A Panel Data Model for Implementation of a Competitive Real Exchange Rate for the Promotion of Economic Growth in MENA Countries

TOUITOU MOHAMMED
Faculty of Economics and Business,
University of Algiers 3,
02 Rue Ahmed Oueked Dely Ibrahim Algiers,
ALGERIA

Abstract: - The objective of this study is to determine whether maintaining a competitive real exchange rate has been beneficial for the economies in MENA countries, in the period 1965 to 2020. To confirm the research hypothesis, we use two econometric models, the first is quantitative which is a balanced panel data model and the second is a qualitative "Logit" response model on panel data, in this case unbalanced, that identifies the variables that promote and control currency devaluations, considered the theory proposed by Berg and Miao (2010). Our result maintains that a competitive real exchange rate has boosted the growth of MENA economies. The existence of the "Penn" effect in developed MENA economies is demonstrated, these countries have developed policies that allow good management of exchange rate misalignments and thus contain the shocks suffered by their currencies.

Key Words: - Exchange rate, Economic growth, Panel data, Balassa-Samuelson, Exchange rate devaluations, MENA countries.

Received: April 27, 2024. Revised: November 23, 2024. Accepted: December 21, 2024. Published: January 21, 2025.

1 Introduction

Years ago, the debate about the relationship between the level and volatility of the exchange rate and economic growth raged among economists. Different empirical studies present two results (coherent and complementary to each other) that associate the real exchange rate (RER) with economic performance. On the one hand, the evidence shows a positive association between a high level of real exchange rate (depreciated) and economic growth. On the other hand, greater volatility of said variable is associated with lower levels of growth.

Recent theoretical and empirical research [1], [2], [3], [4] finds a relationship between per capita income growth and exchange rate misalignments, which, the theory shows, is that by maintaining a competitive exchange rate we can boost economic development. [1], mention that mismanagement of exchange rate devaluations can be catastrophic for an emerging economy. [2], determines that exchange rate misalignments generate a boost in per capita income since a real exchange rate promotes exports. [3], demonstrate that the competitive exchange rate generates constant growth in a country's economy. [4], mention that real exchange rate levels influence the productive structure of countries, boosting exports and decreasing imports.

On the other hand, exchange rate misalignments represent a variable that has not been taken into account to measure economic growth, however, it is interesting to discern its relationship with the momentum of the economy, in this sense, it seeks to create a model that shows which are the determinants that help control exchange rate misalignments. [1], demonstrate a positive relationship between the real exchange rate and economic development. [5], describe that to have adequate control over the exchange rate, sterilized interventions by central banks on the exchange market must be considered, which are supported by the amount of international reserves that each country has; restrictive capital controls that allow control of capital flows, and coordination of efficient macroeconomic policies that include fiscal policies and correct financial openness.

Likewise, the research by [6] is considered, which establishes that the control variables that affect the behavior of the exchange rate are, in themselves, economic fundamentals that encourage exchange devaluations. This variable (exchange rate misalignments) is estimated through an unbalanced panel data model. The dependent variable is

presented as qualitative, taking the value of 0 in the case of currency appreciation and 1 when there is a devaluation. In this sense, a Logit model is carried out on the panel data. The control variables used in estimating this model are central bank interventions; capital controls; government consumption; productivity; unemployment rate; interest rate; commercial opening; savings and population growth rate.

The main objective of this research work is to determine whether maintaining a competitive real exchange rate has been beneficial for the economies of MENA countries for the period 1965 to 2020, The problematic it was, whether is there a positive relation between real exchange rate and economic growth ؟in the same way it seeks to verify the variables that allow correctly managing an exchange rate regime with currency contractions. In this sense, an econometric analysis is presented based on the main studies on the subject; these propose managing panel data models and qualitative response models (LOGIT), using the statistical software R-Project, E-Views, and STATA.

The hypothesis put forward is that a competitive real exchange rate regime boosts per capita income, particularly in the developing economies of MENA countries and this is achieved through adequate control over exchange rate misalignments by implementing sterilized interventions by central banks on the shocks that the currency receives, maintaining adequate capital controls for international flows and coordination of macroeconomic policies.

After this introduction, this text contains five sections. The second summarizes the literature review, showing the relevance of the work in the base and complementary literature. The third explains the methodology implemented for the development of the empirical analysis, the fourth presents the results of the panel data, includes the discussion and the last part presents the conclusion.

2 Literature Review

An extensive literature has evaluated the relationship between the exchange rate and economic growth. The majority of empirical studies have shown the effect of exchange rate fluctuation on exports, trade, investment, capital market, employment, inflation, and growth in developing and developed countries, [7], [8], [9], [10], [11],[12], [13],[14], [15], [16], [17].

[1], [4], [18], [19], [20], [21], demonstrated that the emerging economies of Southeast Asia have kept their currency devalued in recent years, thus maintaining a competitive exchange rate and this has allowed them to achieve constant economic growth.

There is literature that demonstrates cases where managing a regime of this type (competitive exchange rate) is harmful. This depends, according to specialists [22] and others on the management that countries have carried out on their economy.

[23], used fully modified ordinary least squares (FMOLS) and an annual time series of data covering the period 1980-2015 to examine the effect of real effective exchange rate volatility on economic growth in Ghana. The regression results show that real effective exchange rate volatility has a negative and statistically very significant effect on economic growth in Ghana.

[24], investigated the link between GDP, exchange rate pass-through, and the copper price for Zambia and concluded that a decline in inflation was a good determinant of exchange rate volatility.

[25], investigated the effect of real exchange rate instability, with an observation that a low level of exchange rate volatility is required for growth.

[26], claimed that there is a positive relationship between real exchange rate undervaluation and the growth of manufactured exports and high-tech manufacturing industries, but that real exchange rate overvaluation increases the growth rate of primary product industries.

[27], in their study Inflation, Interest Rate, and Economic Growth Nexuses in SACU Countries, they found that inflation is the channel through which the effect of volatility in the exchange rate is passed into GDP.

[28], examined the influence of exchange rate instability on the inflation-growth nexus. Furthermore, they argue that an increasing and constant inflation rate could cause imported inflation at regional levels and erode people's purchasing power.

[29], studied the effects of exchange rate volatility on economic growth in the Democratic Republic of Congo (DRC) from 1990 to 2021, by using vector autoregression (VAR) model. The results indicate that economic growth is a function of its own innovations, the exchange rate, and trade openness. In addition, a depreciation of the domestic currency against the foreign currency hinders economic growth.

[30], investigate the impact of real exchange rate misalignments on economic growth in Tunisia by using the dynamic model approach of the nonlinear autoregressive distributed lag (NARDL), it was found that there was overvaluation and undervaluation during the period 2001 to 2016.

[31], investigate the effects of exchange rate misalignment uncertainty on short-term and long-term economic growth in South Africa, by using the generalized autoregressive conditional heteroskedasticity (GARCH) and vector error correction (VEC) models for the period 2016 to 2022. The findings of this study reveal a negative association between exchange rate uncertainty and short-term economic growth, while the long-term effects yield mixed results.

[32], determining empirically the impact of the exchange rate on economic growth in Algeria. For this, they will adopt an approach in terms of the vector autoregressive model (VAR) with four variables. The empirical results confirm the theoretical expectations that a decline in the real effective exchange rate increases the growth economy.

3 Methodology

In this research work, the determinants of the growth rate per capita income are analyzed since an increase in this variable means greater competitiveness in the country and reflects a better quality of life for its inhabitants. The behavior of GDP per capita growth is estimated using a balanced panel data model and various control variables are considered in the model, which is: exchange rate misalignments; per capita income lagged one period (to include the Balassa-Samuelson effect); commercial opening; savings; human capital and population growth rate. The study period of this model is 1965-2020.

The objective is to estimate the impact of the devalued exchange rate (exchange rate misalignment) on economic growth, in addition to some macroeconomic variables that, according to empirical evidence [1], [3], [4], [5], [21], [23], GDP per capita; government consumption; commercial opening; human capital; population growth rate among others.

According to [4], we can construct the real exchange rate (RER) variable with the following relationship:

$$lnRER = \ln(\frac{1}{pl\_gdpp}) \quad (1)$$

where pl_gdpp is the real GDP production estimated by purchasing power parity (PPP), this variable is obtained from PWT9.1. In the same way, this variable can be achieved with the following analogy, [1]:

$$lnRER = \frac{Xrat_{it}}{PPA_{it}} \quad (2)$$

where $Xrat_{it}$ is the value of the exchange rate in national currency units for US dollars and PPA_{it} is the purchasing power parity conversion. The RER is said to be appreciated when $Xrat_{it}$ is less than PPA_{it} and is devalued when the value of the exchange rate is greater than purchasing power parity.

According to [1], the Balassa Samuelson (The Balassa-Samuelson (BS) effect establishes that there is a possibility that an increase in tradable goods will lead to an increase in non-tradable goods, and consequently an increase in the exchange rate. So prices in the non-tradable sector rise faster than in the tradable sector due to lower productivity growth) effect on the real exchange rate must be taken into account and corrected using the following specification:

$$lnRER = \mathrm{C} + \beta lnrgdpc_{it} + u_{it} \quad (3)$$

where $lnrgdpc_{it}$: the logarithm of real GDP is output at current PPP and u_{it} is the stochastic error term. Thus, the value of the devaluation on the exchange rate is obtained as follows:

$$lndeval_{it} = lnRER_{it} - \widehat{lnRER}_{it} \quad (4)$$

where $lndeval_{it}$ represents the value of currency devaluations, $\widehat{lnRER}_{it}$ are the calculated values obtained from the estimated model of equation (3), while $lnRER_{it}$ represents the real values.

Regarding the growth rate per capita, is constructed from the growth rate of the real gross domestic product per capita as follows [3]:

$$growth = \frac{rgdpc - rgdpc(-1)}{rgdpc(-1)} \quad (5)$$

In accordance with the literature [1], [3], [4], [6], [33], control variables are added to the per capita income growth model that allow estimating robustly the behavior of this variable, these authors implement a lag on the GDP per capita (Percap) which allows knowing the initial value of income, in the same way, they add the misalignments of the exchange rate as explained in equation (4).

Government consumption (Govcons) reports the proportion of real gross domestic product per capita based on production that is represented by government consumption, in current purchasing power parities (PPP) at 2011 prices. The gross domestic savings implemented in the literature [1], [2], [3], [4], is a proportion of the percentage of GDP (gross domestic savings), this variable is obtained from the database provided by the World Bank. Human capital (HC) used by [3], [33] provides an index of human capital per person, which is related to the average years of schooling

and the return to education. The growth rate population (Grpop) is constructed through the differentiation of the population number of each country. [4], [33] demonstrates that it intervenes in the growth of per capita income.

Estimating correctly the effects of exchange rate misalignments on per capita income is of great importance for emerging economies since empirical evidence [1], [2], [3], [4], [6], [33] demonstrates that maintaining a competitive real exchange rate benefits per capita GDP growth.

3.1 Estimation of the Panel Data Model for per Capita Growth

Models with panel data allow estimates to be made on different countries (cross-section) over time (period), which makes it possible to analyze and compare the results of each economy. A pooled balanced panel data model estimated by OLS was performed with the dependent variable being the per capita growth rate explained mainly by exchange rate misalignment and a set of control variables. Similarly, a model with fixed effects in the time section was estimated to observe the evolution of growth in each year and to identify the periods in which the growth rate of per capita income was most affected. Likewise, the cross-section of the model allows us to know the behavior of growth in each of the MENA economies in the sample. On the other hand, a random effects model over time was created, this methodology assigns random values to these variables in order to optimize the results, unlike fixed effects that maintain constant values, and this model is estimated by the Generalized Least Squares (GLS) methodology. The period used in all models covers the period from 1965 to 2020.

$$Growth_{it} = \beta_0 + \beta_1 percap(-1)_{it} + \beta_2 pLndev_{it} + \beta_3 Govcons_{it} + \beta_4 Tradeo_{it} + \beta_5 Saving_{it} + \beta_6 HC_{it} + \beta_7 Grpop_{it} + \beta_8 D_{it} + u_{it} \quad (6)$$

where $percap(-1)_{it}$ is the per capita income lagged by one period; $Lndevit$ are the devaluation values on the exchange rate obtained in equation (4), for the sample of MENA economies it is expected that the devaluations will have a positive sign, since this indicates a positive relationship between the real exchange rate and growth of per capita income as indicated by empirical evidence [1], [2], [4], [6], [33]; $Govcons_{it}$ represents government consumption, and likewise, the aforementioned literature indicates a positive relationship of this variable with income, so a positive sign is expected in the coefficient; $Savings_{it}$ is savings (Gross national savings), it is one of the variables that have the greatest positive impact on per capita income, in this sense a positive sign is expected; HC_{it} human capital, [3], [33] demonstrate a positive relationship between this variable and income, therefore a positive sign is expected within the model; $Grpop_{it}$ is the population growth rate, for this variable [4], [33] they find a negative relationship on economic growth, which indicates that a negative sign is expected in the coefficient; D_{it} is the dummy variable that represents the effect of the model (fixed or random effects) and uit is the error term. The initial per capita income variable $percap(-1)_{it}$ is added following the hypothesis of conditional convergence of economic growth, which refers to the inverse relationship between the growth rate of per capita income and its initial level, for a given set of regions or countries with similar structural characteristics and a certain period of time, [34]. In this sense, a negative sign is expected in the case in which there is conditional convergence between the economies of MENA and a positive sign when there is no convergence.

3.2 Estimation of Logistic Regression Model for Exchange Rate Misalignments

The evidence from this research work demonstrates that exchange devaluations generate a boost on per capita income, as does empirical evidence [1], [2], [3], [4], [6], [33] however, the author mentions that to achieve constant growth in GDP per capita, currency devaluations must be controlled and managed correctly. As already mentioned, equation 4 represents exchange rate misalignments. If $lndeval_{it}$ turns out to be less than unity, we say that the currency is overvalued; otherwise, if the value is positive, it indicates that the prices of goods produced in the country are cheap compared to the dollar, that is, the currency is devalued. For the estimation of the Logit model, the dependent variable is described as a discrete value of 0 and 1. The dummy variable takes the value of 1 when the currency is depreciated and 0 when it is appreciated.

In relation to the first corner of the trilemma, [5] establishes that the calculation of banking interventions can be approximated by the amount of international reserves that each nation has, and these reserves are defined as:

$$R_m = \frac{\text{foreign assets}_m - \text{foreign liabilities}_m - \text{government diposits}_m}{e_m} \quad (7)$$

where foreign assets represent the assets that each

country has abroad, foreign liabilities are the financial liabilities received from abroad, government deposits represent the deposits of the Public Sector, particularly the Central Government in the form of taxes or payments derived from placements of securities and em is the price of the dollar in terms of national currency. It is then divided by the M2 money supply (A broad definition of money in circulation (M2) includes the M1 money supply, which is, all the coins and banknotes circulating in an economy. However, M2 includes two important variables. The first includes bank deposits, and the second refers to certificates of deposit (CD)), to find out if the amount of external money that enters the countries or the money issued by the central banks is greater:

$$R2_m = \frac{R_m}{M2_m} \quad (8)$$

Then we can write:

$$IntervBC_{p,a} = \sum_{1}^{12} \frac{1}{12}(R2_{p,a,m} - R2_{p,a,m-1}) \quad (9)$$

where $IntervBC_{p,a}$ represents the banking interventions of each country (p) and year (a). Therefore, a positive integer of $IntervBC_{p,a}$ implies a high degree of intervention, because the index will be positive only if the accumulation of reserves exceeds the increase in monetary aggregates.

Continuing with the trilemma, [35] state that conventional sources for calculating capital controls are based on the annual report of the international monetary fund (IMF) on exchange rate arrangements and exchange restrictions (AREAER) (However, they describe that there are deficiencies in this method, which are: 1) they do not take into account the intensity of capital controls; 2) the IMF-based variables are too aggregated to capture the subtleties of actual capital controls, and 3) it is almost impossible to distinguish between de jure (which legislation imposes on capital flows) and de facto (referring mainly to interest rate differentials) in capital transactions.), however the authors define a common method used to overcome the deficiencies of the dichotomous measures of capital controls of the measurements made by the IMF, this involves the construction of variables that depend on the proportion of years with respect to the period examined for which countries have liberalized capital accounts using the AREAER variables. They divide capital controls into four groups: i) on the existence of multiple exchange rates ($K1$); ii) the presence of restrictions on current account transactions ($K2$); iii) restrictions on capital account transactions ($K3$), iv) regulatory requirements for the delivery of export earnings ($K4$).

To focus on the effect of financial openness, instead of capital controls, [36] reverse the values of these binary variables, so that the variables equal one when the capital account constraints are non-existent. Additionally, for controls on capital transitions (k3), a modification (SHAREk3) is used.

$$SHARAK_{3,t} = \left(\frac{K_{3,t} + K_{3,t-1}K_{3,t-2} + K_{3,t-3} + K_{3,t-4}}{5}\right) \quad (10)$$

Then an index for capital openness (KAOPENt) is constructed, which is the first standardized principal component of k1t, k2t SHAREk3, k4t. This index acquires higher values the more open the country is to cross-border capital transactions.

Regarding the third corner of the trilemma, [6] point out that there are some fundamentals that affect economic growth, but also affect exchange rate misalignments. These authors carry out a regression based on the [1] model; in this sense, they find that the explanatory variables of the exchange rate misalignments have two effects, that is, this given variable causes both an appreciation of the exchange rate of balance as faster growth. The control variables that are added to the model are: government consumption, productivity, the unemployment rate and inflation.

A Logit model is estimated with unbalanced panel data due to the lack of data in database research centers, the period used is from 1985 to 2020. The trilemma exposed by [5], is taken into account. In addition to adding control variables such as: government consumption, productivity, the unemployment rate and inflation. In addition, the justification of [6] is considered and the significant variables of the per capita income growth model are added, that is, trade openness, savings and the population growth rate are considered in the model. . The econometric estimation of the model is as follows:

$$DLndev_{it} = IntervBC_{it} + KAopen_{it} + Govcons_{it} + Product_{it} + +Unpr_{it} + inf_{it} + Tradeo_{it} + Savings_{it} + Grpop_{it} + u_{it} \quad (11)$$

where $DLndev_{it}$ is the dummy variable 0 in case

of overvaluation and 1 for the devalued currency; $IntervBC_{it}$ is banking interventions; $KAopen_{it}$ refers to capital controls; $Govcons_{it}$ is government consumption; $Product_{it}$ is productivity; $Unpr_{it}$ is the unemployment rate; inf_{it} refers to inflation and u_{it} is the stochastic error term.

4 Results and Discussions

In table 1, the coefficients of the models turn out to be highly significant in most cases. The decision on the optimal model is made based on the following statistical tests: the Breusch-Pagan test is performed on the pooled model, the statistical value of 0.05 indicates that the null hypothesis cannot be rejected, that is, there is evidence of significant effects, in other words, the random effects model is preferred over the pooled data model; the restricted F-test compares between the pooled panel model and the fixed effects model. In this case, the p-value of 0.0004 dictates that the null hypothesis must be rejected, the fixed effects model is better than the grouped one. Finally, the Hausman statistic allows us to decide between the random effects model and the fixed effects estimator. In this case, the chi-square value is 0.1, which turns out to be too high, so the null hypothesis of the fixed effects model is better. In conclusion, the panel data model that best estimates economic growth is the fixed effects model. This model was built with an analysis over time, which allows us to observe the impact that was obtained in each year.

Consequently, tests are carried out corresponding to the model that best fits the per capita growth rates, which is the time fixed effects model. These tests are presented in the first part of the annexes. Correlation tests were carried out with the objective of identifying the existence of serial autocorrelation, that is, that the errors are related between the variables, and contemporaneous correlation, remember that this problem refers to the existence of a correlation of the errors between two or more economies in the same period. The Breusch-Godfrey test proposed by [37] indicates whether there is serial correlation in the errors, the probabilistic value (p-value) is 0.00006, which leads to rejecting the null hypothesis, that is, there is serial correlation in the model. . In the same way, the existence of heteroskedasticity is sought in the model, the Breusch-Pagan statistic for heteroskedasticity yields a p-value of 0.0000003, the null hypothesis is rejected and the model is said to be heteroskedastic. To correct these problems, a model is created using the robust covariance matrix, [37]:

$$E[\varepsilon\varepsilon'/X] = \Gamma = Y_0 R \quad (12)$$

where Γ is the covariance matrix and R is the autocorrelation matrix. Then we can write:

$$\rho_{ts} = \frac{Y(t-s)}{Y_0} \quad (13)$$

where ts is the correlation coefficient. In this way, the errors can be smoothed to eliminate autocorrelation and heteroskedasticity from the model and achieve consistent estimators.

The corrected model presented in the last column of Table 1 (Appendix) shows the estimators of the uncorrelated and homoskedastic variables. This correction was carried out through the Generalized

Least Squares (GLS) methodology. This method is used through the estimators with errors. White's standard, the White test, allows us to test for nonlinearity using the squares and cross products of all the regressors, that is, it corrects the correlation and heteroscedasticity because it weights the residuals of the coefficients making them homoscedastic.

Furthermore, devaluations turn out to be highly significant and positively affect growth as established by [1], which indicates that maintaining a regime with a competitive real exchange rate has favored the developing countries of MENA, the effect What it creates on growth is a variation of 0.039. Recent evidence shows that growth accelerations tend to be associated with higher investment increases in exports, and real exchange rate depreciation, [2]. In this way, good management of exchange rate misalignments is significant and robust for developing countries, since it maintains constant growth in per capita income, as mentioned by [3]. This result empirically supports what was pointed out by [4] that real exchange rate levels are important for income in developing countries since it can create important effects for the productive structure. This result means that RER depreciation can affect the long-term growth of an economy through an increase in its income elasticity of export demand, which would stimulate export growth for any global growth rate. In this sense, the variations in competitiveness produced by the RER are not spurious, but rather authentic, [4].

This model agrees with [21] in that government consumption is a variable that does not affect economic growth, like trade openness and human capital. On the other hand, savings drive the dependent variable, that is, the higher the savings,

the easier it is to achieve an increase in the development of the MENA economy. On the contrary, the population growth rate has a contractionary effect on growth, that is, as the population grows it is more difficult to maintain momentum in economic development, [4], [33] establish that The higher the population growth rate, the growth of income will lag behind. The high R^2 indicates that the model is representative as well as being consistently estimated.

Bank interventions turn out to be significant (Table 2); however, exchange rate misalignments are affected downwards. That is, when a sterilized intervention is generated, it is 0.3815 times more likely that the currency will be appreciated. In other words, every time a Central Bank (CB) intervened in the markets and the exchange rate, an overvaluation of the currency occurred. [5], mention that CBs must be cautious to implement any intervention, the evolution of supply and demand of the monetary base on tradable goods and the internal interest rate must be taken into account.

Table 2. Logit model of exchange rate misalignments over the MENA countries

Dependent variable: DLndev	Odds Ratios
IntervBC	0.3815241*
	(-1.76)
KAopen	1.076351
	(0.43)
Govcons	46.7652***
	(3.85)
Product	2.218635***
	(3.57)
Unpr	1.019834
	(0.23)
inf	0.4858556
	(-0.13)
Tradeo	1.272418
	(0.14)
Saving	5.160864
	(1.73)
Grpop	0.5710986
	(-1.31)

Note: *p<0.05; **p<0.01; ***p<0.001. The values of the t statistic are in parentheses.

Source: Authors' elaboration

This result proves the "fear of appreciation" of the MENA countries, and in this sense, the central banks intervene every time there is an appreciation in the exchange rate in order to contain shocks to the currency and be able to keep it devalued.

Government consumption is highly significant. This variable controls exchange rate misalignments, that is, for every unit that increases government consumption, it is 46.56 times more likely that a devaluation of the currency will continue. [6] Mention that government consumption describes the equation of the real exchange rate, in this sense, they generate a great impact to promote a strategy with a devalued exchange rate regime.

Productivity is a highly significant variable, indicating that as long as a MENA economy has high productivity it will be 2.2186 times more likely that a MENA economy will keep its currency devalued. [22], [38] indicates that an increase in the productivity of developing countries encourages the devaluation of their local currency and explains that some activities can help increase said productivity, for example, a correct credit allocation policy; that exporting companies be granted financial resources in national currency at costs and deadlines that are appropriate to them; investment in public spending as development of public administration; an improvement in educational and health systems.

The Wald test is a joint test that indicates whether the model variables are estimated correctly. In this sense, in Table 3, the probabilistic value 0.0058 allows us to reject the null hypothesis, that is, the model is correctly specified. The rho LR test formally compares the pooled (logit) estimator with the panel estimator, when rho is zero, the variance component at the panel level is not important and the panel estimator is not different from the pooled estimator, said Otherwise, the model estimated with random effects is optimal for measuring exchange rate misalignments.

Table 3. Statistical tests for the exchange rate disalienations model

Tests of the model	Statistics
Wald	24.16
prob>x^2	0.0058
Rho	0

Source: Authors' elaboration

In summary, the growth of per capita income in the economies of Southeast Asia meets the hypothesis of economic convergence; in addition, constant growth in said income can be obtained by maintaining a competitive real exchange rate and generating large savings. However, this growth is lagged as long as there is a high population growth rate. On the other hand, exchange rate misalignments suggest that MENA economies allow strong intervention by their central banks to keep the currency devalued; likewise, it shows that high productivity and government consumption

help maintain a competitive change.

5 Conclusion

In this research work, it is concluded that an economic policy regime that supports a competitive real exchange rate has benefited the increase in per capita income of emerging economies in the MENA region. The economic results show that in recent decades (1965-2020) their GDP per capita has maintained constant growth thanks to the fact that they have correctly managed the contractions in their currency. In the same sense, they have relied on other control variables that have allowed an increase in per capita income, for example, savings. The greater the amount of savings that a country has, the clearer increase in income will be. Internal savings play an important role in the development of economies; since it allows them to have a source of financing for investments and these are generally used for generating future income.

On the other hand, there are also variables such as the population growth rate that generate a negative impact on growth, that is, as the population index increases it is more complicated to maintain the development of per capita income [4], [33]. Since this variable generally exhibits exponential behavior, it is important to take into consideration its effect on income, as it could act as an inhibitor to income growth.

It is important to mention that the estimates of this research take into account the Balassa-Samuelson effect, which indicates that if there is an increase in wages, it can generate an increase in tradable goods and thus an appreciation of the currency. The existence of the "Penn" effect in developed MENA economies is demonstrated. This effect has caused these countries to develop a "fear of appreciation", which forces them to maintain their devalued exchange rate through sterilized interventions by central banks since this effect suggests that growth in productivity leads to an increase in inflation causing an appreciation in the real exchange rate. However, the Balassa-Samuelson effect compromises the evolution of per capita income by generating an increase in commercial goods and this affects aggregate demand. Income growth meets the hypothesis of economic convergence, therefore, it can be said that, in this sector of MENA economies, income per capita converges to its stationary state over time.

Considering the previous arguments, it is of great importance to measure the misalignments of the exchange rate and the policies and their respective variables that can promote or allow better management of currency devaluations. On the other hand, regarding the control variables that determine the currency appreciation/depreciation policy, it was identified that government consumption drives exchange devaluations; this is thanks to the fact that high consumption promotes a competitive real exchange rate [6]. The above is better reflected in emerging economies since maintaining a devalued currency allows them to have greater financial freedom, this is because the demand for exports is boosted and this allows them to have a greater amount of internal savings that helps drive higher investment levels in the countries.

In conclusion, maintaining a competitive real exchange rate has boosted the growth of MENA economies, these countries have developed policies that they allow good management of exchange rate misalignments and thus contain the shocks suffered by their currencies. Currently, these countries maintain a flexible exchange rate that allows them to have low levels of inflation and maintain competitiveness to achieve an increase in per capita income, it also allows them to boost exports and generate more investment.

References:

[1] Rodrik, D. The real exchange rate and economic growth. Economic Activity, 2008. vol. 39, issue 2 365-439. http://dx.doi.org/10.1353/eca.0.0020.

[2] Kubota, M. (2011). Assessing Real Exchange Rate Misalignments. World Bank Policy Research Working Paper, No. 5925, 1-71, [Online]. https://openknowledge.worldbank.org/server/api/core/bitstreams/da5f4589-016c-5ff7-a337-9b08d30af1c2/content (Accessed Date: May 12, 2024).

[3] Vieira, F. V., & MacDonald, R. A panel data investigation of real exchange rate misalignment and growth. Estudos Econômicos, 2012. vol. 42, n.3. 433-456. http://dx.doi.org/10.1590/S0101-41612012000300001.

[4] Missio, F. J., Jayme, F., Britto, G., & Oreiro, J. L. *Real exchange rate and economic growth: new empirical evidence.* John Wiley & Sons, 2015. 66(4), 686-714. https://doi.org/10.1111/meca.12087.

[5] Barbosa, S. L., Jayme, F. G., & Missio, F. J. Managing real exchange rate for economic growth: Empirical evidences from developing countries. *Journal of post Keynesian Economics*, 2018. vol. 41(4),598-619. DOI: 10.1080/01603477.2018.1486209.

[6] Berg, A., & Miao, Y. The Real Exchange Rate and Growth Revisited: The Washington Consensus Strikes Back?. *IMF Working Papers*, 10/58, 2010. 1-25, [Online]. https://www.imf.org/external/pubs/ft/wp/2010/wp1058.pdf (Accessed Date: May 15, 2024).

[7] Schnabl, G. Exchange Rate Volatility and Growth in Small Open Economies at the EMU Periphery. Economic Systems, 2008. 32 (1), 70-91. https://doi.org/10.1016/j.ecosys.2007.06.006.

[8] Jamil, M., Streissler, E. W., & Kunst, R. M. Exchange Rate Volatility and its Impact on Industrial Production, Before and After the Introduction of Common Currency in Europe. *International Journal of Economics and Financial*, Issues, 2(2), 2012. 85–109, [Online]. https://www.econjournals.com/index.php/ijefi/article/view/93 (Accessed Date: May 17, 2024).

[9] Rjoub Husam. Stock prices and exchange rates dynamics: Evidence from emerging markets. *African Journal of Business Management*, Vol. 6(13), 2012. pp. 4728-4733. https://doi.org/10.5897/AJBM11.2761.

[10] Allen, D. E., McAleer, M., Peiris, S., & Singh, A. K. Nonlinear time series and neural-network models of exchange rates between the US dollar and major currencies. *Risks*, 4(1), 2016. 7. https://doi.org/10.3390/risks4010007.

[11] Alagidede, P., & Ibrahim, M. On the causes and effects of exchange rate volatility on economic growth: Evidence from Ghana. *Journal of African Business*, 18(2), 2017. 169–193. https://doi.org/10.1080/15228916.2017.1247330.

[12] Dal Bianco, S., & Loan, N. C. T. FDI inflows, price and exchange rate volatility: New empirical evidence from Latin America. *International Journal of Financial Studies*, 5(1), 2017. 6. https://doi.org/10.3390/ijfs5010006.

[13] Latief, R., & Lefen, L. The effect of exchange rate volatility on international trade and foreign direct investment (FDI) in developing countries along ―one belt and one road‖. *International Journal of Financial Studies*, 6(4), 2018. 86. https://doi.org/10.3390/ijfs6040086.

[14] Vo, D. H., Vo, A. T., & Zhang, Z. Exchange rate volatility and disaggregated manufacturing exports: Evidence from an emerging country. *Journal of Risk and Financial Management*, 12(1), 2019. 12. https://doi.org/10.3390/jrfm12010012.

[15] Hatmanu, M., Cautisanu, C., & Ifrim, M. The impact of interest rate, exchange rate and European business climate on economic growth in Romania: An ARDL approach with structural breaks. *Sustainability*, 12(7), 2020. 2798. https://doi.org/10.3390/su12072798.

[16] Ioan, B., Mozi, R. M., Lucian, G., Gheorghe, F., Horia, T., Ioan, B., & Mircea-Iosif, R. An empirical investigation on determinants of sustainable economic growth. Lessons from Central and Eastern European countries. *Journal of Risk and Financial Management*, 13(7), 2020. 146. https://doi.org/10.3390/jrfm13070146.

[17] Touitou Mohammed, M. Retia, K. Gaidi, A. Boudeghdegh.The Impact of Exchange Rate Regimes on Economic Growth. Advances in Panel Data Analysis in Applied Economic Research proceeding book, *2017 International Conference on Applied Economics (ICOAE)*, Coventry, UK. Pages 415-428. https://doi.org/10.1007/978-3-319-70055-7_33.

[18] Frenkel, R., Taylor, L. Real Exchange Rate, Monetary Policie and Employment: Economic Development in a Garden of Forking Paths. *Political Economic Research Institue*, 2006. 1-20, [Online]. https://www.un.org/esa/desa/papers/2006/wp19_2006.pdf (Accessed Date: May 13, 2024).

[19] Rapetti, M. Macroeconomic Policy Coordination in a Competitive Real Exchange Rate Strategy for Development. *Economics Department Working Paper Series*, 2011. vol. 3(2), 1-31. DOI: 10.1515/jgd-2012-0009.

[20] Rajan, R. S. Management of exchange rate regimes in emerging Asia. *Review of Development Finance*, 2 (2), 2012. 53-68. http://dx.doi.org/10.2139/ssrn.1961495.

[21] Ribeiro, R. S. M., McCombie, J. S. L. and Lima, G. T. Does Real Exchange Rate Undervaluation Really Promote Economic Growth? *Structural Change and Economic*

Dynamics, 2020. vol. 52(C), pp. 408-417. doi: 10.1016/j.strueco.2019.02.005.

[22] Mohsen B. O., Souphala C., Magda K. Are devaluations contractionary in Asia? *Journal of Post Keynian Economics*, 2002. 25(1). 69-82. http://dx.doi.org/10.1080/01603477.2002.11051349.

[23] Ahiabor, G., & Amoah, A. Examining the Effect of Real Effective Exchange Rate Volatility on Economic Growth: Evidence from Ghana. *Journal of Economics and Economic Education Research*, 20 (1), 2019.1-14, [Online]. https://api.semanticscholar.org/CorpusID:182773857 (Accessed Date: May 14, 2024).

[24] Roger Lionel, Gregory Smith, Oliver Morrissey. Exchange Rate and Inflation Dynamics in a Resource Rich Setting: The Case of Zambia. *South African Journal of Economics*, 2019. Vol. 87(4), 490–514. DOI: 10.1111/saje.12236.

[25] Morina F., Hysa E., Ergün U., Panait M., Voica M. C. The effect of exchange rate volatility on economic growth: Case of the CEE countries. *Journal of Risk and Financial Management*, MDPI. 2020. Vol 13(8), pp. 1-13. https://doi.org/10.3390/jrfm13080177.

[26] Ybrayev, Z. Real Exchange Rate Management and Economic Growth: Export Performance in Kazakhstan 2009-2019. *International Review of Applied Economics*. 2021. 35 (1), 64-90. https://doi.org/10.1080/02692171.2020.1836135.

[27] Taderera Christie, Raynold Runganga, Simbarashe Mhaka, Syden Mishi. Inflation, Interest Rate and Economic Growth Nexuses in SACU Countries. 2021. MPRA Paper 105419, University Library of Munich, Germany, [Online]. https://mpra.ub.uni-muenchen.de/105419/1/MPRA_paper_105419.pdf (Accessed Date: May 12, 2024).

[28] Ebenezer Olamide, Kanayo Ogujiuba, Maredza Andrew. Exchange Rate Volatility, Inflation and Economic Growth in Developing Countries: Panel Data Approach for SADC. *Economies*. 2022. 10. 67. doi: 10.3390/economies10030067.

[29] Kabamba Mbuyi, A. , Kato-Kale Kakasi, C. , Muya Ntumba, C. and Imbaleva Mpebale, E. Exchange Rate Volatility and Economic Growth in the Democratic Republic of Congo (DRC). *Modern Economy*, 13 (5), 2022. 729-746. doi: 10.4236/me.2022.135039.

[30] Hadj Amor Thouraya, Nouira Ridha, Rault Christophe, Sova Anamaria. Real Exchange Rate Misalignments and Economic Growth in Tunisia: New Evidence from a Threshold Analysis of Asymmetric Adjustments. *The Quarterly Review of Economics and Finance*. 88 (5).2023. doi: 10.1016/j.qref.2023.01.007.

[31] Eugene Msizi Buthelizi. Exploring the relationship between exchange rate misalignment uncertainty and economic growth in South Africa. 2023. *Cogent Economics & Finance*, Vol. 11, 2023 - Issue 2, pp.220-226, October. doi: 10.1080/23322039.2023.2267920.

[32] Touitou Mohammed. Yacine Laib Ahmed Boudeghdegh. (2019). The Impact of Exchange Rate on Economic Growth in Algeria. *CBU International Conference (Prague, Czech Republic) proceeding*, Vol. 7 (2019). pp.323-330. https://doi.org/10.12955/cbup.v7.1381.

[33] Gala, P. Real exchange rate levels and economic development: theoretical analysis and econometric evidence. *Cambridge Journal of Economics*, 2008. Vol. 32 (2), pp.273-288. http://dx.doi.org/10.1093/cje/bem042.

[34] Sheikh, M. R., Mushtaq, I. ., Abbas, A. ., & Sultan, S. (2024). Convergence Hypothesis and Economic Growth in ECO Countries: An Insight from MM-QR Approach. *Bulletin of Business and Economics (BBE)*, Vol. 13 (1). pp. 89-104. https://doi.org/10.61506/01.00213.

[35] Chinn, M., & Ito, H. A New Measure of Financial Openness. *Journal of Comparative Policy Analysis*, 2008.10(3) 309-322. https://doi.org/10.1080/13876980802231123.

[36] Wooldridge, J. M. *Econometric Analysis of Cross Section and Panel Data*. London: The MIT Press.2002.

[37] Greene, W. H. *Econometric Analysis*. New Jersey: Pearson Education. 2003.

[38] Tuomas A. Peltonen and Michael Sager productivity shocks and real exchange rates a reappraisal. Working Paper Series No 1046 / April 2009, [Online]. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1046.pdf (Accessed Date: May 30, 2024).

APPENDIX

Table 1. Panel data models for the per capita economic growth model

Variable dependent: Growth	Clustered Data Model	Fixed effects model	Variable effects model	Fixed effects model corrected
Constant	0.200155***	0.169185***	0.192187***	0.131568**
	(5.0986)	(4.2712)	(5.17186)	(3.1411)
Percap(-1)	-0.020977***	-0.019087**	-0.021164**	-0.010896*
	(-3.4813)	(-3.1201)	(-3.4928)	(-2.4894)
Lndev	0.026058	0.029125*	0.026527*	0.039014***
	(1.6901)	(1.9122)	(1.7894)	(3.2725)
Govcons	-0.074192	-0.028197	-0.065074	-0.028867
	(-1.3681)	(-0.4934)	(-1.2301)	(-0.4021)
Tradeo	-0.36074	-0.039182	-0.037124	-0.014891
	(-1.6189)	(-1.7592)	(-1.6698)	(-1.3312)
Saving	0.200081***	0.191185***	0.198178***	0.133085***
	(5.2786)	(4.9023)	(5.3691)	(6.1891)
HC	0.004689	0.008344	0.004722	0.002224
	(0.44182)	(0.6911)	(0.4513)	(0.2411)
Grpop	-0.890986*	-0.898971*	-0.87713*	-1.113275**
	(-2.0301)	(-1.9498)	(-2.0421)	(-3.5624)

Tests for choosing the model	Statistics	Decision
Breusch-Pagan	3.8	
prob>x^2	0.05	Random effects
F-restricted	1.8	
prob>F	0.004	Fixed effects
Hausman	11	
prob>x^2	0.1	Fixed effects

Note: *p<0.05; **p<0.01; ***p<0.001. The values of the t statistic are in parentheses.

Source: *Authors elaboration*

Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

Touitou Mohammed, wrote this paper and responsible for the collection and estimation of the data.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

No funding was received for conducting this study.

Conflict of Interest

The authors have no conflicts of interest to declare.