Determinants of real exchange rate misalignment: An empirical analysis for MENA region

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Abstract

The purpose of this paper is to explain the magnitude of the misalignment of the real exchange rate and its determinants for the MENA countries. Misalignment is defined as the deviation of the real exchange rate from its equilibrium level, unlike volatility which is defined as fluctuations that are very frequent but do not persist. Through this study, an attempt is made to broaden the traditional analysis, focusing mainly on the role of the exchange rate regimes on misalignment of the REER. On the same point of view, the roles of the persistence of misalignment, the quality of institutions, financial development and inflation in the misalignment of the real equilibrium exchange rate of the region. The results of the empirical analysis show that the most advantageous exchange rate regime for the MENA countries is the floating regime. Also, the quality of institutions, financial development and inflation are determinants of the shift of the REER from its equilibrium value.

Keywords: MENA countries, Misalignment, Real exchange rate, GMM, Panel data, Determinants

1. Introduction

Most research does not provide much result on the impact of real exchange rate volatility, although they found a significant impact of misalignment on changes in macroeconomic indicators. The variables that can be affected by the phenomenon of misalignment are the growth of the economy (Cottani et al., 1990, Chra and Grennes, 1993, Rodrik, 2008, Hams and Kretschmann, 2009), the accumulation of capital (Goldberg 1993, Serven 2003, Kandilov and Leblebicioglu 2011), foreign direct investment (Froot and Stein 1991, Glodberg 2009), exports (Skkat and Varoudakis 2000, Freund and Pierola 2012), currency crises. (Bussière and Fratzscher, 2006) and the trade balance (Hoffmann, 2007).

The misalignment of the real exchange rate is usually associated with the choice of an exchange rate regime, mainly following the collapse of the Bretton Woods system in 1973. Normally, each country declares its choice of the exchange rate regime. for international organizations such as the IMF. This is called de jure diet. However, in practice, the de jure regime and regime actually implemented rarely coincide. This divergence leads to the development of the concept of the de facto regime (Reinhart and Rogoff, 2004, Levy-Yeyati and Sturzenegger, 2005), which refer to the exchange rate regime actually implemented. In these facts, this paper focuses on the de facto concept.

In general, each country can convert its de facto exchange rate to another currency, let it float freely or control its floating. Each category includes some variant diets. Exchange rate regimes refer to the level of the nominal exchange rate and the association with a certain level of misalignment. According to the standard macroeconomic models, it is not, at first sight, clear

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which exchange rate regimes induce more misalignment. Under a flexible exchange rate regime, the foreign exchange market determines the appropriate level of the nominal exchange rate. As a result, misalignment of the real exchange rate can only be temporary. On the other hand, given that, under fixed regimes, nominal exchange rates cannot be adjusted, there is a risk of misalignment. However, if goods markets are highly efficient, prices could respond to market pressures and bring the real exchange rate back to equilibrium, even if the nominal exchange rate does not change. In reality, the real exchange rate shows a significant level of misalignment in both fixed and flexible exchange rate regimes. Under the fixed exchange rate regimes this could be related to the rigidity of the nominal price (Engle, 2010). Under fixed exchange rate regimes, this could be due to imperfect information among investors (Edwards, 2011). Some empirical analyzes confirm that the real exchange rate may be non-aligned regardless of the nominal regime (Coudert et al., 2013, Nouira et al., 2011).

While several studies show that the real exchange rate may be misaligned whatever the regime, other studies have focused on demonstrating whether a given regime is more prone to misalignment than others. In this vision, Dubas (2009) has shown that misalignment is more pronounced in developing countries, noting that free floating leads to much more misalignment. In contrast, Coudert and Couharde (2009) and Holtemoller and Mallick (2013) found that the fixed exchange rate induces more misalignment than the floating exchange rate regime. The divergence of the two study results could be due to econometric approaches, to the characteristics of the sample studied. Collins (1996) suggests that the accepted or tolerated degree of misalignment of the real exchange rate depends on other eco-political factors or depends on inflationary pressures. The recent literature identifies two factors that are decisive in the level of acceptance or tolerance of misalignment of the real exchange rate. These two factors are the quality of institutions and financial development. For example, Rodrik (2008) recommends a strategy based on an active imbalance exchange rate when domestic institutions are weak.

Also, Aghion et al. (2009) and Elbadawi et al. (2012) find that the effect of misalignment of the exchange rate on growth is negligible when the financial system of the country is developed. This low cost of misalignment could make the country relatively more tolerant of misalignment.

Through this paper, the method of estimating misalignment should initially be presented, calculating it for the MENA countries. Subsequently, the determinants of their equilibrium real exchange rates are analyzed empirically. We finish this paper with a conclusion and we present some recommendations.

2. Estimation of misalignment of exchange rates

The first step in this analysis is to assess, for each country in the sample, the extent of the gap between the real exchange rate observed and the exchange rate that it should have under the assumption that the macroeconomic balance of the economy is maintained. The observed rate considered here is the actual effective exchange rate that is most commonly used. To obtain the exchange rate consistent with macroeconomic equilibrium, we use an econometric model inspired by the work of Edwards (1988). This model allows us to calculate the real effective balance of the exchange rate. The difference between the real effective exchange rate observed and the equilibrium exchange rate is considered in our study as the measure of misalignment.

2.1.The real effective exchange rate (REER) misalignment model

Since we are dealing with the case of MENA countries, the most commonly used index in the calculation of the REER is the Consumer Price Index (CPI), since it is available in the long run for all country. We therefore calculate the REER over the period 1999-2016 according to the following formula:

$$\ln(REER) = \sum_{j=1}^{9} \left(w_j \ln \left(e_j * \left(\frac{CPI}{CPI_j} \right) \right) \right) \qquad (1)$$

With

- CPI: Country's consumer price index.

- CPI_j **:** Consumer price index of the partner country j.

- e_j **:** The nominal bilateral exchange rate of the country.

- w_j : The weight of the partner j in the country's trade with its main partners.

The REER is constructed in such a way that an increase means an appreciation. It is broken down into two components: a component that relates to the equilibrium real effective exchange rate and a component that refers to misalignment. Indeed, the Edwards (1988) approach distinguishes between the two sources of the REER variation. His initial theoretical and dynamic model considers a small open economy with three types of goods. Exportable goods, importable goods and non-tradable goods. The equilibrium exchange rate is defined as the exchange rate that corresponds to a situation where the internal and external balances are simultaneously attained. The economy is expected to produce non-tradable exportable goods, importable and consumed goods, and non-tradables. The state consumes both importable and non-tradable goods, using both domestic taxes and credits to finance its expenditures. Also, the private sector cannot borrow from abroad. In addition, it is assumed that there is no domestic public debt. The model resolution shows that, under the conditions possible, the high import barriers will result in a real equilibrium appreciation as well as an increase in the consumption of non-tradable goods by the State. An improvement in the terms of trade can result in either real depreciation or real appreciation. An exogenous increase in capital flows leads to a real appreciation of equilibrium.

In his empirical model, Edwards (1988) simplifies the theoretical model and suggests other possible real determinants that could be introduced into the empirical model.

The empirical implementation of this study faces some problems such as the availability of time series of some explanatory variables. To estimate the REER equation, proxies have been taken into account for a few variables, such as import duties and non-tariff barriers. Therefore, these variables can be measured by the degree of openness.

On the basis of what has preceded, the following empirical model is estimated by adding an additional variable namely exchange rate crises, since this variable is a source of significant misalignment independently of the other variables (Dubas, 2009).

$$\ln(\mathbf{REER_{it}}) = \alpha_0 + \alpha_1 \ln(\mathbf{Open\_gdp_{it}}) + \alpha_2 \ln(\mathbf{FDI\_gdp_{it}}) + \alpha_3 \ln(\mathbf{T\_ech_{it}}) + \alpha_4 \ln(\mathbf{Debt\_gdp_{it}}) + \alpha_5 \ln(\mathbf{Expend\_gdp_{it}}) + \alpha_6 Crisis_{it} + \varepsilon_{it} \qquad (2)$$

With

$\mathbf{REER_{it}}$: The real effective exchange rate of country to year t.

$\mathbf{Open\_gdp_{it}}$: The openness rate which is the ratio of imports and exports to GDP. It is expected that trade openness will put pressure on the relative price of tradables and non-tradables, resulting in a depreciation of the equilibrium REER. So its coefficient will have to be negative.

$\mathbf{FDI\_gdp_{it}}$: The net capital flow expressed by FDI relative to GDP. A high capital flow leads to higher demand for tradable and non-tradable goods and leads to a relatively higher price of non-tradable goods with an appreciation of the REER. So its coefficient should be positive.

$\mathbf{T\_ech_{it}}$: The terms of trade expressed by the ratio of exports to imports from country i to year t.

$\mathbf{Debt\_gdp_{it}}$: Debt service to GDP ratio of country i to year t. the more public debt services there are, the more demand there is in foreign currency, thus inducing the depreciation of the REER. So coefficient should be negative.

$\mathbf{Expend\_gdp_{it}}$: Ratio of public expenditure to GDP of country i to year t.

$Crisis_{it}$: The crisis variable takes 1 if it is a crisis year and zero otherwise.

$\boldsymbol{\varepsilon_{it}}$: An error term.

The signs of the variables $\mathbf{T\_ech_{it}}$, $\mathbf{Debt\_gdp_{it}}$, $\mathbf{Expend\_gdp_{it}}$ and $\boldsymbol{Crisis_{it}}$ depend on certain factors such as capital flows and consumption that can be diverted to tradable goods or to non-tradable goods.

2.2.Calculation of the misalignment of the real effective exchange rate

The results of the regression of equation (2) will be used to obtain the equilibrium parameters (coefficients) of the model variables that give the real equilibrium effective exchange rate. Using the estimated coefficients of the equilibrium variables of the effective exchange rate, the degree of misalignment of the REER can be calculated. It should be noted that misalignment refers to the difference between the observed REER and the equilibrium REER (REERE). The latter is given by the adjusted values using the estimated equilibrium coefficients. We define, thus, as misalignment:

$$\boldsymbol{Mis = \left(\frac{REER}{REERE} - 1\right) * 100} \qquad \mathbf{(3)}$$

The positive values of the series of misalignment obtained correspond to an over-valuation and the negative values correspond to an under-evaluation of the real effective exchange rate.

3. Empirical analysis of the determinants of misalignment of the REER

After estimating and calculating the misalignment of the REER, we proceed to estimate the determinants which are behind the skid of the REER of its equilibrium level. Drawing on the work of Ridha Nouira and Khaled Sekkat (2015), we examine the determinants of the misalignment of the REER in the case of MENA countries.

3.1.The model

We estimate the equation of the following model:

$$|Mis_{it}| = \beta_0 + \beta_1|Mis_{it-1}| + \beta_{2j}\sum_{j=1}^{j=3} Regime_{ijt} + \beta_{3k}\sum_{k=1}^{k=k} X_{ikt} + \varepsilon_{it} \qquad (4)$$

With

$|Mis_{it}|$ **:** The misalignment of country i to year t. this variable is taken into absolute value since the two cases of under-evaluation and over-evaluation are considered sub-optimal. This allows us to examine the factor that influences the degree of global misalignment.

$Regime_{ijt}$ **:** This variable refers to a set of regimes that take 1 if the regime implemented by country i is fixed, 2 if the country regime i implemented is intermediate and 3 if the country regime i implemented is floating. According to the exchange rate literature, the type of regime is a determinant of misalignment of the REER.

X_{ikt} **:** The matrix of a set of explanatory variables of misalignment of the REER. This matrix includes:

- The inflation variable which is likely to increase misalignment.

- Institutional quality variable: According to Rodrik (2008), an active imbalance (under valuation) exchange rate strategy can stimulate growth if the quality of institutions in the country is low. We use the International Country Risk Guide (ICRG). The high quality of the institutions is supposed to reduce the tolerance to misalignment. Therefore, the corresponding coefficient should be negative.

- Financial development: Aghion et al (2009) and Elbadawi et al. (2012) find that the effect of misalignment of the REER is weak on growth if the country's financial system is well developed. The lower cost of misalignment could make the country relatively more tolerant of misalignments from the REER to the equilibrium REER. We use the ratio of domestic credit to private sector relative to GDP as a proxy for the financial development of countries (Aghion et al, 2009, Elbadawi et al, 2012).

ε_{it} **:** An error term

$|Mis_{it-1}|$: This is the delayed dependent variable. Our choice to use this variable is motivated by persistent misalignment in developing countries including MENA countries (Nouira et al, 2011).

3.2.The estimation method of the model

In the case of a dynamic panel model, the MCO (Ordinary Least Squares) and GCM (Generalized Least Squares) estimators are often inefficient. The GMM estimator represents a solution to these estimation anomalies. Indeed, the presence of an endogeneity problem does not encourage the use of standard econometric techniques for Dynamic Panel data, since their use is likely to result in biased and non-convergent estimators due to correlation between variables endogenous and the term error. The econometric estimation method used to estimate a dynamic panel model is the Generalized Moment Method (GMM) proposed by Arellano and Bond (1991). Indeed, this method is often used in the recent empirical literature especially in

macroeconomics and finance (Greene, 2011) given the type of data and model analyzed. This method makes it possible to control the individual and temporal specific effects, and to overcome the endogeneity bias of the variables. There are two types of generalized moment estimators: the Arellano and Bond (1991) or GMM difference estimator and the Blundell and Bond (1998) or GMM system estimator. The generalized moments method is recommended for estimating panel data in the sense that it corrects several potential biases introduced by the autoregressive nature of dynamic models.

For our case, the use of a delayed explanatory variable $\boldsymbol{Mis_{it-1}}$ raises the instantaneous problem with the residual error term because if the variable $\boldsymbol{Mis_{it}}$ is correlated with the error term, then $\boldsymbol{Mis_{it-1}}$ is also correlated, which makes the econometric estimators (Fixed-effect model, random-effect model biased and not consistent with the dynamic fit model equation (Nickell, 1981).) Also, the GMM method is effective in the sense that external shocks can affect misalignment and the explanatory variables (Marchira and Mura, 2008, Roodman D, 2009).

4. Estimation of the determinants of misalignment of the REER and results

4.1. Estimation of the misalignment of the REER

4.1.1. Presentation of the study sample

The study sample consists of 10 MENA member countries. We excluded those whose data are not completely available on international databases. Data resources are extracted from the World Bank (WB) statistical resources, UNCTADSTAT (UNCTAD statistical data platform and Kenneth Rogoff site). In our analysis we use the data through a cylinder model over the period of the year 1999 to 2016. We estimate equation (2) to determine the significant parameters of the model variables

$$\ln(\mathbf{REER_{it}}) = \alpha_0 + \alpha_1 \ln(\mathbf{Open\_gdp_{it}}) + \alpha_2 \ln(\mathbf{FDI\_gdp_{it}}) + \alpha_3 \ln(\mathbf{T\_ech_{it}}) + \alpha_4 \ln(\mathbf{Debt\_gdp_{it}}) + \alpha_5 \ln(\mathbf{Expend\_gdp_{it}}) + \alpha_6 Crisis_{it} + \varepsilon_{it}$$

Our goal in estimating this model is to determine the REER equilibrium coefficients with which we can subsequently calculate the misalignment of the REER of each country relative to its equilibrium state.

4.1.2. Descriptive statistics, correlation and stationarity of variables

Before beginning the econometric estimation phase, it seems imperative to conduct exploratory analyzes in terms of descriptive statistics and correlation of variables. This allows having a primitive idea about the nature of relationship between them, their level of correlation, as well as the nature of their distribution.

Table 1: Descriptive statistics of variables

	REER	T_ECH	Open_Gdp	FDI_Gdp	Debt_Gdp	Expend_Gdp	Crisis
Mean	112.5025	1.235529	91.15550	2.108993	51.16867	15.58727	0.470588
Median	104.1954	1.198103	89.06832	1.354242	34.48277	16.17711	0.000000
Maximum	314.8146	2.833778	188.4467	15.75020	337.1000	30.50423	1.000000
Minimum	35.10747	0.594249	30.38308	-1.166836	3.194411	5.745824	0.000000
Std. Dev.	55.66453	0.442521	34.14163	2.307619	67.32783	4.682356	0.500609
Skewness	1.626119	1.182851	0.489669	2.209047	3.172450	0.170078	0.117851
Kurtosis	5.719011	4.404047	2.667587	10.36150	13.53507	2.828818	1.013889
Jarque-Bera	127.2880	53.60594	7.576355	522.1215	1071.323	1.027151	28.33470

Probability	0.000000	0.000000	0.022637	0.000000	0.000000	0.598352	0.000001
Sum	19125.43	210.0400	15496.44	358.5288	8698.675	2649.835	80.00000
Sum Sq. Dev.	523653.3	33.09439	196995.0	899.9424	766083.3	3705.233	42.35294
Observations	170	170	170	170	170	170	170

Source: Author

This table summarizes the descriptive statistics of the variables namely, their average value, their maximum value and their minimum value. We note that the real effective exchange rate (REER) variable has an average value of 112.5% for all the countries in the sample with a variation of between 35.1% and 314.8% during the period studied. The coefficient of Skewness is positive and different from zero, which implies that the distribution is asymmetric on the right, then characterized by a slight spread on the right. The Kurtosis coefficient, or Pearson's flattening coefficient, measures the flattening, or on the contrary the punchiness of a distribution. A high flattening coefficient implies that the distribution is rather pointed in its mean, and has thick distribution tails. In our case study, the flattening coefficient, Kurtosis, corresponding to the REER is of the order of 5.71 which is greater than 3 (Kurtosis of the normal law), reflecting, a leptocurtic distribution, and showing that the density at a larger peak than the normal law. The ratio of the terms of trade has an average value equal to 1.23%, varying between 0.59 and 2.3%. The coefficient Skewness is equal to 1.18, positive and different from zero, hence the distribution of this variable is asymmetric on the right, then characterized by a slight spread on the right. Its Kurtosis coefficient equals 4.4, greater than 3, so its distribution is leptocurtic, with a density at a peak greater than the normal distribution. The ratio of openness to GDP of countries is averaging around 91.15% during the period 1999 - 2016. It varies between 30.38% and 188.44%. Its Skewness coefficient is positive and different from zero, hence its distribution is asymmetric on the right, then characterized by a slight spread on the right. The Kurtosis coefficient, equal to 2.66, is less than 3, so its distribution has a density with a smaller peak than the normal distribution. The ratio of FDI to GDP ratio averages 2.10% of all countries, fluctuating in a range between -1.16 and 15.75. The Skewness coefficient is equal to 2.2, greater than zero; hence its distribution is characterized by a slight spread to the right compared to the normal distribution. Its Kurtosis is greater than 3, hence its distribution has a density with a larger peak than the normal law. The debt-to-GDP ratio variable has an average value over the study period of 51.16%, with a variation for all countries between 3.19% and 337.1%. Its Skewness coefficient is greater than zero, so its distribution is asymmetric on the right. The corresponding Kurtosis coefficient is 13.53, well above 3 and its distribution has a density with a larger peak than the normal distribution. The public expenditure to GDP variable has an average value for the study period equal to 15.58%, varying for all the countries in the sample between 5.74 and 30.5%. Its Skewness is of the order of 0.17, slightly greater than zero, so its distribution is slightly asymmetrical to the right. The Kurtosis coefficient is 2.82, less than 3, so the peak of its density is lower than that of the normal law. Finally, the Crisis variable has an average value of 0.47, fluctuating between 0 and 1. Its Skewness coefficient is of the order of 0.11 slightly greater than zero, hence, it is slightly asymmetrical on the right. Its Kurtosis coefficient is 1.01, less than 3, indicating that the peak of the distribution of this variable is lower than that of the normal distribution.

4.1.3. Variables correlation

Table 2: Correlation Matrix

	REER	T_ECH	Open_Gdp	Fdi_Gdp	Debt_Gdp	Expend_Gdp	Crisis
REER	1.000000						
T_ECH	-0.143440	1.000000					
Open_gdp	-0.463624	0.133745	1.000000				
Fdi_ gdp	-0.042057	-0.118495	0.281493	1.000000			
Debt_ gdp	-0.138526	-0.339724	0.217101	-0.143748	1.000000		
Expend_ gdp	-0.228345	0.024773	0.023542	-0.178777	0.063553	1.000000	
Crisis	-0.097935	-0.112010	-0.072014	-0.162985	0.027246	0.069440	1.000000

Source: Author

The matrix above has revealed the non-existence of a real problem of correlation between the variables of the model. Indeed, all the coefficients are close to zero.

4.1.4. Variables stationarity

Table 3: Correlation Matrix

Variable : REER	**Prob. (level)**	**Prob. (FD)**
Levin, Lin & Chu t	0.01*	0.02*
Im, Pesaran and Shin W-stat	0.45	0.026*
Variable : FDI_GDP		
Levin, Lin & Chu t	0.39	0.0009*
Im, Pesaran and Shin W-stat	0.48	0.0021*
Variable : OPEN_ GDP		
Levin, Lin & Chu t	0.3	0.00*
Im, Pesaran and Shin W-stat	0.91	0.0003*
Variable : T_ECH		
Levin, Lin & Chu t	0.00*	0.00*
Im, Pesaran and Shin W-stat	0.0013*	0.00*
Variable : DEBT_ GDP		
Levin, Lin & Chu t	0.44	0.011*
Im, Pesaran and Shin W-stat	0.85	0.03*
Variable : EXPEND_ GDP		
Levin, Lin & Chu t	0.08	0.00*
Im, Pesaran and Shin W-stat	0.53	0.0006*
Variable : CRISIS		
Levin, Lin & Chu t	0.09	0.98
Im, Pesaran and Shin W-stat	0.09	0.01*

Source: Author

According to the results obtained by the stationarity tests, it seems that there are variables that are level stationary according to the Levin test and are not according to IPS and vice versa. Since the IPS test is more reliable, we observe that there are variables that are stationary in

level, such as the terms of trade variable, while the others become stationary as soon as we convert them into a first difference. . We can conclude that, according to the IPS test, all the variables are stationary in first differences.

4.1.5. Long-term relationship of variables (Cointegration Test)

The Cointegration of variables test makes it possible to check if there is a possible long-term relationship. This test, which must be conditioned by the stationarity of the variables in first difference, is among the tests that justify the validity of the parameters of the model and the general of its fit. The full ordinary least squares (FOLS) model should be estimated if the variables in our model are cointegrated. Indeed, this method, developed by Phillips and Hansen (1990) is likely to clean the error term of any self correlation, heteroscedasticity and endogeneity of the regressors (explanatory variables). For a Cointegration test of variables of a panel, there are 12 indicators with which one can judge the long-term relationship of the variables, such as rho-statistics, PP-statistics, ADF-statistics. Knowing that the explanatory variables are integrated of order I (1), the results of the Cointegration of variables test are summarized in the following table:

Table 4: Cointegration Variables Test

Alternative hypothesis: common autoregressive coefficients. (intra-individual dimension)				
	Statistique	Prob.	Weidhted Statistique	Prob.
Panel v-Statistique	2.481269	**0.0065**	-1.112753	0.8671
Panel rho-Statistique	3.089177	0.9990	3.222828	0.9994
Panel PP-Statistique	-1.984225	**0.0236**	-6.430451	**0.0000**
Panel ADF-Statistique	-1.933880	**0.0266**	-3.096618	**0.0010**
Alternative hypothesis: individual autoregressive coefficients. (interindividual dimension)				
	Statistique	Prob.		
Group rho-Statistique	4.520491	1.0000		
Group PP-Statistique	-8.727907	**0.0000**		
Group ADF-Statistique	-3.495296	**0.0002**		

Source: Author

Among the 11 statistical indicators, we observe that there are seven indicators that seem to be significant at risk level of 5%; their probabilities are below this level of risk. We can conclude that our model variables are cointegrated and hold a long-term relationship. This result will allow us to estimate a Cointegration model as already mentioned above, based on the full ordinary least squares (FOLS) regression technique.

4.1.6. Regression of the Cointegration model by fully modified least squares (FM-OLS)

Table 5: Model estimation by FM-OLS method

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI_GDP	-2.160432	0.082702	-26.12315	0.0000
OPEN_GDP	-0.319288	0.075881	-4.207743	0.0000
T_ECH	-9.383355	0.084982	-110.4155	0.0000
DEBT_GDP	-0.268366	0.071126	-3.773120	0.0002
EXPEND_GDP	-1.025153	0.085345	-12.01183	0.0000
CRISIS	-4.695869	0.104325	-45.01194	0.0000

*** : 10% significance** : 5% significance*** : 1% significance** **Source: Author**

Note that all the coefficients of the variables are significant and affect the REER movement (below the 1% risk level). The coefficient of determination (R^2) of model is of the order of 90.1%, indicating that the model is globally adjusted. The optimal coefficients of this regression will be used to calculate misalignment of the REER relative to its equilibrium level. After calculating the real equilibrium effective exchange rate through its equilibrium parameters, we calculate their difference, which corresponds to the misalignment between the two rates. This difference will make it possible to calculate misalignment according to the formula following equation (3).

4.2. Empirical analysis of the determinants of misalignment of the REER of MENA countries

As already mentioned above, we use the model of equation (4) to estimate the determinants of misalignment:

$$|Mis_{it}| = \beta_0 + \beta_1|Mis_{it-1}| + \beta_{2j}\sum_{j=1}^{j=3} Regime_{ijt} + \beta_{3k}\sum_{k=1}^{k=k} X_{ikt} + \varepsilon_{it}$$

The previous model equation is written in the following form:

$$|Mis_{it}| = \beta_0 + \beta_1|Mis_{it-1}| + \beta_{2j}\sum_{j=1}^{j=3} Regime_{ijt} + \beta_3 inf_{it} + \beta_4 IQ_{it} + \beta_5 FD_{it} + \varepsilon_{it} \qquad (5)$$

The regression results with GMM are summarized in the following table:

Table 6: Model estimation by GMM

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MIS(-1)	0.393277	0.099780	3.941448	0.0001***
REGIME	-20.74799	3.879309	-5.348372	0.0000***
IQ	87.81506	33.32680	2.634968	0.0094***
FD	0.711837	0.298652	2.383498	0.0185**
INFLATION	0.378664	0.158178	2.393909	0.0180**

*** : 10% significance** : 5% significance*** : 1% significance** **Source: Author**

According to the GMM regression results, we note that all model variables affect the level of misalignment of the real effective exchange rates of MENA countries. Indeed, the delayed misalignment variable (MIS (-1)) appears to be very significant and presents itself as a determining factor in the misalignment of the REERs of the MENA countries. Thus, its 1% increase causes an increase in misalignment of the REERs of 0.39 points. Its probability is zero, lower than the risk level of 5%. It can be concluded that the persistence of misalignment in developing countries including MENA countries (Nouira et al, 2011) increases the misalignment of their REERs from one year to the next. With regard to the exchange rate regime, MENA countries generally use either a fixed, intermediate or floating exchange rate regime. We assigned the value 1 for a fixed exchange rate regime, 2 for an intermediate exchange rate regime and 3 for a floating exchange rate regime. We note in the results that this variable has significantly and negatively affects of the REERs of the MENA countries. Thus, if the exchange rate increases by 1%, the level of misalignment in these countries decreases by 20.74 points. So, we can conclude that a floating exchange rate regime is more advantageous for these countries in order to minimize misalignment of their REERs. The type of exchange rate regime in MENA countries is presented as a serious determinant affecting the misalignment of MENA countries'

REERs to their equilibrium values. The quality of institutions seems to have an impact on the misalignment of the REERs of the MENA countries. However, this impact is positive. We can conclude that the quality of institutions in the MENA countries accentuates the level of misalignment of the REERs of the MENA countries. It is also observed that the financial development variable positively and significantly affects misalignment of REERs. The increase in the credit rate granted to the private sector increases the level of misalignment, 1% increase in this rate increases the misalignment of REERs by 0.71 points. Thus, financial development in MENA countries is a serious determinant of the misalignment of REERs within MENA countries. Finally, inflation rate is also an important factor in the misalignment of REERs. In fact, 1% increase in inflation rate causes misalignment to rise by 0.37 points, which makes this variable a determining factor in level of misalignment of REERs. In summary, we can conclude that all variables used in the model appear to be determining factors that affect the level of misalignment of REERs in MENA countries.

5. Conclusion

This paper has been devoted to identifying the factors that influence the misalignment of the REER and its shift in equilibrium value among the MENA countries. The literature review made it possible to define the theme of this study in order to adopt the necessary models to make this evaluation more successful. Overall, the results found support the predilection of economic theory and most previous empirical studies for the effect of real exchange rate fundamentals on its distortion. Indeed, the results obtained from the estimates show that real effective exchange rate is influenced in equilibrium by the exchange rate regime adopted by the MENA countries, by the quality of institutions, by level of their financial development, by degree of persistence of the shift of its equilibrium level and by their level of inflation. It seems to these countries that the most appropriate exchange rate regime is the floating regime. This regime minimizes the misalignment of their REERs. Hence, the type of exchange rate regime in MENA countries is presented as a serious determinant affecting the misalignment of REERs to their equilibrium values. The quality of the institutions in the MENA countries seems to have an impact on the misalignment of the REERs of these countries. Thus, a high level of quality of institutions generates the appreciation of their exchange rate. Also, financial development produces the same effect. Indeed, a credit rate granted to private sector increases level of misalignment, so 1% increase in this rate increases REER by 0.71 points. Finally, inflation rate in MENA countries also contributes to the derailment of the REER from its equilibrium value.

Bibliography

Agénor P-R, Mc Dermott CJ, Prasad ES. (2000). Macroeconomic fluctuations in developing countries: some stylized facts. World Bank Econ Rev; 14(2):251–85.

Aghion PH, Bacchetta P,Ranciere R, Rogoff K. (2009). Exchange rate volatility and productivity growth: the role of financial development. J Monet Econ; 56: 494–13.

Broz JL, Frieden J, Weymouth S. (2008). Exchange rate policy attitudes: direct evidence from survey data. IMF Staff Pap; 55(3): 417–44.

Collins SM. (1996). On becoming more flexible: exchange rate regimes in Latin America and the Caribbean. J Dev Econ; 51(1): 117–38.

Coudert V, Couharde C. (2009). Currency misalignments and exchange rate regimes in emerging and developing countries. Rev Int Econ; 17(1):121–36.

Coudert V, Couharde C, Mignon V. (2013). On currency misalignments within the euro area. Rev Int Econ; 21(1): 35–48.

Dubas JM. (2009). The importance of the exchange rate regime in limiting misalignment. World Dev; 37(10): 1612–22.

Dubas J. (2012). Exchange rate misalignment and economic growth. South west Econ Rev; 39: 121–36.

Edwards S. (1988). Exchange rate misalignment in developing countries. Baltimore: Johns Hopkins University Press.

Edwards S. (2011). Exchange rates in emerging countries: eleven empirical regularities from Latin America and East Asia. National Bureau of Economic Research. Working paper 17074.
Elbadawi IA, Kaltani L, Soto R. (2012). Aid, real exchange rate misalignment, and economic growth in Sub- Saharan Africa. World Dev;40(4):681–700.

Engel Ch. (2010). Exchange rate policies. In: Bank for International Settlements, editor. The international financial crisis and policy challenges in Asia and the Pacific, vol.52. p. 229–50.

Frankel JA, Goldstein M. (1989). Exchange rate volatility and misalignment: evaluating some proposals for reform. National Bureau of Economic Research. Working paper 2894.

Hoffmann M. (2007). Fixed versus flexible exchange rates: evidence from developing countries. Economica; 74: 425–49.

Holtemöller O, Mallick S. (2013). Exchange rate regime, real misalignment and currency crises. Economic Modelling; 34: 5–14.

Kandilov IT, Leblebicioğlu A. (2011). The impact of exchange rate volatility on plant-level investment: evidence from Colombia. J Dev Econ; 94(2): 220–30.

Kao C, Chiang MH. (2000). On the estimation and inference of a cointegrated regression in panel data. In: Baltagi B, Kao C, editors. Advances in econometrics, vol. 15. Elsevier Science. p. 179–222.

Méon P-G, Minne G. (2014). Mark my words: information and the fear of declaring an exchange rate regime. J Dev Econ 107: 244–61.

Nouira R, Plane P, Sekkat Kh. (2011). Exchange rate undervaluation and manufactured exports: a deliberate strategy?. J Comp Econ; 39(4): 584–601.

Pesaran MH. (2004). General diagnostic tests for cross section dependence in panels. CambridgeWorking Papers in Economics, No 435. University of Cambridge. Cesifo Working Paper Series No. 1229.

Pesaran MH. (2007). A simple panel unit root test in the presence of cross section dependence. J Appl Econ; 22: 265–312.

Reinhart C, Rogoff KS. (2004). The modern history of exchange rate arrangements: a reinterpretation. Q J Econ; 119(1): 1–48.

Nouira R, Sekkat Kh. (2015). What determines the extent of real exchange rate misalignment in developing countries? International Econ. 141: 135-151.

Rodrik D. (2008). The real exchange rate and economic growth. Brookings Papers on Economic Activity. p. 365–412.

Saadaoui J, Mazier J, Aflouk N. (2013). On the determinants of exchange rate misalignments. Appl Econ Lett; 20(18): 1608–10.

Sekkat Kh, Varoudakis A. (2000). Exchange rate management and manufactured exports in Sub-Saharan Africa. J Dev Econ; 61(1): 237–55.