Attraction of Foreign Direct Investments and Exchange Rate Variability: The Case of MENA Countries

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Attraction of Foreign Direct Investments and Exchange Rate Variability: The Case of MENA Countries

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Abstract Abstract

Recently, the relationship between exchange rate variability and foreign direct investment has taken a new direction, where the possibility of an asymmetric response of FDI to a measure of exchange rate uncertainty is being assessed.

The aim of this paper is to determine the relationship between FDI flows and exchange rate variability for MENA countries over the period 1999-2019.

We conduct an econometric study on a panel of 16 countries, presenting the impact of exchange rate variability on FDI flows. We applied two models, one linear and the other non-linear. We estimated these two models using the OLS method, the individual effects models and the GMM method, For robustness, we used the Pooled Mean Group-ARDL estimation technique. The results reveal that increasing exchange rate variability has no effect on FDI when the non-linear model is applied, but that this impact becomes favorable with the linear model for the fixed and intermediate exchange rate regimes and unfavorable for the floating exchange rate regime.

Keywords: Exchange rate variability, Foreign Direct Investment, the non-linear model, the linear model, ARDL, MENA.

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1-Introduction

Foreign direct investment (FDI), considered as international capital movements, covers both the creation of subsidiaries abroad and cross-border mergers and acquisitions. They constitute a category of transnational investment in which a resident of one economy owns controls or exercises significant influence over the management of a company resident in another economy (Jensen, 2003; Borensztein et al., 1998; Gorg & Greenaway, 2003; Blomstrom & Kokko, 1997). As a driver of corporate multinationalisation and a major source of capital flows, FDI is one of the main indicators of a country's economic attractiveness. All balance of payments statistics show that FDI has increased significantly since the mid-1980s. It has contributed decisively to the globalization of economies. The search for lower costs and the conquest of new markets, which are difficult to penetrate through exports alone, are among the main motivations for FDI. For host countries, the vast majority of studies have focused on the positive effects and technological spillovers of FDI (human capital formation, easier integration into international trade, creation of a more competitive business environment). Several studies have addressed the issue of FDI determinants in both emerging and developing countries. However, as the characteristics of different economies have been studied, no consensus seems to have been reached on the significant determinants of FDI. The main factors that have attracted FDI to developing countries in recent decades have been the availability of natural resources and the size of the local economy. Other factors, such as the tax burden and the significant risk of capital loss, explain the low level of FDI. Thus, the literature indicates that FDI depends on a series of exogenous and endogenous factors (Anyanwu, 2011). Various factors have been mentioned, including the economic size of the market, the quality of governance, the quality of infrastructure, cultural proximity and the openness of the economy of the FDI destination. In developed and emerging countries, it is important to ensure exchange rate stability in order to achieve macroeconomic policy objectives. In order to create a realistic and stable exchange rate, governments have adopted various exchange rate management policies, particularly for developing economies. For this reason, many countries have been exposed to exchange rate fluctuations, which have become highly uncertain or volatile. This exchange rate volatility is a significant risk factor in the financial world (Hassan et al., 2017). Thus, exchange rate volatility and its determinants for countries have become a new focus of interest. Ajao (2015) indicated that exchange rate volatility leads to a high degree of uncertainty regarding the guarantee of price stability and economic growth and the definition of macroeconomic and monetary policy objectives. He found justifications for real exchange rate volatility due to possible negative effects that must be significant in order to develop appropriate economic

policies to minimise fluctuations. Following the collapse of the Bretton Woods system in 1973, the fixed exchange rate system was abandoned, and countries had to allow their currencies to fluctuate. For countries adopting a floating exchange rate system, exchange rate volatility has become an unavoidable reality. Over the past few decades, globalization has led many countries, especially those with market economies, to place FDI at the heart of their policies. Investment plays an essential role in development, growth, job creation and, by extension, social welfare. It is a non-consumable income that is intended to increase production capital. In economic literature, the nature of the link between exchange rate variability and FDI flows is a subject of debate. In this case, the question that arises is whether exchange rate variability drives FDI. The persistent recurring distortion known as exchange rate misalignment is influenced by the nature of the choice of exchange rate regime following the collapse of the Bretton Woods system (1973). Furthermore, the impact of exchange rate variability on investment must take into account that part of the goods produced and the cost must be denominated in a foreign currency. In this context, Fontagné & Frendenberg (1999) show that the link between exchange rate volatility and FDI must depend on the nature of specialization. ER volatility and misalignment are two of the major factors driving renewed interest in ERV, the second factor being international financial integration. FDI their investments to other countries in order to reduce their production costs and benefit from cheap raw materials and labor in the host country. FDI depends on factors such as economic and political structure, investment incentives, and trade policies in the country of investment. In addition to these, real exchange rate volatility also affects FDI. The volatility of the real exchange rate has created an ambiguous environment conducive to investment decisions. This situation has given rise to a whole stream of research aimed at studying exchange rate dynamics. In such a context, a good model for determining exchange rates is of interest. Such an environment causes either ‘the redistribution of resources between sectors and countries, production flexibility, or investors delaying investment decisions, postponement, and hysteresis delay (Azid et al., 2005).

The exchange rate is an economic policy phenomenon that plays a role in foreign trade. It allows shocks to be transmitted from one economy to another and remains at the heart of political debates in both developing countries (Edward, 1989) and European countries.

With globalisation, until 1970, the main determinant of money supply and demand was trade in goods, and due to interest rates and inflation, ER was the result of capital movements. In addition, the ER regime has an effect on ER misalignment. The monetary crisis reached its peak in 1971 with the collapse of the Bretton Woods system, suspending the convertibility of the dollar into gold.

We conduct an econometric approach with panel data analysis that presents the impact of ERV on FDI flows. in sixty of the largest economies in MENA – the Middle East and North Africa (Bahrain, Jordan, Oman, Qatar, Saudi Arabia, the United Arab Emirates, Kuwait, Morocco, Libya, Egypt, Lebanon, Iran, Tunisia, Algeria, Sudan and Turkey) – from 1999 to 2019 by specifying linear and non-linear models.

With observance to ER regimes, each country in the MENA region has sought to control fluctuations in its ER. The IMF, 2018, classifies three types of exchange rate regimes: fixed exchange rate regimes, such as those in Bahrain, Jordan, Oman, Qatar, Saudi Arabia, the United Arab Emirates, Kuwait, Morocco, Libya, Egypt, Lebanon, Iran and Tunisia; intermediate exchange rate regimes, such as those in Algeria and Sudan; and floating exchange rate regimes, such as that in Turkey.

Following the introduction, the paper is organized as follows. It starts by detailing the literature and empirical review in Section 2. Section 3 describes the model and data, and data analysis and discussion of results in Section 4. Section 5 presents the estimation results. Finally, Section 6 concludes.

2. Literature Review

Research shown in the literature review argued that thanks to a policy of exchange rate stabilization, capital inflows can be rewarded by higher interest rates and a real appreciation of the currency (Corbo, 1985). At the international level, capital inflows, especially exogenous ones, cause fluctuations in the real exchange rate, which results in financing investments in the non-tradable goods sector (Dornbusch, 1973) and indicates that companies in countries with strong currencies gain an advantage in investing abroad through hedging operations (Aliber, 1970), and explains that a decline in the national currency results in the acquisition of domestic assets by foreigners, following the weakening of the relative wealth of agents in the national economy (Froot and Stein, 1991). Three conditions identified for successful FDI: first, the company must have specific advantages that enable it to accelerate its profitability; second, it must be able to exploit these advantages in combination with production factors located abroad (Dunning, 1988). Aizenman (1994) argued that a fixed exchange rate regime is more suitable for FDI than a floating exchange rate regime in the context of real shocks, stating that a fixed exchange rate regime protects real wages and production from the effects of monetary shocks. Other authors have expressed the view that floating exchange rate regimes pose problems for commodity producers, since the prices of exported natural resources are set in dollars. In their opinion, floating exchange rate regimes cause unstable and unpredictable costs (Courchene & Harris, 1999), concluding that the exchange rate regime has no significant effect on the volatility of other variables (Flood & Rose, 1995). Some argued that real exchange rate depreciation is detrimental to productivity growth because it protects domestic firms from foreign competition

(Schembri & Lafrance, 2000) and demonstrated that increased exchange rate variability has a positive impact on investment (Darby et al,. 1999); other analyses the effect of reduced exchange rate uncertainty, due to membership of the European Economic and Monetary Union (EMU), on the intensity of FDI flows in candidate countries. Theoretical models provide an ambiguous picture of how exchange rate uncertainty and volatility affect the direction and magnitude of FDI flows. The main contribution is to note that exchange rate uncertainty and volatility can negatively influence the decision to locate investments in transition and candidate countries. Nominal exchange rate uncertainty hinders FDI inflows into accession countries. The main conclusion is that the adoption of the euro is likely to have a positive influence on FDI inflows into accession countries (Brzozowski, 2006); it showed a negative effect of the exchange rate level on variability and uncertainty for Latin American countries (Isabel Ruiz, 2005); and it concluded that exchange rate variability does not have a significant impact on investment in Canada (Lafrance & David Tessier, 2000).

Studies have shown in an empirical review that the positive relationship between exchange rate volatility and FDI, as indicated by Cushman, 1985, when he studied FDI from the United States to the United Kingdom, Germany, France, Canada and Japan between 1963 and 1978, and Cushman, 1988, when he examined FDI from these countries to the United States between 1963 and 1986, concluded that the exchange rate volatility coefficients were positive, indicating a favorable link with FDI. Furthermore, Goldberg and Kolstad (1995) examined the effect of exchange rate volatility on bilateral FDI from the United Kingdom, Canada and Japan during the period 1978-1999. They used quarterly data (12 quarters) before and after the period and measured exchange rate volatility using the standard deviation of the RER. They indicated that this link is statistically significant and positive. Ullah et al. (2012) showed the relationship between FDI and exchange rates and exchange rate volatility, using time series data from Pakistan for the period 1980-2010. They calculated exchange rate volatility using the ARCH and GARCH models. They found that the depreciation of the local currency has a positive impact on FDI inflows, whereas exchange rate volatility has a negative impact and price volatility is statistically insignificant.

Other studies have shown that there is a negative correlation between exchange rate volatility and FDI, Yang Li & Erick W Rengifo, 2017 examined the host country determinants of China's FDI flows, focusing on institutional quality, exchange rate volatility and natural resources, for the period 2003–2013 across a sample of 49 countries. They found that China's FDI flows are directed towards countries with low institutional quality and abundant natural resources. Furthermore, exchange rate volatility has a moderating effect on China's FDI flows, whilst the appreciation of the Chinese Renminbi (RMB) has a negative effect, and its appreciation increases FDI

flows. Moreover, Bo, 2009 used a partial equilibrium model; he incorporated institutional effects represented by political risk and exchange rate volatility—estimated using GARCH conditional volatility—and their impacts on FDI flows; He used a sample of 53 countries for the period 1984–2005 and demonstrated that institutional risk and exchange rate volatility both have negative effects on FDI flows and that these two effects reinforce one another.

3. Model and Data

In this third section, we describe the sample and data sources as well as the choice of variables. We specify the model used to analyze the effect of exchange rate variability on FDI flows, distinguishing between linear and non-linear models.

3.1. Data

Our analysis covers the period 1999-2019, based on annual data in US dollars and a sample of 16 countries in the MENA region: Algeria, Saudi Arabia, Bahrain, Egypt, Iran, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Sudan, Tunisia, Turkey and the United Arab Emirates. In other words, it covers the entire MENA region, due to the unavailability of macroeconomic data and the existence of countries at war.

Most of the data used comes from the World Bank, the International Monetary Fund, the Organization for Economic Co-operation and Development, and the United Nations Conference on Trade and Development, and econometric estimates are made on the basis of 336 observations.

3.2. Variables

3.2.1. Dependent variable

Foreign direct investment (net inflows (% of GDP): **Also** referred to as international direct investment (IDI) according to the OECD, this is part of the multinationalisation of companies and refers to international capital movements made with a view to maintaining a subsidiary abroad and/or exercising significant influence over the management of a foreign company.

3.1.2. Explanatory

Exchange rate variability: This is exchange rate volatility (ER volatility) + exchange rate misalignment (RER misalignment).

3.1.3. Control variables

Gross fixed capital formation (% of GDP**):** This is defined as the sum of tangible investments made during a year and includes the acquisition of produced fixed assets and the production of such assets by producers for their own use, less disposals.

Net terms of trade (2000 = 100) (Net T0T)**:** This is a statistical indicator that compares export prices with import prices. It is calculated as the ratio between the export price index and the import price index expressed in the same base year.

Gross domestic product per capita (constant 2010) (GDP per capita): This illustrates the importance of a country's economic activity. It measures the value added during a given period and the total expenditure on final goods and services minus imports. It is expressed in constant dollars and can be used to make appropriate comparisons across years, as it takes into account deflation and inflation.

Trade (% of GDP**):** This is the export of goods and services + the import of goods and services as a percentage of GDP. It is an indicator that measures the degree of openness of an economy to foreign trade.

3.3. Empirical model

We will estimate the relationship between FDI and exchange rate variability. Drawing on the work of Furceri & Borelli, 2008; Hanusch et al., 2018; Kodongo & Ojah, 2013; Boateng et al,. 2015; Kosteletou & Liargovas, 2000; Dhakal et al,. 2010; Sharifi-Renani & Mirfatah, 2012; and Kizilkaya et al,. 2015, we use the following linear model:

Eq. (A.1),

$$FDI_{i,t} = \alpha_{i,t} + \beta_1 ERVOL_{i,t} + \beta_2 RERMIS_{i,t} + \beta_3 GDP_{i,t} + \sum_{i=1}^{3} \beta_i ERR_{i,t} + \sum_{i=1}^{3} \beta_j X_{i,t} + \varepsilon_{i,t}$$

Eq. (A.2),

$$FDI_{i,t} = \alpha_{i,t} + \beta_1 ERVOL_{i,t} + \beta_2 RERMIS_{i,t} + \beta_3 GDP_{i,t} + \beta_4 FixedERR_{i,t} + \beta_5 floatingERR_{i,t} + \beta_6 intermediateERR_{i,t} + +\beta_7 GFCF_{i,t} + \beta_8 Net\ TOT_{i,t} + \beta_9 Trade_{i,t} + \varepsilon_{i,t}$$

Using the first difference GMM estimator of Arellano and Bond, 1991 and the system GMM estimator of Blundell and Bond, 1998, which combines first difference equations with level equations? The instruments in the first difference equation are expressed in level terms and vice versa. We obtain:

Eq. (A.3),

$$\Delta FDI_{i,t} = \alpha_{i,t} + \gamma \Delta FDI_{i,t-1} + \beta_1 \Delta ERVOL_{i,t} + \beta_2 \Delta RERMIS_{i,t} + \beta_3 \Delta GDP_{i,t} + \beta_4 FixedERR_{i,t} + \beta_5 floatingERR_{i,t} + \beta_6 intermediateERR_{i,t} + \beta_7 \Delta GFCF_{i,t} + \beta_8 \Delta Net\ TOT_{i,t} + \beta_9 \Delta Trade_{i,t} + \varepsilon_{i,t} \quad (3)$$

Furthermore, drawing inspiration from the work of Ivan Deseatnicov and Hiroya Akiba, 2016, we estimate the following model:

Eq. (A.4),

$$FDI_{i,t} = \alpha_{i,t} + \beta_1 ERVOL_{i,t} + \beta_2 RERMIS_{i,t} + \beta_3 RERMIS_{i,t}^2 + \beta_4 LNGDP_{i,t} + \beta_5 FixedERR_{i,t} + \beta_6 floatingERR_{i,t} + \beta_7 intermediateERR_{i,t} + \beta_8 LNGFCF_{i,t} + \beta_9 LNNet\ TOT_{i,t} + \beta_{10} Trade_{i,t} + \varepsilon_{i,t}$$

Our theoretical model suggests that exchange rate misalignment has a negative effect on FDI flows.

Thus, FDI flows from MENA countries are defined as dependent on exchange rate misalignment (Gouider and Nouira, 2014), hence a non-linear relationship between FDI and exchange rate misalignment. We introduce the term 'RERMIS2' to examine whether this effect exists. We interact with RERMIS and ERVOL to examine the effect of ER variability on FDI.

4. Data analysis and discussion of results

The purpose of this section is to study descriptive statistics, variance inflation factor (VIF) and tests, and to analyze and reveal the results of the estimates.

4.1. **Data analysis**

4.1.1. Descriptive statistics and correlation matrix

Before proceeding with the estimates, this subsection presents the descriptive statistics for the variables used (Table 1), as well as the correlations between these variables (Table 2).

Table 1. We also note that the average GDP indicator, which measures the level of gross domestic product per capita, is very high (16,274.7) with a maximum (69,679.09) and a minimum (960.3803). It appears that, on average, FDI is relatively low (2,963), while the maximum is (23,211) and the minimum is (-3,176). We can see that the exchange rate volatility indicator (ERVOL) is relatively high (10.858) with a maximum (105.740) and a minimum (-0.229). It can be seen that the exchange rate misalignment indicator (RERMIS) is very low (-0.052) with a maximum (1.047709) and a minimum (-0.929). We find that the variable Gross Fixed Capital Formation (GFCF) is relatively high (24.007) with a maximum (48.459) and a minimum (6.205) and that the terms of trade (Net TOT) are relatively high (136.182) with a maximum (290.930) and a minimum (59.433). The trade variable (trade) is relatively high (84,247) with a maximum (191,872) and a minimum (16,668).

Table 2. The correlation coefficients in Table 2 are moderately low. We observe a negative correlation between FDI and exchange rate volatility (ERVOL); they move in opposite directions. On the other hand, there is a positive correlation between FDI and exchange rate misalignment (RERMIS); they move in the same direction, which leads us to conclude that the variables used are correlated. The above matrix therefore revealed that there is no real correlation problem between the variables in the model. Indeed, all the coefficients are close to zero.

Figure_1. This simple graph of exchange rate volatility relative to FDI reveals a non-linear relationship and negative correlation between the variables.

Figure_2. This simple graph of exchange rate misalignment versus FDI reveals a non-linear relationship and an absence of correlation between the variables.

Table 3. We observe that the probabilities of the variables FDI, ERVOL, RERMIS, GDP, GFCF, Net TOT, and Trade are less than 5%, so we accept H0, meaning that these variables follow the normal distribution.

4.1.2. Variance Inflation Factor (VIF) and tests

Table 4. We can see that the VIF is closer to 1, so the model is more robust because the factors are not influenced by correlation with other factors.

Table 5. The probability of the test is zero; it is less than 5%, so we can reject the hypothesis of normality of errors.

Ramsey Reset Test

H_o: no omitted variables

F (3, 326) = 16.25 Prob > F = 0.0000

The probability of the test is 0.0000, which is less than 5%, so we can reject the hypothesis at the 10% significance level. Therefore, the model is not correctly specified.

Heteroscedasticity

Breusch-Pagan test Ho: Constant variance chi2 (1) = 70.13

Prob > chi2 = 0.0000

The probability = 0.0000 is less than 10%, so we reject the null hypothesis H0.

Wooldridge test for autocorrelation H0: no first-order autocorrelation

F (1.15) = 14.517 Prob > F = 0.0017

The probability = 0.0017 < 1%; therefore, we can reject the H0 hypothesis, absence of first-order autocorrelation. The errors are auto-correlated.

Chow test

For the Chow test, with the probability P = 0.999, we accept the null hypothesis H_0 of stability of the coefficients between the two subsamples. Consequently, the model is not globally well determined.

5. Estimation results

5.1. Linear model

Table 6. We note that Prob > F = 0.0000 < 5%, so the model is globally significant. The P-value of the ERVOL variable is less than 1% and 5% for fixed and floating exchange rate regimes, so it is statistically significant and negative, but it is not statistically significant for the intermediate exchange rate regime. We observe that the P-value of the RERMIS variable is less than 1% for the floating exchange rate regime, so it is statistically significant and positive, whereas for the fixed and intermediate exchange rate regimes, this variable is not statistically significant if we apply the OLS method. We note that for the GDP and Trade variables, the probabilities are less than 1%, so they are statistically significant, negative for GDP and positive for Trade. It is noted that for the GFCF variable, it is statistically significant and positive for the floating exchange rate regime (p < 1%), but it is not statistically significant for the fixed and intermediate exchange rate regimes. It is noted that the Net TOT variable is statistically significant and negative for the intermediate and floating exchange rate regimes but not significant for the fixed exchange rate regime.

R^2 is equal to 0.1789 for the fixed exchange rate regime, 0.1859 for the intermediate exchange rate regime and 0.1910 for the floating exchange rate regime. R^2 is strong.

Root MSE is around 3, the value is low, indicating a better fit. We note that Prob > chi2 = 0.0001 < 1% and chi2 (8) = 16.79; hence, the fixed effects model is more favorable than the random effects model.

Table 7. It should be noted that the number of instruments is 15, which is less than or equal to the number of groups, individuals or countries, which is 16, which is acceptable. ERVOL, RERMIS, GDP, GFCF, Net TOT, Trade, and the various exchange rate regimes. We observe that the lagged variable FDI (Lag-1) is statistically significant and positive, and its probability is less than 1% for the different types of exchange rate regime. We note that exchange rate volatility is positive and significant for fixed exchange rate regimes and intermediate exchange rate regimes, but not significant for floating exchange rate regimes. A 10% increase in volatility leads to a net FDI inflow of (0.9%) for fixed exchange rate regimes and (0.9%) for intermediate exchange rate regimes. It should be noted that the exchange rate misalignment variable is significant and negative for the fixed exchange rate regime and the intermediate exchange rate regime. It is not significant for the floating exchange rate regime; a 10% increase in misalignment results in FDI inflows of (-92.3%) for the fixed exchange rate regime and (-85.1%) for the intermediate exchange rate regime. For the variables GDP and Net TOT, we note

that they are significant for all three types of exchange rate regime (p < 5% and 10%), positive for GDP and negative for Net TOT. We note that the GFCF and Trade variables are significant and negative (p < 5%) for fixed and intermediate exchange rate regimes and insignificant for the floating exchange rate regime.

For the Arellano-Bond AR (1) and AR (2) tests, we find that their probabilities are greater than 5%, so the errors are not correlated. For the Sargan and Hansen tests, which give us the validity of the instruments, we see that the probabilities are greater than 1% and 5%, so we have the best instruments. Thus, for Hansen's tests, which validate the instruments of exogenous variables, we find that they are greater than 5% for the different exchange rate regimes, so we accept the null hypothesis, meaning that the instruments are valid.

5.2. Non-linear model

Table 8. We note that Prob > F = 0.0000 < 5%, so the model is globally significant, and that the P values for ERVOL and RERMIS are greater than 10%, meaning that these variables are not statistically significant. We note that the p-value for the $RERMIS^2$ variable is less than 5% and 10%, so it is statistically significant and negative regardless of the type of exchange rate regime. It should be noted that for the variables Ln (GDP), Ln (GFCF) and Trade, their probabilities are less than 1%, so they are statistically significant, positive for Ln (GFCF) and Trade, and negative for Ln (GDP). It should be noted that for the variable Ln (Net TOT), the p-value is greater than 10%, so it is not statistically significant.

R^2 is equal to 0.2535 for the fixed exchange rate regime, 0.2523 for the intermediate exchange rate regime and 0.2539 for the floating exchange rate regime. R^2 is strong.

Root MSE is around 1.08, which is low, indicating a better fit.

We note that Prob > chi2 = 21.23% > 10% and chi2 (7) = 9.6 for the intermediate exchange rate regime and that Prob > chi2 = 23.98% > 10% and chi2 (7) = 9.18 for the floating exchange rate regime; hence, the random effects model is preferable to the individual fixed effects model. On the other hand, Prob > chi2 = 0.05 < 10% and chi2(7) = 13.93 for the fixed exchange rate regime; hence, the individual fixed effects model is more appropriate than the random effects model, and, following the problem of multicollinearity in this type of regime, we can say in general that the random effects model is preferable to the individual fixed model.

Table 9. It should be noted that the number of instruments, which is 15, which is less than or equal to the number of groups or individuals or countries, which is 16, is acceptable for ERVOL, RERMIS, Ln (GDP), Ln (GFCF), Ln (Net TOT), Trade and the various exchange rate regimes. We observe that the lagged variable FDI (Lag-1) is statistically significant and positive, and their probability is less than 1% and 5% for the different types of exchange rate regime. Furthermore, we observe that the VOLTC variable is significant and positive

(p<5% and 10%) for the three types of exchange rate regime, and a 10% increase in VOLTC results in an FDI inflow of (1.2%) for the fixed exchange rate regime, (1.2%) for the intermediate regime and (1.5%) for the floating exchange rate regime. It should be noted that the exchange rate misalignment variable is not significant for fixed, intermediate and floating exchange rate regimes. For the variables Ln(GDP), Ln(GFCF) and Trade, it should be noted that they are not significant, whereas the variable Ln(Net TOT) is negative and significant (p < 1%) for the fixed and intermediate exchange rate regimes, with the exception that it is not significant for the floating exchange rate regime.

For the Arellano-Bond AR (1) and AR (2) tests, we see that their probabilities are greater than 5%, so the errors are not correlated. For the Sargan and Hansen tests, which give us the validity of the instruments, we note that the probabilities are greater than 5%; hence, we have the best instruments. Thus, for the Hansen tests that validate the instruments of the exogenous variables, we note that they are greater than 5% for the different exchange rate regimes; hence, we accept the null hypothesis, so the instruments are valid.

5.3. Robustness

For the sake of robustness, we extend our analysis by estimating Eq. (A.4) for 16 MENA countries over the period 1999–2019. Tables 8 and 9 present the results. We conduct a further discussion on the channels through which exchange rate variability impacts FDI. We note that the coefficient associated with the squared exchange rate misalignment variable $RERMIS^2$ is not significant (at the 10% significance level) for MENA countries. After estimating the model coefficients, we test the robustness of the results using the Pooled Mean Group (PMG) estimation technique. According to Pesaran & Shin (2004), this is an effective method for estimating dynamic panels, particularly those for which the number of observations (t) is as large as the number of individuals (i), and it offers the possibility of estimating a long-term relationship between different variables without precautions regarding stationary and co-integration. This flexibility is based on the assumption that the short-term coefficients, the model constant and the error variances may differ between individuals. However, in the long term, these coefficients remain identical, and the data are co-integrated and stationary.

Table 10. We note that Prob>F = 0.0000 < 5%, so the model is globally significant, with significance determined by the P value. We note that the P value of ERVOL is greater than 10%, so this variable is negative but not statistically significant. We observe that the P value of RERMIS is less than 1%, so it is statistically significant and positive. However, the variable $RERMIS^2$ is not statistically significant. The variables Ln (GFCF) and Ln (Net TOT) are not statistically significant, but the variables Ln (GDP) and Trade are statistically significant (p < 1%), one being negative (Ln (GDP)) and the other positive (Trade).

6-Conclusion

In this paper, we sought to understand and address the relationship between real exchange rate variability and FDI flows in MENA countries, with a view to optimising policy. In other words, we studied the impact of exchange rate misalignment and exchange rate volatility on FDI flows, using countries in the MENA region as a reference. The data used are annual and cover the period 1999-2019. We are devoted to presenting reviews of the literature and empirical evidence on exchange rate variability and FDI flows, with some studies confirming that the link between exchange rate variability and FDI is positive (Cushman, 1985; Kiliçarslan, 2018). Other studies, however, have indicated that this link is negative (Foot and Stein, 1991; Kiliçarslan, 2018), while other reviews have indicated that this link is negative (Campa, 1994; Greenway, 2001; and Wang, 2013). Then, we presented the methodology of this paper, specifying two models, one linear and the other non-linear. We explored the Ordinary Least Squares (OLS) method, Individual Effect models and the Generalised Method of Moments (GMM). Next, we examined the descriptive statistics and correlation between the variables. We have plotted shows the negative correlation between exchange rate volatility and FDI flows, revealing a non-linear relationship; on the other hand, it shows that there is no correlation between FDI and exchange rate misalignment. (Figure_1; Figure_2). We presented the descriptive statistics and correlation coefficients of the explanatory variables, revealing that they are low on average (Table 1, Table 2) and that the correlations are positive between FDI and exchange rate misalignment. Conversely, the correlation is negative between FDI and exchange rate volatility. Finally, we studied the relationship between exchange rate variability and FDI. We first observed that the model is robust, since the variance inflation factor (VIF) is close to 1 (Table 4). We then rejected the hypothesis of normality of errors, since the probability is zero (Table 5), noting that the model is not correctly specified and that there is no first-order autocorrelation. Finally, we accepted the H_0 hypothesis of stability of the coefficients between the two subsamples (Chow test), which means that the model is not well determined overall.

Next, we applied two models, one linear and the other non-linear. We estimated these two models using the OLS method, the individual effects models and the GMM method. We have shown that, for the linear model estimated using the OLS method, it is globally significant, and that exchange rate volatility for fixed exchange rate regimes and floating exchange rate regimes is statistically significant and negative. However, for intermediate exchange rate regimes, it is not statistically significant. We observed that exchange rate misalignment for the floating exchange rate regime is statistically significant and positive, whereas for the fixed and intermediate exchange rate regimes, it is not statistically significant. We found that the GDP and trade

variables are statistically significant, negative for GDP and positive for trade, and that the GFCF variable is statistically significant and positive for the floating exchange rate regime, but not statistically significant for the fixed and intermediate exchange rate regimes. We mentioned that the Net TOT variable is statistically significant and negative for the intermediate and floating exchange rate regimes, but not significant for the fixed exchange rate regime, hence, the individual fixed effects model is more favourable than the random effects model (Table 6).

GMM estimates show that the coefficient associated with the lagged FDI variable is statistically significant and positive at a significance level of less than 1% in all three types of exchange rate regime. The results also show that this volatility has a positive and significant effect on fixed and intermediate exchange rate regimes. A 1% increase in exchange rate volatility leads to a 0.09% increase in FDI inflows in fixed and intermediate exchange rate regimes. In floating exchange rate regimes, exchange rate volatility has no statistically significant impact. Our estimates show that the coefficient associated with the exchange rate misalignment variable is negative and significant in the presence of a fixed exchange rate regime and an intermediate exchange rate regime. Thus, a 1% increases in exchange rate misalignment results in FDI inflows of -9.23% in a fixed exchange rate regime and -8.51% in an intermediate exchange rate regime. However, this coefficient becomes insignificant under a floating exchange rate regime. The coefficients of the other variables, GDP, Net TOT, GFCF and Trade, have the expected signs. In a regime where no commitment is made on the exchange rate (floating), the impact of the GFCF and trade variables on FDI inflows is not significant, but this impact is significant and negative in a fixed and intermediate exchange rate regime. The coefficients associated with GDP and Net TOT is statistically significant, positive for GDP and negative for Net TOT, in all three types of exchange rate regime. For the Arellano-Bond AR (1) and AR (2) tests, we have demonstrated that the errors are not correlated. For the Sargan and Hansen tests, which give us the validity of the instruments, we note that we have the best instruments. Thus, for the Hansen tests, which validate the instruments of exogenous variables, we note that they are greater than 5% for the different exchange rate regimes; hence, we accept the null hypothesis, meaning that the instruments are valid (Table 7). We have demonstrated that the non-linear model estimated using the OLS method is globally significant and that the variables ERVOL and RERMIS are not statistically significant. We have revealed that the variable $RERMIS^2$ is statistically significant and negative regardless of the type of exchange rate regime. We mentioned that for the variables Ln (GDP), Ln (GFCF) and Trade, they are statistically significant, positive for Ln (GFCF) and Trade and negative for Ln (GDP). We noted that the variable Ln (Net TOT) is not statistically significant. We found that the random effects model is preferable to the individual fixed effects model for both

intermediate and floating exchange rate regimes, and given the problem of multicollinearity for the fixed exchange rate regime, we can say that the random effects model is more appropriate than the individual fixed effects model (Table 8). Using the GMM method, we found that the lagged FDI variable and the exchange rate volatility variable are statistically significant, whereas the exchange rate misalignment variable is not statistically significant for the different types of exchange rate regimes. For the control variables, we found that the gross domestic product, gross fixed capital formation and trade variables are not statistically significant, whereas the terms of trade variable is negative and statistically significant except for the fixed and intermediate exchange rate regimes; it is not significant for the floating exchange rate regime. We found that the errors are not correlated and that the instruments are valid according to the Arellano-Bond tests, the Sargan tests and the Hansen tests (Table 9).

For robustness, we used the Pooled Mean Group-ARDL estimation technique and found that the model is globally significant and that the exchange rate volatility ERVOL and exchange rate misalignment squared $RERMIS^2$ variables are not statistically significant. However, the exchange rate misalignment variable RERMIS is statistically significant and positive. For the control variables, we observed that the gross fixed capital formation (Ln (FBCF)) and terms of trade (Ln (Net TOT)) variables are not statistically significant. However, the variables (trade) and gross domestic product per capita Ln (GDP) are statistically significant, one with a negative sign and the other with a positive sign.

Finally, the results reveal that increased exchange rate variability has no effect on foreign direct investment if the non-linear model is applied and that this impact is favourable for the linear model if the fixed exchange rate regime is applied, while the intermediate exchange rate regime is unfavorable for the floating exchange rate regime.

In conclusion, the economic situation in the MENA region is worrying, and the outlook for the future remains uncertain. This situation is critical due to political difficulties. To achieve this, countries in the MENA region will need to opt for an appropriate investment strategy, encourage savings, select the right exchange rate regime, strengthen human capital, promote good governance and achieve economic integration, particularly in the Arab countries.

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Figures

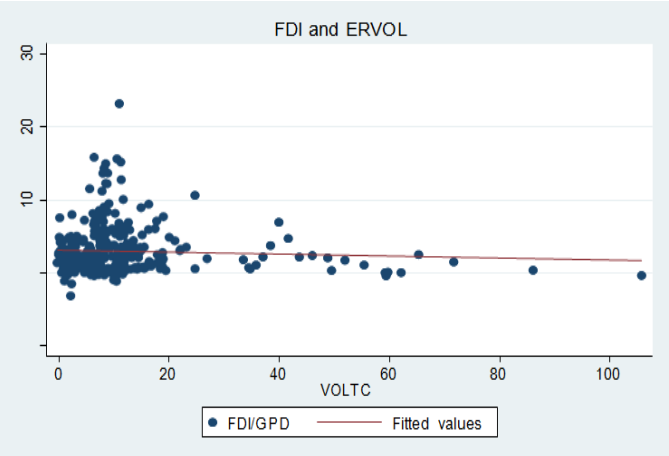

Figure_1, Correlation between exchange rate volatility and FDI flows

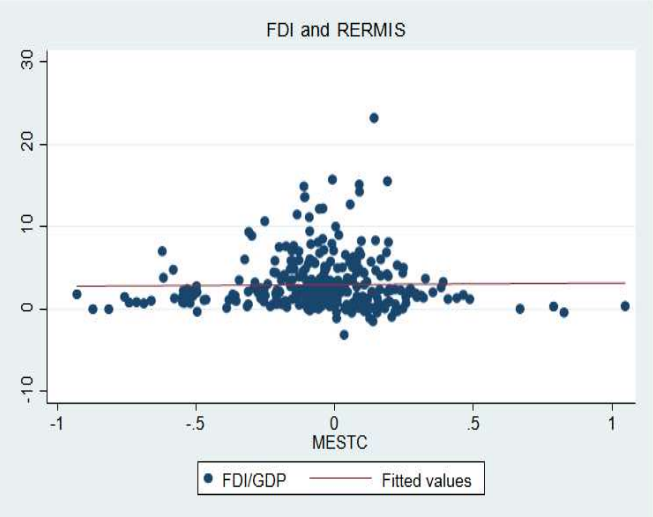

Figure_2, Correlation between exchange rate misalignement and FDI flows

Tables

Table 1. Descriptive statistics

Variables	Mean	Std. Dev.	Min	Max
FDI	2.963	3.281	-3.176	23.211
ERVOL	10.858	13.093	-0.229	105.740
RERMIS	-0.052	0.248	-0.929	1.047
GDP	16274.7	18355.53	960.380	69679.09
GFCF	24.007	7.389	6.205	48.459
Net TOT	136.182	45.925	59.433	290.930
Trade	84.247	35.100	16.668	191.872

Table 2. Correlation Matrix

	FDI	ERVOL	RERMIS	GDP	GFCF	Net TOT	Trade
FDI	1.0000						
ERVOL	-0.0537	1.0000					
RERMIS	0.0153	-0.0408	1.0000				
GDP	-0.1624	-0.1515	0.1329	1.0000			
GFCF	0.0377	-0.0151	-0.2769	0.0205	1.0000		
Net TOT	-0.1768	-0.0235	-0.3791	0.1796	0.2536	1.0000	
Trade	0.2568	-0.0946	-0.1173	0.3980	0.0871	0.0469	1.0000

Table 3.Jarque-Bera normality test

			------joint----	
Variable	Pr (Skewness)	Pr (Kurtosis)	adj chi2(2)	Prob>chi2
FDI	0.0000	0.0000	…….	0.0000
ERVOL	0.0000	0.0000	…….	0.0000
RERMIS	0.1092	0.0000	22.57	0.0000
GDP	0.0000	0.0001	…….	0.0000
GFCF	0.0000	0.0257	18.50	0.0001
Net TOT	0.0000	0.1569	36.49	0.0000
Trade	0.0001	0.6676	12.84	0.0016

Table 4. Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
GDP	1.35	0.738
RERMIS	1.34	0.748
Net TOT	1.30	0.770

Trade	1.25	0.797
GFCF	1.12	0.894
ERVOL	1.03	0.974
Mean VIF	1.23	

647

648 Table 5. Normality test of residual

			------joint----	
Variable	Pr (Skewness)	Pr (Kurtosis)	adj chi2(2)	Prob > chi2
Résidu	0.0000	0.0000	…….	0.0000

649

650 Table 6. Linear model estimation results (OLS, Hausman test, individual effects)

Ordinary Least Squares Method					
Variables	Fixed exchange rate regime	Intermediate exchange rate regime	Floating exchange rate regime	Hausman Test	Fixed individual effect
ERVOL	-0.016*	-0.012	-0.019**		0.040**
RERMIS	0.877	1.149	1.334*		-0.536
GDP	-0.001 ***	-0.001***	-0.001***		-0.001***
GFCF	0.027	0.028	0.038*		0.031
Net TOT	-0.009	-0.011***	-0.010***		-0.005
Trade	0.03***	0.039***	0.033***		0.072***
Constant	1.650**	1.475*	2.013***		-5.676***
P > F	0.0000	0.0000	0.0000		0.0000
R2	0.1789	0.1859	0.1910		
ROOT MSE	3.0046	2.9919	2.9824		
P > chi2				0.010	
chi2(8)				16.79	

651 Asterisks symbolize the level of significance: one for the 10% threshold, two for the 5% threshold and three for the 1% threshold.

652 Table 7. GMM in system, linear model

Variables	fixed exchange rate regime	intermediate exchange rate regime	floating exchange rate regime
FDI	1.162***	1.161***	1.167***
ERVOL	0.009***	0.009***	0.007
RERMIS	-0.923***	-0.851***	-0.795
GDP	0.000***	0.000**	0.000**
GFCF	-0.016**	-0.0149**	-0.011
Net TOT	-0.008***	-0.008***	-0.008**
Trade	-0.006**	-0.006**	-0.009
Constant	1.433***	1.259***	1.467*
Number of observations	320	320	320
Number of instruments	15	15	15

Number of groups	16	16	16
Prob> chi(2)	0.000	0.000	0.000
AR(1)(p-value)	0.009	0.009	0.009
AR(2)(p-value)	0.119	0.118	0.118
Test de Sergan (p-value)	0.021	0.022	0.021
Test de Hansen (p-value)	0.640	0.642	0.646
Hansen test excluding group (p-value)	0.667	0.672	0.856
Difference (null H = exogenous)(p- value)	0.304	0.299	0.131

653 Asterisks symbolize the level of significance: one for the 10% threshold, two for the 5% threshold and three for the 1% threshold

654 Table 8. Non-linear model estimation results (OLS, Hausman test, individual effects)

	Ordinary Least Squares Method			Test d'Hausman	Fixed individual effects	Test d'Hausman	Random effects	Test d'Hausman	Random effects
Variables	Fixed exchange rate regime	Intermediate exchange rate regime	Floating exchange rate regime	Fixed exchange rate regime		Intermediate exchange rate regime		Floating exchange rate regime	
ERVOL	-0.007	-0.008	-0.008		-0.01		-0.019***		-0.019**
RERMIS	-0.006	0.013	-0.057		-0.745**		-0.474		-0.528**
$RERMIS^2$	-1.447**	-1.333*	-1.404*		-0.091		-0.125		-0.086
Ln (GDP)	-0.519***	-0.521***	-0.540***		0.358		-0.455***		-0.379**
Ln (GFCF)	0.741***	0.754***	0.719***		0.541**		0.586***		0.562**
Ln (Net TOT)	-0.107	-0.101	-0.041		0.240		0.262		0.273
Trade	0.0146***	0.014***	0.014***		0.012***		0.012***		0.012***
Constant	2.545*	2.430*	2.364*		-6.447*		0.803		0.052
P > F	0.0000	0.0000	0.0000						
R^2	0.2535	0.2523	0.2539						
ROOT MSE	1.0809	1.0817	1.0805						
P >chi2				0.05		0.2123		0.2398	
chi2 (7)				13.93		9.6		9.18	

655 Asterisks symbolize the level of significance: one for the 10% threshold, two for the 5% threshold and three for the 1% threshold

Table 9. GMM in system, non-linear model.

Variables	Fixed exchange rate regime	Intermediate exchange rate regime	Floating exchange rate regime
Ln (FDI)	1.884**	1.707**	1.924***
ERVOL	0.012**	0.012*	0.015**
RERMIS	0.386	0.337	-0.247
RERMIS ^{2}	2.213	1.684	1.668
Ln (GDP)	0.386	0.345	0.280
Ln (GFCF)	-0.742	-0.641	-0.969
Ln (Net TOT)	-0.476***	-0.543**	-0.239
Trade	-0.009	-0.007	-0.004
Constant	1.172	1.494*	1.080
Number of observations	288	288	288
Number of instruments	15	15	15
Number of groups	16	16	16
Prob> chi(2)	0.000	0.000	0.000
AR(1)(p-value)	0.104	0.081	0.113
AR(2)(p-value)	0.628	0.617	0.685
Test de Sergan (p-value)	0.835	0.805	0.779
Test de Hansen (p-value)	0.783	0.785	0.951
Hansen test excluding group (p-value)	0.751	0.768	0.904
Difference (null H = exogenous)(p-value)	0.463	0.431	0.759

Asterisks symbolize the level of significance: one for the 10% threshold, two for the 5% threshold and three for the 1% threshold.

Table 10. Pooled Mean Group (PMG), non-linear model

Variables	Pooled Mean Group (PMG)
ERVOL	0.008
RERMIS	1.886***
RERMIS ^{2}	0.224
Ln (GDP)	-1.615***
Ln (GFCF)	0.246
Ln (Net TOT)	-0.199
Trade	0.041***
Constant	5.642***
Number of observations	288
Number of groups	16
Log Likelihood	0.000

Asterisks symbolize the level of significance: one for the 10% threshold, two for the 5% threshold and three for the 1% threshold.