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The equilibrium exchange rate and measurement of misalignments in Morocco: Empirical Analysis

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Abstract

The management of the real exchange rate remains the most important topic for economists, as the difficulty they face is how to determine the equilibrium exchange rate, which is one of the most important international macroeconomic problems .
Indeed the determination of the equilibrium REER or also called "equilibrium exchange rate" depends on theoretical analysis, for Driver and Westaway (2004), there is no single definition of the equilibrium exchange rate, the theoretical analyses of the equilibrium REER were made following three main approaches namely the macroeconomic approach (the fundamental equilibrium exchange rate (FEER), the econometric approach (the behavioral equilibrium exchange rate (BEER) and the dynamic approach (the natural real exchange rate (NATREX).
This paper presents an analysis of the real equilibrium exchange rate, its main foundations and its misalignment through an econometric modeling for the Moroccan case, covering the period 1990-2018. An error-correction model (ECM) is estimated to obtain the long-run cointegrating or stable equilibrium relationship.

Keywords: Equilibrium exchange rate, misalignment, ECM.

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1. Introduction

Exchange rate management policy has long played a fundamental role in developing countries, including Morocco in particular. This role has been accentuated above all in the formulation of structural adjustment policies and the stabilization of the macroeconomic framework. According to the World Bank, judicious management of the real exchange rate leads to more efficient and relatively less costly results in the short and medium term, as well as to sustained economic growth.

Indeed, the real exchange rate is one of the most important variables in any economy, as it significantly affects the resource allocation process by changing the profitability between tradable and non-tradable activities .

Moreover, the estimation of the real equilibrium exchange rate is important for countries such as Morocco, which has experienced periods of macroeconomic imbalances that have impacted the productive economic fabric.

The problem of estimating the real equilibrium exchange rate is a subject constantly addressed in the economic literature. The objective of this paper is to analyze the evolution of the exchange rate and their differences with respect to their equilibrium value while estimating the degree of misalignment.

- The major question that arises at this level is the following: How to estimate the long-term equilibrium real exchange rate for Morocco during the period 1990-2018?

Before answering this question, we will first identify the fundamental variables used to estimate the equilibrium real exchange rate, then we proceed to measure the degree of misalignment of the real exchange rate with respect to its long-term equilibrium value.

2. Review of literature

The equilibrium real exchange rate term was introduced by Nurkse (1945), who was one of the pioneers in approaching this concept around the ideal conditions of an economy and defined it as the value of the real exchange rate compatible with internal and external equilibrium objectives.

External equilibrium is defined as the inflow of sustainable external capital to finance the deficit in the current account of the balance of payments and, for internal equilibrium, when the goods market is in a state of crisis.

non-tradable is in a sustainable balance. This concept was later popularized by Williamson (1983, 1994) through the macroeconomic approach to the real exchange rate.

For Soto (1996), the problem of determining the equilibrium real exchange rate can be divided into three stages :

- Establish a definition of the concept of balance,
- Determine a theoretical reference model identifying the fundamental variables that make it possible to estimate the equilibrium exchange rate ,
- Generate an econometric methodology capable of contrasting the predictions of the theoretical model and the data, and make the adopted equilibrium concept operational.

In the economic literature there are generally three approaches that highlight the issue of estimating the equilibrium real exchange rate: macroeconomic (FEER, DEER), econometric (BEER) and dynamic (NATREX).

2.1 Macroeconomic approach

According to this approach, the real equilibrium exchange rate is defined by Edwards (1988) as the relative price of tradable versus non-tradable goods, which simultaneously ensures the internal and external equilibrium of the economy. Internal equilibrium means that supply and demand are equal in the market for non-tradables and will remain so in the future, and that the unemployment rate should not deviate from its "natural rate". External equilibrium is achieved if the current account of a given period is in equilibrium and if the discounted sum of future current account balances is equal to zero. The value of the real equilibrium exchange rate depends on the value of the other variables that determine internal and external equilibrium, called "fundamentals", the real exchange rate (international capital flows, foreign investment, terms of trade, interest rates, level of inflation, productivity growth, etc.). The real equilibrium exchange rate is thus determined solely by its fundamentals.

As well as internal equilibrium is reached when the market for non-tradable goods equilibrates in the present and is anticipated to equilibrate in the future. On the other hand, external equilibrium is reached when the current account balance is compatible with long-term sustainable capital flows.

Moreover, Williamson assumes that the economy is assumed to be at full employment (internal equilibrium) and the current balance corresponds to sustainable financing flows (external equilibrium). Thus, this approach requires to define the level of full employment production in the country and its partners, the sustainable level of the current account and to estimate a trade balance equation.

According to him, there are two main aspects of equilibrium real exchange rate theories :

- the first aspect is based on a two-sector intertemporal general equilibrium model, it defines the real equilibrium exchange rate as the value of the exchange rate compatible with the simultaneous achievement of internal and

external equilibrium in the medium term. Internal equilibrium coincides with the achievement of the potential or sustainable level of output. The external equilibrium is defined by the equality of the current account to an "equilibrium value", generally related to the sustainability of external payments. Analytically, the determination of the real equilibrium exchange rate can be summarized by the graph below :

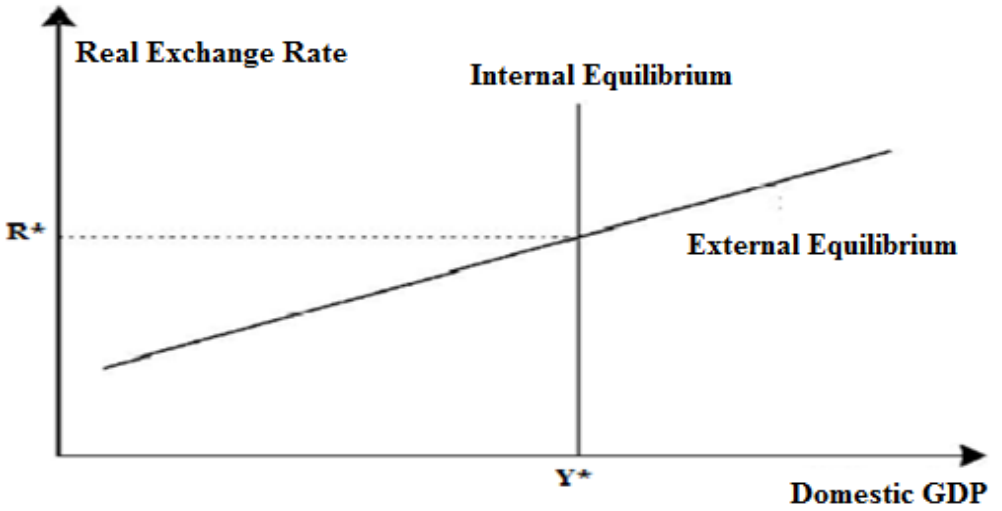

Figure 1: Determination of equilibrium exchange rates

Source: Prepared by the author

- The second aspect is more macroeconomic and defines the exchange rate as an indicator of competitiveness, its equilibrium level makes it possible to achieve external equilibrium while being compatible with internal equilibrium. In this case the real exchange rate is most often considered because it is considered as an indicator of a country's competitiveness, which conditions the orientation of demand towards domestic or foreign production, and not because it reflects the allocation of domestic production capacities between tradable and non-tradable goods.

However, the macroeconomic approach is both descriptive (it aims to forecast the medium-term equilibrium level) and normative (it tells countries what exchange rate levels they could agree on). It poses many theoretical and empirical difficulties. As a coordination model, it requires countries to agree on consistent trade balance targets, the sum of which is zero at the global level. In practice, the choice of the level of sustainable balance is arbitrary, resulting in a high degree of uncertainty about the equilibrium level of the exchange rate. As Borowski and Couharde (1999) summarise: "Williamson's approach is one of comparative statics: it involves

identifying in each period the real misalignment induced by internal and external imbalances. This approach thus ignores the modalities of the return of the exchange rate to its equilibrium level".

2.2 Econometric approach

Clark and MacDonald (1997) proposed a composite model called BEER (Behavioural Equilibrium Exchange Rate), which consists in selecting a set of fundamental variables that can influence the real exchange rate in the long run (term of trade, labour productivity, inflation, stock of net foreign assets, interest rates, etc.) and then looking for cointegrating relationships between the exchange rate and these variables.

According to the authors, the difference between the exchange rate and its estimated long-run value, according to the cointegrating relationship, makes it possible to assess the misalignment of the current rate.

This approach does not explicitly incorporate exchange rate dynamics, since in a misalignment, the fundamentals of the long-run relationship are supposed to exert a restoring force on the current exchange rate to converge to its equilibrium value, but this mechanism is essentially statistical: it is the statistical model (the error-correction model) that provides the convergence property, not the theoretical model. Implicit in this statistical model is the assumption that the real exchange rate converges monotonically to its long-run value.

2.3 Dynamic approach

Stein and Allen (1997) developed a theory of the natural real exchange rate: "the NATREX"[3]. This is defined as the real exchange rate that ensures balance of payments equilibrium in the absence of cyclical factors (production at its potential), speculative capital flows and changes in foreign exchange reserves.

This approach distinguishes three exchange rate horizons: the short, medium and long term.

- In the short term, the real exchange rate depends on the fundamental variables (X), the stock of net assets (S) and short-term cyclical and speculative factors (b), Either :

  $Yt = Yt(X, S, b)$

At this level, the dynamics of the model are based on the convergence of the real exchange rate towards its medium-term equilibrium value through the equalisation of financial returns and the absence of speculative capital flows.

[3] Natural Real Exchange Rate

- In the medium term NATREX depends only on fundamental factors and the stock of net assets: Yt = Yt(X, S)

In this case the two variables capital stock per capita and net international investment position are not stabilised.

- In the long term In the stationary state, NATREX depends only on the fundamental variables: Yt = Yt(X), unlike in the medium term, the capital stock and the net international investment position are, by definition, stable.

The NATREX approach is dynamic and is explicitly based on the long-term determinants of the equilibrium real exchange rate. It can be seen as the reduced form of the exchange rate equation in an econometric model. Unlike FEER, NATREX incorporates stock effects through the dynamics of the net international investment position and the capital stock. It makes it possible to calculate an equilibrium path from the medium term to the long term.
Nevertheless, NATREX suffers like FEER from the assumptions made about internal equilibrium: The labour market is assumed to be in equilibrium, the dynamics of price and wage adjustment are automatically realized . As the FEER and the BEER and NATREX present themselves as a theory of the real equilibrium exchange rate, it only becomes a theory of the nominal exchange rate by evacuating the price-formation mechanisms.
Moreover, NATREX assumes that agents are unable to anticipate exchange rate movements and therefore assumes that agents anticipate exchange rate stability. This assumption has little theoretical basis .

3. Empirical Analysis

To determine the equilibrium exchange rate in Morocco, we will base ourselves on the model estimated by Edwards (1994) which assumes that the economy is small and open according to the production of two types of goods : raw materials intended for export (tradable goods) and non-tradable goods. This model aims to discover how the basic variables affect the real value of the real exchange rate in the long run.
Thus, the equation describing the equilibrium value of the long-term real exchange rate as a function of the basic variables can be described using the following equation:

LTCRE = C0+C1 L (Xt)

In order to estimate this theoretical equation, given the lack of long-term data series, some (proxy variables) will be used instead of variables for which no data are available.

3.1 Presentation of the model variables

Economists such as Edwards, Elbadawi, Stein, Montiel, consider that in the long run, the evolution of the Real Exchange Rate (RER) is closely linked to economic fundamentals. Whereas other economists such as Lafay (1984), for example, see that the evolution of the RRR is very much linked to the level of development of the country.

These fundamental variables retained in our model were chosen according to the theoretical analyses, all these variables are expressed in Nerian logarithm (noted LX for variable X) .

On each figure we will present both the fundamental variables chosen in our econometric model and their evolution during the period 1990-2018 .

- **The real effective exchange rate (REER):** This is a measure of the value of a currency relative to a weighted average of several currencies) divided by a price deflator or cost index.

According to the graph, there is an upward trend in the REER during the period 1990-2000, then a downward trend during the period 2000-2012, and from the year 2012 onwards the rate begins to rise.

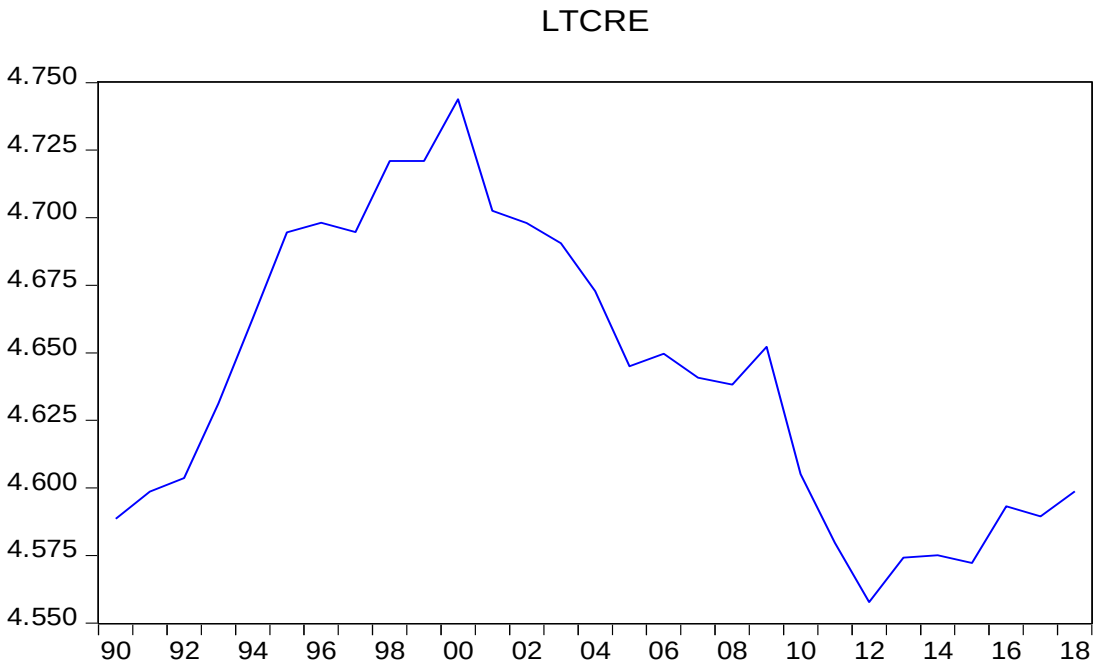

Figure 2: Evolution of the real effective exchange rate (1990-2018)

Source: Prepared by the author based on World Bank data.

- **Productivity (PRD):** defined as the ratio of GDP to the number of employees. Throughout the analysis period, there is an upward trend in productivity.

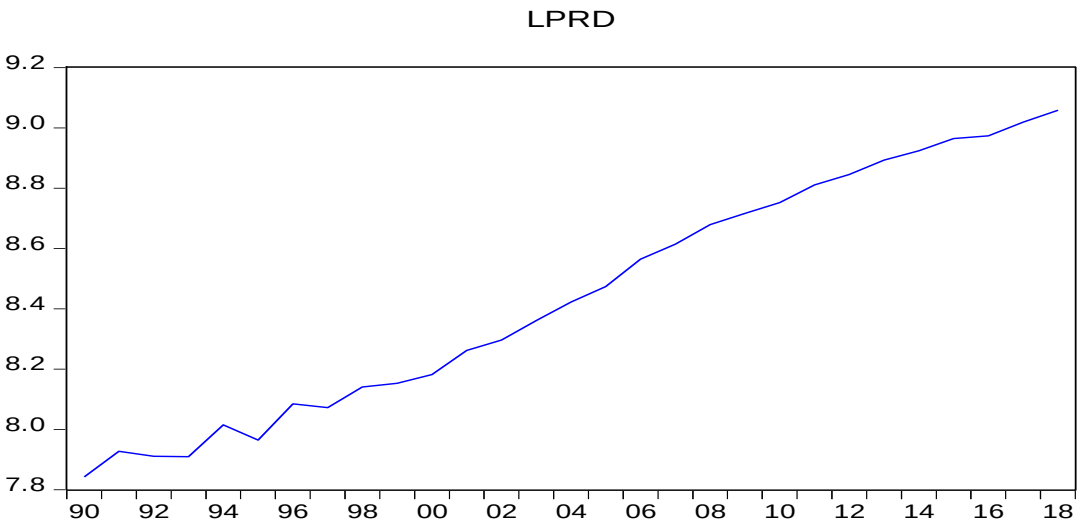

Figure 3: Evolution of productivity in Morocco (1990-2018)

Source: Prepared by the author based on World Bank data.

- **Foreign direct investment as a percentage of GDP (FDI) :** According to the figure of FDI given by the Figure below, we can distinguish two main periods of evolution, the first period 1990 - 2000 saw a fall in FDI inflows, the second period 2000 - 20018 , these investments tend to increase.
  The link between foreign direct investment (FDI) and the exchange rate is rather ambiguous, insofar as exchange rate volatility can both discourage foreign investment (Cushman, 1988) and produce an incentive to hedge against exchange rate risk by locating abroad (Aizenman, 1991).

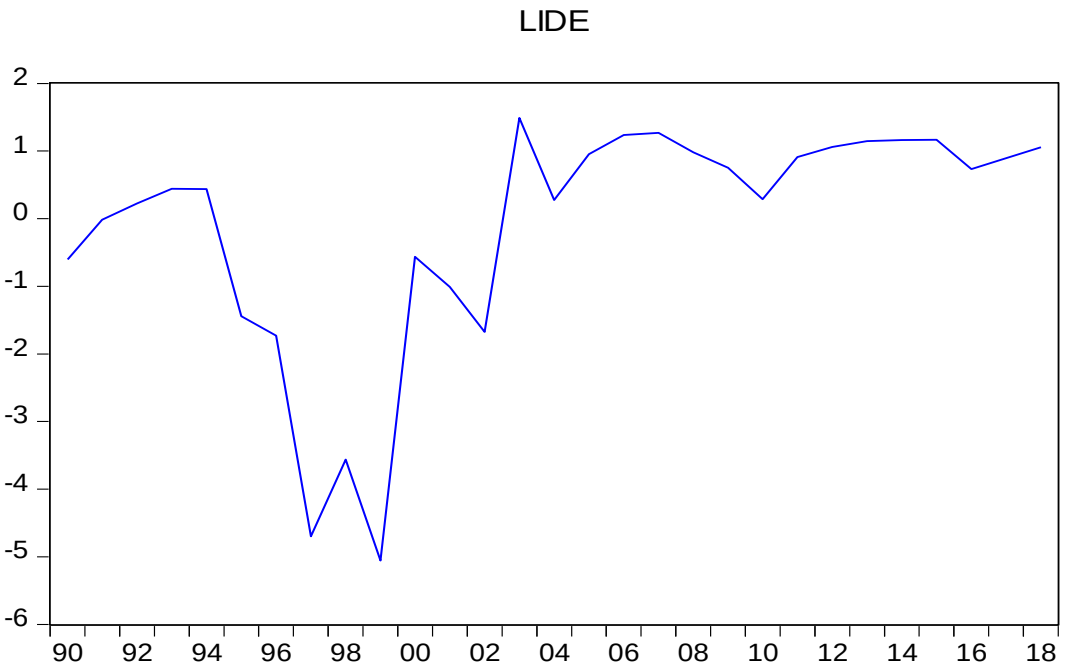

Figure 4: Evolution of FDI in Morocco (1990-2018)

Source: Prepared by the author based on World Bank data

- **The inflation rate (INF):** The inflation rate is one of the determining factors in the evolution of exchange rates even if other elements are taken into account. Inflation corresponds to a generalised increase in prices. It is measured by the consumer price index.

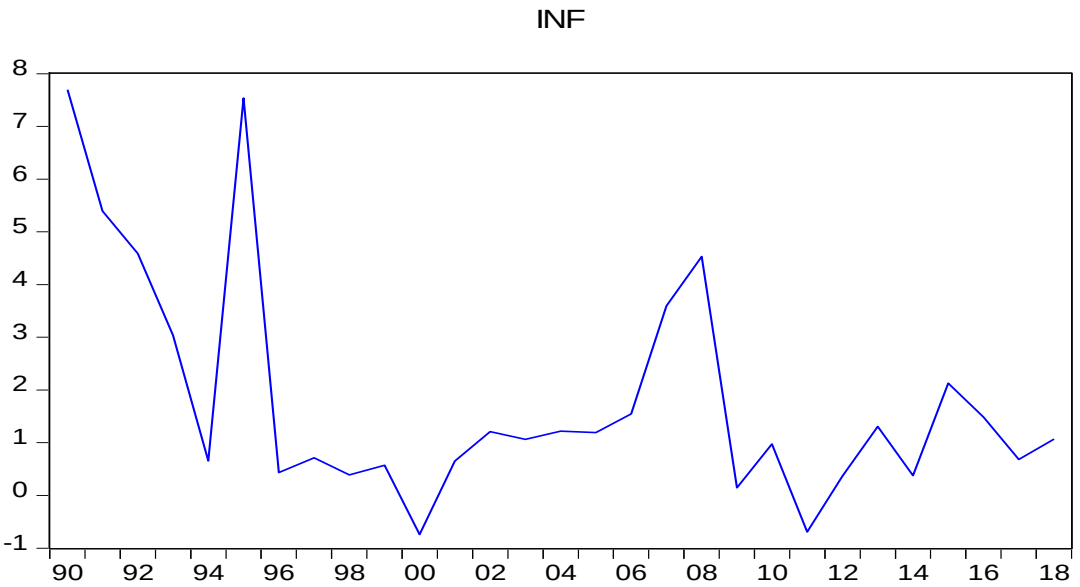

Figure 5: Evolution of inflation rates (1990-2018)

Source: Prepared by the author based on World Bank data

- **The real interest rate (denoted R):** According to the graph below, it can be seen that the interest rate has been on a downward trend during the period 1990-2018.
  Thus, the evolution of interest rates and exchange rates are closely linked to the extent that a rise or fall in rates can have the opposite effect on exchange rates to the extent that a change in interest rates has direct consequences on the value of the currency in relation to other currencies.

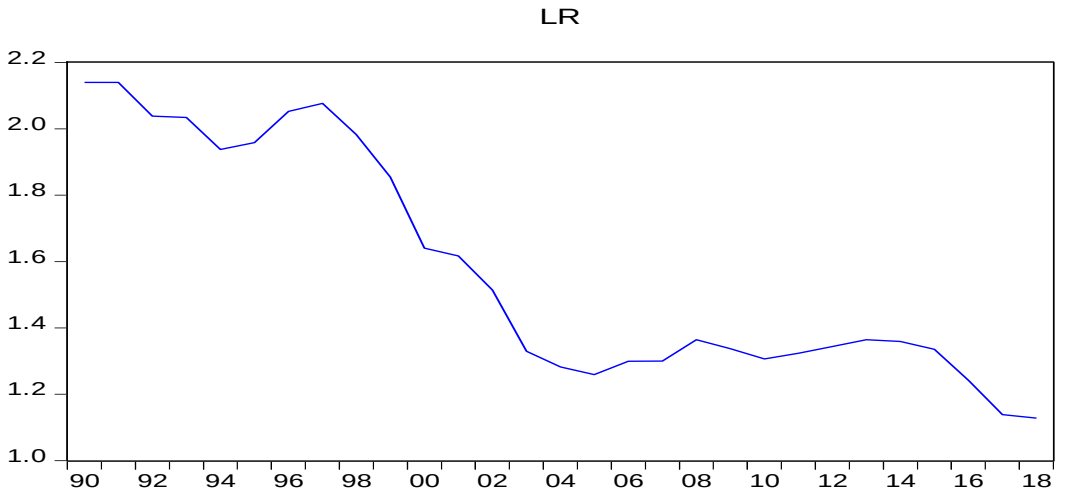

Figure 6: Evolution of interest rates (1990-2018)

Source: Prepared by the author based on World Bank data

3.2 Estimation Methodology

After presenting the theoretical variables of the equilibrium real exchange rate . This section has two main objectives. The first is to estimate the equilibrium value of the Real Exchange Rate (RER) of the dirham by relying on fundamental variables previously analyzed. The second is to measure the degree of misalignment.

The econometric modeling procedure adopted in our work 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 equilibrium Real Exchange Rate (REER) and its fundamental determinants, which is equivalent to positing a linear form as follows:

Equation 1

$$\mathbf{LTCRE = C0+C1LPRD + C2LIDE + C3INF + C4LR + \mathcal{E}t}$$

With

$\mathcal{E}t$ =Identically and independently distributed residues)

And to highlight the existence of these long-term equilibrium relationships, we will adopt the cointegration method based on Engle and Granger's (1987) cointegration tests.

-The second is to have a dynamically stable steady state by adopting the following error correction model (ECM):

Equation 2

$$\Delta \text{LTCRE} = \alpha ECM_{t-1} + \sum_{i=0}^{p} \partial_{1,i} \Delta LPRD_{t-i} + \sum_{i=0}^{q} \partial_{2,i} \Delta LIDE_{t-i} + \sum_{i=0}^{h} \partial_{3,i} \Delta INF_{t-i} + \sum_{i=0}^{S} \partial_{4,i} \Delta LR_{t-i} + \sum_{i=0}^{v} \boldsymbol{\partial_{5,i} \Delta LLTCRE_{t-i}} + \varepsilon t$$

With

- α ECMt-1: The long-run relationship relative to the real exchange rate of lag 1 and α represents the adjustment coefficient or the proportion of the imbalance in (t-1) absorbed in (t) [4]
- ∂ t,i : the coefficients relative to the explanatory variables of the model .
- p,q , h , s,v : the lags .
- Ɛt :This is the residual of the equation .

3.2.1 Stationarity test

The objective of the unit root and stationarity tests is to determine the order of integration of the variables. Three different tests will be used: the usual Agmented Dickey-Fuller (ADF) unit root test, the Phillips-Perron (PP) test and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test.

Each of these tests has its specificity, the ADF test only takes into account the presence of auto-correlations in the series, while the PP test also considers the hypothesis of the presence of heteroskedasticity in the series. As for the KPSS test, it is based on the decomposition of the studied series into a deterministic part, a random walk and a white noise. In other words, it is a nullity test of the variance of the residual of the random walk. Contrary to the two previous tests, the null hypothesis of the KPSS test is that of stationarity. Consequently, the series is considered stationary only when the KPSS statistic is below the critical value.

[4] α is an error correction term, i.e. the rate of automatic adjustment to the steady state, According to Baffes, Elbadawi and O'Connell (1999, page 417), long-term equilibrium is stable only when condition - 2 < α < 0 is verified.

Similarly, we will perform the stationarity test with break.
And the results of the time series stationarity test of the macroeconomic fundamentals as follows :

Table 1: ADF and PP test results

VARIABLES	Lag	Test ADF		Test PP		CONCLUSION
		LEVEL	1st DIF	LEVEL	1st DIF	
LTCRE	1	-2.308478 (pro=0.4161)	-4.240795 (pro=0.0125)CT	-2.297911 (pro=0.4214)	-4.289842 (pro=0.0112)	**I(1)**
LPRD	5	-1.535608 (pro= 0.7892)	-3.792335 (pro=0.0335)CT	-2.574616 (pro= 0.2934)	-8.804409 (pro=0.0000)	**I(1)**
INF	1	-4.512198 (pro=0.0651)	-8.775998 (pro=0.0000)	-4.516444 (pro=0.0641)	-12.95785 (pro=0.0000)	**I(1)**
LR	1	-1.905271 (pro=0.6241)	-3.437693 (pro=0.0183) t	-1.562546 (pro=0.7820)	-3.437693 (pro=0.0183)	**I(1)**
LIDE	3	-2.528948 (pro=0.3129)	-7.282293 (pro=0.00001)ct	-2.533242 (pro=0.3110)	-7.107041 (pro=0.0000)	**I(1)**

Source: Elaborated by the author from EViews10 Software.

Table2: KPSS[5] test results

VARIABLES	Model 1: Inercept		Model 2: Trend and intercept		CONCLUSION
	Level	1st dif	Level	1st dif	
LTCRE	**0.672379**	0.293509	**0.279477**	0.158977	I(1)
LPRD	**0.684657**	0.138599	**0.107009**	0.133190	I(1)
INF	**0.513597**	0.244784	**0.133899**	0.138658	I(1)
LR	**0.613874**	0.112151	**0.125154**	0.091886	I(1)
LIDE	**0.323922**	0.081447	**0.086086**	0.075202	**I(0)[6]**

Source: Elaborated by the author from EViews10 Software

[5] The KPSS tests were performed by first including a constant and then adding a trend to the model.
The critical values of the tests with the inclusion of the constant are 0.739, 0.463, 0.347 for a threshold of 1%, 5% and 10%.
The critical values of the tests with the inclusion of the trend are 0.216, 0.146, 0.119 for a threshold of 1%, 5% and 10%.

[6] According to the KPSS test the variable LIDE is stationary in level I(0) but the other two tests ADF and PP is stationary at the first difference I(1) , so it is concluded that the IDE series is stationary at the first difference I(1).

From the results obtained above from the stationarity study of the series of economic variables, it should be noted that according to the ADF and PP and KPSS tests, all the variables are stationary at the first differences I(1).
Since the variables have the same degree of stationarity, this means that they are cointegrated, which means there is a cointegrating relationship between these variables and the real effective exchange rate.

3.2.2 Engle Granger Cointegration Test

According to the modeling theory of Engle Granger (1981), all cointegrated series can be represented by an error-correction model (ECM), and the results are presented in the following table for the Engle Granger cointegration test.

Table 3: Model estimation result

VARIABLE	Coefficient	Std. Error	t-Statistic	Prob.
LPRD	-0.187400	0.029517	-6.348795	0.0000
INF	-0.006026	0.002857	-2.109079	0.0456
LR	-0.179941	0.037203	-4.836695	0.0001
LIDE	-0.018452	0.004103	-4.496835	0.0001
C	6.515390	0.297965	21.86630	0.0000
R-squared	0.790750	**Durbin-Watson stat**		1.428922
AdjustedR-squared	0.755875	**F-statistic**		22.67385

Source: Elaborated by the author from EViews10 Software

From the above table, it can be said that all the explanatory variables (R INF IDE PROD) are negatively correlated with the real effective exchange rate. We also note that the model has a significant predictive capacity in the sense of the correlation coefficient (R^2) since it is of the order of ***0.79***, as well as Durbin-Watson's test reveals that there is an absence of auto-correlation of the errors.
The residual series (ECMt) is also stationary in the **I(0)**[7] level, so we conclude that across all these tests, there is cointegration between the real effective exchange rate and all other variables.

[7] Engle Granger's first condition

Table 4: Serial stationarity test of residues

ECM_t	**Test ADF** **Prob =(0.0019)**	**Test PP** **Prob = (0.0040)**	**Test KPSS**
	t-Statistic = **-5.126864**	t-Statistic= **-4.720585**	t-Statistic= **0.075756**
1%	-4.374307	-4.323979	0.216
5%	-3.603202	-3.580623	0.146
10%	-3.238054	-3.225334	0.119

Source: Elaborated by the author from EViews10 Software

As shown in the table above, it can be concluded that Engle Granger second cointegration condition is met, which is the stability of the residual series to a lesser degree than the degrees of cointegration of the study variables.

3.3 The Error Correction Model (ECM)

The second step of Engle and Granger's method then consists in estimating an Error Correction Model defined by Equation below:

$$\Delta LTCRE_t = \alpha ECM_{t-1} + \sum_{i=0}^{p} \partial_{1,i} \Delta LPRD_{t-i} + \sum_{i=0}^{q} \partial_{2,i} \Delta LIDE_{t-i} + \sum_{i=0}^{h} \partial_{3,i} \Delta INF_{t-i} + \sum_{i=0}^{S} \partial_{4,i} \Delta LR_{t-i} + \sum_{i=0}^{V} \partial_{5,i} \Delta LLTCRE_{t-i} + \varepsilon t$$

This equation will be estimated using ordinary least squares to correct for existing cointegration risk and its results will appear as shown in the following table:

Table 5: ECM estimation result

VARIABLE	Coefficient	Std. Error	t-Statistic	Prob.
ECM (-1)	-1.081450	0.198508	-5.447883	0.0002
DLTCRE(-1)	0.924209	0.195025	4.738933	0.0006
DLTCRE(-2)	0.308113	0.147340	2.091164	0.0065
DLTCRE(-3)	0.481770	0.170671	2.822806	0.0166
DLTCRE(-4)	0.667126	0.179449	3.717631	0.0034
DLPRD(-1)	0.792365	0.156299	5.069537	0.0004
DINF(-1)	0.013970	0.002487	5.617949	0.0002
DINF(-2)	0.008106	0.002424	3.343626	0.0066
DINF(-3)	0.008539	0.002147	3.976570	0.0022
DLR(-3)	0.121777	0.057529	2.116810	0.0579
DLIDE(-4)	-0.004947	0.002693	1.837112	0.0133
C	-0.029634	0.008335	-3.555404	0.0045
R-squared	0.814270			
F-statistic	4.018804	Durbin-Watson stat		2.086412
Prob(F-statistic)	0.014077			

Source: Elaborated by the author from EViews10 Software

It is clear from the above table that the value of correlation coefficient R^2 reached 0.8142, which indicates the quality of prediction of the regression and its capacity to explain the variations of the exchange rate, meaning that the variations of the independent variables (R, INF, IDE, PRD) explain more than 81.42% of the fluctuations of the exchange rate.

In this respect, the error-correction term (α ECM (-1)) is significant at the 5% significance level and with a negative signal (-1.081450) indicating that the behaviour of the exchange rate may, in the event of a shock, take more than 10 periods until it reaches the long-run equilibrium position .

In other words, this estimate indicates that the speed of adjustment is (-1.081450), which means that in each period (year) more than 108.14% of the exchange rate imbalances are adjusted in the long run.

From the above table, the error correction model (ECM) equation can be estimated as follows:

DLTCRE = -1.0814*ECM(-1) + 0.924*DLTCRE(-1) + 0.308*DLTCRE(-2) + 0.481*DLTCRE(-3) + 0.667*DLTCRE(-4) + 0.7923*DLPRD(-1) + 0.014*DINF(-1) + 0.008*DINF(-2) + 0.008*DINF(-3) + 0.122*DLR(-3) - 0.005*DLIDE(-4) - 0.030

3.3.1 Determination of equilibrium TCRs and measurement of misalignment in Morocco

At this stage, we will determine the equilibrium exchange rate and its deviation from the REER during the study period (1990-2018) with the determination of the periods of appreciation and depreciation of the Moroccan Dirham.

Before calculating the misalignments, we will deduce the equilibrium value of the RCR on the basis of the results of the model estimations. Indeed, the equilibrium value of the exchange rate is obtained by replacing the fundamental variables for the equilibrium values in the estimation of the model.

Table 6: Determination of equilibrium real exchange rate (REER) and measurement of misalignment in Morocco

Number of Observations	Observed real exchange rate	Equilibrium real exchange rate (REER)	Degree of Misalignment
1990	4,5886	4,6254	**-0,0080**
1991	4,5986	4,6126	**-0,0030**
1992	4,6036	4,6344	**-0,0066**
1993	4,6312	4,6408	**-0,0021**
1994	4,6626	4,6528	**0,0021**
1995	4,6946	4,6516	**0,0092**
1996	4,6981	4,6603	**0,0081**
1997	4,6947	4,7113	**-0,0035**
1998	4,7210	4,6965	**0,0052**
1999	4,7210	4,7437	**-0,0048**
2000	4,7439	4,7018	**0,0089**
2001	4,7026	4,6908	**0,0025**
2002	4,6980	4,7119	**-0,0029**
2003	4,6905	4,6754	**0,0032**
2004	4,6728	4,6938	**-0,0045**
2005	4,6450	4,6760	**-0,0066**
2006	4,6497	4,6444	**0,0011**
2007	4,6408	4,6221	**0,0040**
2008	4,6383	4,5980	**0,0088**
2009	4,6523	4,6266	**0,0055**
2010	4,6052	4,6290	**-0,0051**
2011	4,5797	4,6135	**-0,0073**
2012	4,5578	4,5942	**-0,0079**
2013	4,5742	4,5743	**0,0000**
2014	4,5750	4,5748	**0,0001**
2015	4,5722	4,5607	**0,0025**
2016	4,5932	4,5878	**0,0012**
2017	4,5895	4,5997	**-0,0022**
2018	4,5987	4,5891	**0,0021**

Source: Prepared by the author

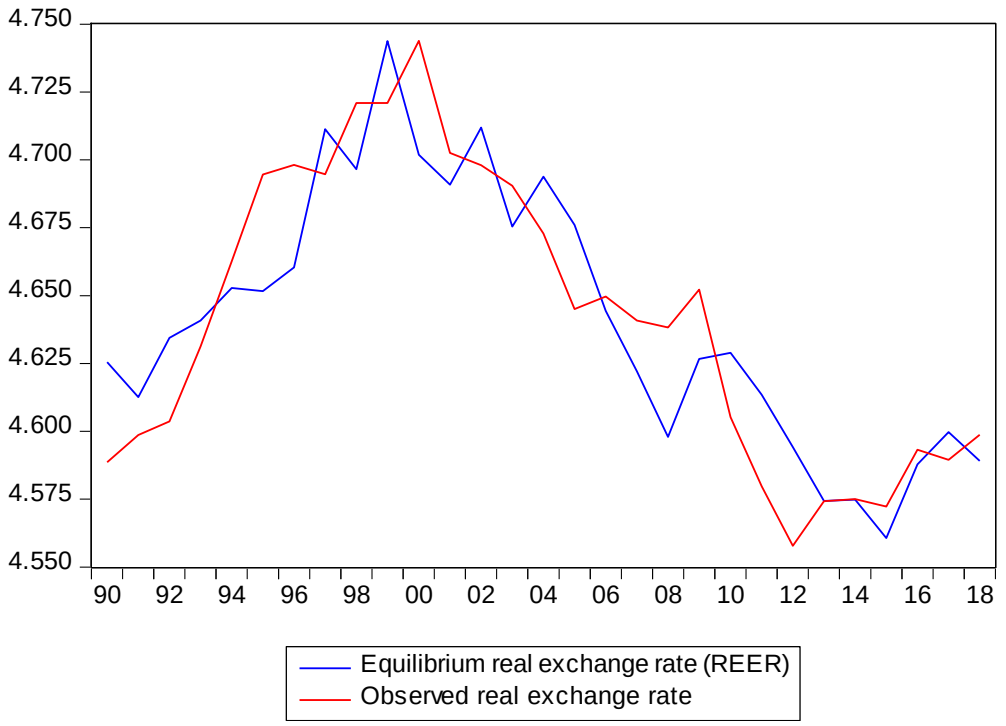

Figure 7: The degree of real exchange rate misalignment has its equilibrium value

Source: Elaborated by the author from EViews10 Software

As already mentioned, our objective is (based on the calculation of the equilibrium REER) to measure the misalignments of the REER of the dirham. So after the determination of the equilibrium TCRE values, we can calculate the misalignments of the TCRE, which is defined as the difference between the observed TCRE and the equilibrium TCRE.
Analytically the measurement of misalignments is done according to the following formula:

Mesa=(T-T*)/(T*)

With ***Mesa:*** is the misalignment index, ***T:*** observed real exchange rate, ***T*:*** equilibrium real exchange rate.

- If the value of the misalignment is positive, ***(Mesa > 0)*** means that the real exchange rate is above its equilibrium value, which means that the Dirham is overvalued.
- If the value of misalignment is negative, ***(Mesa < 0)*** means that the real

exchange rate is below its equilibrium value, which means that the Dirham is undervalued.

- If the value of misalignment is zero, ***(Mesa = 0)*** means that the real exchange rate is equilibrium.

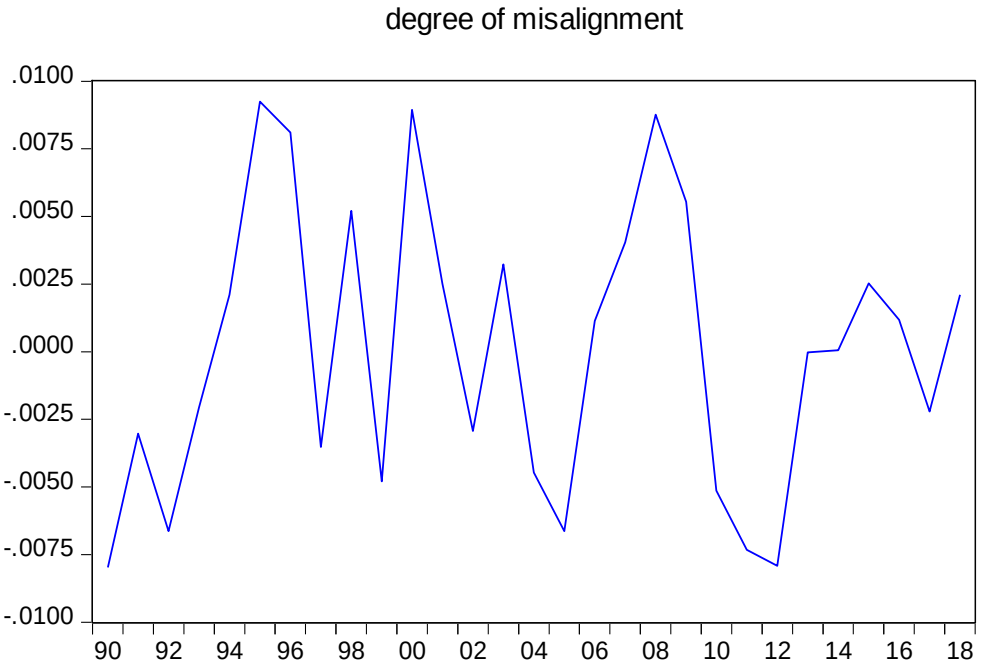

Figure 8: Evolution of misalignment in Morocco between 1990-2018

Source: Elaborated by the author from EViews10 Software

4. Analysis of results

The table below shows the periods of overvaluation and undervaluation of the dirham as follows:

Overvaluation period	Undervaluation period
1994-1996, 1998, 2000-2001, 2003, 2006-2009, 2013-2016, 2018	1990-1993, 1997, 1999, 2002, 2004-2005, 2010-2012, 2017

Source: Prepared by the author

The above table shows that the Moroccan dirham was undervalued during the ***period 1990-1993*** because of the exchange rate policy and the economic context in general, since the main economic indicators at the beginning of the 1990s showed a serious deterioration in the country's economic situation. The external debt increased to over 70% of GDP, the budget deficit and the current account deficit

reached record levels during this period. The Moroccan economy has also suffered the counter cost of many factors: the fall in phosphate prices, the rise of the dollar and interest rates, not to mention the severe drought that marked the period 1990-1993.

However, the ***period 1994-1996*** was characterized by an overvaluation of the value of the dirham. In this context, various reforms were launched and they affected all aspects of the economy, in particular the liberalization of foreign trade (through the signing of free trade agreements, accession to the World Trade Organization (WTO) in 1995), budgetary expenditure, taxation, foreign investment, privatization, etc. The period 1994-1996 was characterized by an overvaluation of the value of the dirham.

Morocco began its privatization programme in 1993, which complemented the liberal measures taken in the 1980s to open up Morocco's economic and industrial fabric. These reforms have improved Morocco's economic and financial performance.

In 1997 and 1999, the value of dirham was evaluated below its equilibrium value because of the economic context characterized by the regression of economic growth (drought years).

While during the ***period 2000-2003***, the value of the dirham was overvalued due to a market capitalization that has improved since 2000, the value of the dirham has appreciated in relation to the dollar, this evolution probably partly explains the diversification of the country's import suppliers.

Concerning the year ***2004-2005*** This period characterized by an undervaluation of the value of the Dirham, during these two years Morocco increased its rate of opening towards international markets, the trade deficit increased, due to a faster increase in imports than exports which is partly explained by an increase in the energy bill. Subsequently, an overvaluation of the dirham was observed between ***2006-2009*** due to the deterioration in the value of dollars and the euro (due to the international financial crisis), as the dirham exchange rate remains indexed to a basket composed of the euro and the US dollar.

This can be explained by the effects of the financial and economic crisis of 2009, which affected growth in Morocco as well as the deterioration of economic activity in partner countries, and was transmitted with a time lag via four main channels, namely foreign demand addressed to Morocco, tourism receipts, transfers from Moroccans residing abroad (MRE) and foreign direct investment (FDI).

During the last five years 2013-2018, they are marked by an overvaluation of the value of dirham, which is explained by an improvement of the current account deficit in relation to GDP. Thus, at the level of trade, 2017 was marked by a sustained increase in both imports and exports, as regards international investments, tourism sector revenues, the external position recorded a good performance.

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