

# Exchange rate volatility and growth in Morocco: An ARDL bound approach

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**Abstract**

The objective of this article is to study the impact of Exchange rate volatility on Moroccan economic growth, based on an ARDL model, on time series from 1990 to 2018 and an according an interpretativist epistemological approach.. The main results show that in the short term and in the long term, Exchange rate have a negative effect on economic growth. In the short term, the investment variable has an instant negative impact on growth in short term but non-significant in the long term. For openness, it has a positive impact on growth. However, in the short and long term, External Debt has not a significant impact on economic growth

**Keywords:** Exchange rate, growth, FDI, ARDL, Morocco

## 1. Introduction

In the international financial literature, choosing an appropriate exchange rate system is still an important issue. In the past 50 years, the choice of exchange rate system has been a decisive factor in determining economic policy choices. From the collapse of the Bretton Woods fixed exchange rate model in the early 1970s, to the wave of financial crises and the introduction of the euro in the 1990s, the debate about choosing an exchange rate system from the most suitable exchange rate system for certain countries has become increasingly fierce. Country or group of countries. Over the same period, the impact of exchange rate fluctuations on economic growth has also attracted much attention.

The exchange rate system describes the exchange rate arrangements that determine the exchange rate. The nominal exchange rate is the rate at which one currency can be converted into another currency. The direct impact of this ratio on several economic indicators is obvious: international trade and capital flows are therefore also important factors in a country's economic performance.

The choice of exchange rate system involves many key economic policy decisions that directly affect economic performance, but may limit actions in other economic policy areas. This choice is an important decision faced by all national authorities or decision makers, and it will affect a person's short-term or long-term economic well-being.

Therefore, exchange rate fluctuations remain a major concern for countries operating in the global economy. Due to the fragility of the financial system and high vulnerability to external shocks, this is especially important for developing economies (Aghion et al., 2009; Tumusiime-Mutebile 2012).

This paper aims to explore the impact of exchange rate on economic growth in Morocco of a time series analysis model over a period of 29 years between 1990 and 2018. The remainder of the paper is organized as follows. Section 2 discusses the literature related to the exchange rate and growth. Next we define our model as well as the estimation procedure in section 3. Finally, the results are reported and discussed in sections 4 and 5.

## 2. Literature review

A series of theoretical and empirical studies have studied the impact of exchange rates on economic growth in developing and developed countries (Aghion et al., 2009; Arratibel et al., 2011; Schnabl 2008, 2009), with mixed empirical results. In fact, the exchange rate literature does not provide a direct link between exchange rate fluctuations and economic growth. However, the controversy was conducted in the context of the results of economic growth under different exchange rate regimes.

In theory, the type of exchange rate regime should not affect the long-term equilibrium value of real variables. In addition, it may affect the adjustment process. In addition, the impact of the exchange rate regime on growth may stem from the impact on the speed of adjustment of random disturbances affecting the domestic economy (Aizenman 1994).

In addition, as an important and complex macroeconomic indicator, economic growth depends on many factors and variables such as society, economy, politics, and culture. However, the literature discussing the relationship between the exchange rate system and economic growth provides some arguments to support the hypothesis that there is indeed a link between the exchange rate system and economic growth.

In this context, Friedman (1953) and Mundell (1960 and 1963) supported the key nature of the exchange rate system in terms of economic policy. Friedman (1953) suggested adopting a flexible exchange rate system, emphasizing the isolationist effect of this system in the face of foreign shocks. In fact, a floating exchange rate system can directly affect medium-term growth by absorbing and/or limiting shocks faced by the economy. Mundell (1960 and 1963) later proved that the attributes of isolationism tend to decrease as capital mobility increases. Therefore, the difference between currency shocks and actual shocks is crucial, as are the liquidity of factors and the scale of the economy. These are the direct effects of the exchange rate system on economic growth.

Aizenman and Frenkel (1982) explain shocks and study their effects on economic activities, with the goal of stabilizing consumption rather than stabilizing output. In fact, these authors later proved that from a consumer's point of view, in the presence of actual shocks, a fixed exchange rate system is recommended. The greater the difference in the actual shocks on supply, the more fixed the exchange rate is required. In fact, the balance of payments tends to absorb shocks, thereby limiting the impact of actual shocks on consumption. The desire for exchange rate flexibility relatively increases the variance of currency demand, currency supply, foreign prices, and final purchasing power parity shocks.

In addition to the impact on the shock adjustment process, the theory also shows that the exchange rate regime can affect economic growth. In fact, by taking actions against fluctuations in economic growth, the exchange rate system can also indirectly affect economic growth through major determinants of economic growth such as investment, foreign trade, financial sector development, and capital flows.

Therefore, an empirical study on the impact of the exchange rate regime on the total amount of economic growth in developing countries can yield some observations; this effect is the combined effect of the exchange rate regime and other variables, namely: the depth and nature of external shocks (Freidman , 1953) (Bailliu J., R. Lafrance and JF Perrault, 2003), accumulation rate capital in kind (Goldberg, 1993; Campa and Goldberg, 1999; Aizenman (1994), Bénassy-Quéré, Fontagné and Lahrière- Révil, 2001, the proportion of foreign debt and FDI (Tornell and Velasco, 1994, Calvo et al., 2001) the degree of capital account openness (Bailliu J., R. Lafrance and JFPerrault, 2003).

The exchange rate system can affect economic growth by mitigating or amplifying the impact and adjustment of economic shocks. A more flexible system can promote higher growth because it will allow economies characterized by nominal rigidity to absorb and adapt to economic shocks more easily. Broda (2002), based on his research on a sample of 75 developing countries from 1973 to 1996, found that the real GDP of countries with a fixed system fell sharply, while benefiting from more flexible systems, their real GDP tended to drop slightly. Real GDP and substantial (and direct) real depreciation.

A flexible exchange rate also allows a country to have an independent monetary policy, which is another means of dealing with internal and external shocks. When the adjustment to shocks is low, one may expect higher growth. In fact, the alleviation of the business cycle has been shown to have a positive impact on the long-term growth rate of the economy. For example, Barlevy (2001) developed a model in which a slowdown in cyclical volatility promotes growth by increasing the average investment level and reducing its volatility.

However, some people believe that, compared with a fixed exchange rate system, a flexible system is more susceptible to exchange rate shocks, aggravating business cycles and slowing growth. For countries with underdeveloped or weak financial systems, this problem may be particularly prominent. These countries may have difficulty adapting to large exchange rate changes under a flexible system. And in terms of using independent monetary policy to facilitate adjustment to shocks, some people believe that this argument is only applicable to countries with credibility in monetary policy. In fact, for some countries, fixing the exchange

rate on hard currency can lead to a smoother business cycle than trying to implement an independent monetary policy. For example, Hausmann et al. (1999) believes that the flexible exchange rate system in Latin America does not allow for a more stable monetary policy, but is more pro-cyclical.

Celik et al. (2017) used the cross-sectional data of 12 transition economies in EEMA (1995\_2014) to study the transfer mechanism from exchange rate to economy through panel data analysis. The results of the study show that increased exchange rate volatility has led to an economic downturn. However, they also pointed out that changes in real exchange rates are not the main variable that explains economic growth.

Paul, FH, Ali, SR, Soomro, R., Ali, Q., & Abbas, SK (2018) analyzed the impact of nominal exchange rate, inflation rate, capital stock and foreign direct investment on Kuwait's economic growth, using 1975- Time series data analysis in 2015. The results confirmed that as the nominal exchange rate rises, it will have a significant positive impact on economic growth.

Recently, Adjei, E (2019) assessed the impact of exchange rate fluctuations on Ghana's economic growth. The study covers the period between 1983 and 2010. Autoregressive conditional heteroscedasticity (ARCH) and generalized autoregressive conditional heteroscedasticity (GARCH) are used to analyze data. The results show that exchange rate fluctuations have had a significant negative impact on Ghana's economic growth.

Khan, MFH (2021) uses time series data from 1990 to 2020 to study the impact of inflation, nominal exchange rate, foreign direct investment, and emergency shocks on Bangladesh's economic growth. Between variable and independent variable.

The results show that exchange rates and foreign direct investment have had a significant impact on the country's economic growth. Inflation, foreign direct investment and the exchange rate have a positive impact, while emergencies such as Covid-19 and natural disasters have a negative impact on Bangladesh's economic development. The research helps decision makers identify, formulate and implement policies that affect the country's economic growth

In the literature on the relationship between the exchange rate system and economic growth, any impact of the exchange rate system on growth through its indirect channels will be captured by the coefficients of each explanatory variable, not by the exchange rate system. Therefore, we cannot separate the effects of these variables caused by the nature of the exchange rate regime on growth from those caused by other factors.

### 3. Data, Model & Methodology

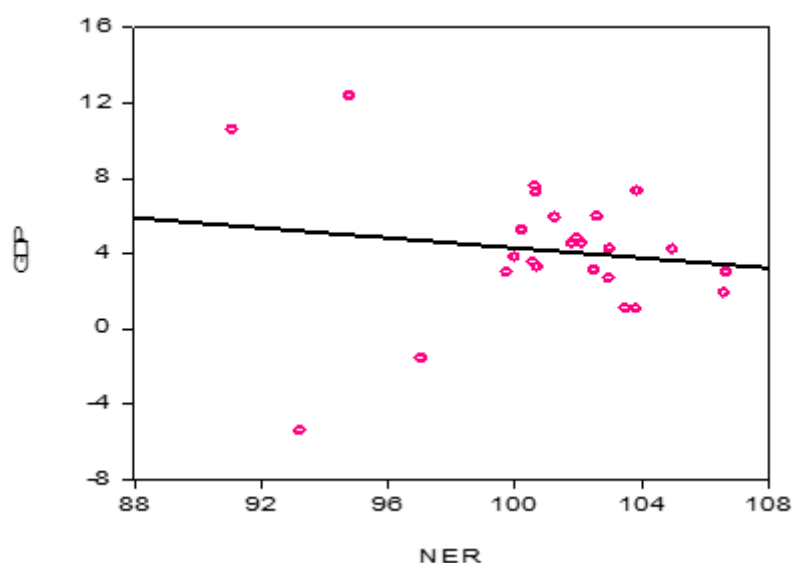
#### 3.1 Data

The data included in our research is annual data from the World Development Indicators (WDI). They cover the period from 1990 to 2018. The following table shows the variables used:

**Table 1.** Description of the variables

Variable	Description	Source
GDP	Gross Domestic Product growth	WDI
NER	The nominal exchange rate	WDI
GFCF	Gross fixed capital formation (% of GDP)	WDI
TRADE	Trade (% of GDP)	WDI
FDI	Foreign direct investment, net inflows (% of GDP)	WDI
ExternalDebt	ExternalDebt(% of GDP)	WDI

**Graph 1.** Relationship between the GDP growth and Nominal Exchange Rate



**Source:** Author's estimates

Reading the above chart, the impact of exchange rate fluctuations on Morocco's economic growth seems to be negative. This preliminary observation respects theoretical intuition.

#### 3.2 Specification & Methodology

In order to check whether the exchange rate has an impact on Morocco's economic growth and infer that it is the engine of growth, we will estimate an autoregressive distributed lag model (ARDL).

The model can capture time effects when explanatory variables. As part of our work, we try to determine the impact of NER on economic growth, while considering other control variables that affect the improvement results: GFCF, TRADE, FDI, and external debt. Exchange rates and growth are presented in an empirical review of the literature. Therefore, we plan to estimate an ARDL model for the following function:

$$GDP=f(NER, GFCF, TRADE, FDI, External Debt)$$

If we intend to capture the short-term and long-term effects of the above explanatory variables on growth, the structure of the ARDL model of our function will be specified as follows:

$$GDP_t = \beta_0 + \beta_1 NER_t + \sum_{i=t}^{y=m} \beta_2 Control_{t,m} + \alpha_i + \varepsilon_i$$

#### 4. Estimations & Results

##### 4.1 Stationarity Test

Many tests can help determine whether a sequence is stationary: Augmented Dickey-Fuller test, Philippe-Perron test, Andrews & Zivot test, Ng Perron test, KPSS, Ouliaris-Park-Perron, Elliott-Rothenberg-Stock, etc. Among them, the three are easy to apply and commonly used. In fact, the ADF test is effective in the case of error autocorrelation, the PP test is suitable for heteroscedasticity, and the AZ test is used for sequences that experience structural failure or endogenous mechanism changes. Therefore, we use the ADF test (Table 2):

**Table 2. Stationarity tests of the series**

	Level		First Difference		Résultat
	Intercept	Trend and Intercept	Intercept	Trend and	
<b>GDP</b>	-2.566842 [0.1116]	-3.662867 [0.0422]	-8.023555 [0.0000]	-7.857649 [0.0000]	I(1)
<b>NER</b>	-2.592806 [0.1082]	-2.381519 [0.3788]	-3.441405 [0.0198]	-3.338280 [0.0851]	I(1)
<b>GFCF</b>	-1.241965 [0.6416]	-1.646569 [0.7478]	-4.802970 [0.0007]	-4.741660 [0.0040]	I(1)
<b>Trade</b>	-0.521772 [0.6012]	-0.624227 [0.5212]	-0.38122 [0.7000]	-0.380057 [0.6999]	I(1)

Pesaran & al. (2001). Therefore, we will use Pesaran & al's cointegration test. (2001) for our research.



## 4.2 Cointegration Test

We will use Schwarz Information Criterion (SIC) to select the best ARDL model that provides statistically significant results with the fewest parameters. The following are the estimated results of the optimal ARDL model used (Table 3)

According to the obtained results, the ARDL model (2, 0, 1, 2, 0, 2) is the most optimized among the other 19 models (Figure 5). In addition, the following test first shows that there is no autocorrelation between error and heteroscedasticity, the error is normal, and the above model is well specified (Table 4).

**Table 3. ARDL model (2, 0, 1, 2, 0,2)**

Fixedregressors: C

Number of modelsevaluated: 486

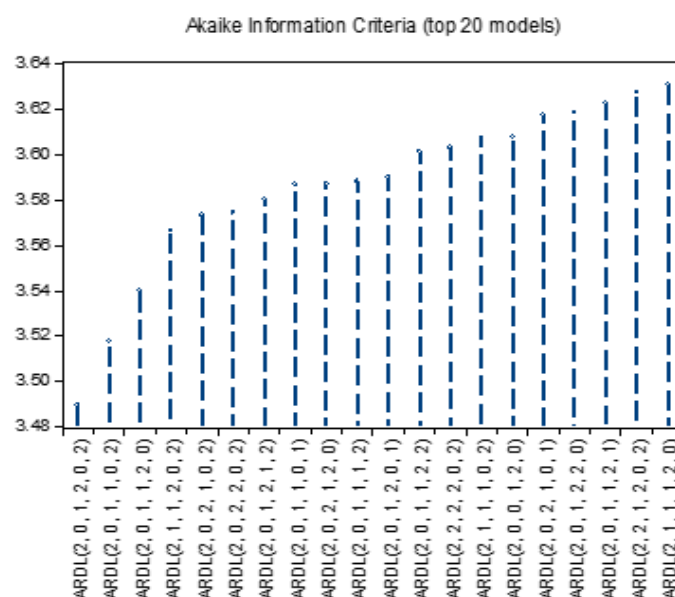
SelectedModel: ARDL(2, 0, 1, 2, 0, 2)

Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP(-1)	-1.408196	0.090651	-15.53420	0.0000
GDP(-2)	-0.623787	0.083132	-7.503606	0.0000
NER	-0.494067	0.187445	-2.635789	0.0232
GCFC	-0.068001	0.300612	-0.226209	0.8252
GCFC(-1)	-0.868916	0.297929	-2.916519	0.0140
TRADE	-0.009409	0.085736	-0.109748	0.9146
TRADE(-1)	0.292689	0.080557	3.633291	0.0039
TRADE(-2)	0.113323	0.066667	1.699837	0.1172
FDI	-0.586550	0.217282	-2.699492	0.0207
ExternalDebt	-0.252910	0.356595	-0.709234	0.4929
ExternalDebt(-1)	0.464833	0.324285	1.433409	0.1795
ExternalDebt(-2)	-0.438254	0.354846	-1.235053	0.2425
C	0.988200	0.626306	1.577822	0.1429
R-squared	0.984136	Meandependent var	-0.316574	
Adjusted R-squared	0.966831	S.D. dependent var	6.664786	
S.E. of regression	1.213823	Akaike info criterion	3.528602	
Sumsquaredresid	16.20704	Schwarz criterion	4.166715	
Log likelihood	-29.34323	Hannan-Quinn criter.	3.697894	
F-statistic	56.86739	Durbin-Watson stat	1.415839	
Prob(F-statistic)	0.000000			

**Source:** Author's estimates

**Graph 2. Graphical values SIC**



**Source:** Author's estimates

All these tests accept the null hypothesis. Therefore, our model is statistically validated. The estimated ARDL model (2, 0, 1, 2, 0, 2) is generally good and can explain 96% of the dynamics of Moroccan GDP growth from 1990 to 2018. After estimating the ARDL model, compare the Fisher F statistic with the critical value (Table 5):

The results of the co-integration test confirm that there is a co-integration relationship between the studied series (F-stat value > upper bound value: at the 1% threshold), which provides an estimated long-term-NER, GCFC, trade, foreign direct investment And the long-term impact of foreign debt on GDP growth.

In Table 6, the adjustment coefficient or "resilience" is statistically significant, it is a negative value, and the absolute value is between 0 and 4. This guarantees an error correction mechanism, thereby ensuring that there is a long-term relationship between variables . As a result, NER has a negative and significant impact on short-term economic growth (for every 1% increase in NER, GDP growth will drop by 0.02%).

**Table 4.** Diagnostic tests of ARDL model

Tests	Serial Correlation	Spécification Ramsey (Fisher)	Normality	Heteroscedasticity
	[p-Value]	[p-Value]	[p-Value]	[p-Value]
Value	1.158676	3.043607	2.751419	0.237617
	[0.3566]	[0.1117]	[0.252660]	[0.9899]

**Table 5.** Cointegration Test of Pesaran& al. (2001)

Modèle	Max. lag	AIC (Lagorder)	F.Statistic
	5	ARDL(2, 0, 1, 2, 0, 2)	17.96541***
Critical Value Bounds			
Significance	LowerBound	UpperBound	
10%	2.26	3.35	
5%	2.62	3.79	
2.5%	2.96	4.18	
1%	3.41	4.68	

**Table 6.** Results of estimation of short-term coefficients

CointegratingForm				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1))	0.623787	0.083132	7.503606	0.0000
NER	-0.494067	0.187445	-2.635789	0.0232
GCFC	-0.068001	0.300612	-0.226209	0.8252
TRADE	-0.009409	0.085736	-0.109748	0.9146
TRADE(-1))	-0.113323	0.066667	-1.699837	0.1172
FDI	-0.586550	0.217282	-2.699492	0.0207
ExternalDebt	-0.252910	0.356595	-0.709234	0.4929
ExternalDebt(-1))	0.438254	0.354846	1.235053	0.2425
CointEq(-1)	-3.031984	0.164133	-18.472726	0.0000

**Source :** Author's estimates

In the short term, our results confirmed the results of Arratibel et al. (2011); Wild Boar (2010); Schnabl (2008, 2009), indicating a negative correlation between exchange rate fluctuations and economic growth. These authors show that increased exchange rate volatility will reduce economic growth (Table 7).

**Table 7.** Results of estimation of long-term coefficients

Long Run Coefficients				
Coefficient				
Variable	nt	Std. Error	t-Statistic	Prob.
NER	-0.162952	0.062824	-2.593774	0.0250
GCFC	-0.309011	0.127666	-2.420466	0.0340
TRADE	0.130806	0.061391	2.130711	0.0565
FDI	-0.193454	0.070995	-2.724892	0.0198
External				
Debt	-0.074648	0.202530	-0.368575	0.7194
C	0.325925	0.205497	1.586034	0.1410

**Source :** Author's estimates

The above table shows that in the long term, the impact of exchange rate fluctuations on Morocco's economic growth is still negative (NER increased by 1%, growth decreased by 0.16%). In addition, the long-term impact of investment on economic growth is negative and significant. However, in terms of opening up, it has a positive and significant impact on economic growth. The impact of FDI on China's economy is negative. In addition, foreign debt has a negative impact, but the impact is not significant.

Based on the results of our empirical analysis, we emphasized the short-term and long-term drivers of Morocco's exchange rate. We also studied the important channels through which exchange rate fluctuations affect economic performance. Considering the overall goal of this research, we then examine the policy implications of our findings to help guide economic policy.

- The most important drivers of the exchange rate fluctuations in Morocco are the structure of trade and FDI, especially
- Therefore, based on our findings, the best policy should be a policy that focuses on FDI and trade sources rather than intervention in the foreign exchange market.
- Our results An important effect of external debt is not an important driver of exchange rate fluctuations for short- and long-term growth.
- Under a flexible exchange rate, the long-term impact of the exchange rate on economic growth through trade channels depends on the diversification and competitiveness of our exports

## 5. Conclusion

In this work, we tried to study the impact of exchange rate fluctuations on Morocco's economic growth. The econometric research was conducted using the ARDL model, which is based on Morocco's annual data for the period 1990-2018. This model allows dynamic analysis of the relationship between economic growth and nominal exchange rates.

From a short-term and long-term perspective, NER has a negative impact on economic growth. For short-term investment variables, it has an immediate negative impact on growth. However, the time dimension should not be ignored here. Over time, the effect of the investment will become positive. For opening up, it has a positive impact on economic growth.

Our empirical results show that exchange rate fluctuations have short-term and long-term negative effects on economic growth. This finding may explain Morocco's decision to switch to a flexible exchange rate system in 2016. In fact, Morocco's reforms to increase exchange rate flexibility will strengthen external resilience, as confirmed by the International Monetary Fund (2019), it will also be impacted by the 2021 pandemic, which confirmed the benefits of finalizing the transition to an inflation targeting framework with a more flexible exchange rate<sup>1</sup>. As (Edwards and Levy Yeyati 2005; Friedman 1953; Hoffmann 2007) argued within the theoretical framework of endogenous growth, the increased volatility under the flexible exchange rate system may help offset the negative impact of exchange rate volatility on Morocco's economic growth. It proves that a flexible exchange rate system enables the economy to adjust to external shocks with minimal production losses. Therefore, these real external shocks have different effects on the domestic and foreign economies.

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<sup>1</sup>IMF, Morocco Request for an Arrangement under the Precautionary and Liquidity Line, ( janvier 2021),

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