0.493	-3.422725	7.099699
	_cons	0.0881013	1.601957	0.05	0.956	-3.051677	3.22788
EXCHANGE							
	INFLATION						
	L1.	-0.0172763	0.0116642	-1.48	0.139	-0.0401377	0.005585
	L2.	0.0268783**	0.0115592	2.33	0.02	0.0042226	0.0495339
EXCHANGE RATE							
	L1.	1.002321***	0.1677807	5.97	0	0.6734767	1.331165
	L2.	0.098027	0.1923557	0.51	0.61	-0.2789833	0.4750373
	_cons	-0.1293439	0.1147938	-1.13	0.26	-0.3543356	0.0956478

The Angle and Granger causality test showed that if the series X and Y are individually I (1), then there would be a causal relationship at least in one direction. Granger-causality test detects the causal relationship between two or more variables. A time series is said to Granger-cause of another time series if the prediction error of current Y declines by using past values of X in addition to past values of Y. We apply a standard Granger causality test to find out whether there is any causal relationship between inflation and the exchange rates. The Granger causality tests presented in table 6 highlight the causal relationship between the

two variables. In fact, the feedback hypothesis is confirmed for Tunisia, showing that there is a unidirectional causality between the inflation and the exchange rates. The results show that there is a unidirectional relationship running from inflation to the exchange rates. This result is important for the policy makers in Tunisia and the government because it has not set any specific targets for the exchange ratess. The exchange rate changes become relevant for the monetary policy only if they influence inflation, Charef and Ayachi, (2015), see table 6.

Table 6: VAR granger causality/Block erogeneity Wald tests

Equation	Excluded	chi2	df	Prob> chi2
INFLATION	CHANGE RATE	0.54684	2	0.761
INFLATION	ALL	0.54684	2	0.761
EXCHANGE	INFLATION	5.4073*	2	0.067
EXCHANGE	ALL	5.4073*	2	0.067

Then, we test the hypothesis that all coefficients except the constant term are zero. The results show a significant P-value, therefore, we can reject the null hypothesis while all the coefficients in the specification are not null. Next, we implement a Lagrange multiplier (LM) test for autocorrelation in the residuals of the VAR model, which was presented by Johansen (1995).[18] This test is performed at lags j = 2. In our case, the null hypothesis of the test is that there is no autocorrelation at lag 2, see table7.

Table 7: Lagrange-multiplier test for residual autocorrelation

Lagrange-multiplier test		
lag　chi2	df	Prob> chi2
1　4.3672	4	0.35859
2　4.8797	4	0.29987

For each variable, we present a test for normality based on Jarque-Bera, skewness and kurtosis tests. The p-values shown in the table above indicate that we can accept the null hypothesis indicating that the residuals are normally distributed, see table8.

Table 8: Tests for normality

Jarque-Bera test				
Equation	chi2	df	Prob>chi2	
INFLATION	0.112	2	0.94552	
EXCHANGE	0.162	2	0.92217	
ALL	0.274	4	0.99142	
Skewness test				
Equation	Skewness	chi2	df	Prob> chi2
INFLATION	0.08841	0.04	1	0.84073
EXCHANGE	0.11222	0.065	1	0.79865
ALL		0.105	2	0.94864
Kurtosis test				
Equation	Kurtosis	chi2	df	Prob> chi2
INFLATION	2.7645	0.072	1	0.78894
EXCHANGE	2.726	0.097	1	0.75547
ALL		0.169	2	0.91913

5. Concluding remarks and policy implications

Our paper studies the probable existence of causality links between the exchange rates and inflation in Tunisia. First, we clarified the Tunisian monetary strategy, and then we studied the relationship between inflation and the exchange rates. The empirical results show that the exchanges rates do not affect the inflation rate suggesting that the pass- through rate is very low. This link can be more developed through the study of the likely effects of previous lagged values of the exchange rates. Moreover, the inflationary environment (at 10% significance level) is more frequently observed to Granger cause the exchange rates. These results imply that there is some help for economic policy-makers in Tunisia in their quest for inflation, the exchange rates and stability. A policy of inflation targeting as an alternative monetary policy combined with a compatible regime of flexible exchange rates could provide

a solution to this dilemma. In fact, with a constant real exchange rate rule, an inflation targeting regime will not be sufficient to properly contain the inflation pressures caused by demand shocks. Therefore, coordinated efforts are needed from the Central Bank's policy makers in order to avoid sending mixed signals to economic agents about its monetary policy stance, which endangers the achievement of its inflation target and has adverse effects on the exchange rates and the policy stability.

Reference

[1] Abdelbaki, H. (2013) 'The impact of Arab spring on stock market performance', British Journal of Economics, Management and Trade, Vol. 3, No. 3, pp.169–185.

[2] Aisen, A. and Veiga, F.J. (2013) 'How does political instability affect economic growth?', European Journal of Political Economy, Vol. 29, No. 1, pp.151–167.

[3] Alexakis, P. and Petrakis, P. (1991) 'Analysing stock market behaviour in a small capital market', Journal of Banking and Finance, Vol. 15, No. 1, pp.471–483.

[4] Amihud, Y. and Wohl, A. (2004) 'Political news and stock prices: the case of Saddam Hussein contracts', Journal of Banking and Finance, Vol. 28, No. 5, pp.1185–1200.

[5] Andreou, E. and Ghysels, E. (2002) 'Detecting multiple breaks in financial market volatility dynamic', Journal of Applied Econometrics, Vol. 17, No. 5, pp.579–600.

[6] Białkowski, J., Gottschalk, K. and Wisniewski, T. (2008) 'Stock market volatility around national elections', Journal of Banking and Finance, Vol. 32, No. 9, pp.1941–1953.

[7] Black, F. (1976) 'Studies of stock price volatility changes', Proceedings of the 1976 Meetings of the American Statistical Association, Business and Economical Statistics Section, Vol. 2, pp.177–181.

[8] Bloom, N. (2009) 'The impact of uncertainty shocks', Econometrica, Vol. 77, No. 3, pp.623–685.

[9] Bollerslev, T. and Mikkelsen, H.O. (1999) 'Long-term equity anticipation securities and stock market volatility dynamics', Journal of Econometrics, Vol. 92, No. 1, pp.75–99.

[10] Bollerslev, T. and Mikkelsen, H.O. (1996) 'Modeling and pricing long memory in stock market volatility', Journal of Econometrics, Vol. 73, No. 1, pp.151–184.

[11] Brooks, R.D., Davidson, S. and Faff, R.W. (1997) ' An examination of the effects of major political change on stock market volatility: the South African experience', Journal of International Financial Markets Institutions and Money, Vol. 7, No. 3, pp.255–275.

[12] Chan, Y. and Wei, K.C.J. (1996) 'Political risk and stock price volatility: the case of Hong Kong', Pacific-Basin Finance Journal, Vol. 4, Nos. 2–3, pp.259–275.

[13] Chan, Y., Chui, A. and Kwok, C. (2001) 'The impact of salient political and economic news on the trading activity', Pacific-Basin Finance Journal, Vol. 9, No. 3, pp.195–217.

[14] Chau, F., Deesomsaka, R. and Wang, J. (2014) 'Political uncertainty and stock market volatility in the Middle East and North African (MENA) countries', Journal of International Financial Markets, Institutions and Money, Vol. 28, No. 1, pp.1–19.

[15] Chen, B. and Feng, Y. (1996) 'Some political determinants of economic growth: theory andempirical implications', European Journal of Political Economy, Vol. 12, No. 4, pp.609–627.

[16] Chesney, M., Reshetarb, G. and Karamana, M. (2011) 'The impact of terrorism on financial markets: an empirical study', Journal of Banking and Finance, Vol. 35, No. 2, pp.253–267.

[17] Choi, K. and Hammoudeh, S. (2009) 'Long memory in oil and refined products markets', TheEnergy Journal, Vol. 30, No. 2, pp.97–116.

[18] Choi, K., Yu, W.C. and Zivot, E. (2010) 'Long memory versus structural breaks in modeling and forecasting realized volatility', Journal of International Money and Finance, Vol. 29, No. 5, pp.857–875.

[19] Christie, A. (1982) 'The stochastic behavior of common stock variance', Journal of Financial Economics, Vol. 10, No. 4, pp.407–432.

[20] Citron, J. and Nickelsburg, G. (1987) 'Country risk and political instability', Journal of Development Economics, Vol. 25, No. 1, pp.385–392.

[21] Figlewski, S. and Wang, X. (2001) Is the 'Leverage Effect' a Leverage Effect?, Working Paper New York University.

[22] Granger, C.W.J. and Hyung, N. (2004) 'Occasional structural breaks and long memory with application to the S&P500 absolute stock returns', Journal of Empirical Finance, Vol. 11, No. 3, pp.399–421.

[23] Hillebrand, E. (2005) 'Neglecting parameter changes in GARCH models', Journals of Econometrics, Vol. 129, Nos. 1–2, pp.121–138.

[24] Hurst, H. (1951) 'Long term storage capacity of reservoirs', Transactions of the American Society of Civil Engineers, Vol. 116, No. 1, pp.770–779.

[25] Inclan, C. anTiao, G.C. (1994) 'Use of cumulative sums of squares for retrospective detection of changes of variance', J. Am. Statist.Assoc,Vol. 89, No. 1, pp.913–923.

[26] Issa, D., Benyagoub, M. and Raballand, G. (2014) Investment Climate Assessment Enterprises' Perception in Post Revolution Tunisia, Finance and Private Sector Development Middle East and North Africa Region, The World Bank [online] http://www.worldbank.org.

[27] Jeribi A., Fakhfekh M., and Jarboui A., (2015),"Tunisian revolution and stock market volatility: evidence from FIEGARCH model", Managerial Finance, Vol. 41, No. 10, pp.1112-1135.

[28] Jeribi A., Fakhfekh M and Hachicha (2015), "Long memory properties on Tunisian sectorial stock market index volatilities: evidence from FIEGARCH model", International Journal of Sustainable Economy (IJSE).

[29] Julio, B. and Yook, Y. (2012) 'Political uncertainty and corporate investment cycles', The Journal of Finance, Vol. 67, No. 1, pp.45–84.

[30] Kaddour, A. and Zmami, M. (2014) 'How does financial sector reacts after special events? An event study analysis of Tunisia after the revolution of 2011', Journal of Social Science Research, Vol. 4, No. 2, pp.554–598.

[31] Lamoureux, C. and Lastrapes, W. (1990) 'Heteroskedasticity in stock return data: volume versus GARCH effects', Journal of Finance, Vol. 45, No. 1, pp.221–229.

[32] Lo, A.W. (1991) 'Long-term memory in stock market prices', Econometrica, Vol. 59, No. 5, pp.1279–1313.

[33] Kadria and Ben Aissa (2014), "The inflation targeting policy in Tunisia? Between perception and reality", MPRA Paper No. 61442,

[34] Mei, J. and Guo, L. (2004) 'Political uncertainty, financial crisis and market volatility', European Financial Management, Vol. 10, No. 4, pp.639–657.

[35] Mikosh, T. and Starica, C. (2004) 'Non stationarities in financial time series, the long-range dependence and the IGARCH effects', The Review of Economics and Statistics, Vol. 86, No. 1, pp.378–390.

[36] Mouley, S. (2013) 'The effects of the global financial crisis and combined transition factors associated with the post-revolutionary period: the case of Tunisia', Strategic Sectors Economy and Territory, No. 1, pp.230–234.

[37] O'Sullivan, A., Rey, M., Mendez, J. (2012) Opportunities and Challenges in the MENA Region, OECD Middle East and North Africa region Regional Economic Update [online] http://www.worldbank.org.

[38] Perotti, E.C. and Oijen, P.V. (2001) 'Privatization, political risk and stock market development in emerging economies', Journal of International Money and Finance, Vol. 20, No. 1, pp.43–69. Sanso, A., Arago, V. and Carrion, J.L. (2004) Testing for Changes in the Unconditional Variance of Financial Time Series, DEA Working Paper 5.

[39] World Bank (2011) MENA Facing Challenges and Opportunities, World Bank Middle East and North Africa Region, Regional Economic Update [online] http://www.worldbank.org.