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Study of the asymmetric impact of trade openness on economic growth in Algeria an econometric study using the nonlinear distributed slow-down autoregression methodology NARDL during the period 1980-2023

Cherif mohamed* (1)
Mohamed.cherif@univ-tiaret.dz
Laboratory of developing the Algerian economic institution, (Algeria)

Belhaoues salima (2)
S.belhaoues@cu-elbayadh.dz
Laboratory of sustainable development in the high plateaus and desert regions,

Chachoua abdellah (3)
abdellah.chachoua@univ-tissemsilet.dz
Laboratory of modern economy and sustainable development, (Algeria)

Boussaid mohamed abdelkrim (4)
Mohamedabdelkrim.boussaid@univ-tiaret.dz
Laboratory of developing the Algerian economic institution, ((Algeria)

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Abstract

This research paper aims to try to highlight the impact of trade openness on economic growth in Algeria during the period 1980-2023 through the use of the nonlinear distributed slowdown autoregression methodology (NARDL), where the dependent variable of economic growth was expressed in per capita GDP, while the

* Corresponding author: Belhaoues Salima

independent variables were represented in the rate of trade openness, exports as a percentage of GDP, imports as a percentage of GDP, exchange rate and foreign direct

The study has reached a number of results, most notably that trade openness contributes to improving growth rates in addition to the similarity of positive and negative shocks to the index of trade openness to economic growth in the long and short term, so this study supports the hypothesis that trade openness contributes to achieving economic growth

- ✓ **Keywords:** Economic growth. Trade openness. NARDL. Algeria
- ✓ **JEL Classification**: O11. F11. F43

1. INTRODUCTION

The global economy is witnessing rapid developments and important transformations in the current era, where the position and power of countries are determined by their economic performance. In this context, economic growth plays a vital role in achieving development and prosperity. Algeria is one of the countries striving to achieve sustainable economic growth and diversify its economic base.

Economic growth is one of the basic concepts in economics, and it refers to the increase in the total production and income of an economy over a specified period of time. Economic growth can be achieved by increasing productivity, investment, innovation and providing an enabling economic environment. This results in improving the standard of living, increasing employment opportunities and advancing the state in the economic and social fields.

Trade openness is one of the economic policies aimed at encouraging trade exchange and the flow of goods, services and capital between countries. Trade openness involves removing trade barriers such as tariffs and trade restrictions to facilitate international trade. Trade openness can be bidirectional, with exports and imports encouraged both through free trade agreements and bloc organizations.

Algeria faces significant challenges in achieving sustainable economic growth and diversifying its economic base. Despite possessing rich natural resources such as oil and natural gas, Algeria's economy is still heavily dependent on the oil sector. Therefore, trade openness is a necessary step to achieve sustainable development and diversify sources of income. By boosting exports and increasing FDI opportunities, Algeria can boost its economy and achieve sustainable growth in the long term.

Problem focus

Through the above, the features of the problem of the study emerged as follows:

What is the impact of trade openness on Algeria's economic growth?

In an attempt to answer the problematic possibility, we have proposed three hypotheses, which we will test their validity and validity on the ground:

- There is a long-term equilibrium relationship between the study variables;
- There is an asymmetric impact of trade openness on Algeria's economic growth in the short and long term;
- The significant impact of trade openness on Algeria's economic growth in the short and long term;

The importance of this study stems from Algeria's need to achieve sustainable economic growth and diversify sources of income. By understanding the impact of trade openness on economic growth, government policies can direct their efforts and take appropriate decisions to promote trade openness and economic development. In addition, the study can contribute to enriching the scientific literature on the Algerian economy and provide results that are politically and economically viable.

This study aims to analyze the asymmetric impact of trade openness on economic growth in Algeria. The relationship between trade openness indicators such as the volume of exports and imports and trade openness and their impact on key economic variables such as GDP will be studied. The study will rely on Algeria's official economic and trade data and will use quantitative economic tools to analyze data and assess the relationship between variables.

Many researchers and those interested are looking forward to understanding the relationship between trade openness and economic growth in Algeria. This research is an attempt to analyze the impact of trade openness on economic growth and to provide viable results and benefit in formulating economic policies to achieve sustainable development in Algeria. The study will rely on economic data and quantitative data analysis tools to reach reliable and informed conclusions.

In order to cover of all aspects of our research, answer the problem of research and test the validity of the hypotheses, we divided our study into three axes, where we will first review the relationship between trade openness and economic growth in the theoretical literature, and in the second step we will try to review this relationship in the applied literature, and finally we will build a standard model that allows us to explain the relationship between the variables of the study in Algeria.

2. LITERATURE REVIEW

Although the theoretical links between trade and economic growth have been debated for more than two centuries, their real implications are still debated. The first wave of arguments in favor of trade can be traced back to the classical school of economic thought that began with Adam Smith, and was later enriched by the works of Ricciardo, James Mill and John Stuart Mill in the early part of the nineteenth century. Since then, the justification for free trade has been widely debated. The various indisputable benefits that international specialization brings to the productivity of nations are well documented in the economic literature. In the past decade, however, there has been a sudden and impressive resumption of activity in the economic growth literature sparked by internal growth theory, leading to a large-scale inventory of models emphasizing the importance of trade in achieving a sustainable rate of economic growth. These models focused on various variables, such as the degree of openness, the real exchange rate, tariffs, terms of trade, and export performance, to verify the hypothesis that open economies grow faster than closed economies. Although most models emphasized the link between trade and growth, they noted that trade was only one of the variables in the growth equation. Advocates of the system, however, have argued that trade is in fact the main driver of growth in Southeast Asia. They argue that Hong Kong (China), Taiwan Province of China, Singapore and the Republic of Korea, the so-called Four Tigers, have succeeded in achieving high and sustainable rates of economic growth since the early sixties of the twentieth century. Because of its free-market and outward-oriented economies.

The earliest theoretical studies on openness and economic growth focused in large part on the premise of export-led growth as the basic measure of trade openness and a viable means of raising economic growth rates by the early eighties, the export-led orientation and export promotion had already ensured a broad consensus among researchers and policymakers, so much so that they had become A "**conventional wisdom"** among most economists in the developing world. This remains the case in some international organizations, the international banking community, multilateral lenders such as the World Bank and the International Monetary Fund, and among key policymakers. Advocates of an export-free trade strategy point out that most developing countries that have pursued inward-oriented policies under the import substitution strategy, mostly in Latin America, have made weak economic achievements. Some of them showed on average a complete lack of growth, and these facts were partly responsible for the great change that occurred in the trade literature in the eighties. Edwards S. (1992) argues that exports stimulate economic growth by generating positive externalities on non-commercial sectors through the application of more efficient production techniques and management methods. Where the traditional economic development literature considers exports to be a mechanism that encourages

economic growth, especially since We looked at the successful growth experiences such as South Korea, Singapore, Hong Kong and Taiwan, which were based mainly on encouraging exports and liberalizing foreign trade in the sixties of the last century.

With the emergence of theories of internal growth in the early nineties, attention shifted to imports rather than exports as a mechanism for achieving economic growth, for example, we find a study (Rivera-Batiz & Romer, 1991) and (Grossman & Helpman, 1991), which focused on the role that trade plays as a conduit for the transfer of imports of knowledge globally, as it enables local producers to obtain a wide range of capital goods that expand production efficiency. The circulation of advanced economies is also intense. R&D of goods with developing countries will provide them with greater potential to catch up and Madsen (2009) suggests that R&D intensity exerts sustained effects on economic growth, which is consistent with the Schumpeterian theory of growth.

The role of trade in achieving and disseminating technical progress has also received great attention in theoretical studies on the subject, with Grossman & Helpman (1991) arguing that these more open systems allow small economies to absorb technology in developed countries at a rapid pace, enabling them to achieve high growth rates. It is clear that foreign leasing encourages the circulation of technology from north to south, as Coe & Helpman, 1995) that if the policy of trade liberalization is implemented in developing countries, this will give them an opportunity for rapid diffusion of technology, enabling them to imitate new technology rather than innovate it. The authors also provide strong evidence that the diffusion effect of R&D activities reduces the size of the North-South technology gap.

Another topic that interests us when analyzing the relationship between trade openness and economic growth is learning through trading, which is likely to materialize when the economy faces international competition, while a study (Frankel & Romer, 1999) suggests that trade can raise income levels by stimulating the accumulation of human and physical capital and increasing production.

It is not easy to show the links between trade openness and economic growth, as it is certain that this field is rich in the literature of economic thought, in addition to various models and theories of trade, a number of empirical and statistical studies have been carried out to try to reject or support the cause of free trade. We find that there is a current of studies that proved that increasing the openness of the economy to international trade would achieve high rates of income and economic growth, while the other current rejected these results because of the overestimation of the effects of foreign trade or that they are not measured correctly.

3. APPLIED LITERATURE

In previous studies, the relationship between trade openness and economic growth has been explored, and there are two different views on how trade openness affects economic growth.

There are studies that have found that there is a positive impact of trade openness on economic growth. According to these studies, trade openness enhances countries' opportunities to participate in global trade, contributes to increased foreign direct investment, technology transfer and improved productivity. These studies suggest that trade openness can boost innovation and competitiveness and create new jobs, ultimately leading to stronger and sustainable economic growth. On the other hand, there are other studies that question the direct positive impact of trade openness on economic growth. These studies suggest that the potential impacts of trade liberalization may be complex and depend on the economic and political conditions of the countries involved. These studies argue that trade openness may increase competitive pressures on uncompetitive domestic industries and thus have a negative impact on economic growth and jobs.

Studies vary in the methodologies used, the data analyzed, and the economic contexts studied. This divergence has caused different outcomes and divergent trends about the impact of trade liberalization on economic growth.

Through this part of the research, we will try to present and explain a set of studies in chronological order, as follows:

3.1 Studies that have demonstrated the existence of trade openness to economic growth

Foreign trade liberalization and its impact on economic growth is an important and debated topic in the world economic literature. There are a number of foreign studies that have indicated a positive impact of foreign trade liberalization on economic growth. I will review some notable studies in this regard:

- **(Michaely, 1977)**

In this research paper, the researcher focused on studying the relationship between trade liberalization represented in exports and economic growth represented in the growth of per capita income, where he limited his experience using a cross section on a sample consisting of 41 developing countries during the period from 1950 to 1973, and using the growth of per capita income as an indicator in which economic growth and growth in the share of exports as an indicator expressing trade liberalization and using the rank correlation methodology of Spearman. To verify whether export growth

rates are really related to GDP growth rates, where the coefficient recorded a positive and significant value estimated at (0.308) for all sample countries, and another high value was recorded for a sample consisting of 23 middle-income countries estimated at (0.523).

In the results of the study, **Michaely** found a strong and positive relationship between the growth rate of exports, the growth rate of per capita income, and the growth rate of national product as a whole. The correlation was weak only in 18 countries of the sample, which are considered relatively poor, while the rest of the sample's 23 countries were strong and positive. Thus, the researcher concluded that economic growth is affected by exports when these countries have achieved minimal development. The study supports the hypothesis that exports drive economic growth. But it should be noted that this study ignores the internal factors of countries that affect economic growth such as government policies and the international economic situation as the researcher also ignored the effects of unequal trade and the role played by the global market in determining the prices of products and the distribution of wealth as the study is based on specific and inaccurate time data to reach correct results, which means that the study does not fully reflect the effects of export on economic growth in World.

- **(Balassa B., 1978)**

Bella Balassa has conducted more than one study in his field of research on the relationship between economic growth and the country's exports, and the first **Balassa** study in 1978-1981 examined the relationship between economic growth and exports, taking into account the extent to which employment growth rates affect domestic investments on GDP in addition to the growth rate Local investments in a sample estimated at 11 countries with a solid industrial base during two time periods:

The first period from 1960 to 1966 and the second period from 1967 to 1973 using GDP growth as an indicator expressing economic growth and real export growth as an indicator to express trade liberalization in addition to a number of other variables such as net exports, increase in export versus output growth, average ratio of export growth to production versus output growth, and using correlation in ranks and production function in addition to the least squares method.

The results of the study showed the great effectiveness of export growth on the growth of national savings, which positively affects economic growth rates, and the reason, according to **Bella Balassa**, is that the export promotion policy would lead to the efficient allocation of resources according to comparative advantages, allow the introduction of technical progress and development to face increasing foreign competition and enable to take advantage of the advantages of large scale. However, it should be noted that this study was not based on data It did not take into account the

general changes that occur in the global economy and government policies over the years, but despite some weak points in the study, it is still considered an important reference in understanding the relationship between export and economic growth.

- **(Dollar, 1992)**

Using a sample of 95 developing countries in the period from 1976 to 1985, the study dealt with the sources of growth in these countries using GDP per capita growth to express economic growth. Then they conducted a reduction of the economic growth rate on the two indicators in addition to the investment ratio, where he built the openness index on the weighted average of distortions and variations of the exchange rate in addition to other indicators such as the investment rate, the variation of the real exchange rate, the real exchange rate distortion index, and the application of section regressions, the least squares method and sensitivity test.

The results of this study pointed to the fact that there is a positive relationship between GDP growth and indicators of outward orientation, and this study provided strong results about the relationship between trade openness and economic growth in the long term, although in the short term it may show us the costs of low job opportunities and real wages for unskilled labor, but this does not prevent us from benefiting from the gains of trade in the long term, which are able to offset the costs of the long term. Al-Qusayr by adopting appropriate policies aimed at confronting this imbalance.

- **(Edwards S., 1998)**

It is a study in which the researcher wondered whether the indicators applied to express openness actually reflect the impact of trade policies applied to productivity growth or they reflect the potential effects of changes omitted from the model and for this he used Pannell data for 93 developing and developed countries during the period 1960-1990 and included the productivity growth index to express economic growth and 9 indicators of trade policy such as the Sachs & Warner index World Bank index 1987 and index Leamer 1988 and the average black market premium and other indicators such as per capita real income primary and human and primary capital The researcher also added the equity index used in the study of both Johanson and Sheehy 1995, which reflects the role of institutions in economic growth as it helps to reduce transactions and allows individuals to give a large time to production The index takes values from 1 to 5 reflect the scores The highest and weak protection in addition to a variable of political instability represented by the average number of politically motivated attacks during the 1980s period in addition to the inflation index, which expresses political instability using the weighted least squares method and tools for estimation.

The results of his study showed a positive and significant relationship between trade openness and productivity growth, as he noted that when introducing the new variables, the original variables were not affected in the model, and the model remained conservative on the positive relationship between productivity and economic openness, and inflation did not have any impact on the growth of total productivity, but the results of his study confirmed the important role played by property rights in explaining economic growth. Edwards S., 1992)

- **(Mishaelight & Hlalefang, 2018)**

This study aimed to analyze the impact of foreign trade on economic growth in Switzerland and the Arab Republic of Egypt using annual data for the period from 1990 to 2014, using the ARDL model. Economic growth was expressed at the GDP growth rate, while trade openness was expressed in total exports and imports. Economic growth as theoretical analyses suggested that these two factors are positively correlated in the sense that foreign direct investment affects employment by creating jobs and providing companies with the necessary funds to expand, which promotes economic growth.

Tests revealed a long-term and positive correlation between economic growth, trade openness, employment and foreign direct investment in Switzerland the results of the study also showed a positive impact of foreign direct investment on economic growth in the Arab Republic of Egypt, while a negative and insignificant impact of employment on economic growth in Egypt was recorded in the short term. The results also showed a positive and important relationship between economic growth and trade openness, increasing the latter by 1% leads to an increase in economic growth by 1.86% Thus, this study proved that trade openness promotes economic growth, and the study also recommended that the government and policy makers pursue policies that will promote trade openness in Switzerland through bilateral trade agreements that are favorable and ensure an environment that promotes international trade and technology transfer.

3.2 Studies that denied the impact of trade openness on economic growth

Despite the existence of a large number of studies that proved the positive impact of trade openness on economic growth, there is another stream of studies that proved the existence of a negative or somewhat weak impact of foreign trade liberalization on economic growth. In the following, we will mention the most important influential studies in the field

- **(Sachs J., 1987)**

It is a research paper submitted by Sachs in 1987, in which he raised strong doubts about whether trade liberalization is really necessary as a successful strategy to go

abroad, through a comparison between a group of Southeast Asian countries and a group of American countries, where he noted the broad role of government in the countries of the first group compared to the countries of the American continent, looking at the experience of Southeast Asian countries, the researcher confirmed in this research paper that the success achieved by these countries does not It is only due to the openness of its economies to international trade, but it was linked to interventionist government policies, which were very decisive and contributed strongly to their development path through the application of various policies and mechanisms such as preventing full import liberalization and encouraging exports.

- **(Walde and Wood, 2004)**

This study aimed to find evidence about whether the state of liberation from the perspective of competence is based on a strong basis, the researchers worked in their article to classify previous experimental studies on the basis of the methodologies used in the study: current rates, country growth regressions, Granger causality test, Panel models, instrumental variables and studies at the micro level.

The researchers found that the causality tests between exports and growth are largely ambiguous, as for the national growth declines (Walde and Wood, 2004) found that the studies suffer from a lack of explanatory power, but with regard to the rest of the methodologies, the problems of durability appear in addition to the lack of inclusion of studies of political variables as important factors that can seriously delegate the explanatory power of these roles. According to the authors, the previous literature has overlooked the links between economic growth and trade policies and it is not clear to them whether economic growth leads to further trade liberalization or whether trade liberalization leads to more economic growth. , 2004, p. 277). This would pose a major problem for countries because they determine the options of developing countries either to invest in human and physical capital and focus on R&D activities or to outsource, such as learning through trading (Walde & Wood, 2004, p. 276).

- **(Freund & Bolaky, 2006)**

The researchers study aims to study the impact of trade on growth The researchers used the cross section and levels of regression, which aims to capture the impact of openness on growth in the long term, then the researchers study the impact of trade growth on income growth using regressions that reflect variables in the medium term on a sample of 112 countries Where economic growth was expressed in real logarithm and average per capita income based on purchasing power parity while openness was expressed using nominal trade to GDP and some other independent changes such as the organization index and the imaginary variable of the composition index, population

density, distance from the equator and the rule of law and using the least squares method and IV,2SIV.

The results of the study concluded that there is a simple and positive correlation between income and openness, while no positive effect of trade on growth was found in more organized economies (openness hinders growth in more organized countries), meaning that the impact of openness is positive only if the levels of regulation are less than 3.9, meaning that there is no significant effect of openness on growth in cross-section declines. The relationship is collapsing in more organized economies as the researchers concluded through the results of the cross-sectional analysis that the impact of trade on long-term growth is often absent at best and negative at worst in highly regulated countries. According to them, for trade to be viable to boost growth, the regulatory environment in highly regulated countries must be improved. For their part, they pointed out that trade liberalization alone is not enough to strongly stimulate economic growth, but must be accompanied by other policies such as promoting investments in physical and human capital, improving the quality of institutions, fighting bribery, and maintaining a fixed exchange rate.

- **(Maache & Benlarbi, 2022)**

This study sought to search for the relationship between openness to foreign trade and economic growth in Algeria during the period 1985 to 2015 using the co-integration model of automatic regression for the distribution of time gaps ARDL, using the GDP per capita index to express the dependent variable (economic growth) and the independent variable (trade liberalization) was expressed in the openness index as a percentage of GDP in addition to some Other variables such as the inflation index, the percentage of government expenditure as a percentage of GDP.

At the end of this study, the researchers concluded a number of important results, most notably the absence of any relationship in the short and long term between trade openness and economic growth rates, which is mainly due to the inflexibility of the productive sector and exports, which represent more than 95% of petroleum products and the high volume of imports, which negatively affected the Algerian trade balance and growth rates during the study period. Causal relationship from trade openness to economic growth and vice versa.

4. EXPERIMENTAL

In this theme, we will study the nature of the relationship between trade openness and economic growth in Algeria during the period between **1980-2023** using the nardl model

- **Data and methodology:**

The variables of the study were selected based on previous studies and analysis of economic theories that dealt with the subject of our research and in order to study the impact of trade openness on economic growth in Algeria was expressed by the following variables: (world bank data, 2024)

- **GDP (GDP):** GDP per capita is the quotient of GDP divided by the population in the middle of the year. GDP is the sum of the total value added by all producers residing in the economy plus any product taxes and less any subsidies not included in the value of the products. It is calculated without deducting the depreciation of manufactured assets or making any liabilities due to resource depletion and degradation. Natural. Data in constant US dollars.
- **Exports of goods and services (% of GDP) "EX":** Exports of goods and services represent the value of all other goods and market services provided to the rest of the world. These include the value of goods, shipping, insurance, transportation, travel, franchising, license fees, and other services such as telecommunications, construction, financial services, informatics, business and personal and government services. It does not include compensation employees, investment income (formerly called factor services) and transfer payments;
- **Imports of goods and services (% of GDP) "IM ":** Imports of goods and services represent the value of all other goods and market services from the rest of the world. They include the value of goods, shipping, insurance, transportation, travel, franchises, license fees, and other services such as telecommunications, Construction, financial services, informatics, business, personal and government services. It does not include employee compensation, investment income (formerly called factor services) and transfer payments;
- **Real Effective Exchange Rate** (**ERR):** The real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against the weighted average of a number of foreign currencies) divided by a price deflator or cost index."
- ***Trade openness OP:*** It is calculated through the following relationship**:**

Exports + Imports / GDP

Where the impact of trade openness will be divided into the impact of positive and negative shocks.
Constant prices of the US dollar were used in 2010.

- **Foreign direct Investment (FDI):** Foreign direct investment (FDI) is the net investment inflows to acquire a permanent share in management (10 per cent or more of voting rights) in an enterprise operating in an economy other than the investor's economy. It is the sum of equity capital, reinvested proceeds and other Long-term capital and short-term capital, as shown in the balance of payments. This series illustrates net gross i.e. net FDI in the reporting economy minus net FDI by the reporting economy to the rest of the world. Data are expressed in current US dollars.

The study model will be estimated according to the mathematical relationship:
GDP = f (op^+,op^- inv; Im, Ex, Err)

Methodology of the nonlinear model of self-regression with slow distributions (NARDL)):

The NARDL model of cointegration appeared in 2013 by **(**Yongcheol; **2013),** which differs from the **ARDL** model by taking into account the asymmetric effect caused by the independent variable in the case of increase or decrease on the dependent variable, as it is an expansion or generalization of the linear estimate of the autoregressive method with time gaps. **ARDL** (Youngcheol, byungchul, & matthew, 2013, p. 77) and then developed by Pesaran et all (2001) and more recently by (**Shin and all 2004** *)* The model allows the study of asymmetry in the short and long-term relationship between variables in addition to being a powerful tool for testing the cointegration of a set of time series variables in one equation, unlike other cointegration models where the order of the time series is the same as well**.**
Mathematical formula for *the NARDL* model (salima & hakim, 2024, p. 95):

The independent variable is divided between negative and positive values. Based on this division, the introduction of both variables into the **ARDL** model will produce the **NARDL** model according to the following formula:

$$\Delta\gamma_t = \mu - p\gamma_t + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{j=1}^{p-1} a_j \Delta_{\gamma-j} + \sum_{j=0}^{q-1} (\pi_j^+ \Delta x_{t-j}^+ + \pi_j^- \Delta x_{t-j}^-) + \varepsilon_t$$

where $\boldsymbol{\theta^-\theta^+}$ represents the long-term information of the analog relationship in the model, $\boldsymbol{\pi_j^-\pi_j^+}$ Represents asymmetric estimators in the short term. The diagnostic tests

of the NARDL model are similar to the **ARDL** model, as the cointegration is tested according to the null hypothesis. $(\boldsymbol{\mu = \rho = \theta^{+} = \theta^{-} = 0})$ As well as testing the normal distribution of the error limit and the stability of the model in addition to tests for variance variation and independence of error limit.

The **NARDL** method features an additional test, the long-term Symmetry test, where the null hypothesis H_0 is tested using the Test Wald test against the alternative hypothesis which states asymmetry Symmetry The null hypothesis for this test is given in the following form:

$$H_0: \left(\beta^{-} = -\frac{\theta^{-}}{\rho}\right) = \left(\beta^{+} = -\frac{\theta^{+}}{\rho}\right)$$

This test can also be used to find the symmetry test for parameters in the short term according to the following null hypothesis

$$H_0: \sum_{j=0}^{q-1} \pi_j^{+} = \sum_{j=0}^{q-1} \pi_j^{-}$$

An important diagnostic test in the **NARDL** model is the Asymmetric Cumulative Dynamic Multiplier Effect test in the dependent variable caused by the change in the positive independent variable $(\boldsymbol{X^{+}})$ and the negative independent variable $(\boldsymbol{X^{-}})$ in one unit. which reflects the effect of short-term shocks on the behavior of the dependent variable, and shows the analog effect of these shocks in the short term.

4.1 Stationarity using statistical tests: We will be able to test stationarity based on the developed Dickie Fuller test, the results of the tests are clear according to the two hypotheses as follows:

H_0: time Serie a module root

H_1: time Serie is devoid of the root of the module

Table No.01: Represents the ADF test

UNIT ROOT TEST RESULTS TABLE (ADF)
Null Hypothesis: the variable has a unit root

	At Level						
		GDP	**Op**	**INV**	**IM**	**EX**	**ERR**
With Constant	**t-Statistic**	-0.5668	-0.1553	-1.3854	-1.2010	-1.9109	-5.9944
	Prob.	***0.8673***	***0.9364***	***0.5806***	***0.6653***	***0.3244***	***0.0000***

		n0	n0	n0	n0	n0	***
With Constant & Trend	**t-Statistic**	-2.5082	-1.2999	-1.2849	-1.8412	-0.5617	-3.3291
	Prob.	***0.3228***	***0.8747***	***0.8784***	***0.6667***	***0.9763***	***0.0773***
		n0	n0	n0	n0	n0	*
Without Constant & Trend	**t-Statistic**	0.4141	-1.8347	-0.9284	-0.1107	0.6458	-5.3882
	Prob.	***0.7983***	***0.0638***	***0.3088***	***0.6397***	***0.8519***	***0.0000***
		n0	*	n0	n0	n0	***
	<u>At First Difference</u>						
		d(GDP)	d(OP)	d(INV)	d(IM)	d(EX)	d(ERR)
With Constant	**t-Statistic**	-2.9004	-5.4716	-6.4141	-3.8554	-5.3003	-4.5363
	Prob.	***0.0540***	***0.0000***	***0.0000***	***0.0050***	***0.0001***	***0.0008***
		*	***	***	***	***	***
With Constant & Trend	**t-Statistic**	-2.8459	-5.4633	-6.3874	-3.8072	-5.8670	-6.8884
	Prob.	***0.1901***	***0.0003***	***0.0000***	***0.0259***	***0.0001***	***0.0000***
		n0	***	***	**	***	***
Without Constant & Trend	**t-Statistic**	-2.6855	-5.1719	-6.4998	-3.8706	-5.2413	-3.5622
	Prob.	***0.0085***	***0.0000***	***0.0000***	***0.0003***	***0.0000***	***0.0008***
		***	***	***	***	***	***

Source: Prepared by researchers based on EVIEWS12 outputs.

The ADF test shows that the GDP, OP inv, im, ex series are unstable at a level, where the p-values of (T) were recorded in them exceeding the level of significance; pro <0.005

Its difference series are stable at the first difference, while the err series is stable at the level. This satisfies the requirement to apply the autoregressive model for slowing time gaps

4.2 Causality study: Causality study based on the Angel-Granger test; the results are clear according to the test of the two hypotheses as follows:

H0: S series $_I$ does not affect growth

H0: Growth does not affect the S I series

where $I=\{oP^{+},oP^{-}, inv , Im; Exe, err\}$

Table No.02: Causality test for Angel Granger

Null Hypothesis:	Obs	F-Statistic	Prob.
DOP does not Granger Cause D GDP	41	2.21303	0.1240
DGDP does not Granger Cause DOP		2.02645	0.1466
DINV does not Granger Cause D GDP	41	1.30497	0.2837
DGDP does not Granger Cause DINV		1.04325	0.3627
DIM does not Granger Cause D GDP	41	1.10497	0.3422
DGDP does not Granger Cause DIM		4.00521	0.0269
DEX does not Granger Cause D GDP	41	8.99907	0.0007
DGDP does not Granger Cause DEX		1.34059	0.2744
DERR does not Granger Cause D GDP	41	0.02654	0.9738
DGDP does not Granger Cause DERR		0.03016	0.9703

Source: Prepared by researchers based on EVIEWS12 outputs.

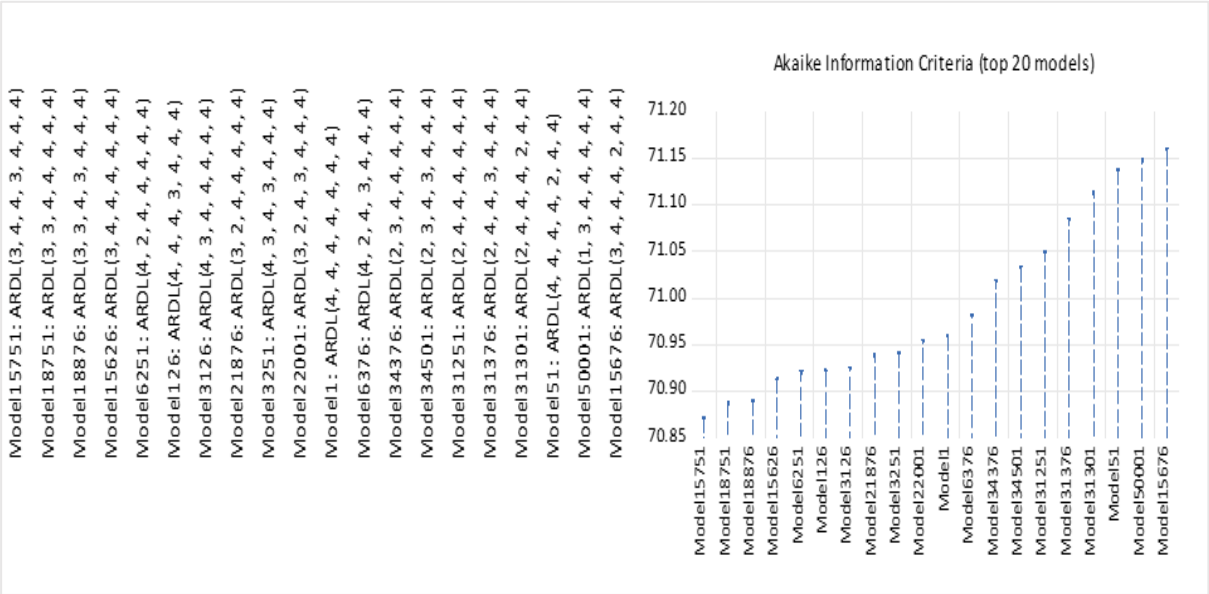
Through Angel Granger's causality test, it is shown that the significant levels are greater than the critical levels at the 95% confidence level, and therefore there is causality between the two variables, which mean there is feedback

4.3 Estimation of the standard model: The estimate of the model (NARDL) to measure the relationship between economic growth and OP, inv; Im; Exe ERR, trade openness, foreign investment, exports, imports, real exchange rate by measuring the asymmetric impact of trade openness on economic growth, it is necessary to identify a number of research stations that are clear as follows:

4.3.1 Estimating the optimal slowdown periods

The test of optimal slowdown intervals we reached the selection of mathematical models and optimal combinations of probabilistic models according to the BIC criterion and the results are as shown in the following figure:

Figure No. (01): representing estimates of optimal slowdown periods



Source: Prepared by researchers based on EVIEWS12 outputs.

According to the AIC Slow Interval Test, the top 20 models were formulated as shown in the figure above, and the best model according to optimal slowdown periods is ARDL (3.4.4.3.4.4.4.4)

4.3.2 Bounds Tests

The condition of joint cointegration is one of the necessary conditions to find the long- and short-term equilibrium relationship, and after meeting the stability condition of the K chains, the Bound test can be performed (salima & hakim, 2024, p. 95), the results of which are evident through the following table:

Table No.03: BOUNDS TEST Results

F-Bounds Test			**Null Hypothesis: No levels relationship**	
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
F-statistic	7.247782	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99
			Finite Sample: n=40	
Actual Sample Size	39			
		10%	2.218	3.314
		5%	2.618	3.863
		1%	3.505	5.121
			Finite Sample: n=35	
		10%	2.254	3.388
		5%	2.685	3.96
		1%	3.713	5.326

Source: Prepared by researchers based on EVIEWS12 outputs.

It is clear from the table that the statistical value (F) is equal to f=7.24, which exceeds the critical values of the upper limit I (1) =3.87 at the level of significance 5%, and therefore we assert the existence of a long-term complementary relationship between the dependent variable and the independent variables, and this requires us to estimate the equilibrium relationship in the short and long term of the NARDL

_model Estimation: After fulfilling the condition of joint integration through the test Bounds, it is intended to measure the long-term relationship and the short-term relationship and it is shown in the table below:

- **Estimation of long-term parameters**: The long-term equilibrium relationship is illustrated by measuring the symmetrical impact of trade openness on economic growth (salima & hakim, 2024, p. 95) as shown in the table below:

Table No.04: represents the coefficients of the long-term relationship

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
OP_POS	-2.56E+14	1.18E+15	-0.216300	0.0052
OP_NEG	2.74E+13	3.49E+14	0.078676	0.0008
INV	-1005453.	2571482.	-0.391002	0.0028
IM	430829.9	208565.6	2.065681	0.0244
EX	1134817.	491185.0	2.310365	0.0102
ERR	2.34E+13	2.95E+13	0.792612	0.0082
C	-4.40E+16	1.86E+16	-2.362184	0.0561

Source: Prepared by researchers based on EVIEWS12 outputs.

It is shown from the table that the probability value of the significant model coefficients is 0.05>(pro_{OP}+=0.0052), 0.05>(pro_{OP}-=0.0008), meaning that the model accepts partial validity, where the coefficient of determination R2=0.9984, meaning that the interpreted variables explain the dependent variable by 99.84%, the statistical probability value is explained by 0.05>(Prob = 0.001), and therefore the model accepts a total validity

- **Estimation of short-term parameters:** The long-term relationship model estimation is back to estimating the equilibrium relationship in the short term (salima & hakim, 2024, p. 95), whose features are illustrated by the following table.

Table No.05: Short-term equilibrium relationship model.

ARDL Error Correction Regression
Dependent Variable: D(GDP)
Selected Model: ARDL(3, 4, 4, 3, 4, 4, 4)
Case 2: Restricted Constant and No Trend
Date: 01/18/24 Time: 01:16
Sample: 1980 2023
Included observations: 39

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP (-1))	0.183884	0.078465	2.343518	0.0576
D(GDP (-2))	0.375309	0.097779	3.838339	0.0086
D(OP_POS)	-5.46E+14	1.50E+14	0.000000	0.0000
D(OP_POS(-1))	9.14E+12	1.60E+14	0.000000	0.0000
D(OP_POS(-2))	5.52E+14	1.52E+14	0.000000	0.0000
D(OP_POS(-3))	1.88E+14	1.08E+14	0.000000	0.0000
D(OP_NEG)	-9.95E+12	9.23E+13	0.000000	0.0000
D(OP_NEG(-1))	-1.21E+13	1.15E+14	0.000000	0.0000
D(OP_NEG(-2))	-8.85E+13	1.20E+14	0.000000	0.0000
D(OP_NEG(-3))	9.61E+14	1.16E+14	0.000000	0.0000
D(INV)	-1714904.	345146.0	-4.968633	0.0025
D(INV(-1))	343058.4	357940.5	0.958423	0.3749
D(INV(-2))	-2655587.	341531.8	-7.775520	0.0002
D(IM)	81702.78	75587.57	1.080902	0.3213
D(IM(-1))	-51733.74	103903.7	-0.497901	0.6363
D(IM(-2))	-474392.2	88864.73	-5.338363	0.0018
D(IM(-3))	-703132.0	95617.71	-7.353575	0.0003
D(EX)	618500.5	74110.73	8.345627	0.0002
D(EX(-1))	-315467.6	103162.7	-3.057962	0.0223
D(EX(-2))	-847955.1	83328.18	-10.17609	0.0001
D(EX(-3))	-871386.6	99011.11	-8.800898	0.0001
D(ERR)	3.73E+13	6.26E+12	0.000000	0.0000
D(ERR(-1))	-3.66E+13	6.72E+12	0.000000	0.0000
D(ERR(-2))	3.25E+13	6.07E+12	0.000000	0.0000
D(ERR(-3))	-5.21E+13	6.17E+12	0.000000	0.0000
CointEq(-1)*	-0.782456	0.069810	-11.20840	0.0000

R-squared	0.979372	Mean dependent var	3.71E+14
Adjusted R-squared	0.939703	S.D. dependent var	1.79E+15
S.E. of regression	4.41E+14	Akaike info criterion	70.51131
Sum squared resid	2.52E+30	Schwarz criterion	71.62035
Log likelihood	-1348.971	Hannan-Quinn criter.	70.90922
Durbin-Watson stat	3.128233		

* p-value incompatible with t-Bounds distribution.

Source: Prepared by researchers based on EVIEWS12 outputs.

It is clear through the ECM model that the error correction coefficient records the negative value ECM = -0.78 and the significant value (Prob ECM=0.0000) > 0.05 That is, there is an equilibrium relationship in the short term, and that the model restores equilibrium after (15) months, and on the other hand, most of the parameters of the model recorded a significant significance at the confidence level (95%)

4.4 Diagnostic tests

4.4.1 Bg residual correlation test: The Breusch–pagan –Godfreu test determined the serial correlation of the model remainders (salima & hakim, 2024, p. 95), and based on the Eviews program, the results are clear from the following table:

Table No.06: BG test for model remainders

Heteroskedasticity Test: Breusch-Pagan-Godfrey **Null hypothesis: Homoskedasticity**			
F-statistic	0.368667	Prob. F(32,6)	0.9696
Obs*R-squared	25.85196	Prob. Chi-Square (32)	0.7701
Scaled explained SS	0.917226	Prob. Chi-Square (32)	1.0000

Source: Prepared by researchers based on EVIEWS12 outputs.

It is clear from the table that the p-value of (OBS*R2) that follows the x2 distribution was 0.05< (pro_{x2}=0.7701) and therefore the model is free of the problem of serial correlation of residuals

4.4.2 Self-regressive variance instability test ARCH: The test results are shown through the following table:

Table No.07: ARCH test for variance instability

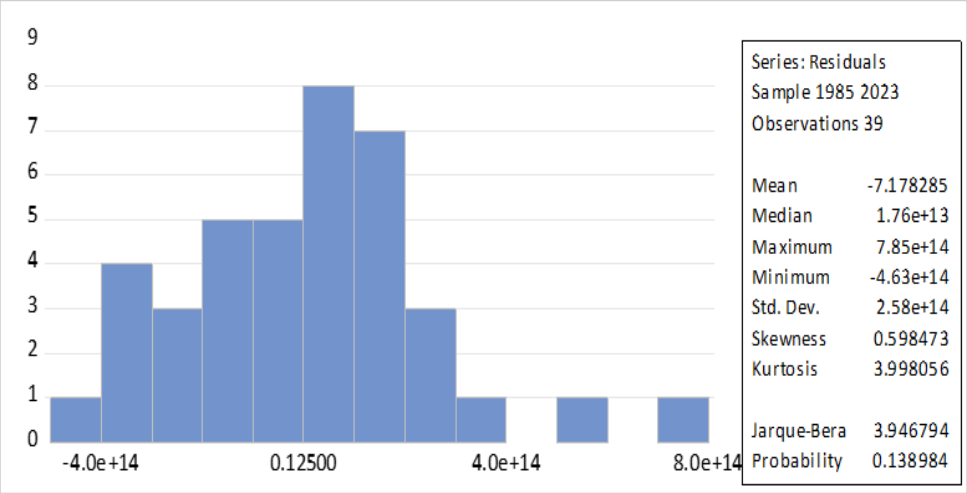
Heteroskedasticity Test: ARCH			
F-statistic	2.381791	Prob. F(1,36)	0.1315
Obs*R-squared	2.358099	Prob. Chi-Square(1)	0.1246

Source: Prepared by researchers based on EVIEWS12 outputs.

it is clear from the table that the p-value is 0.05<(pro_{x2}=0.1246) corresponding to (ob*R2) and therefore requires the acceptance of H0, which states that the model is free of the problem of instability of variance

4.4.3 Normal distribution test JB: Through which the null hypothesis is tested, which states that random errors of the model follow the normal distribution, and the results of the Jarque Bera test are as follows:

Figure No. (02): Test for normal random error distribution



Source: Prepared by researchers based on EVIEWS12 outputs.

The above figure shows that the p-value: 0.05<(pro_{JB}=13.89) Therefore, we accept H0, which states that random errors of the model follow the normal distribution

4.4.4 Testing the appropriateness of determining and designing the estimated model in terms of the RAMSEY function: This test measures the extent of the functional relationship of the model (salima & hakim, 2024, p. 95) and using Eviews 12 The results are clear from the following table:

Table No.08: Test the relationship of a model by RAMSEY

Ramsey RESET Test
Equation: NARDL02
Omitted Variables: Squares of fitted values
Specification: GDP GDP (-1) GDP (-2) GDP (-3) OP_POS OP_POS(-1) OP_POS(-2) OP_POS(-3) OP_POS(-4) OP_NEG OP_NEG(-1) OP_NEG(-2) OP_NEG(-3) OP_NEG(-4) INV INV(-1) INV(-2) INV(-3) IM IM(-1) IM(-2) IM(-3) IM(-4) EX EX(-1) EX(-2) EX(-3) EX(-4) ERR ERR(-1) ERR(-2) ERR(-3) ERR(-4) C

	Value	Df	Probability
t-statistic	0.063886	5	0.9515
F-statistic	0.004081	(1, 5)	0.9515
Likelihood ratio	0.031822	1	0.8584

Source: Prepared by researchers based on EVIEWS12 outputs.

The table shows that the p-value of Fisher is 0.05<(pro(f) = 0.95) and therefore we accept the null hypothesis H0, i.e. the functional form of the model is acceptable

4.5 Long-term and short-term symmetry test: The symmetry of equilibrium coefficients in both the long and short term, the derogatory form of the study model takes the following formula:

D(GDP) = C(1) + C(2)* GDP (-1) + C(3)*OP_POS(-1) + C(4)*OP_NEG(-1) + C(5)*INV(-1) + C(6)*IM(-1) + C(7)*EX(-1) + C(8)*ERR(-1) + C(9)*D(GDP (-1)) + C(10)*D(GDP (-2)) + C(11)*D(OP_POS) + C(12)*D(OP_POS(-1)) + C(13)*D(OP_POS(-2)) + C(14)*D(OP_POS(-3)) + C(15)*D(OP_NEG) + C(16)*D(OP_NEG(-1)) + C(17)*D(OP_NEG(-2)) + C(18)*D(OP_NEG(-3)) + C(19)*D(INV) + C(20)*D(INV(-1)) + C(21)*D(INV(-2)) + C(22)*D(IM) + C(23)*D(IM(-1)) + C(24)*D(IM(-2)) + C(25)*D(IM(-3)) + C(26)*D(EX) + C(27)*D(EX(-1)) + C(28)*D(EX(-2)) + C(29)*D(EX(-3)) + C(30)*D(ERR) + C(31)*D(ERR(-1)) + C(32)*D(ERR(-2)) + C(33)*D(ERR(-3))

From it, we can derive the coefficients of the short and long term as follows according to the following two hypotheses:

Short-term null hypothesis c7+c8+c9+c10=c11+c12+c13

Long-term null hypothesis = (-c4)⁄c_2 : (-c)⁄c_2

Therefore, the symmetry test can be studied as follows:

4.6 Long-term symmetry test, which is illustrated by the following table

Table No. (09): Wald test for long-term effect symmetry

Wald Test:

Equation: NARDL

Test Statistic	Value	Df	Probability
t-statistic	0.496369	6	0.6373
F-statistic	0.246382	(1, 6)	0.6373
Chi-square	0.246382	1	0.6196

Null Hypothesis: C(3)/C(2)=C(4)/C(2)

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)/C(2) - C(4)/C(2)	2.85E+15	5.75E+15

Delta method computed using analytic derivatives.

Source: Prepared by researchers based on EVIEWS12 outputs.

The table shows that the p-values are greater than the level of significance, i.e. (pro_t=0.6373)>0.05, (pro_f=0.06373)>0.05, 0.05<(pro_{x2}=0.6196), and therefore there is symmetry effect in the long term

4.7 Short-term symmetry test The results of the short-term effect are subject to hypothesis testing C(11)+C(12)+C(13)+C(14)=C(15)+C(16) +C(17)+C(18) and the results are clear from the following table:

Table No.10: WALD test for short-term effect symmetry

Wald Test:
Equation: NARDL

Test Statistic	Value	Df	Probability
t-statistic	0.041612	6	0.9682
F-statistic	0.001732	(1, 6)	0.9682
Chi-square	0.001732	1	0.9668

Null Hypothesis: C(11)+C(12)+C(13)+C(14)=C(15)+C(16) +C(17)+C(18)
Null Hypothesis Summary:

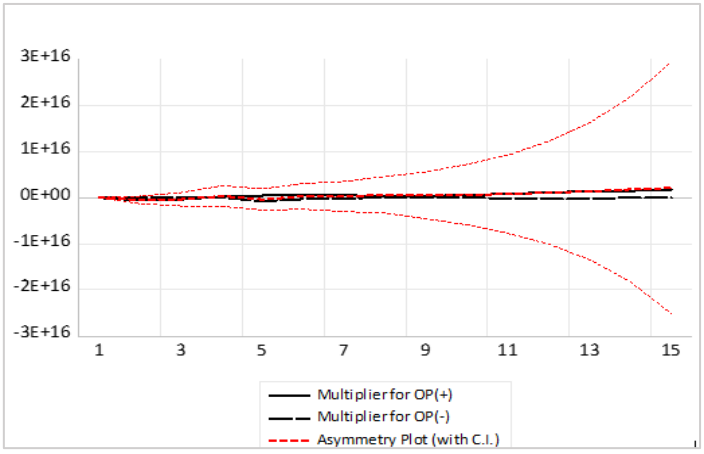
Normalized Restriction (= 0)	Value	Std. Err.
C(11) + C(12) + C(13) + C(14) - C(15) - C(16) - C(17) - C(18)	1.21E+13	2.91E+14

Source: Prepared by researchers based on EVIEWS12 outputs.

The outputs show that (pro_t=0.9682)>0.05, (pro_f=0.9682)>0.05, (pro_{x2}=9668)>0.05, and therefore accept the hypothesis of the similarity of the effect of the short-term parameters.

4.8 Asymmetric dynamic cumulative effect multiplier test: It represents the asymmetric effects of positive and negative shocks of the independent variable on the dependent variable and allows us to track the effects of asymmetric modification in the dependent variable after both positive and negative changes that occur in the independent variable and allows us to know when the effects are identical and when they are asymmetric and the test results are illustrated by the following figure:

Figure No. (03): Dynamic cumulative Effect multiplier test.

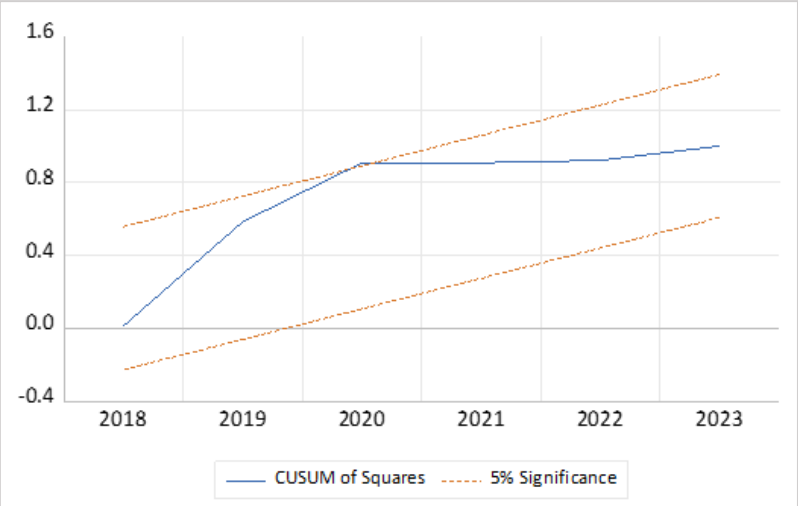


Source: Prepared by researchers based on EVIEWS12 outputs.

The figure shows that there is a cumulative and dynamic effect in the dependent variable resulting from a single shock in the independent variable OP-, OP+.

4.9 Structural stability test: CusumSq-Cusum: The stability results are shown by the following figure:

Figure No. (04): Cusumq-Cusum structural stability test

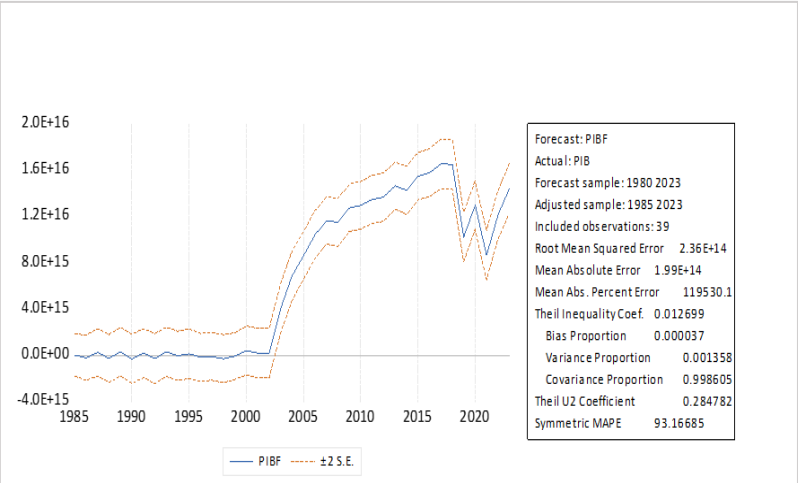


Source: Prepared by researchers based on EVIEWS12 outputs.

The figure shows that the CUSUM statistic is within the critical limits at the 95% confidence level, i.e. there is consistency and stability of the model between the results of the two terms.

4.10 Predictive performance test of the model: Based on the results of Eviews 12 we obtain the following results.

Figure No. (05): Predictive performance of the NARDL model.



Source: Prepared by researchers based on EVIEWS12 outputs.

The figure above shows that the coefficients of Theil Inequality Coef, Bias Proportion, Variance Proportion, are close to the curl, while the Covariance Proportion statistic is close to the correct one, which indicates that the model has predictive ability.

5. RESULTS AND DISCUSSION

The applied study resulted in a number of results:

- The existence of a long-term equilibrium relationship between trade openness OP and economic growth GDP, where the value of Fisher recorded a significant significance of (Sig5% = 7.24), which indicates that trade openness contributes to improving economic growth rates, which is consistent with the theoretical literature on the relationship between the two variables.
- The growth rate responds to trade openness in the short term, which indicates the sensitivity of the national economy to openness to international markets, as the error correction coefficient (ECM) recorded a negative significant value at the confidence level (95%), which indicates that the model regains equilibrium after 15 months.
- Similarity to positive and negative shocks to the trade openness index on long- and short-term economic growth.
- Growth responds directly to negative shocks of trade openness and is delayed in three years retrospectively, while it responds inversely to positive shocks and is delayed by three years in the short term.
- Positive shocks to trade openness to the international market positively affect growth, while negative shocks adversely affect the development of long-term growth indicators.

6.CONCLUSION:

In conclusion, we can say that trade openness plays a crucial role in promoting economic growth. By increasing the volume of international trade and sharing resources and knowledge, the national economy can benefit from increased productivity, market expansion and improved technology. Trade openness promotes sustainable development and contributes to job creation and improved standard of living. By strengthening international cooperation and strengthening economic ties, trade openness can contribute to global economic prosperity and stability. Through our applied study, we can answer the problem of the study and say that trade openness positively affects economic growth in Algeria.

Based on previous research and studies, and in light of the impact of trade openness on economic growth in Algeria, a number of

recommendations can be made aimed at activating the role of trade openness in achieving economic growth in Algeria. Here are some of the suggested recommendations:

- Administrative procedures should be simplified and costs and barriers to business in Algeria should be reduced. This requires improving infrastructure and providing efficient logistics services, as well as developing a robust IP protection system, enhancing transparency and combating corruption.
- Efforts should be moved towards diversifying the Algerian economy and achieving a shift from heavy dependence on the oil sector to other sectors.
- Economic diversification should be encouraged by supporting manufacturing, agriculture, tourism, technology, financial services and e-commerce.
- Efforts should focus on enhancing the competitiveness of Algerian companies and promoting exports. This can be achieved by providing support and financing to SMEs, providing information and export training, and expanding foreign trade networks through participation in international exhibitions and conferences.
- Investment in R&D and technology transfer should be promoted to enhance competitiveness, improve quality and innovation in Algerian products. This can be achieved by fostering public-private collaboration, encouraging investment in technology projects, and providing space for startups and innovative companies.
- Invest in education and training to develop the skills and competencies needed to develop Algeria's workforce. This can be achieved through the development of high-quality educational and training programs aimed at developing business, managerial and technical skills.
- Partnerships with other countries and international organizations should be strengthened to promote trade and investment in Algeria. This can be achieved by strengthening bilateral and multilateral cooperation, exchanging experiences and encouraging foreign direct investment.

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