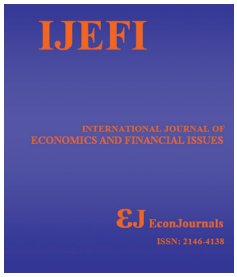

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Empirical Analysis of the Impact of Exchange Rates on Economic Growth in Emerging Countries: Case of Morocco

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ABSTRACT

This article analyzes the impact of exchange rate fluctuations on economic growth in emerging markets, with a particular focus on Morocco during the period 1994-2022. It employs an econometric methodology based on panel data to examine this complex relationship. The study highlights how exchange rate fluctuations, often rooted in economic fundamentals, can affect economic growth through various channels, including investment, foreign trade, and financial development. The results reveal a negative correlation between exchange rate depreciation and economic growth, suggesting that prudent exchange rate management is crucial to supporting economic development. The conclusions emphasize the importance of a well-calibrated exchange rate policy to maintain sustainable competitiveness and promote economic growth in developing countries.

Keywords: Exchange Rate, Economic Growth, Panel Data, Fluctuations
JEL Classifications: F31, F43, O55, C32, E44

1. INTRODUCTION

Morocco, like other developing countries, cannot escape the dynamics of the global economy. Indeed, while economic openness offers various advantages, such as increased foreign trade, the rise of capital flows, and the transfer of technologies, it also exposes the national economy to potentially destabilizing external shocks. In this context, exchange rate policy plays a crucial role, not only in the success of short-term economic measures but also in the success of long-term liberalization efforts, thereby directly influencing overall economic performance.

The economic literature emphasizes the influence of the exchange rate on economic growth, primarily through its impact on investment, foreign trade, and financial development. The real exchange rate, as an indicator of an economy's competitiveness, is essential for achieving sustainable internal and external balance. Consequently, it is imperative that the macroeconomic policies and development strategies adopted by developing countries incorporate this factor in order to effectively support economic growth. In this regard, inappropriate exchange rate policies can severely undermine economic performance, a phenomenon observed in many developing countries, including Morocco. This article aims to empirically explore the impact of the real exchange rate on economic growth by employing panel models applied to a sample of nine countries over the period from 1994 to 2022.

2. LITERATURE REVIEW

The relationship between exchange rate fluctuations and economic growth remains a complex and debated topic in contemporary economic literature. These fluctuations, often defined as deviations between the real exchange rate and its equilibrium level, are largely influenced by economic fundamentals. The Balassa-Samuelson hypothesis, though proposed several decades ago, continues to be relevant in current discussions. It suggests that productivity

increases in tradable goods sectors lead to wage increases, which affect the prices of non-tradable goods and can cause an appreciation of the real exchange rate (Balassa, 1964; Samuelson, 1964). However, recent analyses emphasize the role of demand-side factors, such as public spending and external shocks, including changes in terms of trade and capital flows, as highlighted by Frenkel and Mussa (1985) and more recently by Hooper and Shephard (2020), who reexamined the effects of capital flows on exchange rate fluctuations in the context of globalized markets.

Recent research also highlights the role of real shocks in exchange rate volatility. Indeed, the work of Clarida and Gali (1994) and Gauthier and Tessier (2002) on Canada has been enriched by more recent studies, notably those of Mendez and Coelho (2018), who showed that supply shocks in emerging economies can lead to unexpected exchange rate fluctuations, sometimes contradicting the Balassa-Samuelson hypothesis. Kandil and Mirzaie (2008), previously highlighted the diverse effects of fluctuations on aggregate demand and supply, but these findings were further expanded by Beirne and Antonakakis (2019), who examined the impact of exchange rate fluctuations on economic growth in Asia, emphasizing that these effects vary depending on the origin of the shocks (supply or demand) and the level of development of the country.

On the other hand, Edwards (1989) identifies two main sources of exchange rate fluctuations: inconsistencies in macroeconomic policies and changes in economic fundamentals. These conclusions were partially revisited and expanded by Garcia and Saurez (2018), who emphasized the importance of monetary policy in managing exchange rate fluctuations in emerging economies. Lane and Milesi-Ferretti (2020), who demonstrated that the monetary policy of major economies, particularly during crisis periods such as COVID-19, has a disproportionate effect on exchange rate fluctuations in developing economies, recently revisited Dornbusch's model (1976), which shows how unexpected monetary shocks can cause short-term exchange rate fluctuations.

Contemporary literature also examines the repercussions of exchange rate fluctuations at both macroeconomic and microeconomic levels. The analyses of Edwards (1989-1990) have been extended by recent studies, such as those by Rey and Wickremasinghe (2019), who examined the effects of real exchange rate fluctuations on economic growth in emerging countries in Asia and Africa. Their study confirms that distortions in relative prices between tradable and non-tradable goods continue to lead to resource misallocation, hindering economic growth. These findings are consistent with those of Fosu (2000) and more recently Coulibaly (2020), who reexamined the case of ECOWAS countries.

Regarding exchange rate overvaluation and undervaluation, the studies by Ghura and Grennes (1993) have found resonance in more recent work. Kose and Rogoff (2018) demonstrated that overvaluation continues to hamper growth in several developing countries, notably in sub-Saharan Africa, while undervaluation can stimulate external competitiveness, leading to faster economic growth. Additionally, Pick and Vollrath (1994) explored the specific impacts on agricultural exports, a study further developed in 2019 by Li and Zhang, who confirmed that exchange rate fluctuations negatively influence the agricultural sectors of developing countries due to variations in export costs.

Furthermore, Aguirre and Calderon (2005), as well as Gala and Lucinda (2006), highlighted the complexity of interactions between exchange rate fluctuations and growth, emphasizing the particularly harmful effects of overvaluation. Rodrik (2008) similarly concluded that countries with undervalued real exchange rates experience stronger growth. Hausmann and Hidalgo (2020), who explored the relationship between exchange rates, economic structure, and growth in developing countries, have validated this conclusion in recent analyses. Finally, the studies by Elbadawi et al. (2009), as well as by Berg and Miao (2010), have found further elaboration in the research of Korinek and Alquist (2020), who emphasize that prudent exchange rate management is essential for maintaining long-term economic competitiveness.

3. DATA AND METHODOLOGY

The research methodology adopted in this study is based on the use of panel data, a type of longitudinal data that captures both cross-sectional variations among different individuals and temporal dynamics for each individual. The econometric approach employed aims to examine the impact of exchange rate fluctuations on economic growth. This analysis is rooted in economic theory, which suggests that exchange rate fluctuations can influence economic growth either directly or indirectly by modulating economic responses to external shocks.

3.1. Model Specification

Therefore, the use of panel data, with its ability to integrate both temporal and individual dimensions, allows for a better understanding of complex economic interactions and their medium-term effects on growth. To apply the theoretical model of the impact of exchange rate fluctuations on economic growth, this study will draw on empirical work by several economists, including Perrault et al. (2001), Lys (2003), and Huang and Malhotra (2004). In analyzing this effect, we will use the following growth function:

$Y = f$(REER, CPE, GFCF, INF, TOPEN, POP)

The model can be written in its general form with all explanatory variables (Xi, t) as follows:]

$$Y_{it} = \alpha i + \beta' X_{it} + \varepsilon_{it}$$

With: (t = 1, 2, 3,... T; and i = 1, 2, 3,... N); Yit: represents the real per capita GDP growth rate of country i in period t

ß = The parameters to be estimated for each independent variable;

Xit = The independent variables affecting the growth of country i in period t;

εit = The random error term for country i in period t

In light of the sample used in the analysis, the previous growth function is rewritten according to the following formula:

$$GDP_{it} = \alpha_{it} + \beta 1 REER\ it + + \beta 2\ CPEit + \beta 3\ GFCFit + \beta 4\ INFit + \beta 5\ TOPENit + \beta 6\ POPit + \varepsilon_{it}$$

3.2. The Sample of Countries Used in Our Study

This analysis is based on a sample of Nine countries, selected for their diversity and the availability of data over the studied period (1994-2022). This sample includes the BRICS countries (Brazil, Russia, India, China, South Africa); Chile; two North African countries (Morocco, Egypt); and Turkey.

The BRICS countries, along with Chile, have experienced significant economic growth, primarily driven by an export-oriented strategy and the development of service industries. These nations have successfully attracted foreign investments, supported by competitive production costs and favorable demographics. Additionally, Chile stands out for its free-market economy and the robustness of its financial policies.

The North African countries, while exhibiting similar economic dynamics, display distinct characteristics. Morocco notably leverages its agricultural sector and its trade openness policy, while Egypt benefits from the diversity of its economy despite a context of political instability. Turkey, on the other hand, is characterized by a diversified economy, supported by a robust manufacturing sector, dynamic agriculture, and a growing service industry.

3.3. Description of Variables

The variables in this study were selected based on previous experimental research, taking into account the specific characteristics of the Moroccan economy as well as the availability of statistical data for the period under review (Table 1). The data used for the estimation of the econometric model consist of annual data covering the period from 1994 to 2022. The analysis was conducted using the Eviews software, with the primary sources of data for these variables being the statistics from the World Bank and the IMF.

4. RESULTS

4.1. Descriptive Statistics

This result highlights a notable fluctuation in per capita GDP growth rates between 1994 and 2022, with extremes observed in Brazil (−4.84% in 1990) and China (13.6367% in 2007) (Table 2). Similarly, the economic openness rate exhibits considerable variations, peaking in China (114.35% in 2008) and reaching a minimum in Brazil (15.16% in 1996), with an overall average of 56.22% during this period. In terms of investment, China records the highest rate (45.6898% of GDP), contrasting sharply with Brazil, which has the lowest rate (14.985% in 2016). Regarding public expenditure, Morocco registered the maximum (115.2658% in 2012) while Egypt recorded the minimum (73.10864% in 2016), with an overall average of 100.2899. Statistical tests indicate that the growth rate, real exchange rate, economic openness rate, and demographic growth rate follow a normal distribution, as evidenced by the Jarque-Bera test and its associated probability.

4.2. Analysis of the Correlation Between Variables

Through Table 3, it is noted that the correlation matrix between these explanatory variables reveals the following results. Firstly, a significant correlation is observed between the per capita GDP growth rate (GDP) and population growth (POP), with a correlation coefficient of 55.33%. Similarly, a significant correlation is found between the GDP and investment (represented by GFCF), with a correlation coefficient of 59.19%. Additionally, an important correlation is identified between the trade openness rate (TOPEN) and the real exchange rate (REER), with a correlation coefficient of 67.2%. Furthermore, GDP shows a positive correlation with investment (GFCF) and the trade openness rate (TOPEN), with correlation coefficients of 0.591935 and 0.021542, respectively. On the other hand, GDP is negatively correlated with REER, POP, inflation (INF), and public expenditure (CPE), with correlation coefficients of −0.117501, −0.553357, −0.106475, and −0.133573, respectively.

4.3. Estimation Results of the Model

The specification and estimation of the model involve selecting the most appropriate among three possible specifications to describe the observed data: the Pooled OLS regression model, the fixed effects model (or LSDV), and the random effects model (Table 4). The Pooled OLS regression model aggregates all observations without considering the panel structure, treating the data as if they were homogeneous across time and space. This model simplifies the analysis by employing the Ordinary Least Squares (OLS) method, but it overlooks the potential heterogeneity between countries. By pooling data from nine different countries, this model obscures individual variations among them, erroneously assuming that the data's behavior is uniform across all periods and individuals. The general formula for the regression equation in this model is as follows:

Table 1: Description of the study variables

Variables	Description	Expected Effects
Dependent variable		
GDP	Annual GDP growth rate in %	
Variable of interest		
REER	Real effective exchange rate	Positive/Negative Effect
Control Variables		
GFCF	Gross FIXED CAPITAL FORMATION (% of GDP)	Positive effect
CPE	Current public expenditures	Positive effect
POP	Population growth rate	Positive effect
TOPEN	Trade openness rate	Positive effect
INF	Inflation Rate	Negative effect

Table 2: Results of descriptive statistics

Variables	Observations	Mean	Median	Maximum	Minimum	Jarque-J-Bera	Prob
GDP	261	2.468245	1.974921	13.63634	−4.841800	3.31632	0. 31239
REER	261	101.5808	100.0000	220.5743	57.59450	10.716	0.062700
TOPEN	261	56.22519	55.71000	114.3500	15.16000	3.065296	0.215963
POP	261	1.156180	1.149619	2.566457	−0.327669	1.210791	0.545859
INF	261	36.94074	3.629399	2947.733	−1.401474	81617.02	0.000000
GFCF	261	24.83987	23.04681	45.68988	14.98083	92.08965	0.000000
CPE	261	100.2899	100.2333	115.2658	73.10864	185.0529	0.000000

Table 3: Correlation matrix results

Variables	GDP	REER	TOPEN	POP	INF	GFCF	CPE
GDP	1						
REER	−0.117501	1.000000					
TOPEN	0.021542	0.672000	1.000000				
POP	−0.553357	0.293751	0.018491	1.000000			
INF	−0.106475	−0.016506	−0.243925	0.134973	1.000000		
GFCF	0.591935	0.139759	0.087048	−0.018052	−0.079130	1.000000	
CPE	−0.133573	0.013745	0.213342	0.108065	−0.028117	0.107285	1.000000

Table 4: Estimation results of the models

Models	Pooled regression model			Fixed effects model			Random effects model		
Variable	Coefficients	t-Statistic	P-value	Coefficients	t-Statistic	Probabilité	Coefficients	t-Statistic	P-value
Constant	9.956407	3.236947	0.0014	14.27438	3.167501	0.0017	14.07139	3.783393	0.0002
TOPEN	0.005344	0.578357	0.5635	−0.005238	−0.241911	0.8091	−0.004756	−2.313788	0.0753
CPE	−0.099441	−3.350444	0.0009	-0.115723	−2.732541	0.0067	−0.124676	−3.435285	0.0007
GFCF	0.254777	10.07209	0.0000	0.119654	2.212054	0.0279	0.168447	4.093592	0.0001
INF	−0.000531	−0.769942	0.4420	−0.000624	−0.983847	0.3262	−0.000686	−1.095983	0.2741
REER	−0.028326	−2.596657	0.0100	−0.020843	−1.686504	0.0930	−0.020561	−1.862261	0.0537
POP	−1.078899	−3.297062	0.0011	−0.638054	−1.376016	0.1701	−0.780424	−1.869044	0.0428
R^2	0.319959			0.518105			0.715382		
Adjusted R^2	0.306625			0.490680			0.674486		
F-statistic	22.48572 (Prob=0)			18.89177 (Prob=0)			1 3.34719 (Prob=0)		
Durbin-Watson stat	1.248954			1.761189			1.981965		

$Y_{it}=\alpha+\beta X_{it}+u_i+\epsilon_{it}$, (where i: represents the individual or cross-sectional unit, t: denotes the time periods.

4.4. Applying the Hausman Test and Choosing the Appropriate Model

The random effects model provides superior estimates compared to the pooled regression and fixed effects models. The validity of this observation is assessed through the Hausman test, which determines the appropriateness of either random or fixed effects for our model.

The Hausman test is crucial in selecting between a fixed effects model and a random effects model. This test is structured around two primary hypotheses:

- Null Hypothesis (H_0: E (αi/Xi) = 0): If this hypothesis is confirmed, it implies that the random effects model is appropriate, and the Generalized Least Squares (GLS) method is the most suitable for estimation.
- Alternative Hypothesis (H_1: E (αi/Xi) ≠ 0): If this hypothesis is validated, the fixed effects model is preferable, necessitating the use of the Ordinary Least Squares (OLS) method.

The formula for the Hausman test is as follows:

$$H=(\beta MCG-\beta LSDV)T[Var(\beta MCG-\beta LSDV)]-1(\beta MCG-\beta LSDV)$$

- If the p-value of the test exceeds 5%, the null hypothesis is accepted, indicating that the random effects model is the most appropriate.
- If the P-value is below 5%, the alternative hypothesis is favored, thereby supporting the fixed effects model.

This methodological choice is essential to ensure the integrity and accuracy of the statistical analysis in our study.

The results presented in the Table 5 indicate that the value of the Hausman test statistic is 11.514854, with an associated probability of 0.0737. Since this probability exceeds the 5% threshold, the null hypothesis is accepted, thereby justifying the selection of a random effects panel model as the most appropriate for the analysis.

Following the results of the Hausman test, the random effects model was selected, and the parameters of the model were then estimated using the ordinary least squares (OLS) method. The obtained results, as shown in Table 5, provide important insights.

The study employs econometric tools to evaluate the quality of a statistical model by examining whether the results align with economic theory. The analysis reveals a strong correlation between the dependent variable and the explanatory variables, with a coefficient of determination (R^2) of 0.715382. This indicates that

Table 5: Hausman test result

Correlated Random Effects-Hausman Test				
Test Summary		**Chi-square. Statistic**	**Chi-square. d.f.**	**Prob.**
Cross-section random		11.514854	6	0.0737
Cross-section random effects test comparisons				
Variable	**Fixed**	**Random**	**Var (Diff.)**	**Prob.**
TOPEN	−0.005238	−0.004756	0.000239	0.9751
CPE	−0.115723	−0.124676	0.000476	0.6816
GFCF	0.119654	0.168447	0.001233	0.1646
INF	−0.000624	−0.000686	0.000000	0.5380
REER	−0.020843	−0.020561	0.000031	0.9595
POP	−0.638054	−0.780424	0.040665	0.4802

71.53% of the variability in the growth rate is explained by these variables, thereby confirming the validity of the model.

Although the trade openness rate and inflation rate exhibit P>5%, indicating that they are not statistically significant at this level, their coefficients have signs consistent with theoretical expectations. Conversely, variables such as national expenditures, gross fixed capital formation, real effective exchange rate, and population growth rate display P<5%, affirming their significance and alignment with theoretical predictions.

The results also indicate that public expenditures have a negative effect on economic growth, suggesting an inverse relationship between these two variables, as noted in previous studies. Moreover, increased investment appears to significantly boost economic growth, highlighting the importance of investments in production and per capita income. Similarly, a growing population can either hinder or promote economic growth, depending on the investment in the social sector.

The exchange rate and inflation rate also show a negative relationship with economic growth, although with varying statistical significance. These findings suggest that economic dynamics, such as exchange rate depreciation, can influence output by affecting import costs and improving the trade balance, thus stimulating growth. These observations underscore the complexity of economic interactions and the necessity of careful economic policy management to sustain growth.

5. CONCLUSION

The exchange rate is a key variable in macroeconomics, influenced by both internal and external economic indicators. Achieving strong and stable economic growth is a central objective of macroeconomic policies, including exchange rate policy. This analysis examines the impact of the exchange rate on economic growth in Morocco between 1994 and 2022, using a panel data model.

The empirical results indicate a negative and statistically significant relationship between the exchange rate and economic growth: A 1% depreciation of the exchange rate leads to a 0.20% increase in economic growth. This phenomenon corroborates the findings of previous research by economists such as Bosworth et al. (1995). A strong appreciation of the exchange rate can slow down economic growth, while a significant depreciation can accelerate it, according to Razin and Collins (1997).

The inverse relationship can be explained by the fact that the depreciation of the national currency reduces the prices of local products, thereby stimulating foreign investment, which in turn boosts investments, promotes exports, and attracts capital inflows. This has a positive impact on overall economic performance and contributes to the country's economic growth.

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