

Exchange Rate Influence on Morocco's Economic Growth: What if institutional quality matters to support this link?, EL YAMANI, K.¹

1. PhD in economics, Research Laboratory in Management Science of Organizations, National School of Business and Management, Ibn Tofail University, Kenitra, Morocco, kaboul.elyamani@gmail.com.

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Abstract:

Traditionally, the exchange rate has not held a prominent role in the formulation of economic growth theories. However, it gained considerable attention after the collapse of Bretton Woods system, when the exchange rate received significant macroeconomic implications. However, only few studies have attempted to investigate the relationship between the exchange rate and economic growth in Morocco. Therefore, the main aim of this paper is to examine how variations in the real effective exchange rate (REER) impact GDP per capita growth in Morocco from 1988 to 2019.

An exploratory data analysis was conducted. This step involved analyzing simple and partial correlations, using the REER as a control variable, to understand the relationships between the variables. The correlation analysis was complemented by a multivariate analysis, using the principal component analysis method. Following the exploratory data analysis, a multiple regression was estimated using the ordinary least squares method.

The estimation results show that the introduction of the institutional quality variable into the model reveals a negative impact of REER on economic growth in Morocco. This result is consistent with the findings from the correlations and principal component analysis, which indicate a strong link between the exchange rate and institutional quality.

Keywords: Exchange rate ; economic growth ; correlations ; principal component analysis (PCA) ; Ordinary least squares (OLS).

Influence du taux de change sur la croissance économique au Maroc : Et si la qualité institutionnelle importe pour appuyer ce lien?

Résumé

Traditionnellement, le taux de change n'était pas au centre des théories de la croissance économique. Toutefois, il a reçu une importance considérable après l'effondrement du système de change de Bretton Woods en raison de ses implications macroéconomiques majeures. Cependant, peu d'études ont examiné la relation entre taux de change et la croissance économique au Maroc. Cet article vise donc à examiner comment les variations du TCER impactent la croissance du PIB par habitant au Maroc entre 1988 et 2019.

Une analyse exploratoire des données a été menée. Elle a consisté à analyser les corrélations simples et partielles, en utilisant le TCER comme variable de contrôle, afin de comprendre les relations entre les variables. L'analyse des corrélations a été complétée par une analyse multidimensionnelle, à l'aide de la méthode d'ACP. L'analyse exploratoire des données a été suivie par une régression multiple estimée par la méthode MCO.

Les résultats de l'estimation montrent que le TCER impacte négativement la croissance économique au Maroc, à condition que la variable qualité institutionnelle soit introduite dans le modèle. Ce résultat est appuyé par les constats relevés suite aux corrélations et à l'ACP, qui montrent le lien fort entre le taux de change et la qualité institutionnelle.

Mots clés: Taux de change, croissance économique, corrélations, analyse en composantes principales (ACP), Moindres Carrées Ordinaires (MCO).

Introduction :

With the growth of global economic interdependence, the exchange rate has garnered significant attention from researchers and policymakers, particularly following the collapse of the Bretton Woods exchange rate system. This event marked a major turning point in international debates, highlighting the importance of the exchange rate due to its significant macroeconomic implications (Eichengreen, 2008). The collapse of the Bretton Woods system led to substantial adjustments in monetary and trade relations between countries, sparking a growing interest in understanding the mechanisms and effects of exchange rates on the economies of nations (Obstfeld & Rogoff, 1995). This subject concerns both developed and developing countries. However, the influence of the exchange rate is much more pronounced in the economies of developing countries than in those of developed countries (Aman et al., 2017), as one of the most important structural problems in developing countries is the phenomenon of foreign dependence (Karahan, 2020). Today, many developing countries are striving to comprehend the patterns linked to international trade flows and exchange rates to determine their countries' economic growth and stability (Pramanik, 2021).

Numerous authors have studied the relationship between exchange rates and economic growth. However, there is still no universal consensus on the obtained results. Nevertheless, there are some arguments regarding the direct influence of the exchange rate on economic growth. One argument suggests that the exchange rate system influences growth through its effects on economic policy by adjusting to shocks that affect the economy (Yougbaré, 2009). Additionally, the exchange rate can impact economic growth through other factors. The most frequently cited channels in the literature are international trade and investment, as suggested by (Sturzenegger & Levy Yeyati, 2007) and (Gluzmann et al., 2012). These channels represent the fundamental determinants of economic growth outlined in growth theories.

Although the international economic literature on the subject is extensive. However, few studies have examined the Moroccan case. Most studies have found no significant impact of Morocco's exchange rate variations on economic growth within the same year (El yamani et al., 2019; Haoudi & Rabhi, 2020; SALHI & Echaoui, 2018; Ziadi & Abdallah, 2007). However, some studies present alternative findings. For instance, the study conducted by Haoudi & Rabhi (2020) identified a long-term impact of the exchange rate on growth. Similarly, the study by (Amri et al., 2022) demonstrated a significantly negative impact in the medium and long-term using autoregressive distributed lag method.

However, Studies on the subject remains rare, which motivates us to make a valuable contribution to the existing literature and actively participate in the ongoing academic debate. Morocco's gradual transition to a floating exchange rate regime emphasizes the need to expand the sparse literature on the topic, to further the discussion on the consequences of adopting either a fixed or floating exchange rate regime in Morocco.

This study aims to examine the hypotheses proposed by researchers. In this study, our objective is to examine the following question:

How do variations in the real effective exchange rate of the Moroccan dirham affect per capita GDP growth in Morocco?

Based on the literature review mentioned above, we have formulated two research hypotheses:

H₀: The exchange rate has no significant impact on Morocco's economic growth.

H₁: The exchange rate has a significant impact on Morocco's economic growth.

To address our research question, we will first review the economic literature. This literature review will begin by examining economic growth theories to determine whether the exchange rate has been considered a determinant of economic growth. The aim is also to identify potential explanatory variables that could be incorporated into our econometric model. Additionally, we will review studies that have specifically focused on analyzing the influence of the exchange rate on economic growth at both international and national levels.

The literature review will be followed by an empirical investigation, which includes exploratory data analysis. The preliminary analysis will involve bivariate analysis to examine simple and partial correlations between variables, with the exchange rate variable serving as the control variable. This analysis will be complemented by a multivariate analysis based on principal component analysis (PCA) to understand the relationships between the variables. Next, we will specify and estimate an econometric model using the ordinary least squares (OLS) method.

The structure of the paper is as follows: Section 2 provides a review of the relevant literature. Section 3 elucidates the methodology employed and introduces the variables used in the study. Section 4 centers on the exploratory data analysis conducted, while Section 5 addresses the specification of the econometric model. The results and discussion are outlined in Section 6. Lastly, the concluding remarks are presented in the final section of the paper.

1. Literature review

Improving the living conditions of the population and ensuring social well-being are crucial objectives for governments in all states (Gneba et al., 2023). Economic growth is considered the most important factor influencing individual income levels (Barro & Sala-i-Martin, 2004). Therefore, understanding the determinants of economic growth is key to raising individual living standards.

Over the years, economic growth theories have evolved significantly. These theories aim to clarify the necessary conditions for growth and identify its general determinants. Starting from classical school of economics, authors like Smith, Ricardo, and others contributed to the first

reflections associated to economic growth theories, particularly those pertaining to the division of labor, capital accumulation, trade, and the law of diminishing returns (Sharipov, 2015).

The classical theory was followed by other approaches. In 1956, Solow introduced the first neoclassical growth model (Solow, 1956). Solow's model emphasized the importance of technical progress for growth, although technical progress was considered exogenous. To address this limitation, new theories emerged in the mid-1980s, known as endogenous growth theories. These modern theories aimed to explain the endogenous nature of technical progress, initiated by Solow, by focusing on the determinants of investments and the role of spillover effect, technological innovation (P. Romer, 1989; P. M. Romer, 1986), human capital (Lucas, 1988), and public expenditures (Barro, 1990).

Traditionally, the exchange rate has not played a key role in economic growth theories (Ramoni-Perazzi & Romero, 2022). However, after the collapse of the Bretton Woods exchange rate system, the exchange rate gained greater importance due to its macroeconomic implications (Eichengreen & Temin, 2000).

Several authors have studied the relationship between exchange rates and economic growth, but the results are not yet unanimous. Some arguments focus on the direct influence of the exchange rate on economic growth, particularly through the influence of the exchange rate system on growth through its effects on economic policy and adjustments to shocks affecting the economy (Yougbaré, 2009). Additionally, the exchange rate can impact economic growth through other factors, such as international trade and investment (Gluzmann et al., 2012; Sturzenegger & Levy Yeyati, 2007), which are fundamental determinants of economic growth according to growth theories.

On the trade side, currency depreciation encourages exports, reduces imports, and directs household consumption toward local markets, thereby supporting economic growth (Karahan, 2020). In opposition, exchange rate overvaluation undermines export competitiveness and subsequent growth (Ghosh et al., 1997). In addition to the trade channel, exchange rate variations can also affect growth through domestic and foreign investment. In developing countries, new investments often rely on imported capital goods. When imported production inputs become more expensive due to exchange rate depreciation, new investment tends to decline, leading to a drop in aggregate demand and adversely affecting economic growth (Buffie, 1986). On the other hand, opening to capital flows can generate investments that positively impact a nation's economic growth, especially if they are directed towards productive sectors (Bailliu, 2000).

In contrast to the international literature, few studies have addressed the relationship between exchange rate variations and economic growth in Morocco. Most studies examining the case of Morocco have found no significant impact of exchange rate variations on economic growth during the same year. (Ziadi & Abdallah, 2007) used time series analysis to study the relationship between the exchange rate and growth in Maghreb countries from 1966 to 2003, and they found no influence of variations in the real effective exchange rate on growth in

Morocco. (SALHI & Echaoui, 2018) employed a VAR model to study the impact of the exchange rate on economic growth in Morocco from 1985 to 2016, and their results indicated no significant impact on GDP per capita growth. Similarly, (El yamani et al., 2019) concluded that the exchange rate was not significant in their multiple regression model for the period 1988-2017. (Haoudi & Rabhi, 2020) used the ARDL method to study the effect of the real exchange rate on economic growth in Morocco from 1988 to 2016 and found no short-term effect, but an appreciation of the exchange rate could reduce economic growth by 24% in the long term.

Given the limited number of studies on the relationship between exchange rate variations and economic growth in Morocco, and most of them not finding a significant impact, it is important to contribute to the debate and enrich the economic literature. In the following section, we present the methodology we have employed to approach this subject in a new way.

2. Methodology

2.1. Research approach

To highlight the relationship between the exchange rate and economic growth in Morocco, our research approach encompasses three main stages. Firstly, we conducted a literature review to identify explanatory variables for economic growth based on relevant theories and previous studies addressing the subject matter. These variables will be analyzed and sort during the empirical phase to select the most relevant ones for explaining Morocco's economic growth. The study period will depend on the data availability.

Secondly, before specifying the econometric model, we plan to conduct an exploratory data analysis. This analysis will involve examining simple and partial correlations among the variables, as well as employing principal component analysis (PCA) to gain a deeper understanding of the interrelationships among the variables.

Finally, an econometric model will be developed using a stepwise regression using the Ordinary Least Squares (OLS) method, which is deemed appropriate given that the variables included in the final model will be selected based on their statistical significance. Furthermore, acknowledging the potential causal relationships among the variables in the model over time, we will conduct the Granger causality test before proceeding with the estimations. This will provide a dynamic aspect to our model.

2.2. Variables and data

In what follows, we present selected variables from the literature review, according to data availability. The variables under analysis include one endogenous variable representing economic growth and eleven potential explanatory variables, which will be analyzed and sorted in the empirical phase to select those most relevant to our model.

- **Endogenous variable:**

GDPpc Annual percentage growth of Gross Domestic Product per capita, based on constant currency. This variable measures the real growth of GDP per capita. Economic growth, as the term implies, quantifies the change in production within an economy over a given period. This variation is measured through the evolution of the GDP (Boluze, 2020).

- **Exogenous variables:**

- ✓ **Real Effective Exchange Rate (REER):** The index of the real effective exchange rate is the nominal exchange rate divided by a price deflator or cost index.
- ✓ **Domestic Investment (Inv):** Variable measured by Gross Fixed Capital Formation (GFCF), which is the aggregate that measures fixed capital investment by different resident economic agents. Data is provided in constant billion Moroccan Dirhams. Several authors have examined the link between investment and growth. (Barro & Sala-i-Martin, 2004) argue that these two variables are positively correlated, with an increase in investment leading to higher GDP growth rates.
- ✓ **Public Expenditure (Dp):** Final consumption expenditures of public administrations, including all government expenditures for purchases of goods and services. Data is provided in constant billion Moroccan Dirhams. Public Expenditure is one of the mechanisms introduced by endogenous growth theory to explain growth (Barro, 1990).
- ✓ **Credit (Cred):** Net domestic credit is the sum of net credits granted to the non-financial public sector and the private sector as well as other accounts. Data is provided in constant billion Moroccan Dirhams. According to (King & Levine, 1993) this variable is strongly correlated with growth.
- ✓ **Foreign exchange reserves (Res):** Foreign reserves are reserves in foreign currencies or gold held by the central bank. Data is provided in constant billion Moroccan Dirhams. The accumulation of foreign exchange reserves may in fact reflect a foreign exchange strategy that bases growth on exports (Vidon, 2007). According to (Arslan & Cantu Garcia, 2019), foreign exchange reserves are accumulated to depreciate the local currency, to support exports.
- ✓ **Internet (net):** Proxy for technology, it measures the number of internet users as a percentage of the population. Data is provided in percentage. Solow's theory highlights the crucial role of technological progress as the sole foundation for sustainable well-being and achieving the optimal growth path that maximizes consumption (Sharipov, 2015).
- ✓ **Human Capital (HC):** The Human Capital Index is based on years of schooling and the return on education. Human capital at all levels of education, including higher education, has a positive effect on growth rates (Gyimah-Brempong et al., 2006; King & Levine, 1993).
- ✓ **Terms of Trade (Te):** The terms of trade index reflect the ratio of the export unit value index to the import unit value index. (Mendoza, 1995) argues that terms-of-trade shocks account for almost half the variability of current GDP.
- ✓ **Financial Development (Df):** The Financial Development Index is a measure that summarizes six indices grouped under three measures associated with the degree of

development of financial institutions and financial markets in terms of depth, access, and efficiency. Financial services play a crucial role in stimulating economic growth by facilitating the accumulation of capital at a higher rate and enhancing the efficiency with which economies use this capital (King & Levine, 1993).

- ✓ **Market Concentration (MC):** The Herfindahl-Hirschman Index of market concentration is a measure of the dispersion of the value of trade among an exporter's partners. Schumpeter characterized economic development as the process of introducing new combinations, which encompasses the opening of new markets and the introduction of new products (Maddison, 1982).
- ✓ **Institutional Quality (IQ):** Index based on three institutional variables, namely the quality of bureaucracy, law and order, and corruption. Data is provided in percentage.

The institutional quality index used in this study is based on previous research conducted by (Bekaert et al., 2005; Law et al., 2013). (Rodrik, 2008) argues that institutional and market failures undermine the sustainability of growth in developing countries. (Bailliu et al., 2003; Husain et al., 2004) emphasize that the growth performance associated with exchange rate regimes depends on a country's institutions. As well as the effect of the exchange rate on economic growth, it is also dependent on the level of corruption (Ramoni-Perazzi & Romero, 2022).

It should be noted that the explanatory variables mentioned above will be sorted in the estimation phase. Consequently, certain variables may be excluded from the final model if they are found to be statistically insignificant.

2.3. Data sources and measurements:

Moreover, the variables used in the analysis are from the following databases: the World Bank, the International Monetary Fund, the Penn World Table, and The International Country Risk Guide. The period studied is based on data availability and covers the period from 1988 to 2019. To standardize the measurements of variables denominated in foreign currencies, we opted to use data measured in constant Moroccan dirhams. This choice aims to avoid the effect of inflation. Finally, to facilitate the interpretation of the estimated coefficients of the model, we have converted the variables denominated in foreign currencies into billions of dirhams.

3. Exploratory Data Analysis

Before proceeding with the econometric estimations, we chose to conduct an exploratory data analysis, which combines a simple and partial correlation analysis between variables, and a principal component analysis (PCA). The purpose of this analysis is to highlight relationships between variables which would be useful for interpreting the econometric estimates.

3.1. Correlation Analysis

The correlation analysis we conducted includes both simple correlations (Table 1) aimed at understanding the relationships between variables, and partial correlations (Table 2) which use the exchange rate as a control variable to assess its impact on the relationships between other variable pairs. This step proved useful in adding further variables to our analysis, and our research was characterized by frequent cross-referencing between literature review and empirical investigation.

Through the simple and partial correlation analysis between variables, we were able to conclude the following results:

- Firstly, economic growth was found to have no correlation with all the variables analyzed.
- REER exhibited significant correlation with all variables except growth (correlation coefficient between -0.409 and -0.705).
- The presence of the REER was deemed important in justifying the relationships between variables, as evidenced by the coefficients of partial correlations between variable pairs being lower than those of simple correlations. Furthermore, institutional quality was found to be correlated only with the REER in simple correlation, i.e., a coefficient of 0.683, but coefficients of partial correlations between institutional quality and most other variables became significant when the exchange rate was used as a control variable, indicating a strong relationship between the exchange rate and institutional quality.

Table 1: Simple correlation results

		GDPpc	REER	Inv	PE	Cred	Res	Net	HC	ToT	DF	MC	IQ
GDPpc	C	1	0,066	-0,034	-0,047	-0,067	0,027	-0,058	-0,032	-0,084	-0,028	-0,233	-0,078
	S		0,721	0,853	0,799	0,716	0,882	0,753	0,863	0,649	0,881	0,2	0,673
REER	C	0,066	1	-,564**	-,705**	-,587**	-,409*	-,691**	-,428*	-,443*	-,471**	0,313	,683**
	S	0,721		0,001	0	0	0,02	0	0,015	0,011	0,006	0,081	0
Inv	C	-0,034	-,564**	1	,927**	,978**	,910**	,960**	,975**	,896**	,966**	-0,247	0,011
	S	0,853	0,001		0	0	0	0	0	0	0	0,173	0,952
PE	C	-0,047	-,705**	,927**	1	,964**	,770**	,980**	,881**	,888**	,883**	-0,3	-0,225
	S	0,799	0	0		0	0	0	0	0	0	0,095	0,215
Cred	C	-0,067	-,587**	,978**	,964**	1	,841**	,982**	,957**	,919**	,937**	-0,244	-0,021
	S	0,716	0	0	0		0	0	0	0	0	0,178	0,907
Res	C	0,027	-,409*	,910**	,770**	,841**	1	,816**	,934**	,772**	,919**	-0,196	0,124
	S	0,882	0,02	0	0	0		0	0	0	0	0,282	0,499
Net	C	-0,058	-,691**	,960**	,980**	,982**	,816**	1	,914**	,877**	,909**	-0,265	-0,141
	S	0,753	0	0	0	0	0		0	0	0	0,142	0,44
HC	C	-0,032	-,428*	,975**	,881**	,957**	,934**	,914**	1	,897**	,961**	-0,196	0,161
	S	0,863	0,015	0	0	0	0	0		0	0	0,281	0,377
ToT	C	-0,084	-,443*	,896**	,888**	,919**	,772**	,877**	,897**	1	,856**	-0,239	-0,015
	S	0,649	0,011	0	0	0	0	0	0		0	0,188	0,934
DF	C	-0,028	-,471**	,966**	,883**	,937**	,919**	,909**	,961**	,856**	1	-0,259	0,062
	S	0,881	0,006	0	0	0	0	0	0	0		0,152	0,736

		GDPpc	REER	Inv	PE	Cred	Res	Net	HC	ToT	DF	MC	IQ
MC	C	-0,233	0,313	-0,247	-0,3	-0,244	-0,196	-0,265	-0,196	-0,239	-0,259	1	0,211
	S	0,2	0,081	0,173	0,095	0,178	0,282	0,142	0,281	0,188	0,152		0,247
IQ	C	-0,078	,683**	0,011	-0,225	-0,021	0,124	-0,141	0,161	-0,015	0,062	0,211	1
	S	0,673	0	0,952	0,215	0,907	0,499	0,44	0,377	0,934	0,736	0,247	

Source Output IBM SPSS 20

Table 2: Partial correlations results.

Control Variables		GDPpc	Inv	PE	Cred	Res	Net	HC	ToT	DF	MC	IQ	
REER	GDPpc	C	1	0,003	-0,001	-0,035	0,059	-0,017	-0,004	-0,061	0,004	-0,267	-0,168
		S	.	0,985	0,997	0,851	0,751	0,926	0,983	0,744	0,984	0,146	0,367
	Inv	C	0,003	1	0,904	0,968	0,901	0,956	0,983	0,873	0,962	-0,09	0,656
		S	0,985	.	0	0	0	0	0	0	0	0,629	0
	PE	C	-0,001	0,904	1	0,958	0,744	0,962	0,904	0,905	0,88	-0,118	0,495
		S	0,997	0	.	0	0	0	0	0	0	0,528	0,005
	Cred	C	-0,035	0,968	0,958	1	0,813	0,985	0,965	0,908	0,925	-0,079	0,642
		S	0,851	0	0	.	0	0	0	0	0	0,675	0
	Res	C	0,059	0,901	0,744	0,813	1	0,808	0,92	0,722	0,902	-0,079	0,604
		S	0,751	0	0	0	.	0	0	0	0	0,674	0
	Net	C	-0,017	0,956	0,962	0,985	0,808	1	0,947	0,881	0,915	-0,072	0,626
		S	0,926	0	0	0	0	.	0	0	0	0,702	0
	HC	C	-0,004	0,983	0,904	0,965	0,92	0,947	1	0,873	0,953	-0,073	0,686
		S	0,983	0	0	0	0	0	.	0	0	0,696	0
	ToT	C	-0,061	0,873	0,905	0,908	0,722	0,881	0,873	1	0,818	-0,117	0,439
		S	0,744	0	0	0	0	0	0	.	0	0,529	0,013
	DF	C	0,004	0,962	0,88	0,925	0,902	0,915	0,953	0,818	1	-0,133	0,596
		S	0,984	0	0	0	0	0	0	0	.	0,475	0
	MC	C	-0,267	-0,09	-0,118	-0,079	-0,079	-0,072	-0,073	-0,117	-0,133	1	-0,004
		S	0,146	0,629	0,528	0,675	0,674	0,702	0,696	0,529	0,475	.	0,982
	IQ	C	-0,168	0,656	0,495	0,642	0,604	0,626	0,686	0,439	0,596	-0,004	1
		S	0,367	0	0,005	0	0	0	0	0,013	0	0,982	.

Source Output IBM SPSS 20

The bivariate analysis, which examines the relationship between two variables, was extended to multivariate analysis by using the method of principal component analysis (PCA) within the framework of exploratory data analysis. The results of this analysis are then presented in the subsequent title.

3.2. Principal Component Analysis (PCA)

To further analyze the data and explore the relationships between variables, we have chosen to conduct a multidimensional analysis using principal component analysis (PCA). The goal of PCA is to synthesize the information gathered and provide a better understanding of the relationships between the analyzed variables.

Before proceeding with PCA, we will first perform some necessary checks to ensure its feasibility. This includes conducting KMO and Bartlett tests to assess the quality of the sampling, as well as examining the total variance explained to determine the number of axes on which our

variables can be distributed. Finally, we will extract the matrix and plot of the components to better visualize the distribution of the variables on the selected axes.

✓ Quality of Sampling

To assess the feasibility of conducting principal component analysis, we consulted the KMO index which measures the quality of the sampling. The KMO¹ index was found to be 0.832, indicating that the sampling is of good quality. Additionally, Bartlett's specificity test is significant, as its probability tends towards 0.

✓ Total Variance Explained

Based on the results of the total variance explained, it was determined that three axes capture most of the available information, accounting for 89.24% of the variance. Axis 1 explained 65.06% of the information, while Axis 2 and Axis 3 capture 14.52% and 9.66% respectively.

Table 3: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %.	Total	% of Variance	Cumulative %.	Total	% of Variance	Cumulative %.
1	7,807	65,06	65,06	7,807	65,06	65,06	7,526	62,717	62,717
2	1,742	14,517	79,577	1,742	14,517	79,577	1,943	16,195	78,911
3	1,16	9,663	89,241	1,16	9,663	89,241	1,24	10,329	89,241
4	0,686	5,72	94,961						
5	0,271	2,255	97,216						
6	0,183	1,525	98,741						
7	0,076	0,633	99,374						
8	0,035	0,289	99,663						
9	0,019	0,161	99,824						
10	0,011	0,092	99,916						
11	0,006	0,054	99,97						
12	0,004	0,03	100						

Source Output IBM SPSS 20

✓ Component matrix

The main findings from the PCA analysis confirm those of the correlation analysis and provide additional insights. The component matrix reveals that GDP per capita growth (GDPpc) and market concentration (MC) are well-represented in axis 3 with coefficients of 0.863 and -0.542 respectively. These two variables are negatively correlated. Furthermore, the analysis confirms the positive relationship between exchange rate (REER) and institutional quality, as these two variables are represented in axis 2. and are positively linked, with coefficients of 0.681 and 0.931 each. This finding reinforces the correlation results presented in the previous section. The remaining variables are mostly associated with axis 1 and consist mostly of financial variables.

¹ Kaiser-Meyer-Olkin;

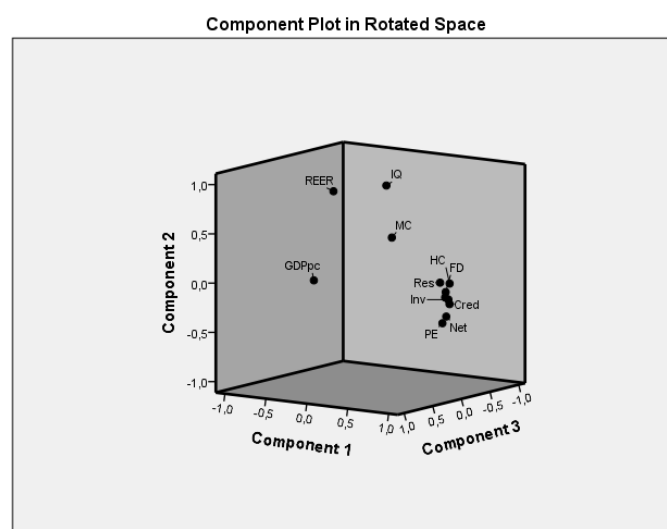
Table 4: Component Matrix

	Component		
	1	2	3
GDPpc	-0,04	-0,186	0,863
REER	-0,628	0,681	0,234
Inv	0,988	0,096	0,013
PE	0,965	-0,149	-0,066
Cred	0,986	0,056	-0,036
Res	0,89	0,227	0,112
Net	0,98	-0,073	-0,067
HC	0,961	0,252	0,052
ToT	0,916	0,102	-0,025
DF	0,958	0,159	0,06
MC	-0,304	0,431	-0,542
IQ	-0,08	0,931	0,189

Component Matrix

Extraction Method Principal Component Analysis.

a. 3 components extracted.

Source Output IBM SPSS 20**Figure 1: Component plot**

Source IBM SPSS 20

After completing the exploratory data analysis, the next step is to present the methodology used to develop the econometric model.

4. Econometric Model

To evaluate the influence of the Real Effective Exchange Rate (REER) on Moroccan GDP per capita growth from 1988-2019, we employed multiple regression using the Ordinary Least Squares (OLS) method. We followed a stepwise method to choose the best model among different combinations to be tested. In the following sections, we will first assess the stationarity of the variables and determine the order of integration of each variable, and then proceed with the necessary transformations. Next, we will conduct Granger causality test to identify causal links between variables and integrate a dynamic aspect of the model. Finally, we will present the econometric model we developed.

4.1. Stationarity

To avoid spurious regression, we initially conducted the Augmented Dickey-Fuller (ADF) test and applied necessary transformations to ensure the stationarity of the variables. By comparing the t-statistic values (ADF) with Mackinnon's critical values and examining the significance of the probability, we determined that the variables GDPPh, REER, Domestic Investment, Public Expenditure, Credit, Foreign Exchange Reserves, Internet, Financial Development, and Institutional Quality are integrated of order 1. On the other hand, Human capital is integrated of order 2. Terms of trade and market concentration are integrated at the level.

Now that we have identified the order of integration for the variables under examination, we can proceed to test for causality in the Granger sense.

4.2. Granger Causality Test

To account for the potential causal relationships between the variables in our model and to incorporate a dynamic aspect into the model, we conducted a Granger causality test. This test identified the lagged variables that will be included in the estimation phase with the other stationary exogenous variables.

The results of the Granger causality test generate two potential lagged variables that may affect GDP per capita growth in Morocco, namely: market concentration lagged by one year and institutional quality lagged by two years.

Table 5: Granger causality test Results

Null assumptions	Number of delays	F-statistic	Probability
MC does not Granger Cause PIBH	1	9.38970	0.0049
IQ does not Granger Cause PIBH	2	5.09723	0.0143

Source Output of EViews 10 software

After conducting the stationarity and Granger causality tests, we can proceed to the next step of econometric modeling.

4.3. Model specification:

To specify our econometric model, we used multiple regressions estimated by the ordinary least squares method, following the stepwise method. The objective was to identify the best equation among all the tested combinations between the stationary explanatory variables and the lagged variables identified based on the Granger test. Using EViews 10 software, we were able to obtain the best econometric model that fulfills all the econometric requirements for validity, among all the equations tested. The best model chosen is the one that best meets the required econometric requirements, namely the model with the highest R^2 and validated econometric tests. The established tests concern the test of overall significance (Fisher statistical probability), the test on coefficients/ multicollinearity (variance inflation factor (VIF)), the tests on residuals (autocorrelation, normality, heteroscedasticity), and the stability tests (Cusum and Cusum of squared/ structural stability of the model).

The model used to explain GDP per capita growth in Morocco is as follows.

$$\text{Pibh} = \alpha_0 + \alpha_1 \text{REER} + \alpha_2 \text{pibh}(-1) + \alpha_3 \text{HC} + \alpha_4 \text{net} + \alpha_5 \text{inv} + \alpha_6 \text{dp} + \alpha_7 \text{IQ}(-2) + \alpha_8 \text{MC}(-1) + \varepsilon_1$$

Where:

- | | |
|--|---|
| <ul style="list-style-type: none"> • GDPpc growth in Gross Domestic Product (GDP) per capita. • REER real effective exchange rate. • Inv domestic investment. • Net proxy of technology. • HC human capital index. | <ul style="list-style-type: none"> • PE government expenditure. • MC market concentration. • IQ institutional quality. • α_0 constant. • α_1 to α_8 coefficients to be estimated. • ε_1 error term. |
|--|---|

To ensure the econometric assumption of no autocorrelation in the error terms, the model is aligned using GDPpc(-1) to represent the GDP growth lagged by one year. This adjustment was necessary because the correlogram of the residual errors indicated autocorrelation problem. Additionally, the two-year lagged institutional quality IQ(-2) and one-year lagged market concentration MC(-1) were obtained through a Granger causality test.

5. Results and Discussion

In the table below, we present the results of our econometric estimating Morocco's GDP per capita growth during 1998 to 2019 by ordinary least squares method.

The estimation results allow us to reject the null hypothesis H0, which suggests that the exchange rate has no significant impact on economic growth in Morocco, and to accept the alternative hypothesis H1, which asserts that the exchange rate has a significant impact on economic growth in Morocco.

Table 9 Estimation Results

Explanatory variables	Estimated coefficients
REER	-0.718533**
GDPPC(-1)	-0.876840***
HC	-554.1682
NET	-0.286051
INV	-0.013826
PE	-0.019118
IQ(-2)	0.727911***
MC(-1)	-75.50394**
C	0.964913
R ²	0.85
R ² Adjusted	0.79

Significance level *** 1% ** 5%

Source Output software Eviews.10

Based on the estimation of the GDP per capita growth equation, it has been found that the R^2 value is 0.85 and the adjusted R^2 value is 0.79. This suggests that the explanatory variables employed in the model can explain around 79% of the variation in GDP per capita growth in Morocco.

Our findings demonstrate that economic growth in Morocco, as estimated by our econometric multiple regression model, is influenced by fluctuations in the real effective exchange rate (REER), economic growth lagged by one year, market concentration lagged by one year, and institutional quality lagged by two years. Specifically, GDPpc growth exhibits a negative correlation with the first three variables, while demonstrating a positive relationship with institutional quality.

Our study reveals that an increase of one point in the Real Effective Exchange Rate (REER) has a significantly negative impact on GDPpc growth, with a decrease of approximately -0.72 points. This implies that the appreciation of the exchange rate is harmful to economic growth, as it negatively affects export competitiveness and foreign direct investment attractiveness. This finding is consistent with the existing literature, which also reports a negative correlation between exchange rates and growth. Nevertheless, compared with number of previous studies that have dealt with the Moroccan case, including (El yamani et al., 2019; Haoudi & Rabhi, 2020; SALHI & Echaoui, 2018; Ziadi & Abdallah, 2007)

our result differs in terms of the significance of the coefficient associated with the exchange rate, where these authors did not find a significant impact of exchange rate variations on economic growth in Morocco. We attribute this variation to the inclusion of the institutional quality variable in our model, which was not considered in prior studies. As is well-established in econometrics, adding or removing a variable from a model can leads to different results. Our exploratory data analysis, including partial correlations and principal component analysis (PCA), further supported the strong relationship between the exchange rate and institutional quality.

Furthermore, our research has been supported by the literature findings. It has been emphasized that the growth performance associated with exchange rate regimes depends on the institutions of countries (Bailliu et al., 2003; Husain et al., 2004), the effect of the exchange rate on economic growth is also contingent upon the level of corruption (Ramoni-Perazzi & Romero, 2022).

Secondly, the coefficient of the lagged variable of Morocco's economic growth is significantly negative. Specifically, an increase of 1% in the lagged variable is linked to a decrease in GDPpc growth by approximately -0.88 points. This suggests the instability of Morocco's economic growth during the studied period. It is worth mentioning that other factors, including climatic hazards, may have contributed to this trend, particularly given the country's reliance on weather patterns for its agricultural output, which can significantly affect its overall output.

The lagged market concentration index has a negative effect on economic growth, whereby a 0.01-point increase in the index results in a decrease in GDPpc growth of approximately -0.75

points. The concentration of trade with specific regions or certain products may contribute to this negative association, particularly since Morocco trades mostly with European countries. Developing countries often specialize in products that have uncertain demand and may not be very profitable. Additionally, external factors such as product prices and demand fluctuations may also play a role.

Institutional quality, with a lag of two years, exhibits a positive association with economic growth, where an increase of 1% in institutional quality leads to a rise in GDPpc by 0.73 points. This lagged impact indicates the gradual influence of economic and structural policies on macroeconomic indicators. Enhancing institutional quality is vital for sustainable growth as institutional and market inefficiencies can hinder economic growth in developing nations.

On the other hand, the variables of investment, internet access, human capital, and public spending do not exhibit a significant influence on GDPpc growth in Morocco. This lack of significance can be attributed to various factors such as Morocco's low investment levels, the inability of human capital to adapt to technological changes due to a poorly ranked educational system globally, and the inefficient usage of the internet that does not prioritize learning new knowledge and techniques.

Conclusions and prospects:

The aim of this research paper was to examine the link between exchange rate and economic growth in Morocco, given the limited literature on this subject. The paper sought to measure the impact of exchange rate fluctuations on economic growth in Morocco from 1988 to 2019, using exploratory data analysis and stepwise regression estimated by the OLS method.

First, we conducted an exploratory data analysis that included simple correlations and partial correlations, with the Real Effective Exchange Rate (REER) as a control variable. The analysis showed that economic growth was not significantly correlated with all studied variables, but REER was significantly correlated with all variables except growth. The partial correlation coefficients between the pairs of variables decreased when REER was used as a control variable, indicating the importance of REER in explaining the relationships between the variables. Additionally, we found a strong link between the exchange rate and institutional quality.

Second, the correlation analysis was complemented by a multivariate analysis, using the principal component analysis (PCA) method. Indeed, according to the three-axis component matrix we were able to find that GDP per capita (GDPpc) growth and market concentration is negatively related, and this was indeed a result we were able to achieve in the econometric estimation phase. The PCA also allowed us to confirm once again the link between the exchange rate and institutional quality, which strengthens the correlation results, as well as supports the regression results.

Before proceeding to the estimations, we conducted an ADF test to identify non-stationary variables and then proceed with the necessary transformations. We have also established Granger

causality test to give a dynamic aspect to our model and to identify in this way the lagged variables and conducted multiple regressions using OLS method to estimate the chosen exogenous variables. The best model chosen is the one with the highest R^2 and ensuring the successful completion of all econometric tests.

The estimation results indicate a significantly negative relationship between REER and GDPpc. Specifically, an increase in REER of one-point results in a decrease in GDPpc of about -0.72 points. Furthermore, the significance of the exchange rate coefficient in the growth equation depends on the presence of the institutional quality variable in the equation. Indeed, as is commonly accepted in econometrics, the addition or removal of a variable from the model leads to different results. Similarly in our case, when we remove the variable associated with institutional quality, the coefficient on the exchange rate becomes.

This observation is supported by the results of the partial correlations and principal component analysis (PCA) we carried out in the exploratory phase of the data, which show the strong relationship between the exchange rate and institutional quality. Additionally, our research is supported by economic literature, It is widely accepted that the growth performance associated with exchange rate regimes depends on countries' institutions (Bailliu et al., 2003; Husain et al., 2004). In addition, institutional quality is one of the determinants of the choice of exchange rate regimes (Calvo & Reinhart, 2002; Husain et al., 2004; REINHART & ROGOFF, 2004).

Moreover, countries with low institutional quality often opt for fixed exchange rate regimes, while those with high institutional quality choose flexible exchange rate regimes (Husain et al., 2004; REINHART & ROGOFF, 2004), just as the effect of the exchange rate on economic growth depends on the level of corruption (Ramoni-Perazzi & Romero, 2022). In the case of Morocco, institutions suffer from various shortcomings, including high levels of corruption and low bureaucratic quality, which partly explain the adoption of the fixed exchange rate regime in recent years. Our results conclude that the relationship between the exchange rate and institutional quality justifies the significance of the REER coefficient in the GDPpc equation.

Our research makes significant contributions both theoretically and methodologically. Unlike many studies that have attempted to analyze the same issue in the Moroccan context, our study demonstrates the significant impact of exchange rate fluctuations on Moroccan economic growth by incorporating the institutional quality variable into our model. This explanatory variable has not been used in prior research. Our findings indicate that institutional quality plays a crucial role in the relationship between the exchange rate and economic growth in Morocco. Furthermore, our methodological contribution lies in the application of the stepwise method to select the optimal combination of explanatory variables and in conducting bivariate and multivariate exploratory analyses to gain a better understanding of the interrelationships among the variables under investigation.

Our results shed light on the absence of a significant simple correlation between economic growth and the Real Effective Exchange Rate (REER) and provide an explanation for the non-

significant impact reported in previous studies. It reveals that the influence of the exchange rate on economic growth depends on the presence or absence of other fundamental factors.

Nevertheless, it is important to acknowledge the limitations of our study. Firstly, it does not compare Morocco with other developing countries, which would be valuable for a comparative analysis using panel data. Secondly, due to data availability, we used annual data, whereas having data with monthly, quarterly, or semi-annual frequency would enable a better interpretation of exchange rate fluctuations.

Furthermore, future research could explore the moderating role of institutional quality in explaining the relationship between the exchange rate and economic growth, with the aim of creating an institutional environment that fosters economic growth in Morocco, especially in the context of transitioning to a floating exchange rate regime.

Bibliography:

- Aman, Q., Ullah, I., Khan, M. I., & Khan, S.-D. (2017). Linkages between exchange rate and economic growth in Pakistan (an econometric approach). *European Journal of Law and Economics*, 44(1), 157–164.
- Amri, Y. E., Bouhadi, A. E., & Benali, M. (2022). The asymmetric effect of exchange rate fluctuations on economic growth in Morocco: Application of non-linear ARDL approach. *Repères et Perspectives Economiques*, 6(2), Article 2. <https://doi.org/10.34874/IMIST.PRSM/RPE/34801>.
- Arslan, Y., & Cantu Garcia, C. (2019). *The size of foreign exchange reserves* (pp. 1–23) [BIS Papers chapters]. Bank for International Settlements. <https://econpapers.repec.org/bookchap/bisbisbpc/104-01.htm>.
- Bailliu, J. (2000). Private Capital Flows, Financial Development, and Economic Growth in Developing Countries. In *Staff Working Papers* (No. 00–15; Staff Working Papers). Bank of Canada. <https://ideas.repec.org/p/bca/bocawp/00-15.html>.
- Bailliu, J., Lafrance, R., & Perrault, J.-F. (2003). Does Exchange Rate Policy Matter for Growth? *International Finance*, 6, 381–414. <https://doi.org/10.1111/j.1367-0271.2003.00123.x>
- Barro, R. J. (1990). Government Spending in a Simple Model of Endogeneous Growth. *Journal of Political Economy*, 98(5, Part 2), S103–S125. <https://doi.org/10.1086/261726>.
- Barro, R. J., & Sala-i-Martin, X. (2004). *Economic growth* (2nd ed). MIT Press.
- Bekaert, G., Harvey, C., & Lundblad, C. (2005). Does financial liberalization spur growth? *Journal of Financial Economics*, 77(1), 3–55.

- Boluze, L. (2020, December 17). *Croissance économique: Définition et calcul*. Capital.fr. <https://www.capital.fr/economie-politique/croissance-economique-1388889>.
- Buffie, E. F. (1986). Devaluation, investment and growth in LDCs. *Journal of Development Economics*, 20(2), 361–379.
- Calvo, G., & Reinhart, C. (2002). Fear of Floating. *The Quarterly Journal of Economics*, 117(2), 379–408.
- Eichengreen, B. (2008). *The Real Exchange Rate and Economic Growth*. <https://openknowledge.worldbank.org/handle/10986/28013>.
- Eichengreen, B., & Temin, P. (2000). The Gold Standard and the Great Depression. *Contemporary European History*, 9(2), 183–207.
- El yamani, K., Jerry, M., Qafas, A., Charef, F., & Saadaoui, M. (2019). Effet du taux de change sur la croissance économique du Maroc. *Revue du contrôle, de la comptabilité et de l'audit*, 3(1), Article 1. <https://revuecca.com/index.php/home/article/view/339>.
- Ghosh, A., Gulde, A.-M., Ostry, J., & Wolf, H. (1997). Does the Exchange Regime Matter for Inflation and Growth? *IMF Economic Issues*, 2.
- Gluzmann, P., Yeyati, E., & Sturzenegger, F. (2012). Exchange rate undervaluation and economic growth: Díaz Alejandro (1965) revisited. *Economics Letters*, 117, 666–672. <https://doi.org/10.1016/j.econlet.2012.07.022>.
- Gneba, P. M., Fanwa, M., Yacouba, Y. C., & Njoda, M. T. (2023). Dette publique et croissance économique au Cameroun. *Alternatives Managériales Economiques*, 5(2), Article 2. <https://doi.org/10.48374/IMIST.PRSM/ame-v5i2.39803>.
- Gyimah-Brempong, K., Paddison, O., & Mitiku, W. (2006). Higher education and economic growth in Africa. *The Journal of Development Studies*, 42, 509–529. <https://doi.org/10.1080/00220380600576490>.
- Haoudi, A., & Rabhi, A. (2020). TAUX DE CHANGE ET CROISSANCE ECONOMIQUE AU MAROC: EVIDENCE EMPIRIQUE. *Finance & Finance Internationale*, 1(18), Article 18. <https://revues.imist.ma/index.php/FFI/article/view/19178>.
- Husain, A. M., Mody, A., & Rogoff, K. S. (2004). Exchange rate regime durability and performance in developing versus advanced economies. *Journal of Monetary Economics*, 52(1), 35–64. <https://doi.org/10.1016/j.jmoneco.2004.07.001>.
- Karahan, Ö. (2020). Influence of Exchange Rate on the Economic Growth in the Turkish Economy. *Financial Assets and Investing*, 11(1), Article 1. <https://doi.org/10.5817/FAI2020-1-2>.

- King, R. G., & Levine, R. (1993). Finance and Growth: Schumpeter Might be Right. *The Quarterly Journal of Economics*, 108(3), 717–737. <https://doi.org/10.2307/2118406>.
- Law, S. H., Azman-Saini, W. N. W., & Ibrahim, M. H. (2013). Institutional quality thresholds and the finance – Growth nexus. *Journal of Banking & Finance*, 37(12), 5373–5381.
- Lucas, R. E. (1988). ON THE MECHANICS OF ECONOMIC DEVELOPMENT. *Journal of Monetary Economics*, 40.
- Maddison, A. (1982). *Phases of Capitalist Development*. Oxford University Press.
- Mendoza, E. (1995). The Terms of Trade, the Real Exchange Rate, and Economic Fluctuations. *International Economic Review*, 36(1), 101–137.
- Obstfeld, M., & Rogoff, K. (1995). The Mirage of Fixed Exchange Rates. *Journal of Economic Perspectives*, 9(4), 73–96. <https://doi.org/10.1257/jep.9.4.73>.
- Pramanik, S. (2021). Exchange rate and Economic Growth—A comparative analysis of the possible relationship between them. *MPRA Paper*, Article 111504. <https://ideas.repec.org/p/pra/mprapa/111504.html>.
- Ramoni-Perazzi, J., & Romero, H. (2022). Exchange rate volatility, corruption, and economic growth. *Heliyon*, 8(12), e12328. <https://doi.org/10.1016/j.heliyon.2022.e12328>.
- REINHART, C., & ROGOFF, K. (2004). The Modern History of Exchange Rate Arrangements: A Reinterpretation. *QUARTERLY JOURNAL OF ECONOMICS*, 48.
- Rodrik, D. (2008). The Real Exchange Rate and Economic Growth. *Brookings Papers on Economic Activity*, 2008, 365–412. <https://doi.org/10.1353/eca.0.0020>.
- Romer, P. (1989). *Endogenous Technological Change* (No. w3210). National Bureau of Economic Research. <https://doi.org/10.3386/w3210>.
- Romer, P. M. (1986). Increasing Returns and Long-Run Growth. *Journal of Political Economy*, 94(5), 1002–1037. <https://doi.org/10.1086/261420>.
- SALHI, S. E., & Echaoui, A. (2018). *L'impact du taux change sur la croissance économique: Une analyse en modèle VAR des canaux de transmission Cas du Maroc*.
- Sharipov, I. (2015). CONTEMPORARY ECONOMIC GROWTH MODELS AND THEORIES: A LITERATURE REVIEW. *Centre for European Studies, Alexandru Ioan Cuza University*, 7(3), 15.
- Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, 70(1), 65–94. <https://doi.org/10.2307/1884513>.

- Sturzenegger, E. L. Y. and F., & Levy Yeyati, E. (2007). *Fear of Appreciation* [Business School Working Paper]. Universidad Torcuato Di Tella. <https://econpapers.repec.org/paper/udtwpbsdt/fearapp.htm>.
- Vidon, E. (2007). *L'accumulation de réserves de change est-elle un indicateur d'enrichissement d'une nation ?* 7.
- Yougbare, L. (2009). *Effets macroéconomiques des régimes de change: Essais sur la volatilité, la croissance économique et les déséquilibres du taux de change réel* [Phdthesis, Université d'Auvergne - Clermont-Ferrand I]. <https://tel.archives-ouvertes.fr/tel-00377436>.
- Ziadi, N., & Abdallah, A. (2007). *Taux de change, ouverture et croissance économique au Maghreb*. Commission Economique pour l'Afrique des Nations Unies (UNECA). <http://www.gate.cnrs.fr/uneca07/communications%20pdf/ZIADI%20Abdallah-%20rabat.pdf>.