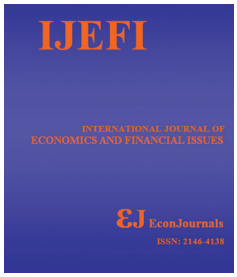

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Exchange Policy and Misalignments in Morocco: A Quantitative Analysis

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ABSTRACT

The research examines the equilibrium exchange rate and misalignment quantifications for the case of Morocco over the period 1990-2022. Based on an econometric model developed by Edwards in 1994, fundamental variables such as productivity, foreign direct investment, inflation and the real interest rate are analysed to estimate the equilibrium value of the real exchange rate (REER) of the Moroccan dirham. The results show a cointegration between the REER and the fundamental variables, indicating the existence of a long-term relationship. The analysis of misalignments reveals periods of overvaluation and undervaluation of the Moroccan dirham, influenced by economic factors and monetary policies. This study has important implications for economic and monetary policy in Morocco, particularly with regard to export competitiveness and macroeconomic stability.

Keywords: Equilibrium Exchange Rate, Misalignment, Error Correction Model, Morocco
JEL Classification: C22, F31

1. INTRODUCTION

Policies for managing exchange rates have always been crucial for developing nations like Morocco. This function has received special attention in the formulation of policies meant to modify economic systems and stabilise the macroeconomic environment. The World Bank states that wise real exchange rate (REER) management fosters both longer-term economic growth and shorter- and medium-term outcomes that are more efficient and relatively less expensive (Karim and Touzani, 2020). Estimating the equilibrium real exchange rate is also essential for nations like Morocco, whose productive economic fabric has been impacted by periods of macroeconomic imbalances.

In an economy, the exchange rate is important from both a macroeconomic and a microeconomic perspective. Since the exchange rate serves as an explicit and reliable anchor for domestic price stability, for example, the macroeconomic component is linked to concerns about financial stability. Several empirical results obtained in Latin American, Asian and African countries show that there is a close relationship between the behaviour of the real exchange rate and economic performance (Ali et al., 2015). While the economies of East Asia have grown thanks to stable real exchange rates, Shabsigh and Domaç (1999) have argued that the persistence of a mismatch in these values has hampered the economic progress of African countries. Every economy relies heavily on the exchange rate, and to manage it effectively, decision-makers need to be aware of the equilibrium real exchange rate (ERER), a fundamental indicator of economic performance (Ali et al., 2015). The "ideal" real exchange rate refers to the rate that exists in an economy when there are no price rigidities, frictions or other short-term variables. Levels are known as real exchange rate misalignment, or RERM. The equilibrium real exchange rate is expressed as a function of additional macroeconomic factors using the Behavioural Equilibrium Real Exchange Rate (BERER) technique. In other words, a misalignment occurs when the real exchange rate deviates from the equilibrium exchange rate (Ali et al., 2015). The ERER has the potential to impact on economic

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growth through at least two different mechanisms. Firstly, they could have an impact on domestic and international investment, particularly portfolio investment, which would have an impact on the process of capital accumulation. Secondly, the tradable sector and its competitiveness vis-à-vis the rest of the world may be affected by an unbalanced real exchange rate (Razin and Collins, 1997). As a result, the ERER creates significant distortions that harm several economic sectors. For example, misalignment in the form of overvaluation of the domestic currency acts as a tax on the prices of tradable goods. Given the negative impact of the ERER on economic growth, the authorities are endeavouring to ensure that the nominal exchange rate is set at an appropriate level.

In Morocco, macroeconomic management continues to attach great importance to determining the real equilibrium value of the dirham, particularly in the light of current financial globalisation. Thus, one of the most delicate decisions that a nation must make in order to maintain its price competitiveness and reduce the loss of income is to manipulate the external value of its currency (Bouazza and Mafamane, 2020). However, determining the equilibrium exchange rate does not depend on a single method. In addition to the one that simply refers to PPP theory and the one based on structural exchange rate, currency and portfolio models, there is another approach that adds the concept of underlying equilibrium. Thus, we speak of a fundamental equilibrium real exchange rate (FEER), a desired equilibrium (DEER), a natural equilibrium (NATREX), a behavioural equilibrium (BEER), etc.

The research aims to empirically estimate the long-run equilibrium real exchange rate for the period 1990-2022. The Moroccan authorities are increasingly interested in analysing the behaviour of the exchange rate. Since the 1980s, Morocco has undertaken a process of liberalisation of its economy, mainly in its financial system, which led to the establishment of the Moroccan foreign exchange market in 1996. These developments have been accompanied by gradual adjustments to exchange rate policies. The main concern of the Moroccan monetary authorities was to prevent the dirham from depreciating while preserving its competitiveness. Thus, it is essential to consider the determination of the equilibrium exchange rate for the Moroccan dirham. Consequently, the central research question is as follows: How can we estimate the long-term equilibrium real exchange rate for Morocco?.

The remainder of the study is structured as follows: (1) The literature review is presented in section, (2) while the data and methodology are discussed in section. (3) The empirical results are discussed in section, (4) and the study concludes in section (5) with implications and future research directions.

2. LITERATURE REVIEW

One of the first to tackle the idea of the ideal circumstances of an economy is Nurkse (1945), who established the term equilibrium real exchange rate. According to him, it is the real exchange rate's value that satisfies the goals of both internal and external equilibrium. When there is a crisis in the product market, internal equilibrium occurs when there is a sustained inflow of external capital to finance the current account deficit in the balance of payments (Karim and Touzani, 2020). The non-tradable sector is in stable equilibrium. The next step is Williamson (1983; 1994) popularised this idea using the macroeconomic approach of the real exchange rate.

The BEER approach is a popular method for calculating the equilibrium rate of change. It models the rate of change as a function of well-chosen macroeconomic fundamentals. Using data collected from a panel of 12 developing countries, Edwards (1989) developed a model that showed how nominal and real factors influence the short-term RER, while only real factors have an impact on the "equilibrium rate of change" (steady state). It has been established that inconsistent macroeconomic policies lead to an overestimation of the real rate of change. In another panel analysis of the equilibrium rate of change for 93 countries, Razin and Collins (1997) took into account several fundamental factors such as labour productivity, the terms of trade, annual long-term capital inflows as a proportion of GDP, yearly resource sales as a percentage of GDP, and the annual expansion of the money supply excess in relation to output growth. They discovered that sub-Saharan Africa, South and Central Asia, and Europe have the most noticeable misalignments. According to research by Lim (2000), the quantity of external debt and the total cumulative difference in real interest rate differentials are the two main factors determining the value of the Thai baht. He carried out an empirical analysis using the error correction model and discovered that the estimated long-run equilibrium real exchange rate for the Thai baht followed the equilibrium real exchange rate quite closely. However, Omerbegovic (2006) found that at the end of 1996, the actual rate of change in Malaysia was overestimated by 11.5%. According to Rajan et al. (2000), productivity (measured by GDP per capita) is a significant factor influencing the actual real equilibrium rate of change in any given economy. They observed persistent and significant misalignments between the Thai baht and the Japanese yen by using the usual Johansen cointegration test to the natural real rate of change model created by Stein (1994) using quarterly data spanning the years 1988-1999. Terra and Valladares (2010) examined periods of real exchange rate appreciation and depreciation for a sample of 85 countries between 1960 and 1998, and used a Markov model with regime switching to characterise the real exchange rate misalignment series. They found no evidence of misalignment in some countries, but in other countries there was a divergence between the real exchange rate in one regime and the other state. When two discordant regimes coexist in a country, the more sustainable regime is the one that is depreciated. According to Soto (1996), To determine the actual rate of change of equilibrium, three steps are necessary. Firstly, it is essential to provide a precise definition of the term "equilibrium." Secondly, a theoretical reference model needs to be established that identifies the key variables required to calculate the equilibrium rate of change. Finally, an economic methodology needs to be developed that allows the predictions of the theoretical model to be compared with empirical data, thereby operationalising the concept of equilibrium adopted.

There are three main ways that the economic literature handles the problem of estimating the equilibrium real exchange rate: (i) the macroeconomic approach (FEER, DEER), (ii) the

economic approach (BEER) and (iii) the dynamic approach (NATREX). Firstly, and following the macroeconomic approach, Edwards (1989) defines the real equilibrium exchange rate as the proportionate cost of tradable goods compared to non-tradable goods, which concurrently maintains the external and economic balance inside. According to internal equilibrium, the unemployment rate cannot stray from its "natural rate" and the current and future levels of supply and demand for non-tradable commodities on the market are equal. When future balance of payments balances are discounted to zero and the balance of payments for a given period is in equilibrium, external equilibrium is achieved. The "fundamentals", a group of additional variables that provide internal and external equilibrium, determine the value of the real exchange rate. These variables include the terms of trade, foreign investment, international capital flows, interest rates, inflation, productivity growth, and so on. So the fundamentals of the exchange rate are the only factors that define its true equilibrium (Karim and Touzani, 2020). The market for non-tradables reaches internal equilibrium when it is stable both now and in the foreseeable future, while external equilibrium is achieved when long-term sustainable capital flows match the current account balance. Williamson (1983; 1994) postulates that the current account reflects sustainable financial flows and that the economy is in full employment, which corresponds to internal and external equilibrium. Therefore, establishing a trade balance equation, figuring out the sustainable level of the current account, and specifying the output level to attain full employment are critical elements in this strategy. He argues that equilibrium real exchange rate theories have two fundamental aspects. The equilibrium real exchange rate is defined as the value of the exchange rate that allows both internal and external equilibrium to be achieved in the medium term (Karim and Touzani, 2020). This definition is predicated on an intertemporal economic model with two sectors. When production reaches its potential or is consistently high, internal balance is reached. The current account's equality with a "equilibrium value" connected to the sustainability of foreign payments defines external equilibrium (Dornbusch et al., 2011; Lane and Milesi-Ferretti, 2007; Obstfeld and Rogoff, 1995). In addition, the exchange rate acts as a measure of competitiveness, balancing internal and external needs. The real exchange rate is favoured because it reflects national competitiveness, influencing local or foreign demand, rather than the distribution of production between tradable and non-tradable goods (Burstein and Gopinath, 2014; Campa and Goldberg, 2005; Lane and Milesi-Ferretti, 2007; Levchenko et al., 2010). However, the macroeconomic method is both normative and descriptive. It instructs nations on the exchange rates to use and seeks to predict the level of medium-term equilibrium on which they might agree.

Numerous theoretical and empirical difficulties arise from this. As a coordination model, it necessitates that countries agree upon uniform trade balance targets, the total of which equals zero globally (Karim and Touzani, 2020). There is actually a great deal of uncertainty regarding the exchange rate's equilibrium level since it is arbitrary to determine the level of sustainable balance. The findings of Borowski and Couharde (1999) state that Williamson's method is a comparative statistical strategy that entails determining the actual misalignment brought about by internal and external imbalances in each era. As a result, this method ignores the specifics involved in the exchange rate's return to equilibrium. Second, in accordance with the econometric method, Clark and MacDonald (1999) suggested a composite model called the Behavioural Equilibrium Exchange Rate (BEER). It entails selecting a subset of fundamental variables that are most likely to have a long-term impact on the actual exchange rate and then searching for cointegrating correlations between these variables and the exchange rate. The authors contend that the difference between the exchange rate and its anticipated long-term value, as established by the cointegrating relationship, can be used to evaluate the misalignment of the current rate. Although the long-term relationship's fundamentals are meant to act as a restoring force in the event of misalignment, causing the current exchange rate to converge towards its equilibrium value, this mechanism is essentially statistical in nature because the statistical model, not the theoretical model, provides the convergence property. As a result, exchange rate dynamics are not specifically included in this approach. Third, the dynamic approach, which claims that Stein and Allen (1997) created the natural real exchange rate (NATREX) hypothesis of the natural real exchange rate. It stands for the real exchange rate, which keeps the balance of payments in balance when cyclical factors like potential production, speculative capital flows, and changes in foreign exchange reserves are absent. Three time scopes for the exchange rate are distinguished by this method: Short term, medium term, and long term. The real exchange rate is influenced by short-term cyclical and speculative factors (b), as well as by the stock of net assets (S) and fundamental variables (X).

$$Y_t = Y_t(X, S, v) \quad (1)$$

The model's current dynamics are predicated on the real exchange rate's convergence towards its medium-term equilibrium value, which is brought about by the equalisation of financial returns and the lack of speculative capital flows. The medium-term net asset stock and fundamentals form the foundation of NATREX.

$$Yt = Yt(X, S) \quad (2)$$

The capital stock per capita and the net international investment position are not constant in this scenario. When NATREX achieves a stationary state, it is solely dependent on these fundamental variables throughout the long run. The capital stock and the net foreign investment position are inherently stable, in contrast to the medium term.

$$Yt = Yt(X) \quad (3)$$

The explicit foundation of the NATREX dynamic approach is the set of long-term factors that establish the equilibrium real exchange rate. In an econometric model, they can be observed in reduced form in the exchange rate equation. In contrast to FEER, NATREX considers the influence of stocks by utilising the net foreign investment position and the capital stock dynamics, allowing for the computation of a medium- and long-term equilibrium path (Karim and Touzani, 2020). Regarding the internal equilibrium hypothesis, NATREX, like FEER, has certain limitations because it makes the assumption that wage and price dynamics happen

automatically and that the labour market is in equilibrium. The FEER, BEER, and NATREX theories of equilibrium real exchange rates transition to theories of nominal exchange rates only when the price formation mechanisms are eliminated. Furthermore, despite the lack of strong theoretical backing, NATREX assumes that agents predict exchange rate stability since it believes them to be incapable of predicting exchange rate fluctuations.

3. DATA AND METHODOLOGY

3.1. Data

According to economists like Edwards, Elbadawi, Stein, and Montiel, there is a direct relationship between shifts in the real exchange rate (REER) and shifts in economic theories across time. However, other economists, like Lafay (1984), contend that there is a direct relationship between changes in the TCR and a nation's degree of development. The primary variables in our model were chosen based on theoretical considerations; all of these variables have a natural logarithmic expression. The following variables are discussed as significant to the study: Real exchange rate of effectiveness (REER): Based on a weighted average of multiple currencies, this is a measurement of a currency's value divided by a cost index or price deflator. GDP divided by the total number of workers is productivity, or PROD. Throughout the examined period, productivity has generally increased. Amount of foreign direct investment (FDI) relative to GDP. The relationship between FDI and the exchange rate is complex, as exchange rate fluctuations can both dissuade foreign investment and encourage it to look abroad to protect itself against exchange rate risk (Aizenman and Grimmett, 1991; Arthur and Addai, 2022; Cushman, 1988; Tien et al., 2022; Veeramani et al., 2020). The inflation rate (INF), which is a key factor in exchange rate fluctuations (Edwards, 2006; Hasran et al., 2023; Iqbal, 2022), even when other factors are taken into account. The general increase in prices, which constitutes inflation, is generally measured by the consumer price index (CPI). The real interest rate (RIR) is considered a relevant variable for the study, as it is closely linked to changes in exchange rates. The value of the currency in reference to other currencies may directly alter in response to an interest rate change. Exchange rates may therefore have opposite effects from a rise or fall in rates (Alshubiri, 2022; Eichengreen, 2007; Liu and Lee, 2022; Razmi et al., 2012; Rodrik, 2008). Table 1 sets out all the variables in the study, their definitions and their sources.

3.2. Methodology

The model Edwards created in 1994 will be used to determine Morocco's equilibrium exchange rate. This model assumes a small open economy based on the production of non-tradable goods and tradable goods, primarily raw resources for export. The aim of this model is to evaluate the long-term effects of fundamental variables on the effective value of the exchange rate. The long-term equilibrium value of the effective exchange rate as a function of key variables is defined by Equation 4:

$$LnREER = \lambda_0 + \lambda_1 Ln\,(X_t) \quad (4)$$

This section first presents the theoretical factors associated with the equilibrium real exchange rate before pursuing two main goals. The first is to estimate the equilibrium value of the dirham's real exchange rate (REER) using the fundamental elements that were previously analysed. The second goal is to measure the degree of misalignment. Our econometric modelling method is based on two fundamental ideas from long-run equilibrium theory: firstly, there exists a long-run equilibrium relationship between the basic factors that determine the equilibrium real exchange rate (ERER). This relationship can be expressed in linear form as follows:

$$LnREER = \lambda_0 + \lambda_1 LnPROD + \lambda_2 LnFDI + \lambda_3 INF + \lambda_4 LnRIR + \varepsilon t \quad (5)$$

With, LnREER refers to the neperian logarithm of the equilibrium real exchange rate. LnPROD refers to the natural logarithm of total output, and LnFDI represents the natural logarithm of FDI flows as a percentage of GDP. INF corresponds to the level of inflation, measured by the consumer price index. Finally, LnRIR indicates the real interest rate. The residuals (εt) are assumed to be identically and independently distributed over time. In addition, we will use the cointegration approach, which is based on Engle and Granger's (1987) cointegration tests, to demonstrate the presence of these long-run equilibrium relationships.

The second concept is to use the error correction model (ECM) to achieve a dynamically stable state, so the equation can be rewritten as follows:

$$\begin{aligned} \Delta LnREER &= \beta ECM_{t-1} + \sum_{i=0}^{p} \alpha 1,i \Delta LnPROD_{t-1} + \\ &\sum_{i=0}^{q} \alpha 2,i \Delta LnFDI_{t-1} + \sum_{i=0}^{h} \alpha 3,i \Delta INF_{t-1} + \\ &\sum_{i=0}^{s} \alpha 4,i \Delta LnRIR_{t-1} + \sum_{i=0}^{v} \alpha 5,i \Delta LnREER_{t-1} + \varepsilon_t \end{aligned} \quad (6)$$

Where β is the adjustment coefficient, signifying the percentage of the imbalance in (t−1) that is adjusted in (t) and ECM_{t-1} is the long-run relationship regarding the real exchange rate of the preceding era. The coefficients linked to the explanatory variables in the model are denoted by the terms α t, i. The model's various lags are denoted by the notations p, q, h, s, and v, while the error term is measured by ε_t.

4. RESULTS AND DISCUSSION

4.1. Analysis of Stationarity

When analysing time series, it is crucial to understand whether the observed data is influenced by a trend or whether it fluctuates stably around a long-term average. This is where unit root and stationarity tests come into play. These tests are designed to detect whether

Table 1: Definitions and sources of variables

Variables	Definitions of variables (measures)	Sources
Real effective exchange rate	The value of a currency divided by a cost index	WDI
Productivity	GDP divided by the total number of workers	WDI
Foreign direct investment	FDI flows as a percentage of GDP	WDI
Inflation	The consumer price index	WDI
Real interest rate	The inflation rate deducted from the nominal interest rate	WDI

WDI: World development indicators

a time series is affected by non-stationary components, which could distort the results of subsequent analyses. The Augmented Dickey-Fuller (ADF) test is one of the most commonly used tools for detecting the presence of a unit root in a time series. By examining the statistical significance of a coefficient in a linear regression, the ADF test can indicate whether the series is non-stationary. To improve the accuracy of the test, lag terms are added, hence the term 'augmented'. The Phillips-Perron (PP) test has a similar objective, but is distinguished by its robustness to complex autocorrelation structures and residual heteroscedasticity. This test adjusts the test statistics to take account of these potential complications, offering a reliable alternative to the ADF test. Finally, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test approaches the issue from a different angle. Rather than testing for the presence of a unit root, the KPSS checks the stationarity of the series around a trend. A result indicating non-stationarity suggests that the series follows a stochastic rather than deterministic trend. The results of the stationarity test for the macroeconomic fundamentals time series are displayed in Table 2.

Based on the results of the ADF and PP tests, all the variables are stationary at the first order of differentiation, as shown in Table 2. This characteristic implies cointegration, or the presence of a long-term link, between the variables and the actual effective exchange rate. These findings support the degree of integration of the variables in order I(1) and are in line with the KPSS test results shown in Table 3.

4.2. Engle Granger Cointegration Test

Table 4 below displays the Engle-Granger cointegration test results. Any cointegrated series can be described by an error correction model (ECM), according to Engle-Granger's (1981) modelling theory.

Table 2: ADF and PP test results

Variables	ADF Test		PP Test		Lag
	I (0)	I (1)	I (0)	I (1)	
LnREER	−2.309	−4.241**	−2.298	−4.290**	1
LnPROD	−1.536	−3.793**	−2.575	−8.805***	5
INF	−4.513	−8.777***	−4.518	−12.959***	1
LnRIR	−1.906	−3.439**	−1.564	−3.439**	1
LnFDI	−2.529	−7.284***	−2.535	−7.109***	3

***, **indicate significance levels of 1% and 5% respectively. The criterion used to determine delays is the Akaike Information Criterion (AIC)

Table 3: Results of the KPSS test

Variables	Constant		Trend and constant		Order
	I (0)	I (1)	I (0)	I (1)	
LnREER	0.673	0.293	0.280	0.159	I (1)
LnPROD	0.685	0.139	0.108	0.134	I (1)
INF	0.514	0.245	0.134	0.139	I (1)
LnRIR	0.614	0.113	0.126	0.092	I (1)
LnFDI	0.324	0.082	0.087	0.076	I (0)

Adding a trend to the model after adding a constant allowed for the execution of the KPSS tests. For thresholds of 1%, 5%, and 10%, respectively, the critical values of the tests with the constant included are 0.740, 0.464, and 0.348. For tests that include the trend, the critical values are 0.120, 0.147, and 0.217 for thresholds of 1%, 5%, and 10%, respectively. The FDI series is regarded as stationary at the I (1) first difference based on the findings of the other two tests, ADF and PP, even if the LIDE variable is stationary at the I (0) level according to the KPSS test

In Table 4, it is clearly established that there is a negative correlation between the real effective exchange rate and all explanatory factors (PROD, INF, RIR, FDI). Furthermore, we observe that the Durbin-Watson test indicates no autocorrelation of errors and that the model exhibits significant predictive capability, as evidenced by the coefficient of determination (R^2) which is approximately 0.80. Considering that the residual series (ECM_t) is likewise stable at level I(0), which is the first condition of Engle Granger, we infer that there is cointegration between the real effective exchange rate and all other variables across all tests. Furthermore, Table 5's indication of residual series stability, albeit marginally below the degrees of cointegration of the variables under investigation, implies that the second requirement of Engle-Granger cointegration is met.

4.3. Estimation of the Error Correction Model

Table 6 reveals an R^2 coefficient of 0.82, indicating the robustness of the regression forecast and its ability to explain fluctuations in the exchange rate. This suggests that variations in RIR, INF, FDI,

Table 4: Results of the Engle granger test

Variables	Coefficient	SD	T-Statistic	Probability
LnPROD	−0.188	0.030	−6.349	0.0000
INF	−0.007	0.003	−2.110	0.0456
LnRIR	−0.180	0.038	−4.837	0.0001
LnFDI	−0.019	0.005	−4.497	0.0001
Constant	6.516	0.298	21.867	0.0000
R^2	0.80			
R^2-ajusté	0.76			
Durbin-Watson	1.43			
F-statistic	22.68			

SD: Standard error

Table 5: Results of residual series stationarity

ECM_t	ADF Test	PP Test	KPSS Test
T-Statistic	−5.127***	−4.721***	0.076
1%	−4.375	−4.324	0.216
5%	−3.604	−3.581	0.146
10%	−3.239	−3.226	0.119

***indicates significance level at 1%

Table 6: Error correction model estimation result

Variable	Coefficient	SD	T-statistic	Probability
ΔlnREER(-1)	0.93	0.20	4.74	0.0007
ΔlnREER(-2)	0.31	0.15	2.10	0.0066
ΔlnREER(-3)	0.49	0.18	2.83	0.0167
ΔlnREER (-4)	0.67	0.18	3.72	0.0035
ΔlnPROD (-1)	0.80	0.16	5.07	0.0005
ΔINF (-1)	0.02	0.01	5.62	0.0003
ΔINF (-2)	0.01	0.01	3.35	0.0067
ΔINF (-3)	0.01	0.01	3.98	0.0023
ΔLnRIR (-3)	0.13	0.06	2.12	0.0580
ΔLnFDI (-4)	−0.01	0.01	1.84	0.0134
Constant	−0.03	0.01	−3.56	0.0046
ECM (-1)	−1.09	0.20	−5.45	0.0003
R^2	0.82			
F-statistic	4.02			
Prob (F-statistic)	0.02			
D-W	2.09			

SD: Standard error

and PROD as independent variables account for over 82% of the exchange rate fluctuations.

In this regard, the error correction coefficient (ECM (-1)) shows a negative signal (−1.09) with a significance level of 1%, suggesting that the exchange rate may require more than ten periods to reach long-term equilibrium following a shock. In other words, this analysis implies that the adjustment rate is (−1.09), indicating that approximately 109% of long-term exchange rate imbalances are corrected in each period (year).

The equation of the error correction model (ECM) can be computed using the information from the table above:

$$\Delta LnREER = 0.93\times\Delta lnREER_{(-1)} + 0.31\times\Delta lnREER_{(-2)} + 0.49\times\Delta lnREER_{(-3)} + 0.67\times\Delta lnREER_{(-4)} + 0.80\times \Delta lnPROD_{(-1)} + 0.02\times \Delta INF_{(-1)} + 0.01\times \Delta INF_{(-2)} + 0.01\times \Delta INF_{(-3)} + 0.13\times\Delta LnRIR_{(-3)} - 0.01\times \Delta LnFDI_{(-4)} - 0.03 - 1.09\times ECM_{(-1)}$$

4.4. Calculating Morocco's Equilibrium Real Exchange Rate and Measuring Misalignment

At this stage, in Table 7, we will determine the phases of appreciation and depreciation of the dirham and assess the divergence of the equilibrium exchange rate from the REER over the study period (1990-2022). Before calculating the misalignments, we will determine the equilibrium value of the REER from the results of the model estimates. Indeed, during the model estimation process, the equilibrium value of the exchange rate is found by replacing the base variables with equilibrium values. The deviation of the real exchange rate from its equilibrium value is shown in Figure 1.

As previously stated, our goal is to determine the real effective exchange rate (REER) misalignments of the Moroccan Dirham by first determining its equilibrium REER. Misalignments of the REER refer to the difference between the observed REER and the equilibrium REER, which requires establishing the values of the equilibrium REER before proceeding with this measurement. To gauge these misalignments, we employ an analytical approach based on the following formula:

$$D = \frac{(ORER - ERER)}{ERER} \quad (7)$$

With D as the misalignment index, where ORER represents the observed real exchange rate and ERER represents the equilibrium real exchange rate. A positive value of misalignment (D > 0) indicates an overvaluation of the Dirham, meaning that the real exchange rate exceeds its equilibrium level. Conversely, a negative value of misalignment (D < 0) suggests an undervaluation of the Dirham, implying that the real exchange rate is below its equilibrium level. Finally, a zero misalignment (D = 0) indicates that the real exchange rate is balanced. Figure 2 illustrates the degree of misalignment over the period 1990-2022.

4.5. Analysis of the Results

Table 8 presents the periods during which the Dirham was overvalued and undervalued. In the early 1990s, key economic indicators signaled a significant decline in Morocco's economic situation. The results highlight a continuous devaluation of the

Table 7: Results of determining the REER and measuring misalignment in Morocco

Observations	Observed RER	Equilibrium RER	Degree of Misalignment
1990	4.5887	4.6255	−0.00796
1991	4.5987	4.6127	−0.00304
1992	4.6037	4.6345	−0.00665
1993	4.6313	4.6409	−0.00207
1994	4.6627	4.6529	0.00211
1995	4.6947	4.6517	0.00924
1996	4.6982	4.6604	0.00811
1997	4.6948	4.7114	−0.00352
1998	4.7211	4.6966	0.00522
1999	4.7211	4.7438	−0.00479
2000	4.744	4.7019	0.00895
2001	4.7027	4.6909	0.00252
2002	4.6981	4.712	−0.00295
2003	4.6906	4.6755	0.00323
2004	4.6729	4.6939	−0.00447
2005	4.6451	4.6761	−0.00663
2006	4.6498	4.6445	0.00114
2007	4.6409	4.6222	0.00405
2008	4.6384	4.5981	0.00876
2009	4.6524	4.6267	0.00555
2010	4.6053	4.6291	−0.00514
2011	4.5798	4.6136	−0.00733
2012	4.5579	4.5943	−0.00792
2013	4.5743	4.5744	−0.00002
2014	4.5751	4.5749	0.00004
2015	4.5723	4.5608	0.00252
2016	4.5933	4.5879	0.00118
2017	4.5896	4.5998	−0.00222
2018	4.5988	4.5892	0.00209
2019	4.6021	4.6081	−0.00130
2020	4.5877	4.5841	0.00079
2021	4.5901	4.5861	0.00087
2022	4.5901	4.5861	0.00087

Degree of Misalignment = (Observed RER - Equilibrium RER)/Equilibrium RER

Table 8: Periods of evaluation of the Moroccan dirham

Overvaluation	1994-1996; 1998; 2000-2001; 2003; 2006-2009; 2013-2016; 2018-2019; 2021-2022
Undervaluation	1990-1993; 1997; 1999; 2002; 2004-2005; 2010-2012; 2017; 2020

Figure 1: The amount that the real exchange rate deviates from its equilibrium value

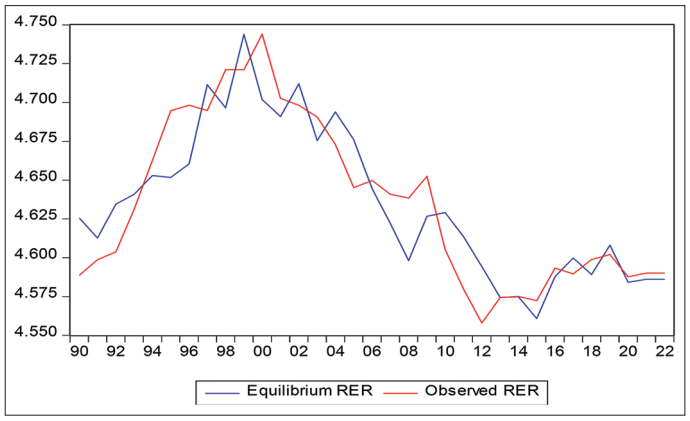
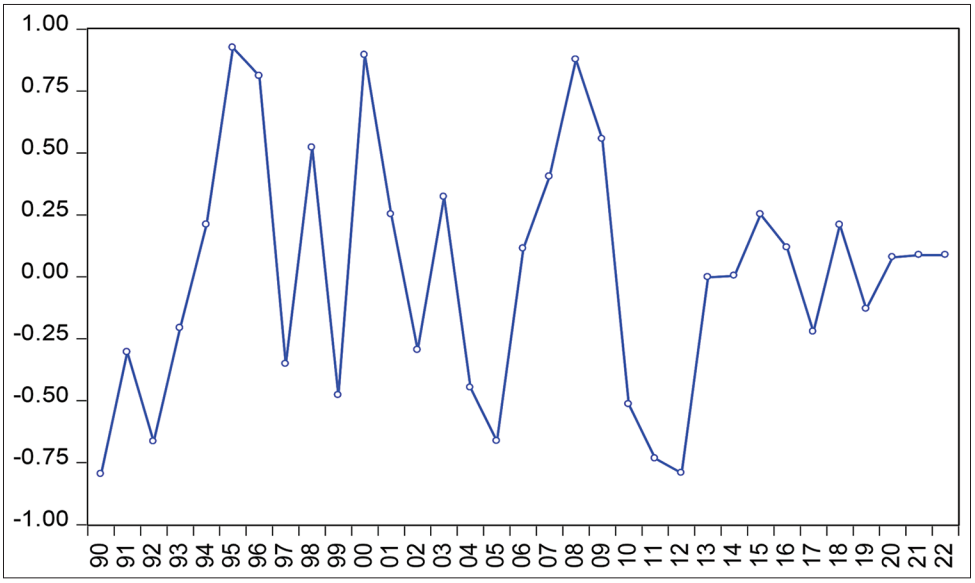


Figure 2: Morocco's misalignment development



Moroccan Dirham throughout the period 1990-1993, in response to exchange rate policy and the global economic context. During this period, the country experienced historical peaks in budget and current account deficits, while external debt exceeded 70% of GDP. Various factors contributed to this economic deterioration, including falling phosphate prices, appreciation of the dollar and high-interest rates, as well as severe drought characterizing this period. However, an overvaluation of the Dirham occurred between 1994 and 1996, prompting the implementation of various reforms affecting all aspects of the economy. Budgetary expenditure, taxation, foreign investments, privatisation, and trade liberalisation were all included in these reforms. Notably, free trade agreements were signed, and the nation joined the World Trade Organisation (WTO) in 1995. In 1993, Morocco launched its privatization program as a complement to the liberal policies adopted in the 1980s to broaden its industrial and economic base. These initiatives contributed to improving Morocco's financial and economic performance. However, the value of the dirham was depreciated in comparison to its equilibrium level in 1997 and 1999 because of the economic environment, which was marked by decreasing economic development (most notably as a result of years of drought).

Although the Dirham was overvalued between 2000 and 2003 due to better market capitalization since 2000, its value increased against the dollar, likely promoting diversification of the country's import suppliers. Compared to 2004-2005, the value of the Dirham depreciated during these 2 years as Morocco intensified its openness to foreign markets. Consequently, the trade deficit widened, with imports growing faster than exports, partly attributable to rising energy costs. Furthermore, the dollar and euro lost value as a result of the global financial crisis, which caused the dirham to become overvalued between 2006 and 2009. Note that the exchange rate of the Dirham is still based on a basket consisting of the US dollar and the euro.

The 2009 financial and economic crisis had an impact on Morocco's growth as well as the decrease in economic activity in its partner countries, which explains these facts. These effects were transmitted through four main channels, namely tourism revenues, remittances from Moroccans residing abroad (MRA), FDI, and foreign demand for Morocco, with a time lag.

The overvaluation of the Dirham during the period 2013-2018 can be attributed to an improvement in the current account deficit relative to GDP. Consequently, the year 2017 witnessed a steady increase in imports and exports at the commercial level. In terms of foreign investment and tourism sector revenues, the external position also experienced positive growth.

During the period 2019-2022, the evolution of the Moroccan Dirham exchange rate misalignment presented significant trends. In 2019, an increase in misalignment was observed, signaling an overvaluation of the Dirham. This overvaluation may result from various factors such as excessive currency appreciation or favorable economic conditions. This may have implications for the competitiveness of Moroccan exports in international markets. Conversely, in 2020, a decrease in the exchange rate misalignment was recorded, indicating a reduction in the overvaluation of the Dirham. This decrease may result from a reassessment of economic fundamentals or monetary policy measures aimed at stabilizing the currency. Currency depreciation can make domestic products more competitive in international markets, thereby stimulating economic growth. During the years 2021 and 2022, the exchange rate misalignment remained slightly overvalued.

5. CONCLUSION

The research focuses on evaluating the equilibrium exchange rate of the Moroccan Dirham over the period 1990-2022, using the error correction model (ECM). Through this analysis, we identified periods of overvaluation and undervaluation of the Dirham, highlighting the economic factors and monetary policies that influenced these fluctuations.

The results show that the Moroccan Dirham has undergone periodic adjustments in response to various economic shocks, such as budget deficits, adverse weather conditions, and fluctuations in global markets. Economic reforms undertaken have often impacted the value of the Dirham, notably by stimulating foreign investment and improving export competitiveness. However, persistent misalignments have been observed, underscoring the need for more robust monetary and economic policies to maintain exchange rate stability.

In this regard, recommendations can be made, such as implementing coherent fiscal and monetary policies, diversifying exports, and promoting investments in high-value-added sectors. For future research directions, it would be pertinent to delve deeper into the analysis of specific determinants of exchange rate misalignments, including examining trade policies, capital flows, and global macroeconomic conditions. Additionally, a comprehensive study of the effects of exchange rate volatility on economic growth and financial stability could provide valuable insights to guide future public policies.

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