Research Paper

Relationship between the Exchange Rate and Macroeconomic Instability Before and After the Tunisian Revolution

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Abstract

The year 2011 has been marked as a major turning point in the Tunisian modern history from different perspectives. The popular uprising and the fall of the former regime in January led the country into a period of political and economic instability that has notably affected the national stock market. In this respect, the present study aims at investigating the dynamic links between the yield on the stock index and the macroeconomic instability in an environment characterized with political uncertainty.

In a bid to analyze the political uncertainty's impacts on the stock market and on the macroeconomic aggregates, mainly on the inflation and the exchange rate before and during the 2011 revolution, we consider it useful to implement an empirical testing on the nature of interaction binding these associated variables. To this end, a specified an error correction model is estimated to examine the period 1984-2016, to help highlight the short and long-term effects associating the considered variables.

The reached results proved to indicate that the Tunisian Dinar (TND) exchange rate remains noticeable the variable which continued to undergo an adjustment process following the inflation and the political uncertainty related dynamics. The financial indicator "Tun-Index" is discovered to be not only weakly exogenous, but also closely associated with a "rate of endogeneity" that stands as noticeably lower than the exchange rate. In effect, the strong inflation the state had with eased throughout the economy during period 2012-2016 entailed remarkable devaluations of the TND to take place. Actually, such a significant devaluation turns out to have its exploration in the political uncertainty predominates the state affairs.

Keywords: ***Uncertainty policy, macroeconomic instability, ECM.***

1. Introduction

It is work noting that the fundamental causes lying behind the financial and macroeconomic imbalance consist not only in the imbalance relating to the current-account sales, but also in the financial recession which shook certain countries of the Arab world, owing to the Arab Spring related because of the political events (Obstfeld, 2012). Indeed, the political instability appears to play an important role through affecting the stock-exchange relating prices. In this context, the political uncertainty turns out to be closely is associated with a rather remarkable volatility of equity prices and reduction in investment and employment in the sectors highly sensitive to such policies (Baker and al, 2016). According to Chau et al. (2014), such an uncertainty proved too has increase of the stock markets relating volatility in the MENA countries. In this sense, and on examining the political events impact on the Turkish stock market titles' exchange, Aktas and Oncu (2009) concluded that the stock market prices proved to behave in an inverse way further to any bad political event. Furthermore, (Niederhoffer, 1971; Culter, Poterba and Summers, 1998) confirmed that the stock-exchange yields are actually bound to the world events. These yields tend to be more important in absolute value than the other days' yields. Accordingly, Daktas and Oncu (2009) considered to examine the political events' impact on the titles' exchange on the Turkish stock market, exactly at the time, when the Turkish Parliament rejected the project of the law concerning Iraq, which gives the permission to the American army to intervene and to be easily deployed in Iraq. The Government's refusal to ratify the laws project has resulted in a noticeable reduction in the Turkish stock index. On using the ordinary least squares (OLS) method, the authors concluded that the stock market prices turned out to behave in an inverse way face to an inconvenient political event. Among the most important repressions associated with political uncertainty one could well cite the macroeconomic instability. In this regard, several authors proposed to examine the impact of such as uncertainty on certain macroeconomic aggregates. In 2011, the Tunisian revolution marked the beginning of an historical period. Tunisia has progressed at the political level with the consensual adoption of a new by established constitution, and the emergence of a very dynamic civil society (Olsen et al., 2010). Yet, this political and social instability that prevailed following the revolution and the succession of various' outer

foreign shocks, particularly the war in Libya, have remarkably affected the Tunisian economy, resulting in recurrent financial crises. In addition, the local capital market turns out to be inefficient and the access to banks to finance investment restricted (Sayah, 2011). As for Baker et al. (2016), they studied the political uncertainty as associated with greater price volatility, reduced investment and employment in the sectors highly sensitive to political stability. According to them, the political uncertainty recently persistent in the United States and Europe may have affected macroeconomic performance. There are also effects associated with political uncertainty on price volatility, investment rates and employment growth. Concerning the Tunisian model, several authors have examined the impact of political uncertainty on the economic instability. In this regard, Kaddour and Zmami (2014) studied the impact of the political, economic, social and terrorist events on the Tunisian stock exchange during the revolution period. They noticed that political uncertainty leads to a decreased performance of the volatility. In this respect and on examining the impact of the Arab spring rate on the main stock markets, Chau et al. (2014) have noticed that political uncertainty increased the MENA countries' stock market's volatility.

After January 2011, the blatant depreciation of the Tunisian Dinar (TND) hindered the various policies set by of the Central Bank, mainly the inflation targeting monetary policy and threatened its credibility (inflation targeting). These events have also affected the evolution of the financial indices Tun-index and, there from, its yields (Galal and Reiffers, 2014). In this regards, and in a bid to combat the economic instability, the central bank has tried to implement reforms and devise new politics whereby a stable, effective and reliable financial system could be established.

In Tunisia, the monetary policy has supported the banking credit area. The Central Bank of Tunisia (BCT) has launched monetary policy aimed at preserving the currency value through monitoring the inflation rate. According to the International Monetary Fund (IMF), this measure should require, firstly, supporting the short-term economic recovery with an investment-oriented fiscal expansion, while preserving the macroeconomic and financial stability against difficult external environment, domestic political and social conditions situations. The monetary and financial sector policies should therefore be focused on aim containing the inflation, protecting the exchange reserves and strengthening the banking sector at a level close to that persisting observed in the partner and rival countries. The role of such on this policy exchange consists in defending the internal and external value of the exchange rate, maintaining its stability and supporting the Government set economic policy (Nabli and al., 2004).

The present work aims at estimating the implications of the political uncertainty as an outcome of the 2011 revolution, on the Tunisian financial market and on the macroeconomic aggregates, on the light of empirical models as based on the OLS and VECM theories**.**

2. Literature Review

The security value depends on specifically relates factors as well as on several cyclical factors closely related to the country's economic situation, evolution of exchange rate and inflation rate. These are macroeconomic factors that affect volatility (Rozeff and Kinney, 1976). According to the study conduct by Fisher (1930), the profitability nominal rate of financial asset is equal to the sum of the profitability real rate of the share and the early inflation. Based on the co-integration model, the author notices that inflation lies at the origin of stock market price increases. Yet, these rates have a negative effect on the short-term stock exchange prices in case companies do not manage to adjust correctly their profit margins and their prices with regard to the various situations prevailing in stock exchange prices. In this sense, Mukherjee (1995) undertook to analyze the association binding the stock market prices in Tokyo by relying on macroeconomic variables as bases on the VECM approach. He includes the existence of a positive relationship binding the exchange rate supply and share purchase price, industrial production and share price, and finally between the exchange rate and share price. In regard of the American market, Flannery and Protopapadakis (2000) proposed to analyze the effect of 17 macroeconomic indicators on the stock market over a period of 16 years (1980-1996). Based on the MGARCH model, the authors discover that the producer price index and the consumer price index appear to directly affect the stock market returns. Based on the multi-varied GARCH model, Sheng-Yung Yang (2004) considered to the volatility persisting between exchange rates and share purchase prices concerning the period 1979-1999 and a sample of 7 countries (United States, Japan, France, United Kingdom, Italy, Canada and Germany). He deduced that the exchange rate fluctuations proved have a direct and significant impact on the future share price evolution. In the same context, Kate (2005) analyzed the relationship between exchange rates and short-term and long-term equity prices by means of the cointegration tests and multivariate Granger causality tests. In addition, he examined the dependency structure between exchange rates and stock prices for 5 countries (United States, England, Germany, Japan and France). It showed the existence of a significant positive dependence betweenthe stock market and the movements of foreign exchange market during the periods and in all countries. Through, a VAR GARCH-M model, Mun (2007) proposed to analyze the impact of the exchange rate and stock market volatility over the 13 years (1990-2003) for Japan and US. He discovered that the increase in exchange rate appreaced to influence positively the local stock market volatility, and negatively affect the American stock markets' volatility. According to the same author, the increase on exchange rate makes variations reduce the correlation between the local stock markets and the US besed ones.In turn, Adjuasi (2008) analyzed the impact of exchange rate fluctuation on the stock exchange of Ghana using the EGARCH model. Using a monthly data for 54 years (1951-2005), he noticed the existence of an inverse relationship between the efficiencies on the Ghanaian stock market and the exchange rates' volatility. According to him, the macroeconomic environment must be stable enough to facilitate the entry of investors. In another, study conducted by Irfan and Safdar (2013) an explanation is proved as to the impact of crucial macroeconomic variables on stock market performance. The authors based their study on four independent variables (exchange rate, inflation rate, interest rate and unemployment rate) and a dependent variable (the equity return) during a period that spread between February 2005 and May 2012. On using the GARCH model, they come to conclude that both of the interest rate and exchange rate stand as very important variables in the share price fluctuation, owing to the significant yield effect they of the yield have on the stock market. Muazu (2014) studied the effects of macroeconomic variables the stock market retrn, yield over a 10 years period (September, 2000-September, 2010). Their study was based on a Johansen Vector Error Correction Model (VECM) and the multi-dimensional cointegration approach. Their reached results showed the presence of a long-term relationship binding equity returns and

macroeconomic variables. Through dynamic cointegration, Panayiotis and Diamandis (2011) examined the relationship between the stock market prices and exchange rate in regard of the Latin American countries. They have discovered the persistence of a significant long-term relationship between the foreign exchange market and local stock markets. Yet, they noted that the relationship with political stability has been affected with monetary and financial crises, such as the Mexican Peso crisis in 1994 and the sub-prime crisis prevalent during the period 2007-2009.

In the Tunisian context, however, the Revolution has engendered a serious political and financial instability fulminating in remarkable spleen variations on the exchange rate, the inflation rate and the " Tun-Index " financial index.

3. Macroeconomic analysis of the Tunisian transition context

In the present study, the macroeconomic analysis is focused on two periods. The first period runs from 1984 to 2010. As for the second period from 2011 to 2016, it is known as the period of the revolution in Tunisia. The first period was characterized by the establishment of a Structural Adjustment Plan (SAP) in Tunisia, in 1986, following bitter economic, social and political problems in Tunisian experienced. In the beginning of the first period, Tunisia experienced a remarkable drop in foreign exchange reserves. According to the BCT, the currency reserves available then allowed to matter for only a period of no more than Four or Five days. That situation has resulted in a voluntarism devaluation of the TND, as claimed by it the experts of the World Bank and the IMF (International Monetary Fund), along with the reduction in exports and foreign direct investment. To shield against the measures touching the parity of the TND, other financial measures affected the banking system as well as the stock market have been issued, in a bird to revitalize them. These measures concern mainly the liberalization, though to a certain extent, of the interest rate on the credits granted by commercial banks. In other words, the economic agent has, from now on, the power to negotiate the cost of his loan, essentially the profit margin, with his banker. Indeed, by the end of 1980s, a significant energization of exchanges, financial assets in value and in volume (increase of the market capitalization as well as the volume of transactions).Was noticed, in this sense, the decade 1990-2000 was worked by a noticeable increase of the new introductions to the stock exchange of Tunis ether by increasing the capital of the recently highly-rated companies, or by the sale on one hand of this one. During the period 2000-2010, the macroeconomic indicators in Tunisia also knew an important improvement with a strong economic growth going up from 5.5 % in 2006 to 6.3 % in 2007 and 5.8 % in 2008. During this period, the inflation rate was around 3.1 % and the budget deficit of 3 % of the GDP in 2007.

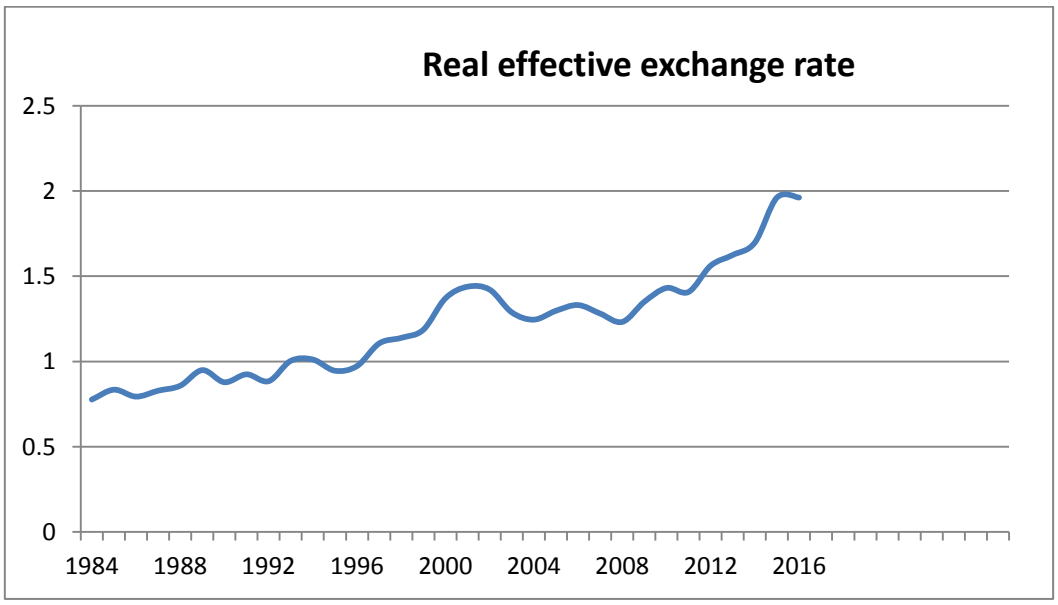
After the Tunisian Revolution of January 14th, 2011, the country was pushed for a period of political, social and economic transition which brought about a freedom of expression to the Tunisian citizens, but a cute (Jarboui and al, 2015). During the period 2011-2016, the inflation rate reached even the hold of 6 % for years, negatively affecting the purchasing power of the Tunisian consumers as well as the companies', competitive capacity, especially the exporting ones. Consequently, the exchange market knew a total imbalance as far as the BCT does not manage anymore to intervene to adjust the TND due to seen the indiscretion of exchange. Accordingly, the TND parity confused a noticeable sliding with regard to the major currencies. For instance, the TND lost 26 % of its value with regard to the Euro between 2010 and 2016. Hence, the political uncertainty in Tunisia has had negative effects on the market capitalization. These economic problems, affecting the stock market, the inflation and the exchange, had fatal effects on the value of the sovereign debt in TND as well as on the funding sources of the economy. It is worth at reminding this level, that in the 2016, level of sovereign debts reached the rate of 69, 5 % of the GDP (Gross Domestic Product), the equivalent of a 54 billion amount, more than doubles him with regard to its level in 2010. These phenomenal increases in debt, in subsidies (2.2 billion in 2010 in 4.5 billion in 2016) in the payroll (less than IND 8 billion in 2010 in TND 14, 5 billion in 2016) and in the trade balance deficit TND 8.298,1 billion in 2010 to TND 11.5 billion in 2016) allow us to talk about a serious economic situation affecting the Tunisian economy.

In the Tunisian context, the Tunisian revolution has about a political and financial instability culminating in remarkable variations in trade and increases in consumer prices.

In this respect, the exchange policies s represent the set of the rules which help determine the intervention of the monetary authorities in the foreign exchange market and ,there from, thus the behavior of the exchange rate (Mouley, 2000). The choice of the exchange rate, diet and its effect on the economic performance are among the most litigious questions of the economic policy. It highly depends on the specificities and characteristics of the economy. Indeed, in the context of a transition an economy, the parity of the national currency is the result of the interdependence of several socio-economic factors. The social and political instability comes to amplify the macroeconomic problems such as the inflation, to which the exchange rate is largely indexed (Alagidede and Ibrahim, 2016). The reduction in production intended for the export is too significantly remarkable as to puncture the exchange reserves of the country. This does not miss lowering the value of the national currency (Neely, 2017). The 1980s were marked with a noticeable reduction in the income transfers of the Tunisian workers abroad, a reduction in agricultural production due to drought accompanied by a reduction in the production of hydrocarbons as well as in their price. All these factors contributed to have the voluntarism depreciation of the TND with the institution of the STEP in 1987. With the aim of hedging the inflation, the BCT introduced the rule of the real actual exchange rate IN A BID to protect the country's competitiveness. The real exchange rate considerably depreciated during the period 1986-1988. The 1990s were characterized with careful monetary and fiscal policies, and a stability of the international environment, which helped maintain assured a macroeconomic stability. By the end of 1990s, the BCT followed a strict application of strictly the rule of the real actual exchange rate, while combining it with a strong monetary and fiscal discipline and control of capital flows (Sab and Karpowicz, 2002). This politic pulled a growth of the Tunisian economy of 7, 32 % and a reduction in inflation by more than 5 % in 2004. In effect, Abiding by this rule brought the Tunisian monetary authorities to adjust periodically the nominal exchange rate. By the end of 1999, the adoption of this rule was softened and moderated the response of the nominal exchange rate to the exogenous shocks (Calvo and Reinhart, 2000). Noteworthy however, since 2000, the national currency was depreciated to support the exports. The total depreciation of the nominal actual exchange rate as registered between 2000-2010, was of the rate of 30 %, and between 2011-2015, it approached 15 %. During the period (2000-2010), the diet of exchange was "floating managed" with the aim of maintaining the balance trade. Follow the ring the revolution of 2011, the BCT

pursued a policy of maintaining more flexible exchange following the blatant depreciation of the TND to enhance the competitiveness and avoid the exhaustion of the exchange reserves. In fact, with regard to the end of 2010 and until December, 2011, the exchange rate of the dinar on the interbank market recorded a reduction of 4, 1 % with regard to the US Dollar and in 0, 8 % with regard to the Euro.

Figure 1: the evolution in real actual exchange rate in Tunisia (1984-2016)



Authors' conception: IFS data

On a global scale, and following the Revolution, the caretaker government managed to avoid the collapse of the economy as it was able to maintain a decent level of foreign exchange reserves and control inflation. The exchange rate has been used to protect the real competitiveness of the economic sector. The BCT depreciated the exchange rate in real terms as it took into account the increase in unit labor costs relative to the partner countries. In certain cases, when the national currency risks losing its value, the BCT intervenes by providing foreign currencies to support the TND. This is the case of the national currency depreciation following the Financial Minister' declarations released in April 2017. To cope with that depreciation, the Central Bank announced the support of the TND by injecting foreign currencies on the foreign exchange market.

3.1. Political uncertainty and inflation rate dynamics

The monetary policy framework is based on monetary aggregates, on credit and on a diverse range of indicators (import price, output gap, and inflation) closely related to inflation. To ensure price stability, the BCT supervises the liquidity of banks and directs the short-term interest rates through a number of measures (reserve requirement instruments, the BCT initiated and operations initiated by banks).

The BCT used the open market operation in terms of regulation (payment) of banking liquidity to contain the interest rate in a chain (channel) marked by the call for tenders (minimum rate) and the rate of repurchase (maximum rate). Consequently, the monetary policy led by the BCT, can be qualified as neutral with a certain rigidity of the interest rates, (Kadria well and Aissa, 2014).

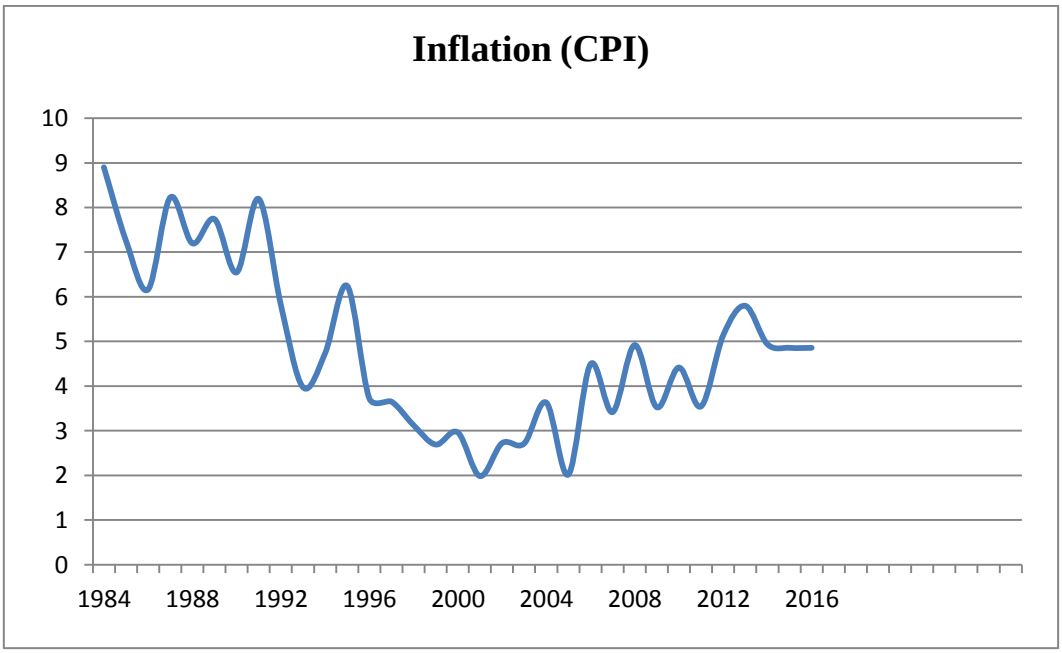
The problem which floats is that the BCT declared objectives were not always reached. These results should enhance the installation of system whey the authorities initiatives could effectively assessed. Such the BCT makes remarkable efforts to predict short and medium-term inflation forecast to benchmark serve as reference to the decision-making in monetary policy and to mass media by a provide up a produce or measure whereby it could enhance its politics, there from hits credibility. For a more supple and flexible context, we expect that the BCT provides further its strategy, clearer and more frequent explain the sliding of intermediate targets and greater highlights of the interest rates' roles. In conformity set with the regulations, the BCT must coordinate and support the State's targeted economic policy. With the triggering of the revolution, the BCT was expected to fulfill its function and is independence in decision-making. Yet, the BCT Governor remains still standing as a guarantee of its autonomy. For instance, only 12 changes took place of the Governor's post in 55 years. It is necessary to say that the mandate of the BCT governor is of six renewable years. In what follows, an attempt will be made to understand the changes occurring in the inflation rate over the last four decades. It allows considering that in has been he is slowed down, through the identification of an important inflation with shifting upward trends from one period to another. The 1963-1972 periods was characterized with a tendency to warder of relatively low inflation. Indeed, the average inflation rate over that period as measured by the consumer-, index prices remained at 3.4 %. It was only during of the first oil crisis of 1973 when the inflation accelerated, reaching the rate of 4.1 % further to the increase in the oil price. Starting from 1974, the authorities began to pursue a policy of increasing demand to stimulate economic growth. They increased wages by increasing the foreign exchange supply. Unfortunately, this policy helped only aggravated inflation, which reached the level of 5.5% in 1975. During the following period (1976-1978), inflation declined considerably, and the GDP continued to grow as a result of improved exports and the General Compensation Fund (GSF). The 1979-1982 period coincided with the second oil crisis, which explains the acceleration of the inflation rate starting from 1979, by 10.2 % per year. This accelerated inflation came along with an unfavorable economic situation. Yet, the active period1982-1986 is characterized with a

light deceleration, as the inflation rates proved to vary between 4.1 % in 1982 and 6.3 % in 1986.The years 1984-1986 were characterized with a clear slowing down of the inflation trend.

This evolution could well it's have explanation in the economic recovery appearing during that period, with the exception of the year 1986, further to the improvement of productivity and the compression of the domestic demand that culminated what succeeded in 1986 in an unbearable deficit of the common payments. To cope with the payments balance related crisis, the BCT devalued the TND remarkable, modified its monetary policy and launched the price liberalization program as part of the general economic reforms that were put in place during the period.

As for the period 1987-1990, it was characterized with a stabilization of the inflation rate at around 7.4 %. This result is attributable to a management policy of the domestic demand based on a compression of the public spending in the flexion of the inflation level. The period 1991-1994 was characterized with a reduction in the inflation rate at about 5.7 % on average per year. This decrease resulted from the pursuit of the restrictive budgetary and monetary policies. From the second half of 1994, the inflation rate went up to reach 6.3 % in 1995. This evolution was the result of incidental factors, mainly the increase in world prices for the most part of the imported products and the price drop of certain farm produces. Concerning the period 1996-2002 it witnessed knew an important deceleration of the inflation rate, set at between -1.7 % in 1996 and 2.8 % in 2002. This noticeable reduction in the inflation rate created a favorable and stimulating climate for private investments and helped in to reducing the interest rates, thus encouraging the dynamics of economic activity, job creations and exports. In this context, Khemiri et al, (2013) identified two main inflation systems in Tunisia during the period 2001-2009: a period of low and stable inflation associated with a low level of transmission, and a period of high inflation associated with a high pass-through level. Figure 2 illustrates shows the evolution in inflation rate recorded for during the last two decades in Tunisia.

Figure 2: Inflation rate evolution (1984-2016)



Authors' conception: IFS data

In 2009 and 2010, however, inflation increased slightly and slowly, while remaining moderate. In fact, inflation, as measured by the CPI (consumer price index), reached 3.7% in 2009 and rose to 4.5% in May 2010. This increase was mainly due to the rise in food prices. In 2012, the average annual inflation rate reached 5.6 %, compared to 3.5 % in 2011, mainly because of the rise in prices noticeable in all sets of products, particularly foodstuffs, the prices of which increased by 8.4 % by the end of the preceding year. One particularly, since June, 2012, the inflation pressure became inertial. This rise in inflation may also be due to the rise in domestic demand. The output gap was negative in the post-revolution period ranging, from +1.82 in 2010 to -2.31 in 2011 and -1.95 in 2012. Nevertheless, there was an increase by 0.36 point between 2011 and the third quarter of 2012 (year by year), explained by an overall upward trend of the aggregate demand. In addition, the transfer effects associated with imported inflation through an effective denomination help justify the exchange rate depreciation. Nevertheless, the BCT made indisputable efforts to support the exchange rate through its intervention in the foreign exchange market to adjust the inflation differential with regard to the partners. After completing its full liquidity allocation policy in 2011, the BCT continued in 2013 with the policy initiated in 2012 based on a neutral intervention strategy that rests on the evolution of autonomous liquidity factors. This tendency is justified by the fact that inflation exclusively related to monetary factors relevant to Tunisia.

In December 2013, the BCT decided to introduce the swaps agreements as a new tool of monetary policy in a bid to widen the range of tools that help regulate the banking liquidity and better direct the interbank interest rates. The BCT intended to reinforce the efficiency of its monetary policy in terms of price stability. The inflation was fed in particular by the increase in prices foodstuff, the depreciation of the TND against the Euro, smuggling and the insufficient control of the distribution networks. In 2014, the inflation rate reached 5.5 % then declined to 4.9 % in 2015. The study conducted by Mhamdi and al., (2014) reveled that the administered prices stand as a major obstacle measure, to the interpretation and forecast of inflation. In fact, the BCT has no control over 30 % of the IPC basket. It constitutes a sign of

weakness of the economic system, entailing that the monetary authorities should continue with their efforts to liberalize the prices.

One could, therefore, conclude that inflation has kept on increasing during recent years for various reasons mainly, (lack of supply, continuous depreciation of the TND, current account deficit), which oppressed the Tunisian citizen's purchasing power. The transition to a more flexible monetary regime, namely inflation targeting of, remains a challenge in itself.

In fact, the BCT has become more transparent to the public and more or less independent from the political power, and a big effort has been made by the BCT to analyze and a forecast the short and medium-term inflation. However, it is not sufficient because targeting inflation requires a restructuring of the needs and adjustments at all levels.

4. Empirical Study of the relationship birding between political uncertainty, macroeconomic instability and stock market

In this section, an empirically testing of the effect of political uncertainty on the stock market and macroeconomic aggregates particularly on inflation, exchange rate and stock index 'Tunindex' before and during the Revolution. To this end, we considered to specify and estimate an error-correcting model relating to during the period 1984-2016, which would help us highlight the short-term and long-term effects persisting among the relevant variables.

To examine the relationship between, the Tun-Index, inflation rate, exchange rate and political uncertainty factors, we make appeal to an ECM model after to Engle and Granger (1987). This test requires that the variables in question should be integrated in the same order. We start with determining the variables' integration degree. In other words, we proceed with a stationary test of variables: political uncertainty, Tun-index, inflation and exchange rate, using the Augmented Dickey Fuller test (ADF) and the KPSS test.

4.1. Stationary tests

The results of both of the ADF and KPSS stationary tests prove to indicate that variables inflation, exchange rate, political uncertainty and Tun-indexes are not stationary in level, while becoming stationary following an initial differentiation (Wu, 2000, Kuwornu and Owusu-Nantwi, 2011 and Zhang, 2012).

Table 1: ADF test

Variable	Variables in level	Variables in first difference	5% Critical values	The integration of the variables in level	The integration of the variables in first difference
	Student's statistics	Student's statistics			
Inflation	-1.45	-3.56	-2.85	1	0
Political uncertainty	-1.18	-5.30	-3.55	1	0
Tun-Index	-1.25	-4.24	-3.55	1	0
Exchange rate	-1.399	-5.17	-3.55	1	0
Offset parameter	1	4			

Table 2: KPSS Test

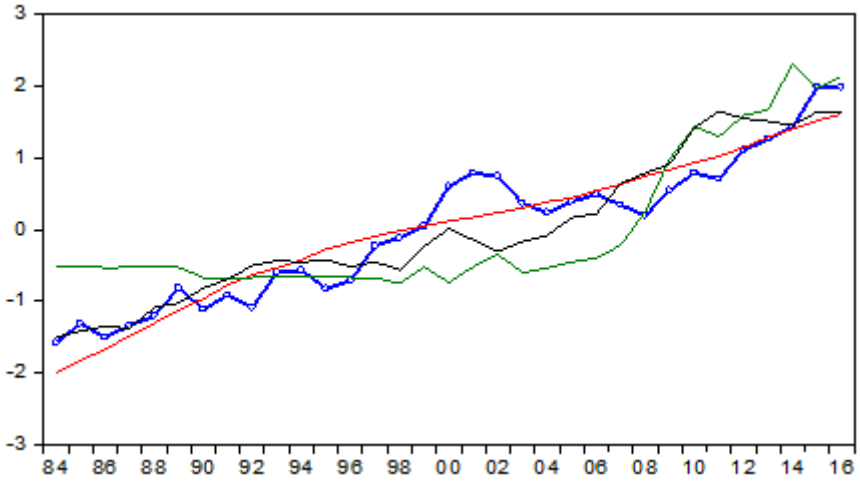
Variable	Variables in level	Variables in first difference	5% Critical values	The integration of the variables in level	The integration of the variables in first difference
	LM Statistics	LM Statistics			
Inflation	0.76	0.42	0.46	1	0
political uncertainty	0.56	0.38	0.46	1	0
Tun-Index	0.64	0.34	0.46	1	0
Exchange rate	0.73	0.20	0.46	1	0
Truncation parameter (l)	2	3			

4.2. Cointegration tests and long-term dynamics

The long-run dynamics persistent between inflation, exchange rate, Tun-Index and political uncertainty, both before and during the Revolution, will be empirically determined through a cointegration test of Johansen. In the case where a long-term relationship appears to prevail among the four variables, Johansen as well as Engel and Granger (1987) prove to specify the persistence existence of at least a dynamic of adjustment among these variables. The weakness associated with Johansen's exogeneity test (1992) allows us to determine weakly exogenous variables that are not weakly exogenous ", which allows us to define the predominant trend of causality between these variables" and the dynamics that characterize them.

Indeed, the cointegration between a numbers of variables indicates the presence of a long-term common trend between them. The possible presence of a long-term relationship between the considered variables indicates the existence of at least an adjustment process adjustment of a variable among four. In our case, we make out whether a long-term relationship does persist between the exchange rate, inflation, Tun-Index and political uncertainty. An examination of Figure 3 highlights that the variables: only the inflation, exchange rate and Tun-Index could be co-integrated, which has not been the case for the four variables, on considering the uncertainty policy.

Figure 3: Exchange Rate Dynamics, Inflation, Tun-Index and Political Uncertainty in Tunisia context (1984-2016)



Authors' conception: IFS data

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It is in fact a graphical analysis that could be contradicted with the Johansen-Juseluis test. Its application must be preceded with a VECM specification that must be jointly used in the cointegration test. The latter's application (see Table 3) indicates that, globally, the VECM must incorporate only a constant vector. The Johansen test result shows the presence of a single long-term relationship between the nominal exchange rate, consumer prices, Tun-Index and political uncertainty (see Table 4).

Table 3: Cointegration test Results: Trace Test

Hypotheses	H0 :	r=0	r⩽1	r⩽2	r⩽3
	H1 :	**r⩾1**	**r⩾2**	**r⩾3**	**r⩾4**
Trace Statistics		66,14*	33,4*	11,56	2,11
Theoretical values		47,85	29,79	15,49	3,84

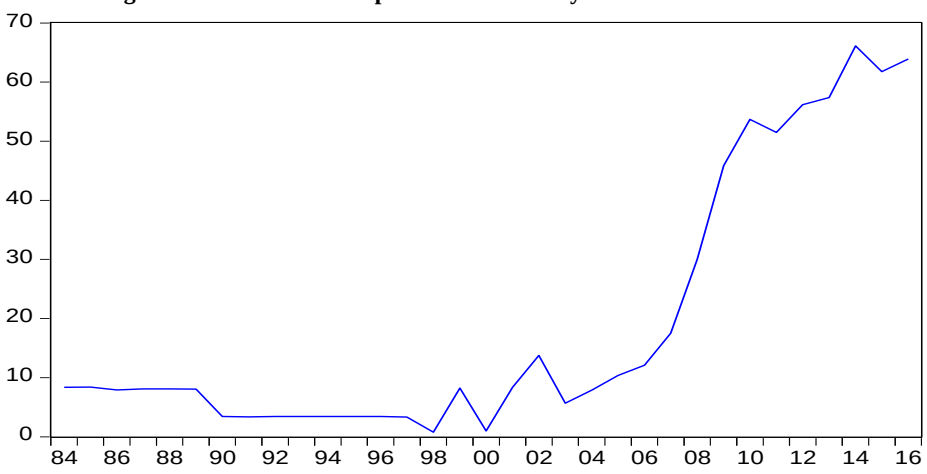
Table 4: Results of the cointegration test: maximum eigenvalue

	H0	r=0	r =1	r =2	r =3
Hypotheses	H1	r=1	r =2	r =3	r =4
Statistics of the maximum eigenvalue		32,74*	21,13	9,44	2,11
Theoretical values		27,58	21,31	14,26	0,25

By normalizing the cointegrating vector against the exchange rate, one could note in the long -run, 1% increase in inflation makes the TND devaluate against the Dollar by 1.3%. This result appears to confirm well the results reached by Dornbusch (1986), highlighting that one of the reasons for monetary depreciation in real terms is the acceleration of inflation. Similarly an, the increase in political uncertainty by 1 % makes the dinar devalue by 0.73 %. In the same sense, Mnif and Kammoun (2015) discovered that political instability is associated with a considerable reduction in local currencies' of value five countries value of the Arab Spring over the period 1992-2016. Our results suggest that a good health of Tunis stock exchange is expressed by a 1 % increase of Tun-Index, which makes the TND appreciate by 0.85 %. A confirmation of this result is also discounted in the work conducted by Lee and Walter (1996). The importance of these parameters with regard to the TND sensibility relevant on the inflation and stock index is recognizable understandable by the Revolution which Tunisia experienced in the beginning of 2011, seriously which affected the macroeconomic indicators.

Figure 4 shows that the indication of political uncertainty began to witness a change in trend and an increase ever since 2004-2005 by 15 points before recording a significant increase starting from 2012 to 2016 exceeding 56.17 points in 2012 to reach 63.89 points in 2016. This economic analysis supposes that the nominal exchange rate appears to undergo a process adjustment (Said not weakly exogenous variable) on behalf of other variables (non-weakly Say weakly exogenous variables).

Figure 4: indication of the political uncertainty in Tunisia: Base-1-2000

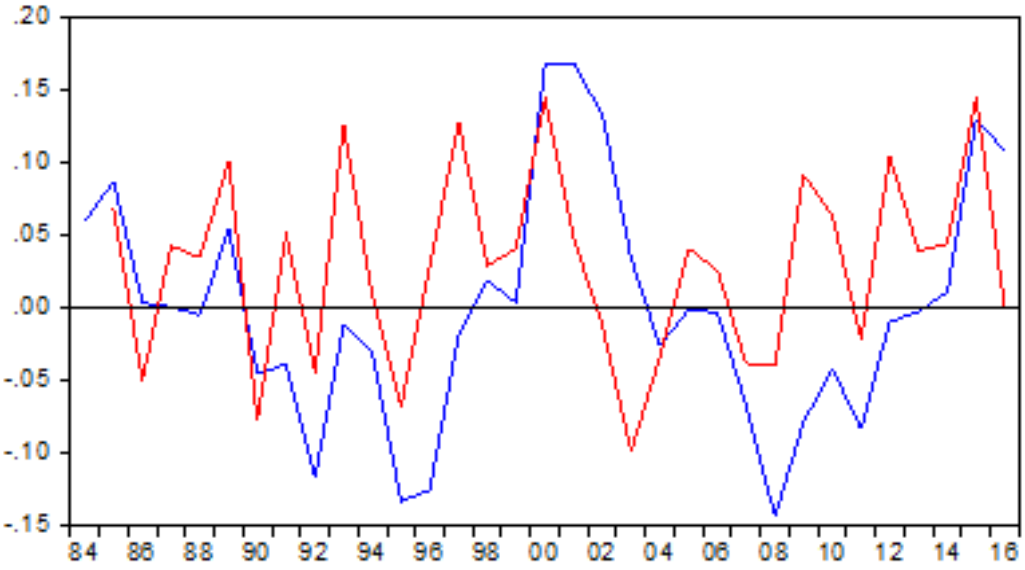


Authors' conception: IFS Data

To confirm the above-figuring economic analysis, we proceed with determining the variable which undergoes an adjustment process by means of the Johansen exogeneity test (1992). The latter supposes the estimation of a VECM as established by the variables: nominal exchange rate, inflation rate, Tun-Index and political uncertainty in Tunisia. Then, we consider determining the strengths of reminder negative and statistically significant. Our attained econometric results appear to indicate that before and during the Revolution, the exchange rate in Tunisia was adjusted by the inflation, but not vises- vase.

Moreover, the stock exchange of Tunis appears to play a noticeable role in adjusting the exchange rate as well as the political uncertainty, as indicated by the weakly exogenous VECM thus contributing significantly in determining the exchange rate dynamics. In effect, it has been discovered that the dynamics of the exchange rate deviations from its equilibrium level are broadly consistent with these relating to the exchange rate absolute increase (see Figure 5). By the end of the 1990 and in the early 2000's up until the year 2008, the TND was relatively in good condition prior to with essing shape to know successive devaluations starting from 2009, which became more remarkable ever since 2011, 'year of the Revolution'. These noticeable dynamics are rather is visualized in the estimated deviations of the TND exchange rate from the equilibrium, since negative are noticeable starting residues from 2000 to 2008, the sign marking a relatively good 'health' for the TND. Actually, starting from the end of the year 2008 did, the deviations change in trend and take a positive pace, indicating a dynamics of devaluation s of the TND, which aggravated in 2011. This economic analysis of the deviations allows us to validate the long-term exchange rate relationship as discovered to persist Johansen technique (1992).

Figure 5: Exchange rate deviations from equilibrium



Authors' conception: IFS Data

Deviations from equilibrium

LEXCH

The acceptance of the long-term econometric relationship (Johansen-Juseluis, 1990) allows us to move on to the second phase, as described expressed by the specification of an error-correction model, where the entirety of the variables will be stationary, enabling the application of the standard significance tests. It is also worth specifying, is that the ECM is interestingly useful for explaining noticeable the increase as divided from a particular variable, in our case, we explain the increase of the TND value from one year to the next, and not the TND real value.

Hence, in so far as the present study is considered, one could well conclude that the long-term dynamics persisting between the exchange rate, inflation, Tun-Index and political instability, before and during the Revolution, may well be interpreted in terms of causality relations which, trend from go to inflation, stock index towards exchange rate. These dynamics were amply confirmed during the revolution as because the inflation witnessed a recurrent w a persistent increase, which was followed with a continuous sliding of the TND. The short-term dynamics between exchange rate, inflation, Tun-Index and political instability, before and during the Revolution, will be highlighted following the estimation of a specific ECM model.

4.3. Short-term and long-term dynamics: estimating an error-correcting model

The empirical highlighting of such a dynamic will follow the estimation of the following theoretical specification:

$$\Delta LCHN_t = \alpha_0 + \sum_{i=1}^{3} \beta_{1i} \Delta LCHN_{t-i} + \sum_{i=0}^{3} \beta_{2i} \Delta LINF_{t-i} + \sum_{i=0}^{3} \beta_{3i} \Delta LINCERPOLI_{t-i} + \sum_{i=1}^{3} \beta_{4i} \Delta LTUNINDEX_{t-i} + \delta ECT_{t-1} + \varepsilon_t$$

The estimation of the specification above via the Ordinary Last Square (OLS) method allows us to clear the short-term effects of inflation, Tun-index as well as political uncertainty on exchange rate.

The long-term effect on the exchange rate, as expressed by the δ imbalance correction term, is captured by the variable 'ECT'. This explanatory variable helps express the exchange rate deviations from equilibrium. Indeed, an important value of δ indicates a

strong correction of the exchange rate according to the country's macroeconomic data, and vice versa.

This adjustment phenomenon can be formalized as follows:

$$CHN_t = CT + CHN_{t-1} + \delta ECT_{t-1}$$

Where: CT expresses the short-term effects or cyclical effects on the nominal TND exchange. Indeed, if ECT_{t-1} is negative, one could well state what can be said that during the preceding year, the exchange rate is below its 'equilibrium' level in other words, less devalued than need be.

Hence, at time t, the exchange rate need be must increased which explains the parameter δ negative character, so that the correction process of the TND value against the dollar (in our case) could be maintained. The econometric results below were reach via the GETS method (Hendry, 1995) to that only the significant variables could be preserved:

$$\Delta LCHN_t = -1.59 - 1.33\Delta LINF_t + 3.45\Delta LINF_{t-1} - 0.91\Delta LINF_{t-3}$$
$$(-2.42) \qquad (3.10) \qquad (-1.65)$$

$$+0.23\Delta LINCERPOLI_{t-2} - 0.0.5\Delta LTUNINDEX_{t-3} + 0.07VM_t - 0.26ECT_{t-1}$$
$$(1.68) \qquad (-1.87) \qquad (2.97) \quad (-2.12)$$

$$R^2=0.59 \qquad DW=2.07$$

The recherad empirical results indicate that the short-run or cyclical dynamics of Tunisia's exchange rate before and during the Revolution were significantly influenced due to the short-run dynamics of inflation, partly because of the Tun-index cyclical dynamics and also by the deviations of the nominal exchange rate from its equilibrium level. This finding may well have its explanation in by the estimated restoring force, which is negative and highly significant. It also is worth mentioning that only 26% of the imbalance of the nominal exchange rate is achieved in relation to the equilibrium. Although this result is the subject an adjustment process, it seems to be non conforming with the fact. One could well state the recall force estimator is biased in as much as it may be good, since we are working on the period 1984-2017, which includes years of 'forced political stability'.

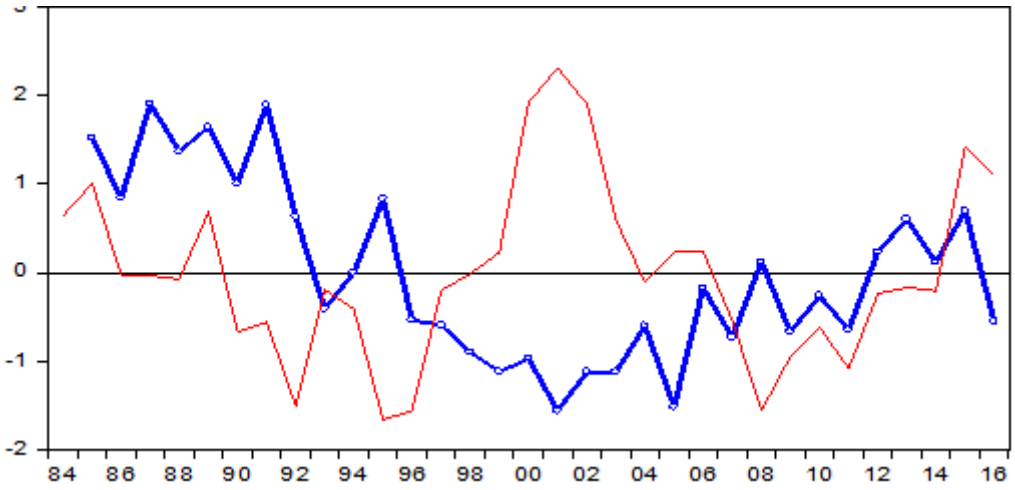
One could also notice that, in the short-term, the exchange rate turns out to be so elastic compared with the inflation, which is not the case in the long run where the elasticity exchange/inflation is considered at 0.58, remarkably lower than 1.3.

With regard to political uncertainty, the short-run elasticity of the exchange rate with respect to this variable appears to be low compared to its long-run level. Futhermore, Even more, in short term, the inflation appears to be the most determining variable in the dynamics of nominal exchange rate. As regard the effect of Tun-Index on exchange rate, the long-term effect seems to be more clearly noticeable in respect of the short-term effect. Thus, the short-term dynamics binding between the exchange rate, inflation, the stock market index and political uncertainty are very much conditioned by the inflation level, which has been significantly political uncertainty amplified Tunisia experienced during the years 2012-2016 a period of galloping inflation of around 5-6% and that persisted for too long. Finally, a dummy variable rated VM, which takes the value 0 concerning ranging the period from 1984 to 2010 and 1 from 2011 to 2016, was introduced into the model to really capture the effect of the Revolution on the nominal exchange rate. This dummy variable appears with a positive estimator (amplification of the TND depreciation) is statistically significant.

The long-run dynamics predominant between exchange rate, inflation, Tun-Index and political uncertainty can be interpreted in terms of the Granger causality (1987). Indeed, the statistical significance of the estimator (δ) proves to indicate the existence of a cointegration relationship between the four variables (Johansen and Juseluis, 1990), along with a causality that trends respectively from the three variables inflation, financial index and political uncertainty towards the nominal exchange rate. Thus, it can be concluded that throughout the study period (1984-2016) and especially during the transition years (not yet finished) as shown in Figure 6, a remarkable shift of the TND against the Dollar, and almost against all the world major currencies, is observed, due to mainly the socio-political environment prevalent in Tunisia and the persistent inflation. In addition, the Tun-Index appears in this causal relationship as a variable that is not significantly decisive not so decisive.

Based on figure 6, one could well mute that the ns of exchange rate deviation from equilibrium and inflation appear to move in the same tendency essentially throughout the period 2010-2016, which confirms of a strong causal relationship attached to inflation, due to mainly political uncertainty affecting the nominal exchange rate. This was not the case during the period 1984-2009, when exchange rate deviations dynamic were are not in line with the inflation dynamics.

Figure 6: Dynamics of inflation and exchange rate deviations from equilibrium



Authors' conception

Cyclical dynamics of inflation

Exchange rate deviations

4. Conclusions

The present work is conceived to investigate the relationship binding the variables exchange rate, inflation, Tunindex and long and short-term political uncertainty before and during the 2011 Revolution in Tunisia. Given the non-stationarity of the variables in question, there was interest in developing an error-correction model. Such a model, as demonstrated by Engle and Granger (1987), requires the search for a cointegration or long-term relationship among between these variables. The Johansen's cointegration test allowed us to identify a long-term relationship between the four studied variables. Finally, in this long-term relationship, exchange appears to be highly sensitive to inflation as engendered by political uncertainty. Through this work, the estimation of an error-correction model enabled us to confirm the existence of a long-term relationship between inflation and political uncertainty, , along with a causal relationship that trend from inflation to the situation of the country's policy towards foreign exchange (Granger, 1987). These empirical results have been highlighted by the statistical significance of the estimator (δ). The short-term dynamics, as persisting between nominal exchange rate, inflation, Tun-index index and political uncertainty, prove to differ remarkably from those discovers with respect to the long run range. The ECM model estimates appear to reveal a high short-term sensitivity of nominal exchange to inflation, which is not the case for the long-run case. In addition, the exchange elasticity, relative to political uncertainty, appears too low compared inflation. Our empirical analysis showed a concordant evolution of the nominal exchange rate deviations from equilibrium and the absolute increase in inflation. These highlights were that the deterioration of the TND during the Revolution period is largely explained by the increase and persistence of inflation as engendered by the country's socio-economic situation fueling inflation. This is due mainly to the short-term dynamics prevailing between the nominal exchange rate, inflation, Tunindex and political uncertainty, which prove to differ noticeably from the long run alerting owes. Such empirical findings lead us to suggest some useful proposals for the Tunisian State, which is confronted with a choice of economic policy to eradicate, or at least attenuate, the country's economic problems in the long run.

Our empirical results have shown that the significantly persistent inflation prevalent during the Revolution has negatively impacted the different sectors' competitiveness, especially w export-destined production. Indeed, as export prices rise, due to inflation, the Tunisian State finds itself obliged to enhance exports through tax reducing measures targeting the abroad oriented sales and must not increase these taxes, as provided by the Finance Act of 2018.

Thus, the relationships in question turn out to be characterized with two-way and unidirectional causalities. It is worth highlighting, however, is that a high endogeneity of Tunisia's nominal exchange rate, where it is determined by inflation and Tunindex. Finally, a wise policy aimed at stabilizing the TND parity and stopping its slide would certainly result in a monitoring of inflation and the maintaining, at an acceptable level, of the competitive potential of the major Tunisian companies, especially the listed ones to avoid the collapse of Tunindex which stands at the origin of the decline noticeable with TND.

This work may well have various implications. In effect, ousting to the political uncertainty prevalent in Tunisia, several financial market and economic environment related factors will affected, more particularly, the decrease foreign direct investments, the fall of the tourism rate and the increase of debts. Meanwhile, among the limits related to our study, one may well cite the can quote the unavailability of certain titles to the Stock Exchange of Tunis, which could have enriched the study and to be reached in the exploration methods. Still, we are well confident findings are liable to further sample size the number of countries making up of the sample along with the institutional variables.

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