ARDL modeling and analysis of the impact of the interaction between the exchange rate and inflation on economic growth in Morocco

Modélisation ARDL et analyse de l'impact de l'interaction entre le taux de change et l'inflation sur la croissance économique au Maroc

Sara EL ABOUDI
Doctorante
Laboratoire Des Sciences Economiques Et Politiques Publiques, FEG
Université IBN TOFAIL
Sara.elaboudi@uit.ac.ma

Imane ALLAM
Docteure
Laboratoire De Recherche En Sciences De Gestion Des Organisations, ENCG
Université IBN TOFAIL
Imane.allam@uit.ac.ma

Mounir EL BAKKOUCHI
Professeur
Laboratoire Des Sciences Economiques Et Politiques Publiques, FEG
Université IBN TOFAIL
elbakkouchi.mounir@uit.ac.ma

Abstract

The effect of exchange rate and inflation variables on macroeconomic performance, particularly economic growth, is a contentious topic for countries' macroeconomic policies. In this study, we aim to examine the impact of the interaction between the exchange rate and inflation on economic growth in Morocco. To accomplish this, we employ an autoregressive distributed lag model (ARDL) to test the influence of this interaction, examining data from the years 1989 to 2019. Our findings indicate that short-term economic growth is significantly affected by the interaction between the exchange rate and inflation (Pass-Through) when lagged in first difference. However, in the long-term, results suggest that economic growth need not be reliant on both exchange rate and inflation.

Keywords :

Exchange rate ; inflation ; economic growth ; interaction ; ARDL.

Résumé

L'effet des variables de taux de change et d'inflation sur la performance macroéconomique, en particulier la croissance économique, est un sujet controversé pour les politiques macroéconomiques des pays. Dans cette étude, nous visons à examiner l'impact de l'interaction entre le taux de change et l'inflation sur la croissance économique au Maroc. Pour ce faire, nous utilisons un modèle autorégressif à retards distribués (ARDL) pour tester l'influence de cette interaction, en examinant les données des années 1989 à 2019. Nos résultats indiquent que la croissance économique à court terme est significativement affectée par l'interaction entre le taux de change et l'inflation (Pass-Through) lorsqu'elle est retardée en première différence. Cependant, à long terme, les résultats suggèrent que la croissance économique n'est pas nécessairement dépendante à la fois du taux de change et de l'inflation.

Mots clés :

Taux de change ; inflation ; croissance économique ; interaction ; ARDL.

Introduction

The relationship between the exchange rate, inflation, and economic growth is a topic that has long been debated in academic circles. Studies have shown that a positive correlation between exchange rate and inflation has a negative impact on a country's economic growth, while a negative relationship between these two factors can accelerate growth rate and improve overall economic performance. In order to understand this relationship, we will first explore the effect of exchange rates and inflation on economic growth separately, and then examine their interaction.

Exchange rates play a major role by determining a country's overall economic situation. An increase in the value of a country's currency leads to a decrease in its exports and attracts more imports from foreign countries. This causes an outflow of funds from the domestic economy and reduces the amount of resources available to domestic firms to invest and grow. This causes a lower productivity and ultimately slower economic growth (Dollar, 1992 ; Easterly, 2005). On the other hand, a decrease in the currency's value makes the country more attractive as a destination for foreign investment and makes its products more competitive in the international market. As a result, foreign companies tend to invest more in the country and increase the local demand for goods and services. This in turn stimulates the growth of domestic industries and accelerates the pace of economic development, which is why exchange rates directly impact economic growth and development (Gluzmann et al., 2012 ; Mario et al., 2011 ; Mbaye, 2012 ; and Rapetti et al., 2011).

Inflation is another crucial factor that influences economic growth. If the prices increase steadily over a period of time, it will tend to increase the general cost of living and thus reducing the purchasing power for consumers. This discourages them from purchasing the products and services offered by domestic companies and causes them to cut back on their spending. This in turn leads to a decline in the volume of sales, which leads to a reduction in production levels and economic output (Kasidi and Mwakanemela (2013)). At the same time, an increase in inflation creates the opposite effect, as it tends to discourage producers from raising their prices and encourages them to increase production to satisfy more demand for their products. Consequently, the economy begins to expand at a faster rate and produce greater quantities of goods and services, which helps to accelerate economic growth (Hamadouche (2017)). Therefore, it can be said that inflation does have a favorable influence on economic growth.

Against this backdrop, Morocco is moving towards a more floating exchange rate system and plans to implement a monetary policy approach that targets inflation, necessitating an

examination of the level of exchange rate pass-through. It is critical to assess how domestic prices respond to exchange rate movements as it is essential to conducting monetary policy. The pass-through channel measures the effect of exchange rate changes on prices through changes in the prices of imported goods. The issue of the pass-through mechanism concerns the links among monetary policy, inflation, and the effects of exchange rate changes on domestic prices.

The objective of this study is to evaluate, through empirical methods, the effect of Pass-Through on economic growth in Morocco. Given the importance of this measure in determining the ideal monetary policy for inflation targeting, our research seeks to address the following question :

What is the impact of the relationship between foreign exchange and inflation on economic growth in Morocco ?

In response to this inquiry, we formulated three hypotheses :

H1 : The impact of the relationship is neutral for economic growth in Morocco.

H2 : The relationship between foreign exchange and inflation has a positive impact on economic growth in Morocco.

H3 : The relationship between foreign exchange and inflation has a negative impact on economic growth in Morocco.

To study the research question, we engaged in both conceptual and empirical work. First, the conceptual work consisted of a review of the literature on Pass-Through analysis to elucidate the interaction between the exchange rate and inflation. Second, the empirical work consisted of an econometric modeling exercise using the ARDL model to assess the effect of the interaction between the exchange rate and inflation on economic growth in Morocco.

1. Review of the literature

We first conduct an in-depth analysis of the interactive relationship that exists within exchange rate and inflation (Pass-Through) by reviewing the theoretical and empirical literature, before undertaking empirical testing of the impact on the variables in the study.

Foreign exchange rates are a fundamental indicator of inflation. Indeed, Dornbusch (1987) provided an explanation of the relation by which the exchange rate and inflation are related for the first time. He built an econometric model and analyzed how the exchange rate affects prices. On the basis of Dornbusch's work, other work has been developed (Brooks. (2002); Nieh, C. C., & Wang, Y. S. (2005); Monfared, S., & Akin, F. (2017)). In studying the relation between the exchange rate and domestic prices, he examines the density of the market, substitutes for imports, and channels for domestic production.

Subsequently, Goldfajn and Valdes (1999) note in this regard that overvaluation of the domestic currency is an important determinant of future currency depreciation ; in most cases, large and medium valuations are reversed by nominal devaluations. At the same time, it has been argued by Taylor (2000) that a low-inflation environment has led to a decline in transmission or pricing power in several countries.

Later on, on the basis of their findings, Choudhri and Hakura (2001) conclude that pass-through correlates positively with the inflation rate, indicating that pass-through is complete for the majority of the countries selected in the sample. In parallel, Calvo, Reinhart and Floating (2002) argue that the perspective of a strong and quick pass-through of exchange rate movements to domestic prices is a factor in central banks showing a realistic "fear of floating" and intervening in foreign exchange markets to avert exaggerated exchange rate movements. This is especially relevant for many developing countries, as transmission appears to be higher than in the case of developed countries.

For Devereux (2001), with a rigid exchange rate system, any action to stabilize inflation leads to output volatility.

In contrast, it is shown by Devereux and Yetman (2003) that pass-through behaviour was positively related to the rate of inflation, but this is not linear, as the extent of pass-through decreases over time.

Thus, in order to maintain the credibility and effectiveness of monetary policy in keeping inflation low, Gagnon and Ihrig (2004) argue that firms should anticipate the negative persistence of any negative exchange rate shock on inflation, and therefore would not pass on the losses in prices.

The extent of exchange rate pass-through for emerging economies is discussed by Ca' Zorzi, Hahn, and Sanchez (2007). They find that for emerging economies with inflation in the low single digits, pass-through to consumer and import prices is modest and not significantly different from the levels in developed economies. The authors also found strong support for a similar degree of exchange rate pass-through as in the case of inflation. Last but not least, there is only weak empirical support for a favorable association at all between open imports and the ECT.

For his part, Kandil (2014) studied the effects of exchange rate fluctuations on import movements and their combined influence on the overall macroeconomic situation. Developed countries tend to be more prone to real effective exchange rate depreciation due to increased inflationary pressures in developing countries. In these cases, price inflation and import growth

follow the same direction as expected exchange rate movements. Conversely, in advanced countries, there is no apparent link between exchange rate movements and their impact on the macroeconomy through import costs.

Özyurt (2016) investigated the level and pace of exchange rate Pass-Through on imported goods prices in the euro area, both at the euro area aggregate and the five largest member economies level. The findings indicate partial impact, likely due to slow nominal price adjustment and market-based pricing behavior of firms.

Additionally, Nasir, Huynh, Luu, and Vo (2020) conducted a study on exchange rate pass-through to inflation expectations. They revealed that exchange rate pass-through has substantial consequences for inflation expectations. While economic growth, labor market prospects, money supply, oil shocks, and fiscal stance significantly affect inflation expectations, the results vary in the short and long term.

Krušković (2020) examined the impact of exchange rate policies on economic growth and prices, demonstrating that countries with an inflation targeting system have lower economic growth and higher unemployment rates.

Olamide, Ogujiuba, and Maredza (2022) analyzed the impact of exchange rate instability on the relationship between inflation and growth. They found that economic growth is negatively correlated with exchange rate instability and inflation. Moreover, they suggested that the indirect impact of exchange rate instability on inflation also negatively affects the inflation-growth relationship, with higher levels of instability posing greater risks.

2. Specification and empirical methodology

2.1. Estimation of the model

Before applying the stationarity and cointegration tests, we will first present the variables used to test the effect of the interaction of exchange rate and inflation variables on Moroccan economic growth. For this study, some variables suggested by the economic theory or tested in other countries, especially in developing countries, have been taken into account. Thus, the model to be estimated is :

$$lGDP = f(REER * Inf, GFCF, FDI, Expen, Impo, Expo)$$

Many econometric studies commonly introduce the logarithm into the GDP variable in order to stabilize the variable by eliminating exponential values. Using this approach, the gap between extreme values is reduced, leading to a narrower distribution of the variables. The major objective is to increase the stability of the data and to facilitate statistical analyses. By using the

logarithm, researchers can better understand the relative variations of GDP and obtain more meaningful results in their economic studies.

2.2.Presentation and source of variables

Table 1 presents the explanatory factors suggested in both theoretical and empirical studies to gauge the influence of the exchange rate and inflation interaction on economic growth within the Moroccan setting.

Table 1 : Description of variables used

Code	Name
Explanatory variables	
REER	*Real effective exchange rate index (2010 =100)*
Inf	*Inflation, consumer prices (annual %)*
GFCF	*Gross fixed capital formation (% of GDP)*
FDI	*Foreign direct investment (% of GDP)*
Expen	*General government final consumption expenditure (% of GDP)*
Impo	*Imports of goods and services (% of GDP)*
Expo	*Exports of goods and services (% of GDP)*
Variable to explain	
Lgdp	*GDP growth (annual %), (transformed into logarithm)*

Source : Authors' compilation

The World Bank's (WDI) database provides the data used in this study. The data is annual and spans from 1989 to 2019. This time frame was chosen due to the reliability of the data and to achieve the study's objective of modeling the impact of Pass-Through on economic growth in Morocco after many years of reforms.

2.3. Model specification

To evaluate the influence of the exchange rate and inflation interaction on economic growth, we will utilize a lagged autoregressive model (ARDL). This dynamic model enables us to consider the impact of time on variable interpretation by employing a framework from recent empirical literature supplemented with some control variables :

$$\Delta lGDP_t = C + \sum_{i=1}^{P} \propto_{1i} \Delta lGDP_{t-i} + \sum_{i=1}^{q} \propto_{2i} \Delta REER_{t-i} * \Delta inf_{t-i} + \sum_{i=1}^{q} \propto_{3i} \Delta GFCF_{t-i} +$$
$$\sum_{i=1}^{q} \propto_{4i} \Delta FDI_{t-i} + \sum_{i=1}^{q} \propto_{5i} \Delta Expen_{t-i} + \sum_{i=1}^{q} \propto_{6i} \Delta Expo_{t-i} + \sum_{i=1}^{q} \propto_{7i} \Delta Impo_{t-i} +$$
$$\beta_1 lGDP_{t-1} + \beta_2 REER_{t-1} * Inf_{t-1} + \beta_3 GFCF_{t-1} + \beta_4 FDI_{t-1} + \beta_5 Expen_{t-1} +$$
$$\beta_6 Expo_{t-1} + \beta_7 Impo_{t-1} + u_t$$

With :

- *REER*Inf : Interaction of the two variables, exchange rate and inflation ;*
- *C : Constant ;*
- *Δ : The first difference ;*
- $\propto_1 ... \propto_7$ *: Short term dynamics ;*
- *p, q : The maximum number of lags for each variable in the study ;*
- $\beta_1 ... \beta_7$ *: Long term dynamics ;*
- u_t *: Error term.*

Many econometric studies commonly introduce the logarithm into the GDP variable in order to stabilize the variable by eliminating exponential values. Using this approach, the gap between extreme values is reduced, leading to a narrower distribution of the variables. The major objective is to increase the stability of the data and to facilitate statistical analyses. By using the logarithm, researchers can better understand the relative variations of GDP and obtain more meaningful results in their economic studies.

2.4. Graphical evolution of the variables

As the graph shows, economic growth fluctuates considerably during the period under consideration. These growth results are mainly explained by periods of expansion (good agricultural season, stable inflation, high exports, etc.) and recessions (drought, deterioration of the international economic situation, economic, financial and health crisis, etc.).

In the years 1990 to 2000, inflation showed a downward trend. Subsequently, price trends have been very stable since the early 2000s thanks to the monetary policies implemented by the government, notably Bank Al-Maghrib.

The real effective exchange rate, meanwhile, has evolved continuously over the period from

1989 to 2019.

Figure 1 : Trends in economic growth, inflation, and the real effective exchange rate in Morocco between 1989 and 2019
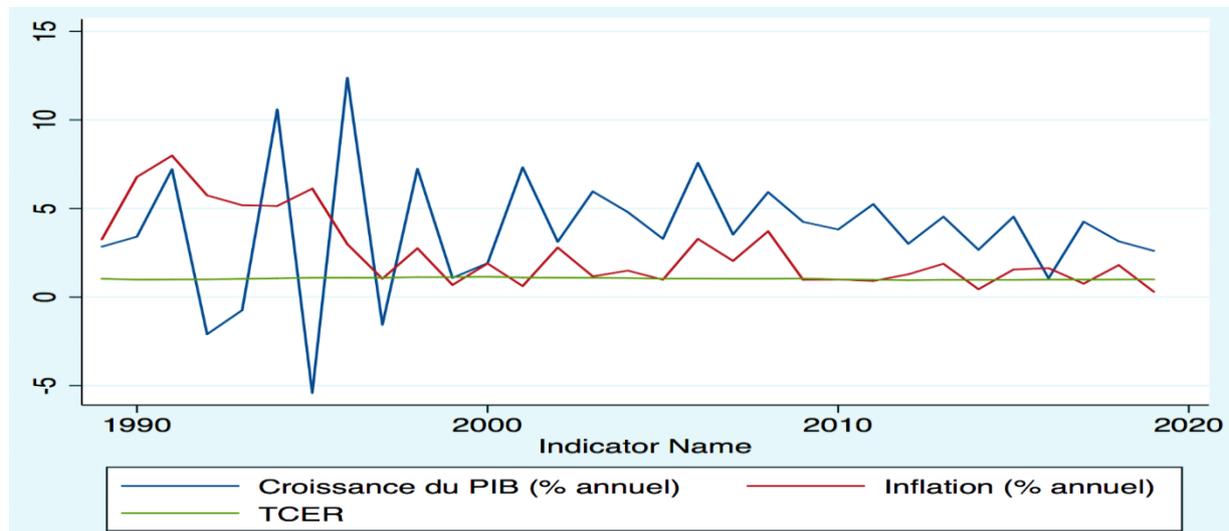
Source : Author's calculations, STATA 15 software

3. Results and discussions

3.1. OLG regression Model

The results obtained using the OLS technique, which aims to estimate the model parameters while minimizing the sum of residual squares, indicate the following results :

Table 2 : Interaction effects

lGDP	Coef.	Std. Err.	t	P> |t|	[95% Conf. Interval]	
Inf* REER	-.0004926	.0001917	-2.57	0.017	-.0008882	-.0000969
GFCF	-.0371887	.0204099	-1.82	0.081	-.0793127	.0049353
Expen	-.005589	.0379505	-0.15	0.884	-.083915	.0727371
Expo	-.0068177	.0189002	-0.36	0.721	-.0458257	.0321903
Impo	.06480818	.0162049	3.95	0.001	.0306365	.0975271
FDI	-.0104224	.0239798	-0.43	0.668	-.0599143	.0390696
_cons	23.993169	.8395401	28.51	0.000	22.119896	25.66441

Source : Author's calculations, STATA 15 software

The results of this second specification show that the interaction between the exchange rate and inflation (Pass-Through) has a negative and significant effect at the 5% level. (-0,00049). Pass-Through has an impact on the entire world economy since all world economies use the same

financial system. Changes in the economic growth of one country negatively affect all other economies through trade relations and borrowing costs.

When the exchange rate rises, it leads to an increase in the price of exports for consumers, which in turn makes imports cheaper for businesses. This results in a negative impact on economic growth as it limits the growth potential of exports. Moreover, in an attempt to stimulate the economy, governments may lower interest rates, including those on foreign currencies, which can further exacerbate the situation by making imports even more affordable for businesses.

3.2.Stationarity of the variables

The stationarity of the variables must be analyzed to verify the order of integration of all the variables in the model. To do this, we have opted for the Dickey Fuller augmented unit root test.

Most macro quantities are normally stationary at the maximum first difference. The table below summarizes the results of the ADF test for all variables in level and first difference.

Table 3 : Unit Root Test

Variables	Retard	Level		1st difference		Order of integration
		Calculated values	Tabulated values *	Calculated values	Tabulated values *	
GDP	2	0.287	2.986	-4.602***	2.986	I (1)
REER	2	-1.015	2.986	-4.972***	2.986	I (1)
Inf	1	-2.127	2.986	-8.507***	2.986	I (1)
GFCF	2	-1.254	2.986	-4.876***	2.986	I (1)
Expo	2	-0.593	2.986	-6.727***	2.986	I (1)
Impo	1	-0.892	2.986	-6.410***	2.986	I (1)
Expen	2	-1.837	2.986	-7.774***	2.986	I (1)
FDI	2	-5.524***	2.986	-13.111***	2.986	I (0)

***10% critical values level

Source : Author's calculations, STATA 15 software

Based on the results of the ADF test, we notice that all the series are not stationary in level except for the FDI variable which displays a significant ADF statistic at the 1% threshold.

On the other hand, after transforming the series into first difference, a technique proposed in the econometric literature, we notice that all the variables have become stationary and

therefore they are integrated of order 1.

3.3. Correlation and causality tests

3.3.1. Correlation test

The best known of the correlation tests, or Pearson's linear correlation coefficient, consists in calculating the covariance quotient of random variables by the product of their standard deviations. This test is therefore a test of quantitative variables.

According to the results of the Pearson correlation, a significant negative correlation of 63% is found between economic growth and the exchange rate, indicating that these two variables tend to vary in opposite directions.

Table 4 : Correlation matrix between variables

	GDP	Inf	REER	GFCF	Expen	Expo	Impo	FDI
GDP	1.0000							
Inf	-0.5800	1.0000						
REER	-0.6305	-0.0312	1.0000					
GFCF	0.7436	-0.4087	-0.5262	1.0000				
Expen	0.7709	-0.6077	-0.4953	0.5595	1.0000			
Expo	0.9218	-0.5985	-0.5386	0.7665	0.7258	1.0000		
Impo	0.9536	-0.5105	-0.6531	0.8681	0.7428	0.9494	1.0000	
FDI	0.2931	-0.4876	-0.0488	0.3071	0.3854	0.4124	0.3291	1.0000

Source : Author's calculations, STATA 15 software

The correlation analysis indicates that there is a moderate negative relationship (-58%) between economic growth and inflation. On the other hand, investment and exports of goods and services are highly and positively correlated with economic growth, with correlation coefficients of 0.74 and 0.92, respectively.

On the other hand, government spending shows a positive correlation with economic growth as GDP moves in the same direction when there is an increase in government spending.

3.3.2. Causality test in the GRANGER sense

In the context of analyzing dynamic links between time periods, the causality concept developed by Wiener (1956) and Granger (1969) seems to be the basis of this analysis.

Beyond these philosophical considerations, Granger (1969) developed an approach based on the dynamics between variables to extract a rigorous version of the "ambiguous" notion of

causality in economics. Indeed, in the Wiener-Granger sense, a chronicle X causes another chronicle Y as soon as the knowledge of the time series X is not neutral for the prediction of Y. The test is based on the following hypotheses :

H0: The variable x does not have a Granger-causal relationship with the variable y.

H1: The variable x has a Granger-causal relationship with the variable y.

Table 5 : Causality test in the sense of GRANGER

Equation	Excluded	Chi2	Df	Prob > chi2
lGDP	REER	.09763	2	0.952
	Inf	4.9641	2	0.084
	ALL	5.4476	4	0.244
REER	lGDP	5.1788	2	0.075
	Inf	.69771	2	0.705
	ALL	10.652	4	0.031
Inf	lGDP	17.396	2	0.000
	REER	32.563	2	0.000
	ALL	37.275	4	0.000

Source : Author's calculations, STATA 15 software

Based on the test results, it can be concluded that inflation has a Granger-causal relationship with economic growth since the associated probability with the KHIDEUX statistic is significant at a 10% level. Conversely, there is no Granger-causal relationship between the exchange rate and GDP. Additionally, it is found that economic growth has a statistically significant Granger-causal relationship with the exchange rate.

Finally, both variables, GDP and the exchange rate, have a causal relationship with inflation. Therefore, the null hypothesis is rejected for both equations and the alternative hypothesis is accepted. In summary, it can be concluded that inflation is determined by economic growth and the real effective exchange rate in a statistically significant way.

3.4.Co-integration test at the bounds of Pesaran and al. (2001)

3.4.1. Boundary cointegration test

Pesaran and Shin (1998), Pesaran and Shin (1999) and Pesaran and al (2001) proposed a cointegration test called "bounds test to cointegration" or "staggered lag test," which is adapted to the current case. This test is used in the context of the cointegrated ARDL specification, which takes the form of an error correction model.

The cointegration test of Pesaran and al (2001) requires estimation of the ARDL model first. The computed test statistic, Fisher's F-value, is then compared to critical values that form the limits.

Table 6 : Boundary cointegration test of Pesaran Shin and Smith 2001

Variables	lGDP ; Inf ; REER ; GFCF ; Expen ; Impo ; Expo ; FDI	
F-stat calculated	1.728	
Critical limit	**Bound <**	**Bound >**
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36

Source : Author's calculations, STATA 15 software

In the end, the results of the final cointegration test validate the absence of a cointegrating relationship between the variables considered in the model, as indicated by the Fisher statistic being lower than the lower bound.

3.4.2. Optimal delay of the SIC information criterion

The method of Pesaran and al (2001) is well adapted to our case of study. Note that the Pesaran cointegration test is applied in two steps :

To begin with, it is important to identify the optimal lag (using AIC or SIC) and conduct Fisher's test to confirm the cointegration among the variables. If there is no cointegration, we must decide the maximum number of lags to incorporate into our model. Next, we determine the optimal lag order for our ARDL model by evaluating the Akaike and Schwartz information criteria. Typically, we select the lag order that yields the highest information criteria.

Table 7 : Optimal lag

Lag	LL	LR	Df	p	FPE	AIC	HQIC	SBIC
0	-128.134	-	-	-	3.3204	9.713622	9.75643	9.8576
1	-52.7153	150.84	9	0.000	.024396*	4.79372*	4.96498*	5.36965*
2	-44.1995	17.032*	9	0.048	.026051	4.82959	5.112929	5.83747
3	-40.697	7.0049	9	0.637	.042175	5.23682	5.66495	6.67664
4	-36.2782	8.8377	9	0.452	.068777	5.57616	6.13274	7.44793

Source : Author's calculations, STATA 15 software

According to the Akaike and Schwarz criteria, the optimal time choice for our model is 1. We note that the AIC criterion indicates that the maximum time we should take in our model is 1. (The star displayed near the statistics in the table).

3.5.Long-and Short-Term Coefficients

The main topic of discussion here is the examination of both long-run and short-run coefficients of the ARDL model. The ARDL model is used to clarify the behavior of GDP through past and present values of the exchange rate, inflation, investment, exports, imports, FDI, and government spending.

STATA software can perform the ARDL modeling automatically. The number of lags is chosen based on the Akaike and Schwarz (SIC) information criteria.

Table 8 : Coefficients of short and long term by the ARDL model

D. lGDP	Coef	Std. Err.	t	P> t	[95% Conf. Interval]	
ADJ						
lGDP						
L1.	.274855	.1625249	1.69	0.119	-.0828599	.6325698
LR						
REER_Inf	-.0002288	.0003021	-0.76	0.465	-.0008938	.0004362
GFCF	.0999528	.055096	1.81	0.097	-.0213126	.2212182
Expen	.173579	.0839345	2.07	0.063	-.0111597	.3583176
Expo	.0607589	.039408	1.54	0.151	-.0259777	.1474954
Impo	-.0119869	.0357946	-0.33	0.744	-.0907703	.0667966
FDI	-.3312868	.1469499	-2.25	0.046	-.6547213	-.0078523
SR						
lGDP						
LD.	.352945	.1331564	2.65	0.023	.0598697	.6460203
REER_Inf						
D1.	.0001282	.0000973	1.32	0.214	-.0000858	.0003423
LD.	.0003208	.0000981	3.27	0.007	.0001049	.0005367
GFCF						
D1.	-.0242573	.0118712	-2.04	0.066	-.0503856	.001871
Expen						

D1.	.0093705	.0263117	0.36	0.728	.0485412	.0672823
LD.	.0443765	.0192919	2.30	0.042	.0019153	.0868377
Expo						
D1.	-.0261107	.0099929	-2.61	0.024	-.048105	-.0041164
Impo	.0392449	.0098214	4.00	0.002	.0176281	.0608617
D1.						
FDI						
D1.	-.0573474	.0181105	-3.17	0.009	-.0972083	-.0174865
LD.	-.0185477	.0086238	-2.15	0.055	-.0375285	.0004332
_cons	-5.033617	3.433607	-1.47	0.171	-12.59094	2.523701

Source : Author's calculations, STATA 15 software

In the short term (ST), our findings indicate that the interaction between the real effective exchange rate (REER) and lagged Pass-Through in first difference has a significant impact on economic growth. At the 1% significance level, the interaction the interaction positively and significantly affects economic growth. This outcome is consistent with theoretical literature, which suggests a positive relationship between inflation, the real effective exchange rate, and economic growth. This relationship can be explained by the direct effect of inflation on exchange rates. When inflation rises, a country's currency depreciates. Even though the real exchange rate has minimal influence on growth, a depreciation tends to accelerate economic growth. A low real exchange rate enhances competitiveness, promotes the development of exports, alleviates external constraints, and facilitates the import of capital not produced locally, which ultimately spurs economic growth. Conversely, a country with low inflation will experience an appreciation of its currency against other currencies, which will negatively impact economic growth.

Theoretical literature suggests that a decline in the national currency value usually leads to an increase in the prices of imported goods, including final and intermediate goods. Such an increase in prices may result in inflation, also known as imported inflation. Moreover, the cost of production also increases due to the rise in imported input prices, leading to cost-push inflation. These effects may be direct or indirect, depending on their impact on prices and the level of aggregate demand and wages.

Our study examines the pass-through of exchange rate fluctuations, which refers to the extent to which domestic prices change as a result of an exchange rate adjustment. Traditionally,

this concept has been defined as the percentage change in the domestic price of an imported good due to a one percentage point change in the nominal exchange rate between the importing and exporting countries. However, this definition has evolved over time to include other types of prices, particularly consumer prices. The degree and process of transmission are the two significant elements that characterize this phenomenon.

The process of transmission occurs in two stages : first, exchange rate fluctuations affect import prices and subsequently influence consumer prices, given that the consumption basket typically comprises both local and imported products. However, these fluctuations can directly impact consumer prices, particularly domestic prices. This is because a depreciation of the domestic currency results in a rise in the price of imported goods, which, in turn, increases demand for locally produced goods that compete with imported goods due to the price differential. The rise in demand exerts upward pressure on domestic prices and wages, resulting in higher domestic prices and inflation.

The extent of pass-through : The extent to which exchange rate changes are reflected in import prices can be considered complete when the fall in the domestic currency's value is fully reflected in import prices. Incomplete or partial pass-through occurs when only part of the depreciation is transmitted to import prices. The extent of pass-through varies across countries, with developing and emerging countries with open markets experiencing higher pass-through, while developed countries and countries with credible monetary policies experience lower pass-through or coefficients. Moreover, the extent of pass-through depends on the share of imported goods in the consumption basket. In reality, the extent of pass-through is influenced by various factors, such as the GDP growth rate, the real exchange rate, the inflationary context, and the exchange rate regime.

In contrast to prior empirical studies examining the same matter, our findings differ in the level of importance assigned to the coefficient linked with the relationship between RRSP and inflation and its impact on economic growth. The earlier research did not establish a substantial impact on economic growth. This variation can be explained by the incorporation of dissimilar variables in our model, as the prior researchers did not incorporate FDI, exports/imports, government spending, and GFCF in their estimates.

Exports of goods and services have a negative and significant impact on economic growth, while imports have a positive and significant coefficient, indicating that economic growth is reliant on the "export-import" effect. Despite promoting growth through exports and enacting favorable policies that support domestic businesses, the Moroccan government still imports

more than it exports, leading to a financial deficit caused by a decline in domestic demand for the country's goods and services. Overall, governments aim to balance imports and exports to maximize the benefits that both have on their economy.

In the long run (LR), we observe a significant and positive effect of public spending, with a threshold of 10%. Specifically, public spending has a positive impact on economic growth in the long term, as it leads to an increase in economic activity. Economists believe that an increase in government spending can result in higher GDP, which measures the total output of goods and services in an economy. Government spending can have various positive effects on the economy, including the creation of new jobs, promotion of economic growth, and provision of basic necessities to people. Therefore, policymakers should prioritize investing in education, health, and infrastructure to improve the well-being of their citizens.

Exchange rate and inflation do not have a significant impact on long-term economic growth. This is because the Moroccan government controls its exchange rate in a way that benefits the economy. Some countries initially experience slow but steady growth due to low inflation. However, once they gain important export markets, they increase their value to boost their economy's growth rate. This temporarily accelerates growth without affecting the inflation rate. Nevertheless, once growth begins to slow, the depreciation of the local currency undermines export growth and diminishes the potential benefits of growth. Eventually, manipulating the exchange rate does not significantly increase a country's real growth rates in the long run. Therefore, other variables have a limited impact on long-term economic growth.

Conclusion

Through the empirical analysis of the studied variables in Morocco, we were able to measure the impact of exchange rate movements on the consumer price index using the Pass-Through problem. This problem involves evaluating how changes in exchange rates affect domestic prices.

In the short run, our analysis of the Pass-Through problem revealed that economic growth is significantly influenced by a delayed Pass-Through, as evidenced by the significant positive effect on economic growth at the 1% threshold. The negative sign of the relationship between the REER and the interaction of inflation on growth aligns with theoretical literature. However, our findings differ from previous studies that did not identify a significant impact of this interaction on Moroccan economic growth. This difference can be attributed to the inclusion of additional variables such as FDI, imports, exports, government expenditures and GFCF in our model estimation process.

Hence, the impact of exports of goods and services on economic growth is negative and significant while imports have a positive and significant effect. Thus, the "exports-imports" effect is a crucial factor in determining economic growth.

Over longer periods, a significant positive effect of government spending can be observed, reaching 10% significance. This suggests that government spending can boost economic growth in the long run. When governments invest in various sectors such as education, health and infrastructure, they create new jobs, stimulate economic activity and meet the basic needs of citizens. Therefore, policymakers and government officials should prioritize new investments in these sectors to achieve long-term economic growth and promote the well-being of their citizens.

Morocco's long-term economic growth is independent of exchange rates and inflation, as the government manipulates the exchange rate to benefit the economy. In addition, other variables have no significant impact on long-term economic growth.

Bibliographic references

Brooks, C. (2002). İntroductory Econometrics For Finance, Cambridge: Cambridge University Press, 340-341.

Ca'zorzi, M., Hahn, E., & Sánchez, M. (2007). Exchange Rate Pass-Through In Emerging Markets.

Choudhri, E. U., & Hakura, D. S. (2006). Exchange Rate Pass-Through To Domestic Prices: Does The Inflationary Environment Matter?. *Journal Of International Money And Finance*, *25*(4), 614-639.

Devereux, M. (2001). Monetary Policy, Exchange Rate Flexibility, And Exchange Rate Pass-Through. *Revisiting The Case For Flexible Exchange Rates*, 47-82.

Devereux, M., & Yetman, J. (2003). Monetary Policy And Exchange Rate Pass-Through: Theory And Empirics. *Hong Kong Institute For Monetary Research, Working Paper*.

Dollar, D. (1992). Outward-Oriented Developing Economies Really Do Grow More Rapidly: Evidence From 95 Ldcs, 1976-1985. *Economic Development And Cultural Change*, *40*(3), 523-544.

Dornbusch, R. (1987). Exchange Rate Economics: 1986. *The Economic Journal*, *97*(385), 1-18.

Easterly, W. (2005). National Policies And Economic Growth: A Reappraisal. *Handbook Of Economic Growth*, *1*, 1015-1059.

Floating, F. O., Calvo, G. A., & Reinhart, C. M. (2002). Vol. Cxvii May 2002 Issue 2. *Technology*, *379*.

Gagnon, J. E., & Ihrig, J. (2004). Monetary Policy And Exchange Rate Pass-Through. *International Journal Of Finance & Economics*, *9*(4), 315-338.

Glüzmann, P. A., Levy-Yeyati, E., & Sturzenegger, F. (2012). Exchange Rate Undervaluation And Economic Growth: Díaz Alejandro (1965) Revisited. *Economics Letters*, *117*(3), 666-672.

Goldfajn, I., & Valdes, R. O. (1999). The Aftermath Of Appreciations. *The Quarterly Journal Of Economics*, *114*(1), 229-262.

Granger, C. W. (1969). Investigating Causal Relations By Econometric Models And Cross-Spectral Methods. *Econometrica: Journal Of The Econometric Society*, 424-438.

Hamadouche, A. (2017). L'impact De L'inflation Sur La Croissance Economique : Cas Des Pays Du Nord-Africain. Revue Des Réformes Economiques Et Intégration Dans L'économie Mondiale, 12(23), 25-39.

Kandil, M. (2015). On The Pass-Through Of Exchange Rate Fluctuations To The Macroeconomy: Imports In Developing And Advanced Countries. *International Journal Of Finance & Economics*, *20*(1), 28-47.

Kasidi, F., & Mwakanemela, K. (2013). Impact Of Inflation On Economic Growth: A Case Study Of Tanzania. *Asian Journal Of Empirical Research*, *3*(4), 363-380.

Klutse, S. K., Sági, J., & Kiss, G. D. (2022). Exchange Rate Crisis Among Inflation Targeting Countries In Sub-Saharan Africa. *Risks*, *10*(5), 94.

Mario, C., Sebastian, F., & Gabriel, P. (2011). Real Exchange Rate And The Structure Of Exports. Retrieved From Http://Mpra.Ub.Uni-Muenchen.De/37846/1/Mpra_Paper_37846.Pdf

Mbaye, S. (2012). Real Exchange Rate Undervaluation And Growth: Is There A Total Factor Productivity Growth Channel?.

Monfared, S., & Akin, F. (2017). The Relationship Between Exchage Rates And Inflation: The Case Of Iran. *European Journal Of Sustainable Development*, *6*(4).

Nasir, M. A., Huynh, T. L. D., & Vo, X. V. (2020). Exchange Rate Pass-Through & Management Of Inflation Expectations In A Small Open Inflation Targeting Economy. *International Review Of Economics & Finance*, *69*, 178-188.

Nieh, C. C., & Wang, Y. S. (2005). Ardl Approach To The Exchange Rate Overshooting In Taiwan. *Review Of Quantitative Finance And Accounting*, *25*, 55-71.

Olamide, E., Ogujiuba, K., & Maredza, A. (2022). Exchange Rate Volatility, Inflation And Economic Growth In Developing Countries: Panel Data Approach For Sadc. *Economies*, *10*(3), 67.

Özyurt, S. (2016). Has The Exchange Rate Pass Through Recently Declined In The Euro Area?.

Pesaran, M.H. Et Shin, Y. (1998), « An Autoregressive Distributed-Lag Modelling Approach To Cointegration Analysis », Econometrics And Economic Theory In The 20th Century : The Ragnar Frisch Centennial Symposium, Vol.31, Pp. 371-413 (Http://Dx.Doi.Org/10.1017/Ccol0521633230.011)

Pesaran, M.H., And Shin, Y. (1999), 'An Autoregressive Distributed Lag Modelling Approach To Cointegration Analysis', In Strom, S., Ed, Econometrics And Economic Theory In The 20th Century: The Ragnar Frisch Centennial Symposium, Cambridge University Press, Cambridge, Chapter 11.

Pesaran, M.H., Shin, Y., And Smith, R.J. (2001), 'Bounds Testing Approaches To The Analysis Of Level Relationships', Journal Of Applied Econometrics, Vol 16, Pp 289–326.

Rapetti, M. (2020, 27 Octobre). The Real Exchange Rate And Economic Growth : A Survey. Journal Of Globalization And Development, 11(2). Https://Doi.Org/10.1515/Jgd-2019-0024

Taylor, J. B. (2000). Low Inflation, Pass-Through, And The Pricing Power Of Firms. *European Economic Review*, *44*(7), 1389-1408.

Wiener, N., 1956. The Theory Of Prediction. In: Beckenbach, E. (Ed.), Modern Mathematics For Engineers. Mcgraw-Hill, New York

World Bank (2022), World Development Indicators | Databank (Worldbank.Org)