Dynamics of the exchange rate in Tunisia

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Abstract

The exchange rates are at the heart of international economic relations and are an integral part of the everyday landscape of economic agents. The Tunisia like the other country is faced with the problem of determination of the rate of exchange that will allow him to achieve the major balances internal and external. The objective of this research is to explain the rate of exchange to the assistance of a number of explanatory variables to enable managers of the economic policy to appreciate in the time their contribution to economic activity. It is clear from the results of this research that have a positive influence on the equilibrium exchange rate while the external capital and the budgetary deficit have a significant negative impact on the equilibrium exchange rate.

Key words:
Exchange rate, budget deficit, exchange term, monetary mass

Introduction

The exchange rate appears today as a strategic variable because it is the reflection of the relations of independence and of domination between economies. The relationship between external debts on economic growth can differ from one country to the other, taking into account its specificity. In effect, as shown by the results of the empirical work already cited, they remain contradictory as to the nature of the
relationship between external debt and growth, according to the panel of selected countries and the period of the study. The purpose of this research is to highlight, through an empirical analysis, the impact of variables macro-economic (monetary mass, budget deficit, exchange term, external capital) the equilibrium real exchange rate in Tunisia. In this context, the question to which we will try to provide a response to the end of this research is: "What are the determinants of the equilibrium exchange rate in Tunisia. What is the impact of macroeconomic variables (monetary mass, budget deficit, external capital and exchange term) on the rate of real exchange of balance?"

1. Framework of analysis and assumptions

Theoretically, the exchange rate which is the course (price) of a currency (currency) by report to another, represents a macroeconomic instrument is quite important, because it allows among other things to measure the state of health of an economy and to adjust the monetary policy and commercial activities of a country. Of this fact, it may be a brake to its increase if it is not regulated and even controlled.

From a macroeconomic point of view, the real exchange rate is an indicator of competitiveness in the sense that it informs on the report of the domestic prices and external prices of goods and services. If it is low, the residents of a country will tend to buy little good and services abroad. Otherwise, they will have the opposite behavior

1.1. Theoretical justifies

The relationship between the exchange rate and the variables economic macro has been the subject of several empirical work. The exchange rate between two currencies is subject to many factors of influence from a macroeconomic point of view. These factors interact between themselves and it is their confrontation which sets the rate of exchange. This is a very monitored by the different political and monetary authorities. Williamson (1985, 1994) defined the real exchange rate as the rate of ensuring in the medium term to the simultaneous achievement of the internal balance and the external balance. A decline in the real effective exchange rate TCER may mean a depreciation of the local currency, leads to a decline in imports which are becoming more expensive and a rise in exports since the domestic products become more competitive abroad. As well, a depreciation of the local currency has a positive effect on the balance of the current account balance.
The field of application of the exchange rate is very large, we will confine ourselves has four factors that can influence the exchange rate.

**The terms of the exchange (TDE):** This indicator allows therefore to measure the purchasing power of exports in imports, that is to say that there is a measure of the ability of a country to pay its imports thanks to its exports. The terms of the exchange express a relative price external. The shocks of the TE influence the equilibrium exchange rate through the relative price of non-tradable relative to the prices of tradable goods. The exchange term is defined as the relative price of exports relative to the prices of imports. The impact of changes in terms of the exchange on the equilibrium exchange rate is theoretically ambiguous according to the authors as Elbadawi and Soto (1997) Aron et al (1997) and Edwards (1989).

**The flow of capital (KE):** Capital flows affect the relative prices of goods tradable and non-tradable and therefore the equilibrium exchange rate. EDWARDS (1989) shows in his study on the developing countries that an increase of capital flows in the economy leads to an appreciation of the exchange rate. Therefore a relaxation of control of capital flows would lead to a depreciation of the exchange rate. An entry of capital in the economy leads to the appreciation of the TCER; while an output of capital depreciates the TCER. In effect, an entry of capital leads to the increase in the demand of non-tradable and therefore the increase in their price. We expect that the sign assigned to this variable is negative.

**The monetary mass (MM):** an increase of the monetary mass is manifested by an appreciation of the real exchange rate of balance. A decline of the monetary mass is manifested by the depreciation of the equilibrium real exchange rate in effect, any increase of the monetary mass leads to the increase of the prices of tradable goods and to the decrease in foreign exchange reserves.

**Budget deficit (DB):** The dependency of a country from the outside to finance its deficit has of influences on the equilibrium exchange rate. In effect when a nation is recourse to external assistance to finance its deficit this implies in a first time of capital inflows but depreciates in a second time the national currency. Then the volume of debts against the outside to a impact on the equilibrium exchange rate. In general, the more the debt of a country is high, more investors are suspicious. In effect, a level of high debt suggests an uncertainty on the solvency of the country and generates the inflation (which depreciates the value of a currency in the foreign exchange market). Everything is then question of confidence of investors. If the investors have confidence in the country, this has no impact on the exchange rate. On the
other hand, if the investors have doubts as to the ability of a country to repay its debt, its currency will depreciate on the foreign exchange market.

The assumptions that we will test in this regard is the following:

\[ \text{H1. There is a positive effect of the monetary mass on equilibrium real exchange rate} \]
\[ \text{H2. There is a negative effect of budget deficit on equilibrium real exchange rate} \]
\[ \text{H3. There is a negative effect of external capital on equilibrium real exchange rate} \]
\[ \text{H4. There is a positive effect of the term exchange on equilibrium real exchange rate} \]

2. **Research Methodology**

Our study therefore is based on the determination of the factors influencing the equilibrium real exchange rate in Tunisia, the variable used in this study is other than variables macroeconomic. To this effect, the data that will serve as the basis for the analysis are annual data. The data used come from the indicators of the development of the World Bank (World Development Indicators 2015); Statistical Yearbooks of the INSAE, of public finance statistics of the Ministry of Economy and Finance. The period of the study extends from 2000 to 2015 and is justified by the desire to cover a sufficient number of years to identify trends more or less significant.

2.1. **Model and measuring variables**

The main objective of this study is to analyze the impact of macro-economic variables on the rate of exchange of the actual balance in Tunisia. In a specific way, the study is to analyze the rate of exchange in Tunisia and to establish a link between the fundamental factors (monetary mass, exchange term, budgetary deficits and external capital) and the equilibrium real exchange rate in Tunisia by an econometric approach. We consider the following model:

\[ Y_i = a_0 + a_1 X_{i1} + a_2 X_{i2} + \ldots + a_p X_{ip} + \varepsilon_i, \quad i = 1, \ldots, n \]
With: $\varepsilon_i$ is the error of the model which expresses, or summarizes, the missing information in the linear explanation of the values of $Y_i$ from $X_{i1},...,X_{ip}$ (problem of specifications, variables not taken into account, etc.).

$A_0, A_1, ..., A_P$ are the parameters to estimate.

In effect, all the variables in the model have been transformed in logarithmic form.

We believe the coefficients using the following model:

$$\text{TCRE} = a_0 + b_1 \text{MM} + b_2 \text{KE} + b_3 \text{DP} + b_4 \text{Te} + \varepsilon_i$$

It is necessary at this level of our work to clarify our approach given that there are several conceptual models explaining the relationship between the equilibrium real exchange rate and the macroeconomic variables. As well, we will analyze the relationship that exists between the monetary mass, the budget deficit, external capital, the terms of the exchange and the equilibrium real exchange rate.

To this effect, in order to be able to respond to our research questions, we will detail the research variables in defining the practical indicators capable of measuring these variables.

### 2.2. Dependent variable

We studied as the dependent variable the real effective exchange rate that represents the exchange rate of a monetary zone, measured as a weighted sum of the exchange rate with the different trading partners and competitors. We measure the nominal effective exchange rate (with the parities Nominal) and the real effective exchange rate, therefore deflated, with the taken into account for this last price indices and their developments. According to Williamson (1994) the equilibrium real exchange rate is defined as the real effective exchange rate to simultaneously achieve the balances internal and external to the medium term. This real effective exchange rate would be our endogenous variable (macroeconomic approach).

### 2.3. Independent variables

In this study, we are going to retain 4 independent variables:

**The terms of the exchange (TDE):** this is the ratio between the value of the exports and imports of a country during a given period.
The flow of capital (KE): Capital flows affect the relative prices of goods tradable and non-tradable and therefore the equilibrium exchange rate.

The monetary mass (MM): An increase of the monetary mass is manifested by an appreciation of the TCER.

Budget deficit (DB): The dependency of a country from the outside to finance its deficit has an influence on the equilibrium exchange rate.

The whole of these factors involved in the explanation of the relationship between the equilibrium real exchange rate and the macroeconomic variables in Tunisia, can be presented in the following figure:

![Figure 1. Search Model](image)

The figure (1) summarizes the assumptions made. The model established includes the various determinants of the exchange rate that we have been able to identify in the literature.

The empirical study will test the whole of these assumptions to determine, by the explanatory variables, those who are non-discriminatory for the dynamics of the exchange rate.
3. Econometric analysis of the determinants of changes

After having presented our model of research, our assumptions, our sample, the techniques selected as well as the preferred tests, we are going to proceed to the actual analysis of the data, their interpretation and the audit of our assumptions.

3.1. Study of the stationarity

Stationarity of the series in level

We test here the assumptions:

H0: The series in level is non-stationary

H1: The series in level is stationary

The application of the test of unit root test series in level allows us to draw the following table:

<table>
<thead>
<tr>
<th>The variables</th>
<th>TCER</th>
<th>TDE</th>
<th>MM</th>
<th>DB</th>
<th>KE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>With constant AND Trend</td>
<td>With constant AND Trend</td>
<td>With constant AND Trend</td>
<td>With constant AND Trend</td>
<td>With constant AND Trend</td>
</tr>
<tr>
<td>T.statistics</td>
<td>-1.2123</td>
<td>-0.4256</td>
<td>-1.3652</td>
<td>-1.87454</td>
<td>-2.4253</td>
</tr>
<tr>
<td>Critical values (thresholds 5%)</td>
<td>-2.4215</td>
<td>-2.5246</td>
<td>-3.2156</td>
<td>-2.3265</td>
<td>-2.5241</td>
</tr>
<tr>
<td>Likelihood</td>
<td>0.1562</td>
<td>0.2152</td>
<td>0.1289</td>
<td>0.1228</td>
<td>0.3110</td>
</tr>
<tr>
<td>Stationarity</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
<td>Non</td>
</tr>
</tbody>
</table>

The table (1) relating to the ADF test shows a value of t statistics lower in absolute value the critical values at the threshold of (5%). The variables studied are therefore non-stationary. Accordingly to this non stationarity, we turn the test level to the first differentiation (variation of the index).
Stationarity of differentiated series

We test here the hypothesis:

H0: The series in first difference is non-stationary

H: The series in first difference is stationary

The application of the test of unit root test of differentiated series allows us to draw the following table:

<table>
<thead>
<tr>
<th>The variables</th>
<th>TCER</th>
<th>TDE</th>
<th>MM</th>
<th>DB</th>
<th>KE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Without constant Or trend</td>
<td>Without constant Or trend</td>
<td>Without constant Or trend</td>
<td>Without constant Or trend</td>
<td>Without constant Or trend</td>
</tr>
<tr>
<td>T.statISTICS</td>
<td>-1.325</td>
<td>-2.523</td>
<td>-3.42</td>
<td>-2.56</td>
<td>-2.75</td>
</tr>
<tr>
<td>Critical values (thresholds 5%)</td>
<td>-1.31</td>
<td>-1.53</td>
<td>-1.38</td>
<td>-2.26</td>
<td>-1.37</td>
</tr>
<tr>
<td>Likelihood</td>
<td>0.000</td>
<td>0.0021</td>
<td>0.0002</td>
<td>0.0017</td>
<td>0.004</td>
</tr>
<tr>
<td>Stationarity I(1)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The table (2) relative to the ADF test indicates to us that the t statistics of the variables studied are widely higher in absolute value to the threshold of (5%). We conclude that the indices relating to these countries are integrated of order (1) or I(1).

3.2. Test of Johansen

The assumptions of the test are:

H0: Presence at least of a cointegrating relationship
H1: absence of cointegration relationship between the variables

The application of the test of Johansen allows us to draw the table below:

Table 3. Test table of Johansen

<table>
<thead>
<tr>
<th>Null hypotheses</th>
<th>Own values</th>
<th>Trace statistics</th>
<th>Critical Values 1%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No *</td>
<td>0.265368</td>
<td>98.58975</td>
<td>81.32652</td>
</tr>
<tr>
<td>At most 1</td>
<td>0.445263</td>
<td>42.523698</td>
<td>53.42153</td>
</tr>
<tr>
<td>More than 2</td>
<td>0.623598</td>
<td>18.421568</td>
<td>33.12845</td>
</tr>
<tr>
<td>At most 3</td>
<td>0.1256321</td>
<td>14.258984</td>
<td>30.98265</td>
</tr>
<tr>
<td>At most 4</td>
<td>0.162354</td>
<td>10.156942</td>
<td>12.03261</td>
</tr>
<tr>
<td>More than 5</td>
<td>0.062538</td>
<td>4.5212136</td>
<td>8.845682</td>
</tr>
</tbody>
</table>

* indicates that we must reject H1 and go to the second iteration.

The results of the test of the trace for the three countries, we show that the variables studied in the model are cointegrated at the threshold of 5%. The null hypothesis of the absence of cointegration is rejected on the fact that the test of the trace indicates the existence of a cointegrating relationship. The disadvantage of this model is that it does not allow us to detect the direction of causality between the variables.

3.3. Correlation Test

The results of the correlation analysis per capita gross domestic product, rate of investment, debt service, rates of population growth and price index of consumption are represented in the table (4).

Table 4. Matrix of correlations

<table>
<thead>
<tr>
<th></th>
<th>TCER</th>
<th>MM</th>
<th>DB</th>
<th>KE</th>
<th>TE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCER</td>
<td>1</td>
<td>0.44</td>
<td>0.32</td>
<td>0.03</td>
<td>-0.06</td>
</tr>
<tr>
<td>MM</td>
<td></td>
<td>1</td>
<td>0.04</td>
<td>0.20</td>
<td>0.11</td>
</tr>
<tr>
<td>DB</td>
<td></td>
<td></td>
<td></td>
<td>0.09</td>
<td>0.12</td>
</tr>
<tr>
<td>KE</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>0.29</td>
</tr>
<tr>
<td>TE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

The MASE Monetary Affairs is positively correlated with equilibrium real exchange rate. Thus, the variable "external capital" is weakly correlated with the dependent variable. However, the correlations do
not highlight that an association without mean that there is between the variables concerned a causal relationship. In addition, it presents a major inconvenience to never reasoning on more than two variables at a time (TSAPI, 1997). Using the test of multiple regression we will try to answer this question.

3.4. Regression analysis

Table 5: analysis by regression

<table>
<thead>
<tr>
<th>The variables</th>
<th>C</th>
<th>MM</th>
<th>DB</th>
<th>KE</th>
<th>TE</th>
</tr>
</thead>
<tbody>
<tr>
<td>The coefficients</td>
<td>0.45</td>
<td>0.98</td>
<td>0.12</td>
<td>-0.076</td>
<td>-0.08</td>
</tr>
<tr>
<td>Likelihood</td>
<td>0.000</td>
<td>0.065</td>
<td>0.112</td>
<td>0.000</td>
<td>0.001</td>
</tr>
<tr>
<td>Prob (F-statistic)</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>30.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>0.926</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R2</td>
<td>0.904</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on the table (5), we note that the explanatory power of this model is acceptable (R adjusts=0.926) and their overall significance can reject the null hypothesis which stipulates that the coefficients are all zero (F=30.24, p<0.05). The result of the model shows that the sign of connection between the variables studied and the dependent variable (TCER) are statically significant. As it is anticipated the monetary mass and the budgetary deficit have a positive influence on the equilibrium exchange rate respectively (B=0.98 p<0.05; b=0.12 p<0.05). Then, the external capital have a significant negative impact on the equilibrium exchange rate (b=-0.76; p<0.05).

The analysis of the overall quality of the model can be performed through the coefficient of determination of the model (R2). The coefficient of determination explains the part of the variability of the dependent variable which is explained by the exogenous variables considered at the level of the model. Of this fact, this coefficient is equal to 0.92 C is to say that the equilibrium real exchange rate is explained at 0.92, by the variables selected.
The coefficient of exchange term is negative and statistically significant. It indicates that a deterioration of the terms of the exchange of a point would entail a depreciation of the real exchange rate of the balance of the order of 0.08 point any thing equal by elsewhere.

According to the literature the monetary mass has a positive impact with the equilibrium real exchange rate. In accordance with the economic literature, it is clear from our regression that the monetary mass exerts a positive and significant impact on the equilibrium real exchange rate. In effect, an increase of one point of the monetary mass would lead to an appreciation of the level of the real effective exchange rate in the order of 0.98 point, all other things being equal.

For the variable budget deficit, the sign of the coefficient is positive and statistically significant. The budget deficit positively affects the equilibrium real exchange rate. The budget deficit has a positive and significant effect on the real effective exchange rate. An increase of 10 per cent of the level of the budget deficit would lead to an appreciation of the real effective exchange rate in the order of 12 %. This result is not totally disagree with the findings of the theory, this could be explained by the fact that the Tunisia made use of other sources of funding for its deficit other than external capital.

The external capital has negative effects on the dynamics of the equilibrium real exchange rate. Its coefficient indicates that an increase of 10% of external capital, leads a depreciation of the equilibrium real exchange rate of the order of 7.6%. This result is in accordance with the theoretical work that shows that an entry of capital leads to the increase in the demand of non-tradable and therefore the increase in their prices, which devalues the equilibrium real exchange rate.

**Conclusion**

The theory of the exchange rate has been at the heart of the debates in the international trade and finds its focal point in theory international monetary and in the analysis of the determinants that affect the exchange rate. The purpose of this research is thus to develop, through an empirical analysis, the impact of macroeconomic variables on the equilibrium real exchange rate. In the light of the results found in the empirical analysis, we can formulate some recommendations:
The monetary mass and the budgetary deficit have a positive influence on the equilibrium exchange rate.

The external capital has a significant negative impact on the equilibrium exchange rate.

In the light of all the foregoing, it is true that this study has done output the determinants of the equilibrium exchange rate, it ignores the Exogenous Shocks and psychological factors that can influence the exchange rate of the balance of the Tunisia.

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