Economic diversification and misalignment of the REER. Comparative study Algeria/Turkey (1980-2019)

TEBACHE Djamal [1]
Lecturer at Ferhat Abbes University, Setif-1-
djamal.tebache@univ-ecosetif.com

CHETBANI Saida
Lecturer at Abderrahmane Mira University, Bejaia
chetbanisaida@yahoo.fr

Received date: 26.02.2021 / Accepted date: 23.03.2021

Abstract
This paper aims to bounce back on the possibility of drawing inspiration from the Turkish example in an approach consisting in developing and strengthening the competitiveness of foreign trade while preserving the value and stability of the Algerian Dinar. This was done by designing a VECM model, calculating the misalignment and determining the fundamentals that can have a direct link with the REER in Algeria compared to Turkey. This modelling was designed with reference to what is stipulated in the BEER approach, which seems to be the most relevant approach for the case of emerging economies. Obtained results reveal the important role of financial liberalization simultaneously with a diversification of the economy in the stability of the RER. As Turkey has succeeded in recent years in diversifying its economy, it has recorded less misalignment of the REER of its currency comparing to the Algerian Dinar.
Keywords: Economic diversification, Misalignment of REER, BEER approach, Algeria, Turkey
Jel classification Codes : C5, E6, F3

Introduction

Despite the age-old subject of the equilibrium real exchange rate, it is still one of the major concerns of monetary authorities, particularly for developing countries. The latter are reputed to have a fragile monetary system that is sensitive to external shocks in a context of globalization and increased financial liberalization.
Since the beginning of the 1970s, major fluctuations and the possibility of misalignment of the real exchange rate of national currencies (sometimes overvalued and sometimes undervalued) have significantly affected the macroeconomic balance of countries throughout the world, generating a structural dysfunction. This effect is all the more important on economic systems already considered fragile, given the mode of financing adopted (debt savings) and the high inflation rate combined with a weak productive system and the trend towards openness to the international market. Hence the need to determine an appropriate

[1] **Corresponding Author** :TEBACHE Djamal, **E-Mail** :djamalzoom@yahoo.fr

equilibrium exchange rate, which seems to be becoming a regulatory instrument. The purpose of this paper is to calculate the misalignment and thus determine the fundamentals that may have a direct link with the REER in Algeria compared to Turkey. In fact, the DA remains subject to a floating -administered regime whilst the Turkish Lira has in recent years experienced a slight inclination towards free floating. This particularity has enabled the Turkish economy to make a considerable leap in terms of foreign trade and competitiveness, which leads us to wonder about the possibility of taking inspiration from the Turkish example in our approach to enhance the value and stability of the Algerian national currency whilst developing and enhancing the competitiveness of foreign trade.

According to R. Nurkse; the achievement of the various balances, which *de facto* constitute the ultimate objective that meets the expectations of developing countries, requires a high and sustainable level of growth while preserving macroeconomic balances. To this end, it appears that these countries must focus their exchange rate policies on the protection of external competitiveness. These exchange rate policies can be effective with a good knowledge of the relevant variables capable of influencing the determination of the equilibrium real exchange rate. However, it seems indispensable to promote and support a productive system that is supposed to accompany this approach, relying, of course, on the equilibrium real exchange rate which could confront the effects of misalignment.

To do this, it becomes essential to monitor the evolution of the factors explaining the equilibrium real exchange rate. However, developing countries are often confronted with a recurrent problem consisting in identifying and determining the fundamentals for understanding the current context in which the real exchange rate of their national currencies is evolving. It is the relevance of this reflection that leads us to focus our study on the misalignment, and convergence dynamics of the equilibrium real exchange rate in two economies whose national currency is often depreciating. This comparative study is carried out with a view to making an overall assessment of the situation in Turkey, which has experienced a considerable economic leap in relation to Algeria from a monetary and economic diversification point of view.

1. Conceptual framework of REER according to different approaches:

Purchasing Power Parity (PPP) theory states that the equilibrium level of the real exchange rate is based on the theory of the law of one price. This theory is considered to be the simplest design approach and the oldest method of estimating equilibrium exchange rates. However, PPP considers the real equilibrium exchange rate to be constant, which raises another difficulty related to the relevance of this hypothesis to the large fluctuations observed empirically.

In the face of these shortcomings, modern theories of exchange rate determination offer a more comprehensive view of the equilibrium real exchange rate.

1.1. The macroeconomic approach (the FEER fundamental equilibrium exchange rate) :

Proposed by Williamson (1985), the FEER is explicitly compatible with the internal and external balance of the economy. Indeed, in the medium term, the economy is assumed to be at full employment (internal balance) and the external trade balance is characterized by a sustainable level of the current account vis-à-vis other countries (external balance).

1.2. The econometric approach: the behavioural equilibrium exchange rate (BEER) :

Initially introduced by Clark and Macdonald, it proposes to first estimate a

reduced equation that includes all the fundamental economic factors suggested by economic theory, then they test the cointegrating relations between the exchange rate and these variables. Clark and Macdonald admit that the BEER approach decomposes the total misalignment of the exchange rate into three elements: transitory factors, deviations of the variables from their equilibrium values, and a random disturbance. Thus, the BEER is considered to be very useful in explaining the conjectural and cyclical movements of the RCR.

1.3. The dynamic approach: the natural equilibrium exchange rate (NATRAX):

This approach is defined as the exchange rate that ensures balance of payments equilibrium in the absence of cyclical factors. NATREX develops a theoretical model with an interesting distinction between the short, medium and long term.

According to the empirical research that has already been carried out on the determination of the equilibrium exchange rate; the BEER approach seems to be the most relevant approach for developing economies (El badawi II 1994), (Edwards1985), (Hinkel and Montiel1999)). This approach considers the REER as resulting from a cointegrating relationship between the fundamentals and the REER. These economic fundamentals are: terms of trade, capital control, trade control, technical progress and capital movement. However, the REER is affected not only by real variables, but also by monetary variables, which is why macroeconomic policy (fiscal and monetary) must be taken into account in the determination of the REER (monetary variables: budget deficit, excess money supply and real variables: all other variables (other than monetary)).

2. The empirical model

2.1. The economic aspects of Algeria and Turkey: Since the 1990s and under the aegis of the IMF, Algeria has embarked on a long process of structural adjustment in order to achieve major balances. However, due to Mother Nature's generosity and excellent rainfall, oil barrel price levels recorded a sharp increase during the period (1999-2008). This enabled Algeria to recover its major macroeconomic balances, and to build up historic levels of foreign exchange reserves (more than 175 billion USD at the end of 2008). However, this fragile equilibrium, identified by a rent economy dependent on gas and oil, will soon reveal several failures. The economic situation remains characterized by a very low level of industrial production excluding hydrocarbons, a considerable unemployment rate, the effervescence of the informal economy, the permanent depreciation of the DA, growing precariousness, increasingly strong social inequalities, and a failing institutional and administrative environment. These failures can be attributed to the shortcomings of a directed economy. Outside the hydrocarbons sector, investments as well as purchases and production were defined administratively, without reference to social objectives or the market. By way of example, Algeria has set itself an objective since 2012 consisting in maintaining the inflation rate at its lowest levels not exceeding 3% (Ould Hennia.H 2020). However, this objective has not been achieved for the whole period, especially for the last few years, which suggests that in terms of planning the long-term vision and an objective approach is totally absent. Consequently, under these conditions, productivity, the driving force of development, is impossible to sustain. Productivity in Algeria compares unfavorably with other countries.

Turkey, like Algeria, has for a long time been compartmentalized and isolated from the world market by relying on the role of the State at all levels. For its part, it was

confronted with a serious economic crisis during the 1980s and early 1990s. The Turkish lira underwent several devaluation processes making the economic situation uncertain. The mid-1990s was marked by the free trade agreement concluded with the EU as part of the opening up to international competition and trade liberalization. However, this situation heavily affected the value of the national currency, which was already in permanent depreciation. Like Algeria, the Turkish government embarked, towards the end of 1999, on a reform program supported by the World Bank and the IMF, designed to stabilize the economy. This program was brought to a halt by the financial crises of November 2000 and February 2001 (OECD, 2002). This revealed the extent of the damage resulting from the difficulty of undertaking monetary and fiscal reforms in the absence of sound structures. To this end, since then, the Turkish government has prioritized structural reforms. The government's program now focuses mainly on the banking sector, budgetary transparency (including a new law on public procurement), and privatization and, more generally, increased private sector participation in the economy. Indeed, the liberalization process has been under way since the 1980s with the aim of opening up the economy to foreign competition. This option was reinforced with the free trade agreement with the EU. As a result, imports and exports account for more than 40% of GDP. However, in terms of FDI, Turkey remains a region with low attractiveness compared to other countries in the region. In terms of external competitiveness, Turkey has evolved considerably, while in Algeria foreign trade is limited to exports of hydrocarbons, which represent around 96% of total exports. As a result, the REER, which is a variable as well as a criterion of economic stability, suffers differently from the effect of misalignment in the two countries, despite the similarities in terms of aims and starting points. The Turkish currency, as well as the economic situation, seems more comforting in relation to the Dinar and the overall situation of the economy in Algeria.

In what follows, we will attempt to highlight the effect of fundamentals on the degree of misalignment of the REER in the two countries, in order to determine the points of comparison that may allow us to correct certain shortcomings if they exist.

2.2. Description and presentation of data: In our study, we will focus on two countries in the Southern and Eastern Mediterranean, Algeria and Turkey. It covers the period [1980, 2019]. We have used several resources in order to collect a sufficient database. Variables (determinants) are carefully chosen to represent perfectly the economic diversification effect. In the Algerian dinar exchange rate model, we will use six variables to determine the real exchange rate: foreign direct investment (FDI) is noted (FDI), total domestic investment (ADI), public expenditure (PA) and gross domestic product (GDP) are expressed directly in US dollars, terms of trade (T0) and economic openness (OUV).

In the Turkish Lira model, we will use five variables, namely : Trade in services(COM) which is represented by the sum of exports and imports of services as a percentage of GDP, savings (EPAR) is expressed directly in current US dollars, aggregate domestic investment (INV), the ratio of international reserves to total external debt stock(RESD), the terms of trade(TE) and economic openness(OUV).

The data used in this study are collected from World Bank and IMF reports. However, in addition to the unavailability of some important data for our study, it

should be noted that disparities, sometimes marked, exist for several data between the different sources, which may affect the reliability of the data series and the results that are based on them.

2.3 Model with a cointegration relationship: In the first step, the real effective exchange rate was modelled; the modelling procedure adopted is based on two important theoretical properties related to long run equilibrium: the first is the existence in the long run of a steady state relationship between the REER and its fundamentals (a cointegration relationship). The cointegration tests, those of Engel and Granger(1987) and Johannsen in the unbroken case. The second is to have a dynamically stable steady state, to do this we have opted for an error correction model (ECM), the latter describes how the variables respond dynamically to deviations from equilibrium, so we can consider the ECM as a model describing the process of short term adjustment towards long term equilibrium.

As recommended in time series econometrics, before opting for any estimation method, a thorough analysis of the properties of the series is indispensable (Dickey fuller test (1979-1981), Phillips-Perron test (1987-) and KPSS test). The results of the estimation indicate that the data series used are not level stationary and that they are almost all integrated of order I(1). This reveals that a shock to the economy has a temporary effect on the real effective exchange rate. In order to make the best use of these data, we will use a VECM model. Preliminary tests for the detection of cointegrating relations between the different variables studied clearly indicate the existence of cointegrating relations in the system under study. The estimation is carried out according to Johansen's method, applicable to the multivariate case. The trace test indicates the existence of two (02) cointegrating equations at the 5% threshold. The LR ratio test of the maximum eigenvalue indicates the existence of two (02) cointegration equations at the 5% threshold.

2.3.1. Estimation of the VECM model: Estimation of the model using Eviews 9 software allowed us to deduce the following relationship:

2.3.1.1. In the case of Algeria :

$$D\ ltcer\ = c\ 1\ *\ \mathrm{LTCER}\ -1\ -1.8240648916 * \mathrm{LTE}\ -1\ +0.0291923398198 * \mathrm{LIDE}\ -1 + 1.16919453123 * \mathrm{LDP}\ -1\ +\ 0.0794485398362 * \mathrm{LINV}\ -1 - 2.67692196115 * \mathrm{LOUV}\ -1\ +\ 35.2870120047\ +\mathrm{C}(3) * \mathrm{D}(\mathrm{LTCER}(-1)) + \mathrm{C}(4) * \mathrm{D}(\mathrm{LPIBC}(-1))\ +\ \mathrm{C}(5) * \mathrm{D}(\mathrm{LTE}(-1))\ +\ \mathrm{C}(6) * \mathrm{D}(\mathrm{LIDE}(-1)) + \mathrm{C}(7) * \mathrm{D}(\mathrm{LDP}(-1))\ +\ \mathrm{C}(8) * \mathrm{D}(\mathrm{LINV}(-1))\ +\ \mathrm{C}(9) * \mathrm{D}(\mathrm{LOUV}(-1)) + \mathrm{C}(10) * \mathrm{D}(\mathrm{LTCER}(-2))\ +\ \mathrm{C}(11) * \mathrm{D}(\mathrm{LPIBC}(-2))\ +\ \mathrm{C}(12) * \mathrm{D}(\mathrm{LTE}(-2))\ +\ \mathrm{C}(13) * \mathrm{D}(\mathrm{LIDE}(-2))\ +\mathrm{C}(14) * \mathrm{D}(\mathrm{LDP}(-2))\ +\ \mathrm{C}(15) * \mathrm{D}(\mathrm{LINV}(-2))\ +\ \mathrm{C}(16) * \mathrm{D}(\mathrm{LOUV}(-2))\ +\ \mathrm{C}(17)$$

$$D\ ltcer\ = \mathbf{-0.246794} *\ \text{cointég tcer}\ +0.130206 * \mathrm{D}(\mathrm{LTCER}(-1))\ -0.003016 * \mathrm{D}(\mathrm{LPIBC}(-1))\ -0.069951 * \mathrm{D}(\mathrm{LTE}(-1))\ +\ 0.013722 * \mathrm{D}(\mathrm{LIDE}(-1)) + 0.032657 * \mathrm{D}(\mathrm{LDP}(-1))\ -0.326690 * \mathrm{D}(\mathrm{LINV}(-1))\ -0.293840 * \mathrm{D}(\mathrm{LOUV}(-1))\ -0.645274 * \mathrm{D}(\mathrm{LTCER}(-2))\ -1.179327 * \mathrm{D}(\mathrm{LPIBC}(-2)) + 0.178386) * \mathrm{D}(\mathrm{LTE}(-2))\ +\ 0.003625 * \mathrm{D}(\mathrm{LIDE}(-2))\ +0.071693 * \mathrm{D}(\mathrm{LDP}(-2)) - 0.222200\ * \mathrm{D}(\mathrm{LINV}(-2))\ -0.763146 * \mathrm{D}(\mathrm{LOUV}(-2)) - 0.007240$$

From the above it can easily be seen that C(1)= -0.246794. This coefficient means that shocks to the real effective exchange rate are corrected by 24.67% by the "feed back" effect; in other words, 24.67% of the imbalance between the desired and effective level of the exchange rate is adjusted.

The long-term equilibrium real exchange rate, according to the fundamentals studied, can be expressed as follows:

$$LTCER_t = 1.824064 * LTE_{t-1} - 0.0291923398198 * LIDE_{t-1} - 1.16919453123 * LDP_{t-1} - 0.0794485398362 * LINV_{t-1} + 2.67692196115 * LOUV_{t-1} - 35.2870120047 + \mu_t$$

μ_t : is a stationary term that summarizes short-term transitory shocks

A 1% increase in public expenditure will lead to an appreciation of the real effective exchange rate of 1.1691.

The impact of government expenditure is positive and significant, its effect depending on the relative importance of tradable and non-tradable goods in the economy (Froot and Rogoff, 1991). If government spending increases in the non-tradable goods sector, this will have a positive effect on the real exchange rate.

The impact of local investment is positive and significant in the real exchange rate model, a 1% increase in investment will appreciate the real effective exchange rate by 0.07944. Such results assume that the effect of the investment rate can be both positive and negative (depending on the final "dominant" effect), as the increase in investment can translate into an increase in demand for non-tradable goods, which leads to the appreciation of the RER. However, the investments made may result in an improvement in the quality of the economic infrastructure and the productive apparatus, on the one hand. They can also contribute to the training of the local Labor force (e.g. construction and equipment of training centers) and the increase in capital intensity facilitates the learning process. These factors contribute to productivity gains for domestic enterprises. Thus, the increase in the investment rate provokes a confrontation between the factors, which contribute positively to the appreciation of the RER, and those which contribute negatively. If the former dominate, the effect will be positive, otherwise it will be negative (Yaya S. Camara 2014).

The relationship between openness and REER is negative, greater trade liberalization leads to a depreciation of the REER because it allows an increase in trade and price convergence. This has been endorsed by Baffes et al (1999) who consider that the rate of openness in the case of developing countries is marked by a greater increase in imports, which leads to the depreciation of the REER.

With regard to the impact of FDI, the results of the estimate indicate that it is positive and significant, an increase in FDI of 1% will reduce the real effective exchange rate by 0.02919 (a real appreciation).

FDI is associated with maintaining competitiveness, in line with the work of Authukorala and Rajapatirana (2003); Saborwosky (2009); Ben Naceur et al (2012) and Combes et al (2012). A set of factors that can justify the benefits of FDI that provides technological and managerial transfer and improves local productivity through the importation of machinery; capital goods and raw materials. In addition, they contribute positively to the development of the export sector (Athukorala and Rajapatirana (2003)) and (Jongwanich (2010)) and the consumption of tradable sector goods (Saborosky (2009)).

In the short run, only the lagged real effective exchange rate has a significant coefficient of (-0.6452), foreign direct investment and trade openness have coefficients of 0.013722, -0.7631 respectively, the other variables in the model

(government expenditure, terms of trade and local investment) all have insignificant effects on the real effective exchange rate.

To provide strong support for the results of the error-correction model, we are interested in residual-based tests, which aim to verify that the residuals of the ERM model are stationary, and are indeed white noise.

2.3.1.2. In the case of Turkey :

$$D\ ltcer\ = c\ 1\ *\ \text{cointég tcer}\ )\ +\ C(3)*D(LTCER(-1))\ +\ C(4)*D(LINV(-1))\ +\ C(5)$$
$$*D(LCOM(-1))\ +\ C(6)*D(LEPARP(-1))\ +\ C(7)*D(LRESD(-1))$$
$$+\ C(8)*D(LTE(-1))\ +\ C(9)*D(LTCER(-2))\ +\ C(10)*D(LINV(-2))$$
$$+\ C(11)*D(LCOM(-2))\ +\ C(12)*D(LEPARP(-2))\ +\ C(13)$$
$$*D(LRESD(-2))\ +\ C(14)*D(LTE(-2))\ +\ C(15$$

$$D\ ltcer\ = -0.165351$$
$$*\ \text{LTCER}\ -1\ +\ \ 0.610871387323*\text{LCOM}\ -1$$
$$-\ 3.03707520452*\text{LEPARP}(-1)\ +\ 0.972191047165$$
$$*\text{LRESD}(-1)\ -0.188310681233*\text{LTE}(-1)\ +\ 1.48837731387\ )$$
$$+\ 0.722603*D(LTCER(-1))\ -0.001105*D(LINV(-1))$$
$$+0.109176*D(LCOM(-1))\ +\ 0.123755*D(LEPARP(-1))$$
$$-0.106328*D(LRESD(-1))\ +\ 0.192320*D(LTE(-1))$$
$$+\ -0.623629*D(LTCER(-2))\ +\ 0.006213*D(LINV(-2))$$
$$+0.060425*D(LCOM(-2))\ +0.073001*D(LEPARP(-2))$$
$$+\ 0.092412*D(LRESD(-2))\ +\ 0.004960*D(LTE(-2))$$
$$-0.032013$$

The long-term equilibrium real exchange rate, based on the fundamentals under consideration, can be expressed as follows:

$$LTCER_t = -0.610871387323*LCOM_{t-1} -\ 3.03707520452*\text{LEPARP}_{t-1}$$
$$-\ 0.972191047165*\text{LRESD}_{t-1} + 0.188310681233*\text{LTE}_{t-1}$$
$$-\ 1.48837731387 + \mu_t$$

μ_t : is a stationary term that summarizes short-term transitory shocks

The variables: trade in services, domestic savings, foreign exchange reserves in relation to external debt service have an appreciating effect on the real exchange rate (a fall in the number of units of the national currency against the dollar). On the other hand, the terms of trade have an effect of real depreciation of the real exchange rate, in the long term. These effects are very easily explained in accordance with theoretical models of the real exchange rate.

Our results show that an increase in the ratio of foreign exchange reserves to total external debt service of 1% will lead to an appreciation of the real effective exchange rate of 0.9721.

This ratio reflects a country's ability to service its external debt with foreign exchange reserves; 40% being the optimal proportion (Brown(1964)).

In general, the higher a country's debt, the more distrustful investors are. Indeed, a high level of debt suggests uncertainty about the country's solvency and generates inflation (which depreciates the value of a currency on the foreign exchange market). It is then all a question of investor confidence; if investors have confidence in the country, it has no impact on the exchange rate. On the other hand, if investors have doubts about a country's ability to repay its debt, its currency will depreciate in the foreign exchange market.

Regarding the savings rate, Lim and Stein (1997) suggest that a rise in the savings rate has direct and indirect effects on the relative price of non-tradable goods. According to these authors, an increase in the savings rate reduces consumer demand for non-tradable goods, which leads to a decrease in their prices. Therefore, the direct effect of this increase in savings would be a depreciation of the real exchange rate. On the other hand, an increase in savings would have indirect effects in the opposite direction on the relative price of non-tradables, i.e. on the real exchange rate. Lim and Stein (1997) indicate that the indirect effect of an increase in long-term savings leads to lower debt (f) and higher capital (k) levels. A higher level of capital (k) and a lower level of debt increase the wealth (k - F) of consumers; this increase in wealth increases the consumption of non-tradable goods as well as their price level. In this case, the indirect effects of an increase in savings appreciate the real exchange rate by increasing the relative price of non-tradable goods. Lim and Stein (1997) find that the indirect effects of an increase in savings will dominate the direct effect and that this increase in the savings ratio will lead to an appreciation of the real exchange rate.

Our results show that, for the Turkish economy, the direct effect is dominant, and therefore its increase has a positive effect on the real exchange rate by appreciating it.

Concerning foreign trade in services has a positive effect on the real value of the exchange rate; an increase in trade in services of 1 will lead to an appreciation of the RER by 0.61087. Indeed, Turkey has dared to open up to international competition since 1980, its objective was to reinforce its productivity while achieving its major balances, this aim seems to have been achieved in relation to the stability of the RER of the national currency.

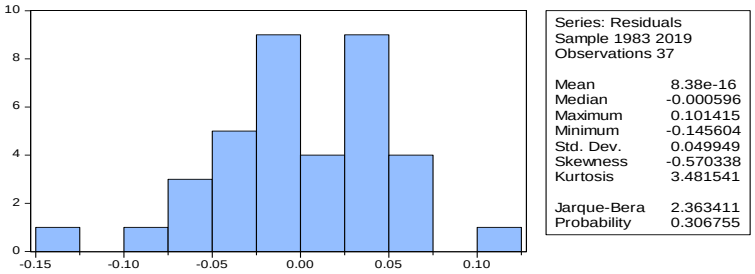
The results also indicate that there is a short-term relationship between the real effective exchange rate and the delayed exchange rate, foreign exchange reserves in relation to debt servicing, savings, local investment and trade in services.

2.3.2. VECM diagnostic tests: To support strongly the results of the error-correction model, we are interested in residue-based tests, which aim to verify that the residuals of the VECM model are stationary, and are indeed white noise.

Residuals stationarity test: The results of the stationarity tests (ADF- PP- KSPP) for the VECM residues indicate that they are stationary in level (see appendix n°02).

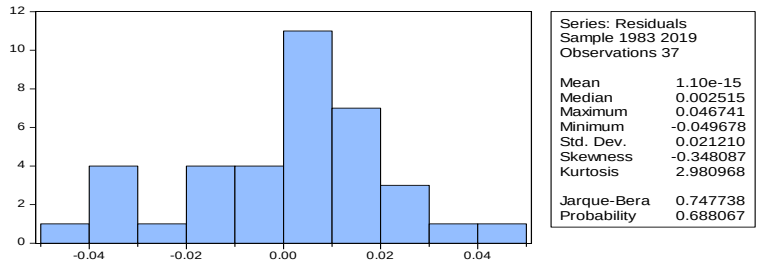
Normality test: The Jarque and Berra (1984) test, based on the notion of Skewness (asymmetry) and Kurtosis (flattening), makes it possible to verify the normality of a statistical distribution.

Figure No. 01: Normality Test of the DA's VECM



Source: Produced by the author using the Eviews software.

Figure n°02 : LT VECM normality test



Source: Produced by the author using the Eviews software.

In the table on the right we have the three statistics: Skewness, Kurtosis and Jarque-Bera. Jarque-Bera has a probability of 0.306755 and 0.688067 for Algeria and Turkey respectively, which is greater than 5%, which means that we accept the null hypothesis of normality of the error terms or residuals.

Heteroscedasticity test: One of the key assumptions of linear models is the assumption of homoscedasticity, i.e. the residuals (error terms) of the model have the same variance. At this level, it is checked whether the errors maintain a constant variance throughout the period.

Table 01: Heteroskedasticity Test of the VECM of the DA

F-statistic	0.433349	Prob. F(21,15)	0.9614
Obs*R-squared	13.97126	Prob. Chi-Square(21)	0.8708
Scaled explained SS	5.065048	Prob. Chi-Square(21)	0.9999

Source: Produced by the author using the Eviews software.

Table n02: Heteroskedasticity Test of LT VECM

F-statistic	1.456563	Prob. F(18,18)	0.2164
Obs*R-squared	21.93830	Prob. Chi-Square(18)	0.2347
Scaled explained SS	7.682321	Prob. Chi-Square(18)	0.9830

Source: Produced by the author using the Eviews software.

Breusch-Godfrey Test :

Table 03: Serial Correlation LM Test of the DA's VECM

F-statistic	0.792191	Prob. F(2,18)	0.4680
Obs*R-squared	2.993311	Prob. Chi-Square(2)	0.2239

Source: Produced by the author using the Eviews software.

Table 04: Serial Correlation LM Test of the LT VECM

F-statistic	0.082494	Prob. F(2,21)	0.7768
Obs*R-squared	0.144778	Prob. Chi-Square(1)	0.7036

Source: Produced by the author using the Eviews software.

The probability of the Breusch-Godfrey test (Prob. Chi-Square(1) = 0.2239, 0.7036) for Algeria and Turkey respectively) is greater than 5% which means that we accept the null hypothesis of non-self-correlation of the error terms**.**

3. The equilibrium real exchange rate and misalignment:

3.1 Calculation of misalignment

One of the objectives of determining the fundamentals of the real exchange rate is to measure the deviation of the real effective exchange rate from its equilibrium value. In order to measure the degree of misalignment, we use the long-run static equation to obtain estimates of the equilibrium real exchange rate. To do this, however, we need to know which values of the fundamentals to use in the equation. Most authors choose to replace the sustainable fundamentals by moving averages centered on several years (4 to 5 years in most cases, (Edwards (1989), El Badawi(1994)) of the observed fundamentals. We then use the following formula (Lee J.et al(2008)):

$$MIS = \frac{REER - REER^{*}}{REER^{*}} * 100\%$$

REER: the observed real effective exchange rate index

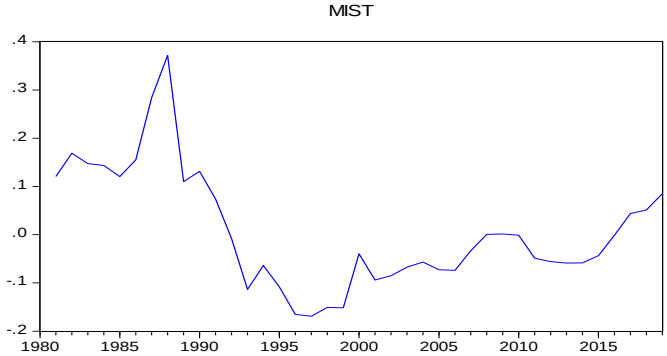
$REER^{*}$**:** The real effective exchange rate estimated from the long-term relationship.

If MIS = 0 %, the observed real effective exchange rate is in line with its equilibrium level, there is no real exchange rate disequilibrium.

If MIS>**0%**, This reflects an overvaluation of the real effective exchange rate.

If MIS<**0%**, This reflects a real undervaluation of the effective exchange rate.

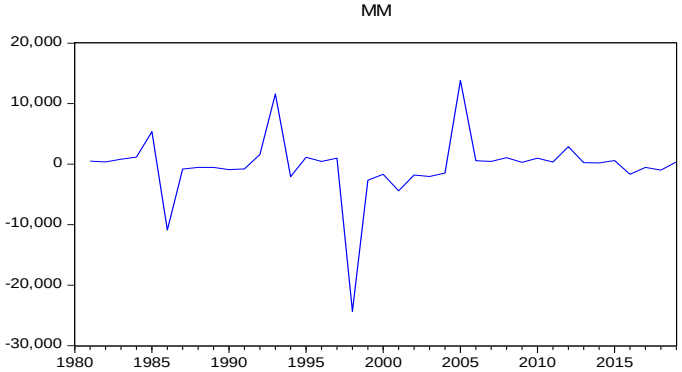
Figure n°3: Calculation of the misalignment of the DA's RER for the period (1980-2019)



Source: Produced by the author using the Eviews software.

The calculation of the misalignment allowed us, with the help of the Eviews software, to obtain the above graph. It is easy to see a period of strong overvaluation (1980-1990), which was followed by a period of undervaluation between 1990 and 2000. With the suspension of payments in 1994, the rescheduling of the external debt and the directives imposed by the IMF, the exchange rate was fairly competitive, which enabled Algeria's economic growth to be revived throughout the period 1994 -1996. During the period 2000 -2015 the REER of the Algerian Dinar fluctuated within a narrow range; it remained close to its equilibrium level, throughout this period, the improvement in foreign exchange reserves played a stabilizing role on the REER of the Dinar. However, the REER remains unstable overall, sometimes over- and sometimes undervalued, which calls into question the major balances.

Figure n°4 : Calculation of the misalignment of the RER of the Turkish lira for the period (1980-2019)



Source: Produced by the author using the Eviews software.

Since the liberalization of its economy in the 1980s, the Turkish lira has been subject to real overvaluation, reaching its peak in 1988. During the period from 1990 to the end of 1993, the real effective exchange rate remained close to its equilibrium level; this stability was confronted by serious macroeconomic imbalances and the reduction in Turkey's credit rating which triggered a rapid fall in the pound. As a result, in 1996 the real exchange rate appreciated by more than 3.23% compared to its 1994 value and compensated for the devaluation carried out by the government at the beginning of the stabilization program (the Central Bank of the Turkish Republic implemented a policy of inflation targeting with the aim of economic recovery). This significant appreciation continued until the end of 1999, and was reinforced by the signing of the Customs Union Agreement with Europe.

Coming to the year 2001, it can be seen that the effect of the fall in external and internal demand on the exchange rate, resulting from the severe economic crisis, can be clearly observed in this figure; the real exchange rate of Turkey remains undervalued throughout 2001 and 2002. However, this instability lasted until 2003, when the REER fluctuated significantly, but it always remained close to its equilibrium value. The world economic situation (crisis of 2007/08 and the war in Syria) had its effect on the Turkish economy, and the REER was overvalued during this period. Since 2006 the TCR of the Turkish Lira has not been subject to fluctuations and has been clearly stable.

Conclusion

By way of conclusion, it can be stated that despite the economic similarities between Algeria and Turkey, the determinants of the REER differ from one country to another. This can be explained by the exchange rate regime adopted, which is relatively administered. Thus, the misalignment of the REER cannot be objectively explained, in some cases, by relying on the PPP approach. Moreover, the BEER approach has demonstrated its effectiveness in this study, especially since it allows us to identify the fundamentals in addition to calculating the degree of misalignment.

The other observation to be made in this study is the role of financial liberalization, economic diversification and the importance of the free floating exchange rate regime. Turkey having opted for this exchange rate regime in recent years has recorded less misalignment of the REER of its currency in relation to the Algerian Dinar, which continues to fluctuate away from its equilibrium value.

In fine, it can be said that the results obtained corroborate, in an overall manner, the prediction of economic theory, and agree with most of the empirical studies carried out. Consequently, the estimated models can constitute an analytical tool for researchers and monetary authorities, allowing them to make rational decisions, especially in an era marked by the opening up of the world market with all the resulting uncertainties regarding monetary shocks.

Referencies:

- Athukorala, P. C., and S. Rajapatirana (2003): Capital Inflows and the Real Exchange Rate: A Comparative Study of Asia and Latin America, World Economy, Vol. 26, Issue 4
- Baffes J.et al. (1999), «Single Equation Estimation of the Equilibrium Real Exchange Rate», in Hinkle L. and Montiel P.J., (ed.), Exchange Rate Misalignment: Concepts and Measurement for Developing Countries, Oxford University Press.
- Ben Naceur S.et al. (2012), «Disaggregated Capital Flows and Developing Countries' Competitiveness.», World Development 40.
- Combes, J. L., T. Kinda, and P. Plane (2011): Capital Flows, Exchange Rate Flexibility, and the Real Exchange Rate, International Monetary Fund Working Paper WP/11/09.
- Edwards S. (1989), «real exchange rate; devaluation and adjustment: exchange rate policy in developing countries », the MIT press, Cambridge, Massachusetts.
- Edwards S. (1987),« Exchange rate misalignment in developing countries», CPO working paper n°442, the World Bank, Washington.
- Elbadawi I. (1994),«Estimating Long Run Real Exchange Rates, in Estimating Equilibrium Exchange Rates», ed. by J. Williamson (Washington: Institute for International Economics).
- FROOT, KENNETH A. AND ROGOFF, KENNETH. "The EMS, the EMU, and the Transition to a Common Currency," in National bureau of eco- nomic research macroeconomics annual. Eds.: STANLEYFISCHER AND OLIVIER BLANCHARD. Cambridge, MA: MIT Press, 1991
- Hinkle L. E., Montiel P. J. (1999),« Exchange Rate Misalignment. Concepts and Measurement For Developing Countries», Oxford University Press.
- Jongwanich, J. (2010). Determinants of export performance in East and Southeast Asia. World Economy, 33(1), 20–41.
- Jongwanich, J., 2010. Capital flows and real exchange rates in emerging Asian countries. Asian Development Bank, 210.

- Lee J. et al.(2008),« Exchange rate assessments: CGER methodologies», Occasional paper 261, International Monetary Fund.
- Lim et Stein (1997), "The dynamics of the real exchange rate and current account in a small open economy: Australia », Clairendon press, Oxford.
- Nurkse R. (1945), « Conditions of international monetary equilibrium », Essays in international finance Review n°4, Princeton University, New Jersey.
- Yaya S. C. (2014),«Régimes de change et performances économiques en Afrique Sub-saharienne», thèse doctorat en science économique, Université de Nice Sophia Antipolis, Paris.
- Ould Hennia.H (2020), « étude économétrique de l'efficacité de la politique monétaire en Algérie (1990-2017) :Approche par le modèle ARDL », Revue Algérienne d'économie et de gestion, Vol 14, n°2, 2020, p427-442
- Saborwsky, C, 2009. Capital inflows and the real exchange rate; can financial development cure to the dutch diseases? IMF Working Paper 09/20.

Appendices:

Appendix n°1:

Dependent Variable: D(LTCER)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 01/08/21 Time: 19:10
Sample (adjusted): 1983 2019
Included observations: 37 after adjustments
D(LTCER) = C(1)*(LTCER(-1) - 1.8240648916*LTE(-1) + 0.0291923398198 *LIDE(-1) + 1.16919453123*LDP(-1) + 0.0794485398362*LINV(-1) - 2.67692196115*LOUV(-1) +35.2870120047) + C(2)*(LPIBC(-1) + 0.661520939106*LTE(-1) - 0.0046828115314*LIDE(-1) - 0.585286847296*LDP(-1) - 0.200410054503*LINV(-1) + 0.0176903835918*LOUV(-1) - 10.2022371334) + C(3)*D(LTCER(-1)) + C(4)*D(LPIBC(-1)) + C(5)*D(LTE(-1)) + C(6)*D(LIDE(-1)) + C(7) *D(LDP(-1)) + C(8)*D(LINV(-1)) + C(9)*D(LOUV(-1)) + C(10)*D(LTCER(-2)) + C(11)*D(LPIBC(-2)) + C(12)*D(LTE(-2)) + C(13)*D(LIDE(-2)) + C(14)*D(LDP(-2)) + C(15)*D(LINV(-2)) + C(16)*D(LOUV(-2)) + C(17)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.246794	0.120165	-2.053787	0.0433
C(2)	0.662441	0.146495	4.521941	0.0002
C(3)	0.130206	0.189473	0.687200	0.4998
C(4)	-0.003016	0.854170	-0.003531	0.9972
C(5)	-0.069951	0.162899	-0.429416	0.6722
C(6)	0.013722	0.004578	2.997171	0.0071
C(7)	0.032657	0.219647	0.148679	0.8833
C(8)	-0.326690	0.210624	-1.551057	0.1366
C(9)	-0.293840	0.307115	-0.956773	0.3501
C(10)	-0.645274	0.216662	-2.978255	0.0074
C(11)	-1.179327	0.772438	-1.526759	0.1425
C(12)	0.178386	0.163871	1.088575	0.2893
C(13)	0.003625	0.004750	0.763217	0.4542
C(14)	0.071693	0.187871	0.381606	0.7068
C(15)	-0.222200	0.228917	-0.970660	0.3433

C(16)	-0.763146	0.318214	-2.398220	0.0263
C(17)	-0.007240	0.030176	-0.239930	0.8128

R-squared	0.810789	Mean dependent var	-0.036304
Adjusted R-squared	0.659421	S.D. dependent var	0.114829
S.E. of regression	0.067013	Akaike info criterion	-2.264127
Sum squared resid	0.089815	Schwarz criterion	-1.523976
Log likelihood	58.88635	Hannan-Quinn criter.	-2.003189
F-statistic	5.356388	Durbin-Watson stat	2.284072
Prob(F-statistic)	0.000308		

Dependent Variable: D(LTCER)
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 01/09/21 Time: 20:26
Sample (adjusted): 1983 2019
Included observations: 37 after adjustments
D(LTCER) = C(1)*(LTCER(-1) + 0.610871387323*LCOM(-1) +
3.03707520452*LEPARP(-1) + 0.972191047165*LRESD(-1) -
0.188310681233*LTE(-1) + 1.48837731387) + C(2)*(LINV(-1) -
2.47840057819*LCOM(-1) + 84.4416196454*LEPARP(-1) -
25.3144264636*LRESD(-1) + 20.067092056*LTE(-1) - 309.078897441
) + C(3)*D(LTCER(-1)) + C(4)*D(LINV(-1)) + C(5)*D(LCOM(-1)) + C(6)
*D(LEPARP(-1)) + C(7)*D(LRESD(-1)) + C(8)*D(LTE(-1)) + C(9)
*D(LTCER(-2)) + C(10)*D(LINV(-2)) + C(11)*D(LCOM(-2)) + C(12)
*D(LEPARP(-2)) + C(13)*D(LRESD(-2)) + C(14)*D(LTE(-2)) + C(15)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.165351	0.065086	-2.540497	0.0186
C(2)	-0.007560	0.002456	-3.078300	0.0055
C(3)	0.722603	0.184749	3.911266	0.0007
C(4)	-0.001105	0.002604	-0.424463	0.6754
C(5)	0.109176	0.033201	3.288384	0.0034
C(6)	0.123755	0.057250	2.161664	0.0418
C(7)	-0.106328	0.043376	-2.451283	0.0226
C(8)	0.192320	0.100229	1.918799	0.0681
C(9)	-0.623629	0.163494	-3.814392	0.0009
C(10)	0.006213	0.002601	2.388997	0.0259
C(11)	0.060425	0.034438	1.754631	0.0932
C(12)	0.073001	0.048192	1.514794	0.1441
C(13)	0.092412	0.035351	2.614089	0.0158
C(14)	0.004960	0.097597	0.050818	0.9599
C(15)	-0.032013	0.007007	-4.568489	0.0002

R-squared	0.814960	Mean dependent var	-0.027917
Adjusted R-squared	0.697207	S.D. dependent var	0.049307
S.E. of regression	0.027132	Akaike info criterion	-4.085257
Sum squared resid	0.016195	Schwarz criterion	-3.432183
Log likelihood	90.57726	Hannan-Quinn criter.	-3.855018
F-statistic	6.920940	Durbin-Watson stat	1.928082
Prob(F-statistic)	0.000035		

Appendix n°2

Augmented Dickey-Fuller test statistic		-4.584010	0.0023
Test critical values :	1% level	-3.857386	
	5% level	-3.040391	
	10% level	-2.660551	

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.351583	0.0031
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.661592
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.403307	0.5619
Test critical values:	1% level	-3.769597	
	5% level	-3.004861	
	10% level	-2.642242	

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.838570	0.0000
Test critical values:	1% level	-3.737853	
	5% level	-2.991878	
	10% level	-2.635542	

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.532030
Asymptotic critical values*:	1% level	0.739000
	5% level	0.463000
	10% level	0.347000