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# Exchange Policy and Economic Growth: Effect of the Real Effective Exchange Rate Misalignment on the Growth of Tunisia

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**ABSTRACT** – *The collapse of the system of Bretton Woods pushed Tunisia adopted various policies of exchange to avoid imbalances of the balance of payments. Since, this country aimed to maintain or to improve its external competitiveness in order to balance its current account through the promotion of exports, this contribute to start again the economic growth. By specifying an equation of economic growth of Tunisia, it's showed that the real effective exchange rate misalignment, indicator of external competitiveness, has negative effect on the economic growth. The fall of real effective exchange rate misalignment, these last years, then explained partly the stabilization of the growth rate of this country can especially since 2001 when the Tunisia softened its policy of exchange rate. A flexible policy of exchange is then desirable to start again the economic growth.*

**KEY WORDS:** *exchange policy, real effective exchange rate misalignment, external competitiveness, economic growth, Tunisia*

## Introduction

The nominal exchange rate is defined as the number of units of a foreign currency which are exchanged against a domestic currency unit. In the developing countries, the real exchange rate is often expressed as the multiplication of the nominal exchange rate by the ratio of the domestic prices at the foreign prices (Kamar, 2005). The multilateral exchange rates (effective nominal exchange rate and effective real exchange rate) express the value of the local currency of a country compared to the whole of the currencies of its partners (balanced according to the trade who bind the country concerned to his partners). A fall of the effective real exchange rate represents a rise of the total competitiveness of the country and, conversely, a rise of the effective real exchange rate represents a fall of this competitiveness.

One lays down finally the exchange rate policy like the whole of the public interventions for the choice of a regime of exchange allowing to achieve certain goals.

Since the collapse of the system of Bretton Woods and the generalization of external imbalances, Tunisia chose successively several exchange policies in order to balance its current account and continue to control its capital account. The purpose of it was to maintain

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or improve its external competitiveness and to promote its exports thereafter (for balance of current account). These policies aimed, moreover, to maintain it or to increase in the economic growth. In this article, we seek to know if Tunisia succeeded in balancing and/or to increase its economic growth in its policy of exchange, especially these last years, and if the policy of total liberalization of its of exchange rate envisaged in 2014 is likely to have reflect positive on its economic growth.

The economic growth was always one of the subjects most covered in economy because of the importance of the goodwill for the population and of the diversity of the factors which could influence it. However, the theoretical and empirical studies which treat effect of the exchange policy on the growth remain still rare. Traditional models of balanced or optimal growth do not even take hopes the economic policies of them to explain the growth and the endogenous models of growth perceive the budget policies and of commercial opening like growth promoters but under certain conditions and without evoking the effect which the exchange policy could have on the economic growth.

But the new contemporary theoretical and empirical approaches (Edwards (1988, 1989), Razin and Collins (1997), Domaç and Shabsigh (1999), Béreau, Lopez Villavicencio and Mignon (2009)) study the impact of exchange policy on the growth and this through the effect of real effective exchange rate misalignment (section 1). The real effective exchange rate misalignment is being defined as the deviation of real effective exchange rate from its equilibrium level. An exchange policy which generates a positive real effective exchange rate misalignment resulting in an overvaluation of the currency was often shown to be a source of loss of external competitiveness especially in the developing countries as Tunisia where the external demand for the domestic products is very elastic at the prices. This loss of competitiveness will generate, thereafter, a fall of exports and a deceleration of the economic growth. On the other hand, when the real effective exchange rate misalignment generates an undervaluation of the currency, it could restart again the economic growth (section 2). It will be shown that this assumption is true for Tunisia by specifying an equation of economic growth in which the growth is explained by several macroeconomic variables of which misalignment of the effective real exchange rate (section 3).

### **Theoretical and empirical study of the effect of the misalignment of the effective real exchange rate on the economic growth**

Edwards (1989, 1990) was the first who has studied the effect of the misalignment of the effective real exchange rate on the economic growth in a study on twelve emergent countries during the period 1965-1985. He showed that, more the positive misalignment of the real exchange rate is high, more the growth is weak.

Razin and Collins (1997) stressed that the misalignment of the real exchange rate can affect, on the one hand, the domestic and foreign investment (an overvaluation of the currency is sign of a raising of prices of the domestic goods compared to the international prices) and thus the process of accumulation of the capital and, on the other hand, the competitiveness of the exchangeable goods whose sale abroad constitutes a significant source of the growth in the open economies. I order to show their thesis; these authors used a model in panel for fixed purposes on a sample of 93 countries over the period 1975-1992.



In the same direction, Domaç and Shabsigh (1999) underlined that a bad management of the exchange rate can involve an overvaluation of the currency and a fall of the growth. According to these two researchers of the International Monetary International Monetary Funds, a currency is described as overvalued (undervalued) when its real exchange rate is the highest (the lowest) that its equilibrium level, the real effective exchange rate misalignment being able to refer to these two situations. However, the notion of misalignment was often associated in the case of overvaluation of the exchange rate, especially in the developing countries. For them, the misalignment of the exchange rate has unfavorable effects on the growth through:

1. The loss of external competitiveness by the raising of exports prices, that has for the effects the deterioration of the current balance and the reduction of the exchanges with outside, from where an unfavorable impact on the production.
2. A fall of the foreign investments; indeed, the misalignment of the real exchange rate involves distortions of the prices of the domestic goods compared to the international prices, what has unfavorable effects on the foreign investments thus causing the fall of the production.
3. The unfavorable effect on the domestic financial markets which results by the increase in uncertainty on these markets and in the encouragement of the speculation against the domestic currency. If overvaluation continue, then several companies or banks can fall in bankruptcy because of the speculation; in this last case, the country is likely to pay the full price to save its financial system.

From this report, Domaç and Shabsigh (1999), tried to release the impact of real effective exchange rate misalignment on the economic growth of Egypt, of Jordan, of Morocco and of Tunisia over the period 1970-1995.

They determined the real effective exchange rate misalignment for each country. The authors used three different measurements of the equilibrium of the real effective exchange rate: a measurement according to the purchasing power parity (Cassel (1992), Balassa (1990), Agarwala (1983) and Cottani and al. (1990)), another one utilizing the black market exchange rate premium (Edwards (1989, 1990)) and at the end a measurement using methodology of Edwards (1989) (developed also by Cottani and al. (1990), Ghura and Grennes (1993)) who expresses the real effective exchange rate according to fundamental (terms of trade, trade openness...).

Then, the authors thought equations which express the rate of economic growth (growth rate of per capita GDP) in function of the real exchange rate variability, of the real effective exchange rate misalignment, investments (investments/GDP), growth rate in terms of trade and population growth. These estimates aimed to release the effect of the real effective exchange rate misalignment on the growth. Using the method of ordinary least squares (OLS) to estimate these equations for each country and each measurement of the real effective exchange rate misalignment, the authors found that, in each estimated equation, the real effective exchange rate misalignment had a significant and negative effect on the growth.

The two researchers of the IMF conclude that, during the years 70 and 80, four Arab countries considered (Egypt, Jordan, Morocco and Tunisia) policies of exchange adopted which had as result an overvaluation of the exchange rate. Empirical results found for each



measurement of the real effective exchange rate misalignment, and for each country, underline the unfavorable impact of this last on the economic growth coming from these exchange policies. On the other hand, these authors notice that liberalization and economic policies of reforms proposed by these countries at the end of the years 80 and at the beginning of the years 90 have resulted, in the majority of the cases, a reduction of the misalignment of the real exchange rate and increased by this fact the prospects for growth in these countries.

Béreau, Lopez Villavicencio and Mignon (2009) empirically studied the relationship between the misalignment of the effective real exchange rate and the economic growth. They considered a nonlinear model as a panel for a sample made up of several developed countries and under development. Their results show that:

- There is a positive and significant relation between the growth and the misalignments when the national currency is underestimated. Indeed, according to them, the undervaluation of the currency increases competitiveness, which stimulates the national production, the investment and exports and reduces the imports. It follows an improvement of the current balance, the GDP and employment.
- Overvaluations affect the growth negatively. Indeed, according to them, the overvaluation of the currency is often the consequence of inconsistencies in the decisions of economic policy, leading to an increase in the probability of appearance of crises of balance of payments and exchange, thus harming the economic growth<sup>1</sup>.

### **Effect of the exchange policy on the competitiveness and the economic growth of Tunisia**

Tunisia applied mainly two exchange policies since the fall of the system of Bretton Woods; from 1973 till 1986, Tunisia adopted fixed exchange policy. Since the devaluation of 1986, Tunisia applies the intermediary exchange policy; it set up crawling band policy. This mode consists to target the exchange rate to a basket of currencies and to fix a band of fluctuation; the central rate and band of fluctuation are given according to their objectives and inflation. The monetary authorities proceeded thus:

- From 1986 till 1989, within the framework of the plan of structural adjustment, the central Bank put lower level the nominal effective exchange rate gradually until the real effective exchange rate reaches its equilibrium level (near to 100 according to the theory of purchasing power parity) with an aim of gaining in competitiveness (Domaç, Shabsigh, 1999).
- During the nineties, the nominal effective exchange rate was given so as to keep the real effective exchange rate constant (application of the theory of PPP); the

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<sup>1</sup> For more references on the theoretical and empirical literature on the effect of the misalignment of the real exchange rate on the economic growth, please refer to the PhD thesis of Hadj Amor, Thouraya. (2007). *Variabilité du taux de change réel, intégration financière internationale et croissance économique : une application aux économies émergentes*. University of Nice – Sophia Antipolis, CEMAFI, p. 158-171.



monetary authorities aimed to preserve competitiveness (IMF, 2002). During this decade, an interbank market of exchange was created in 1994, and, in 1997, the approved intermediaries resident and not residents, were authorized in the long term to constitute counterparts in the exchange transactions for the account of their customers resident and this, with the title of the operations of imports of goods and services and of the financial transactions for one duration maximum twelve months and of the operations of export for one duration maximum nine months.

- Until 2001, Tunisia widened the band of fluctuation of nominal exchange rate; this policy was installation with an aim of applying the recommendations of the IMF which aim at softening the exchange policy (IMF, 2003) with an aim of improving competitiveness.

In order to observe the effect of the exchange policy on the economic growth of Tunisia, we chose to study the impact of the real effective exchange rate misalignment, which could provide the exchange policies, on the growth of this country. The real effective exchange rate misalignment, is considered as measurement of external competitiveness of Tunisia owing to the fact that this country produced generally exports of goods (for example the textile) whose elasticity of the request external by report to the prices is very strong (Ben Marzouka and Safra (1994)).

Thus, in the case of Tunisia, the misalignment of the real exchange rate, when it results in an overvaluation of the currency, has negative effects especially on the economic growth through the loss of external competitiveness; indeed, since flows of capital do not circulate freely towards or starting from this country, the misalignment of the effective real exchange rate has few effects on the foreign investments and the financial markets.

## **Empirical study of the effect of the misalignment of the effective real exchange rate on the economic growth of Tunisia**

### **Working method**

We chose to analyze the relation of "misalignment of the of real exchange rate vs economic growth" by using the method of Domaç and Shabsigh (1999) i.e. we will estimate initially the misalignment of the effective real exchange rate of Tunisia then we will study the impact of this last on the economic growth by using the OLS method.

To determine the misalignment of the effective real exchange rate of Tunisia, we estimated the rate of effective real exchange of balance by using the method of El Badawi (1994).

This author defined the equilibrium real effective exchange rate as that which makes it possible to carry out the simultaneously domestic and external balance. The variables which affect these balances are called "fundamentals". Based on the model of Edwards (1989)<sup>2</sup>

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<sup>2</sup> The model of Edwards (1989) of the real exchange rate was prepared for the developing countries. It takes into account the macroeconomic variables which could affect the real exchange rate as the control of the capital and the barriers tariff. It estimates a relation of long term between the real exchange rate and several structural factors which it calls "the fundamental". It thus obtains an



(utilized by Domaç and Shabsigh (1999)), El Badawi has advanced a model improved of determination of the equilibrium real effective exchange rate. He proposed an econometric method (those of the Engle and Granger (1987)) who allows to determine the fundamentals which have a relation of long term and short term with the real effective exchange rate.

For determine the fundamental which defines the real effective exchange rate, it was proceed (Engle and Granger (1987):

- It was selected some economic variables (nominal effect exchange rate, commercial opening, changes in net reserves, terms of trade, the net total flows of the capital, total public consumption compared to the GDP) who can affect the domestic and external equilibrium of Tunisia ; we test the stationnarity (ADF test) of their values taken in logarithms to determine the order of integration of each variable (fundamental variable); if a variable is not integrated of order 1, then we cannot include it in our model.
- The test of co-integration was made (Johansen, 1988) to determine if there is only one or several vectors of co-integration between the variables which were retained. Method of Engle and Granger could be applied only in the first case.
- Once that the assumption of the existence of only one vector of co-integration is checked, it could pass at the first level of the method of Engle and Granger.

We estimate the long term relation between the fundamental ones and the real exchange rate of balance by using the method of the method of « least squares »; where testing the following relation:

$$\log(e)_t = c + \beta_1 \log(E)_t + \beta_2 \log(TOT) + \beta_3 \log(RES) + \dots + \varepsilon_t \quad (1)$$

where:

**log(e)** measured the logarithm of real effective exchange rate defined in the certain of Tunisia,

**log(E)** the logarithm of nominal effective exchange rate defined in the certain of Tunisia,

**log(TOT)** the logarithm of terms of trade (export unit values/ import unit values ) of Tunisia,

**log(RES)** the logarithm of ratio of the Changes in net reserves to GDP of Tunisia.

It is necessary also that the term of error is stationary so that the relation of co-integration is accepted.

- The second step consists in estimating the relation of short term or the dynamic relation (through the OLS method) which is represented by what is called “the model with correction of error”. It should be checked that the coefficient associated with the force of recall is negative and significant. That makes it

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equation of the balance of the real exchange rate by using the method of least squares ordinary. However, in the empirical analyses, the variables are supposed to be independent, but it proves that some among them like, for example, flows of capital, the productivity, the domestic credit and the public consumption, are correlated. Thus, several variables then appeared non significant in the equation. In the model of Edwards, almost all the variables must be included in the equation, otherwise, the estimated equilibrium real exchange rate does not coincide with this model (Zhang, 2002).



possible to conclude that there is a return towards the balance of the effective real exchange rate.

The values of fundamental balance obtained by applying the filter Hodrick-Prescott<sup>3</sup> (Linjouom, 2004) make it possible to determine the values of balance of the effective real exchange rate. The misalignment of the effective real exchange rate is then calculated as the difference between the effective real exchange rate and its level of balance<sup>4</sup>.

The method of calculation of the effective real exchange rate of balance according to the theory of the purchasing power parity was rejected because this theory was very criticized in the literature (Dufrenot, Mathieu and Mignon (2001)), and with fact the object of controversies in work of Williamson (1994), and that using the reference to the black market of the exchange rate was not taken into account because the black market of the currencies is limited in Tunisia.

Then, for studying the effect of the real effective exchange rate misalignment on the economic growth of Tunisia, we have estimated the equation of economic growth for this country. On the basis of estimated equation by Domaç and Shabsigh, we have specified the equation of economic growth of Tunisia for the period 1975-2007, in which we have only retained the following variables: the real effective exchange rate misalignment, the investments and the growth rate in terms of trade, and we have rejected the variables population growth and real exchange rate variability because the population increased in a regular way and the exchange rate was not very volatile in Tunisia the latest decades. With these variables, we added the government expenditure related to GDP and growth rate number of children inscribed in primary education. Indeed, the government expenditure could have an direct effect on the rate of the economic growth through the consolidation of stock of capital of the economy via the public investment in infrastructure or the investment of the public companies, or indirectly, by increasing the marginal productivity of the factors of production offered by the private sector thanks to the expenditure of infrastructure, education like that concerning other public services. However, the rise of the government expenditure could have negative effects on the economic growth through the increase of the budget deficit and the eviction effect which it exerts on the private investments. Indeed, a study of the effect of the government expenditure on the growth in Tunisia showed that during the years 80, increase of the government consumption expenditure involved a rise of the interest rate and, thereafter, a fall of the private investments; it's so called "eviction effect" (Chaabane and Ghorbel, 2005). Moreover, growth rate number of children inscribed in primary education could have an effect on the economic growth of Tunisia owing to the fact that this variable constitutes a measure of the human capital<sup>5</sup>, as the determining factor

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<sup>3</sup> The filter HP breaks up the variables into transitory and permanent components; we retain the permanent components as being the bearable values of the fundamental ones.

<sup>4</sup> To have more detail on the method of calculation of the effective real exchange rate of balance and of the misalignment of the effective real exchange rate, to refer to the article of Sfahi Benahji, H. (2008). « Choix des politiques de change dans les pays en développement : Etude de la compétitivité de la Tunisie », *Panaeconomicus*, n°3, p.353-367.

<sup>5</sup> This variable was selected as a measurement of the human capital because it does not have all the statistics on the rate of schooling in primary education, out of secondary and to the university and on the rates of growth of the number of pupils inscribed in secondary and university education.



of the growth in the developing countries. Indeed, put aside the role that it exerts on the capital as a factor of production, the human capital takes part in the growth of the productivity through the efforts as regards research and development; it contributes thus to the revival of the economic growth. During three last decades, Tunisia showed its will to regard the human capital as factor essential to the growth and this by developing education. However, the participation of education in the qualification of the labor remains weak, which justifies sometimes negative relations between the level of education and the rate of growth. Indeed, for lack of vocational training, a great number of pupils, once finished the school, are found with unemployment (Gabsi and Abdelkafi, 2005)<sup>6</sup>.

Thus, while using OLS method, we estimated the following equation of the economic growth of Tunisia:

$$G_t = \alpha_1 I + \alpha_2 GE_t + \alpha_3 IP_t + \alpha_4 TOT_t + \alpha_5 MES_t + v_t \quad (1)$$

where:

**G** measured growth rate of per capita real GDP of Tunisia,

**I** investment in percentage of GDP of Tunisia measured by variable "gross capital formation" in percentage of GDP,

**GE** government expenditure of Tunisia in percentage of GDP,

**IP** growth rate number of children inscribed in primary education in Tunisia<sup>7</sup>,

**TOT** variation rate in terms of trade of Tunisia, the terms of trade are calculated by the ratio of the export unit values to import unit values,

**MES** estimation of real effective exchange rate misalignment of Tunisia.

## Results and interpretation

The estimation of the effective real exchange rate of long term of Tunisia over the period 1975-2007 gave the following results:

$$\log(e)_t = \underset{(3.78)^{***}}{2.8} + \underset{(13.56)^{***}}{0.96} \log(E)_t - \underset{(-2.48)^{**}}{0.53} \log(TOT) + \underset{(2.92)^{***}}{0.09} \log(RES) \quad (1)$$

$$\overline{R^2} = 0.95$$

$$R^2 = 0.95$$

According to the equation (1'), the appreciation of the effective real exchange rate of Tunisia is the result of the appreciation of the effective nominal exchange rate, of the increase in the reserves of exchange and the deterioration of the terms of trade<sup>9</sup>.

<sup>6</sup>The statistics relating to these variables come from the data bases of the World Bank (World Development Indicators 2009) and of the International Monetary Funds (International Financial Statistics Online 2009).

<sup>7</sup>Data of number of children inscribed in primary education in Tunisia relating to years 1983 and 1987 were added by linear interpolation.

<sup>8</sup>The values between brackets correspond to the test « t of Student », \* mean that the variable is significant to 10% of breaking value, \*\* mean that the variable is significant to 5% of breaking value and \*\*\* mean that the variable is significant to 1% of breaking value.

<sup>9</sup>The total variables commercial opening, net flows of capital and the total public consumption compared to the GDP appeared non significant. Thus, we have not included them in the equation of the effective real exchange rate.





By using the filter HP, we obtain the values of balance of the effective real exchange rate which we use to calculate the misalignment of the effective real exchange rate of Tunisia (the econometric results are detailed in appendix 1 and the misalignment of the effective real exchange rate is represented in graph 1).

Then, the estimate of the equation of the economic growth of Tunisia gives the following results:

$$G_t = 0.5 I - 0.7 GE_t - 0.7 IP_t - 0.01 TOT_t - 0.1 MES_t \quad (2)$$

$(4.9)^{***}$        $(-3.9)^{***}$        $(-4.9)^{***}$        $(-0.2)$        $(-1.8)^*$

$$R^2 = 0.5$$

$$\overline{R^2} = 0.5$$

According to the equation (2'), it is noticed that the variable **TOT** is not significant, what confirms the results of Domaç and Shabsigh. On the other hand, variables **I**, **GE**, **IP** and **MES** have a significant effect on the economic growth and have the awaited signs as predicted by several theoretical and empirical studies.

Indeed, the investment was always an engine of economic growth, initially because of its direct impact on the growth since it is regarded as a component of the final request, with the Keynesian direction of the term; then, whether it is private or public, it can indirectly induce the growth through the increase in the capacities to produce. Moreover, in Tunisia, investment was always one of the explanatory variables of the growth and especially since the introduction of many reforms (tax, etc...) making it possible to encourage the private investments. The government expenditure and the growth rate number of children inscribed in primary education have a negative impact on the Tunisian growth for reasons which one evoked above.

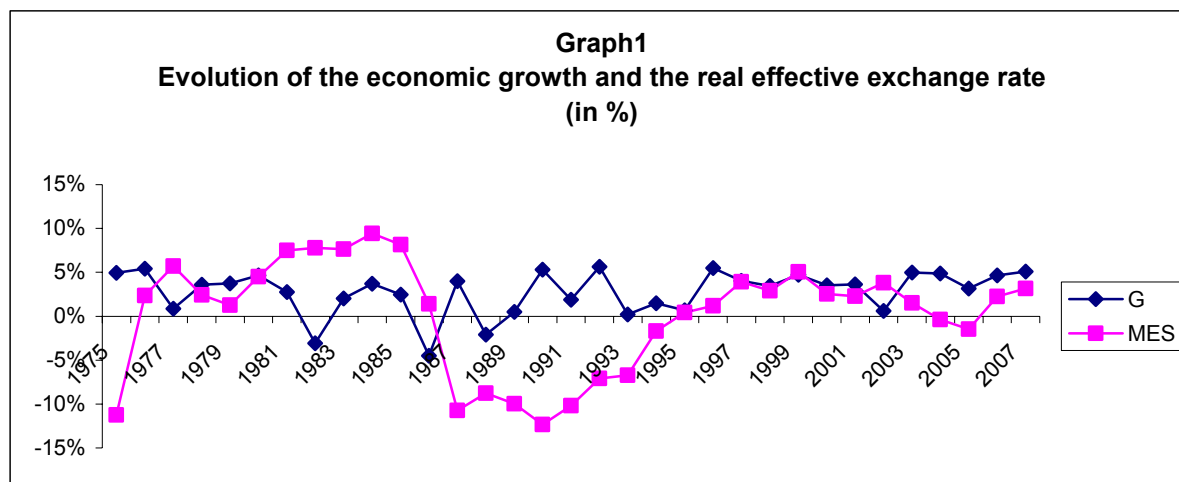
With regard to the real effective exchange rate misalignment, it is noticed that it has a negative and significant effect on the rate of economic growth, i.e., when the value of the real effective exchange rate misalignment is positive, the growth rate drops according to our estimates. So an overvaluation of the currency entrained a loss of external competitiveness and a deceleration of the growth. We could thus conclude that a exchange policy from which entrained an overvaluation of the Tunisian dinar has harmful effects on the economic growth of Tunisia.

On the other hand, when the currency is undervalued i.e. the value of the real effective exchange rate misalignment is negative, then the country gains in external competitiveness and the growth rate increases. This thesis confirms the allegations of the Tunisian authorities which aim, since 2001, cause a drop in the course of the dinar below its equilibrium value (as defined by the theory of the PPP) in order to gain in competitiveness and to start again the growth.

Moreover, by observing the graph 1, it is remarked that the real effective exchange rate misalignment was strongly reduced from 1994, date which Tunisia started to open its foreign exchange market and to liberalize its money market and especially since 2001 (it did not exceed 4%) year where it widened the limit of fluctuation of the rate of exchange. We could remark that starting from this date, the growth rate of per capita real GDP of Tunisia was stabilized and remained positive. Thus, the policy of softening of the exchange rate of caused to reduce the real effective exchange rate misalignment and to encourage the Tunisian economic growth. However, the real effective exchange rate misalignment remains positive



(although in a less proportion), what harms to the economic growth of this country. We thus recommend to Tunisia to continue its policy of softening of the Tunisian dinar, to see to let float its currency in particular in the 2014, because that would make it possible this country to reduce even more the real effective exchange rate misalignment and better promote the economic growth.



Sources: World Development Indicators (2009), author's calculations

## Conclusion

The economic growth depends of several factors where the exchange policy is one of them. This thesis was treated very little by the economic theory; however the exchange rate could play a dominating role to start again the growth. In this study, we estimated the effectiveness of the exchange policies adopted by Tunisia by evaluating the effect of the real effective exchange rate misalignment on the economic growth. Since 1986, Tunisia handled its nominal effective exchange rate in such a way that the real effective exchange rate is stable or below its equilibrium value (according to the theory of the absolute PPP). Consequently, Tunisia started again its growth thanks to the competitive exchange rate. Indeed, we have shown that, a positive misalignment of the effective real exchange rate, as the indicator of loss of competitiveness of Tunisia, has a negative effect on the growth. Since the Tunisian exchange policy aims at cause to drop the real effective exchange rate misalignment, then this policy could have only positive effects on the growth. However, we notice that, in spite of the efforts of the Tunisian authorities, this country continuous to record positive values of the real effective exchange rate misalignment; thus, the flexible exchange policy characterized by the exchange rate more competitive and in conformity with the movements of the market would be adapted better for Tunisia to promote its economic growth.



## Appendix

Picture 1. ADF test on  $\log(e)$ ,  $\log(E)$ ,  $\log(TOT)$  and  $\log(RES)$ 

		<b>Log(e)</b>	<b>Log(E)</b>	<b>Log(TOT)</b>	<b>Log(RES)</b>
	P	1	1	1	1
	Model with trend and intercept	NS (t of trend = -1.86)	NS (t of trend = -2.08)	NS (t of trend = 2.91)	NS (t of trend = 2.56)
I(0)	Model with intercept	NS (t of intercept = 1.83)	NS (t of intercept = 0.96)	NS (t of intercept = 0.73)	NS (t of intercept = -1.35)
	Model without trend nor intercept	NS (t=-1.89)	NS (t=-1.92)	NS (t=-0.64)	NS (t=-0.83)
		<b>D(log e)</b>	<b>D(log E)</b>	<b>D(log TOT)</b>	<b>D(log RES)</b>
	P	1	1	3	3
	Model with trend and intercept	NS (t of trend = 1.05)	NS (t of trend = 0.2)	NS (t of trend = 0.07)	NS (t of trend = 2.41)
I(0)	Model with intercept	NS (t of intercept = -2.1)	NS (t of intercept = -2)	NS (t of intercept = -1.48)	NS (t of intercept = 1)
	Model without trend nor intercept	S in 1% (t=-3.01)	S in 5% (t=-2.57)	S in 5% (t=-1.95)	S in 1% (t=-3.85)

with p : number of lags, NS : Not Stationary (Critical value : 5%), S : Stationary (Critical value : 5%), I(0) :test in level and D(log e), D(log E), D(log TOT) and D(log RES) are first difference respectively of  $\log(e)$ ,  $\log(E)$ ,  $\log(TOT)$  and  $\log(RES)$ .

Picture 2. Co integration test on  $\log(e)$ ,  $\log(E)$ ,  $\log(TOT)$  and  $\log(RES)$ 

Series: LOGe LOGE LOGTOT and LOGRES				
<b>Eigenvalue</b>	<b>Likelihood Ratio</b>	<b>5 % critical value</b>	<b>1 % critical value</b>	<b>Hypothesized No. of CE(s)</b>
0.582732	46.08839	39.89	45.58	None **
0.356215	18.99356	24.31	29.75	At most 1
0.114343	5.341443	12.53	16.31	At most 2
0.049606	1.577242	3.84	6.51	At most 3

\*(\*\*) denotes rejection of the hypothesis at 5%(1%) significance level  
L.R. test indicates 1 cointegrating equation(s) at 5% significance level



Picture 3. Specification of the equation of long term of real effective exchange rate of Tunisia

Variables	Equation
Log(E)	0.96 (13.56)***
Log(TOT)	-0.53 (-2.48)***
Log(RES)	0.09 (2.92)***
C	2.8 (3.78)
R squared	0.95
Adjusted R squared	0.95
ADF test on residu	Model without trend nor intercept stationary in 5% (t=-2.21)

Picture 4. Estimate of the term of correction of error of the equation of the short term of real effective exchange rate of Tunisia

Variable	Coefficient	t-statistic
RESID01 (t-1)	-0.27	-2.2



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