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The Impact of Exports on Kaldor Square Components: An Econometric Study of the Iraqi Economy Using the ARDL Model for the Period (2004-2023)

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Abstract **Original Research Article**

This study aims to analyze the standard impact of exports on the components of the Kaldor Square in the Iraqi economy during the period (2004-2023), using the ARDL model, which is one of the models suitable for dealing with time series data with different levels of integration. This research examines the relationship between exports and industrial output, industrial employment, and industrial productivity, with the aim of determining the effectiveness of exports in stimulating real economic growth in Iraq. Initial results showed the existence of varying correlations in the long run between exports and the components of the Kaldor Square, which reflects the rentier nature of the Iraqi economy and the dominance of the oil sector over the economic structure. The study reached a set of recommendations, the most important of which is the need to diversify the export base and stimulate non-oil industrial exports as a real lever for sustainable growth and improving overall economic performance.

Keywords: Exports, Industrial Output, Industrial Employment, Industrial Productivity, ARDL Model.

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INTRODUCTION:

This research examines the relationship between exports and the components of the Kaldor square in the Iraqi economy, a rentier economy heavily dependent on oil revenues. The study aims to analyze the impact of exports on each of the Kaldor square components using modern econometric tools, focusing on the ARDL model to test relationships in the short and long term. Sustainable economic growth is a fundamental goal sought by all countries, as it is one of the important pillars of achieving economic stability, as Nicholas Kaldor pointed out through his famous laws that clarify the interrelationship between these components and exports. This quadrant, known as the Kaldor square, serves as an analytical framework for understanding the dynamics of economic growth in the Iraqi context. A clear economic peculiarity emerges, represented by the heavy reliance on oil exports, compared to the weak contribution of non-oil sectors, particularly industrial ones, to the gross domestic product. Hence, the importance of this study in shedding light on the role played by exports in driving the components of the Kaldor square within the Iraqi economy using the Autoregressive Distributed Lag (ARDL) model for the period from 2004 to 2023, based on official data from national and international institutions.

Research Problem: Despite the great importance of exports as an effective tool in supporting economic growth, the Iraqi economy still suffers from weak production diversification and excessive dependence on oil exports, with a decline in the contribution of non-oil industrial sectors to the GDP. In this context, the need to study the relationship between exports and the components of the Kaldor square emerges, especially in light of the challenges faced by the Iraqi economy in recent decades, such as political and security crises and fluctuations in oil prices. The main problem lies in the extent of the existence of a short- and long-term dynamic relationship between exports and the components of the Kaldor square in the Iraqi economy. Accordingly, the problem of the study is to try to answer the following main question:

What is the impact of exports on the components of the

Kaldor Square in the Iraqi economy during the period (2004–2023)? Is there a significant causal relationship between these variables that can be measured using the ARDL model?

*Research Hypothesis:*H0: There is no long-run relationship between exports and the components of the Kaldor Square.

H1: There is a long-run relationship between exports and the components of the Kaldor Square.

*Research objectives:*1. To measure the impact of exports on the components of the Kaldor square in Iraq.

2. To test the ARDL relationship in the short and long run.

Research Important: The importance of the research lies in its integration of economic theory (Kaldor's laws) and modern econometric analysis, providing tools for decision-makers in Iraq to understand how to stimulate the industrial sector through export support.

Research structure: To achieve the research objective and verify its hypothesis, the research was divided into two sections. The first section dealt with exports, concept and importance, while the second section dealt with the standard aspect of the research.

1. EXPORTS: CONCEPT AND IMPORTANCE:

Before delving into the details of the research, we can provide a preliminary overview of the concept of exports and their importance in economic schools. The concept of exports can be explained as "those operations related to goods and services that are ultimately provided by residents and non-residents of a country." (Kada Akacem 1990, p. 138)

Exports can also be defined in another way as “foreign openness to goods and services produced within the country, which leads to an increase in the country’s income. Therefore, exports are classified among the factors of addition, i.e., those that add new power to the total spending stream through the multiplier effect.” (Mahmoud Younis, 1987, p. 18)

The importance of exports in economic schools varied from one school to another and can be summarized as follows:

1- Exports in commercial economic thought: Merchant economists emphasized that the most effective means of achieving the greatest amount of precious metals (wealth for the nation) was foreign trade. They also called for harnessing all other economic activities to serve foreign trade. Their demands were not limited to state intervention in trade, but rather called for its comprehensive intervention in economic life to ensure the success of trade, in order to achieve the goal of accumulating wealth for the nation. They also demanded state intervention to regulate its trade relations with other countries. Furthermore, the merchants considered achieving and creating a continuous surplus in exports to be the primary source of enhancing the purchasing power through which the state could obtain its needs from abroad. (Wassaf Saeedi, 2002, p. 7)

2- Exports in Classical Thought: Since the beginning of the eighteenth century, mercantilist ideas began to decline, and classical ideas began to call for complete economic freedom in the field of foreign trade. They presented the idea of economic freedom, which is based on the idea of automatic economic equilibrium. New concepts emerged that advocated non-interference in economic life, which contradicted the mercantilist demand for state intervention in the economy. Classical thinkers addressed the role of exports in expanding the productive base of the economy, achieving increased yields, and stimulating investment in a manner that ensures the greatest possible efficiency in the use of local resources, in addition to attracting foreign capital for investment in the production of export goods. Classical thought clarified the impact of foreign trade on capital accumulation through the resulting increase in real income, increased savings, and investment incentives resulting from the more efficient specialization of economic resources, as a result of the expansion of the market framework and the benefit of economies of scale. Based on the previously presented classical thought regarding their view of foreign trade, especially exports, they considered it not merely a tool for reallocating resources or achieving optimal distribution, but rather a driving force for growth. (Hamsha Abdel Hamid, 2013, p. 53)

3- Exports in Modern Thought: A number of economists have emerged who hold a different viewpoint regarding the role of exports, including (Myrdal, Nurks, and Marx). Marx pointed out the impossibility of foreign trade playing a developmental role for developing countries in light of the control of capitalist countries over international economic relations. Meanwhile, Myrdal believes that foreign trade between developing and developed countries increases the existing disparity in economic levels between the two groups, in addition to the intense competition between these countries to control markets and areas of influence in the world and their control over capital, which has led to an increase in the existing disparity in economic levels between the two groups. He believes that the large markets created by foreign trade work primarily to strengthen the position of developed countries, which already enjoy strong industries, compared to their weakness in developing countries. In addition, there is demand for the latter countries’ exports - often raw or primary materials. Second: Economic balance according to the Kaldor square: Economic policies seek to achieve a number of goals that would achieve economic prosperity. However, these goals

> differ in priority from one country to another according to the nature of the economic systems adopted in them. However, despite this difference, there are generally four common goals that are almost agreed upon by most economists. They actually represent macroeconomic variables, which are key indicators of the level of countries' efficiency in managing their economic files. They are expressed graphically in a combined form as percentages in the Kaldor Square. It was named after the English economist Nicholas Kaldor (1908-1986), who invented it in 1971 to identify the four main goals of any country's economic policy. (Abdelhafid & Mohammed 2023, p. 86)

According to the properties of the Kaldor square, increasing its area indicates achieving better economic performance, noting that the measures of inflation rate and unemployment rate indicate their respective axes inversely, so the optimal goal is to reach 0%. The Kaldor square seeks to achieve the main objectives of economic policy, and it is called a square because there are four main economic objectives. When the objectives are defined by points and these points are connected to each other, you get the shape of a square. It is called magic to emphasize that achieving the four objectives at the same time is a kind of magic, as it is almost impossible. (Ahmed Deif, 2014, p. 21)

Kaldor's growing interest in economic policy was partly due to Britain's slowing growth. The main purpose of this innovation was to provide a logical and empirical reconsideration of the macroeconomic framework as a basis for the economic relationships necessary to achieve certain desired goals. Kaldor went beyond his country's scope, as he succeeded in expanding Keynes's general theory of transition to an open economy, in which government economic policy constitutes a major element. He assumed that successful management of an open economy requires the simultaneous pursuit of the explicit objectives of the variables mentioned in the box. Economists in the OECD have been using this tool since the 1970s to evaluate economic performance, whether at the level of a single country, or at the level of comparative performance between a group of countries or regions (Rivano & Teixeira, 2017, p. 89).

The evaluation of the overall performance of any economy reflects the extent to which the policies set and implemented by governments achieve the main economic objectives, which can be summarized in one main goal, which is raising the standard of living of citizens. This goal is achieved through evaluating the quality of institutions in achieving these objectives. Therefore, there have been many attempts to develop an indicator or a set of indicators that reflect this, despite the difficulty of the matter due to the overlap of economic policies and the difference in their objectives. Although some objectives support others, there are objectives that intersect with the achievement of others, such as increasing the level of economic growth and achieving a low inflation rate. (Nehme, G. Ensuring 2014, p: 197)

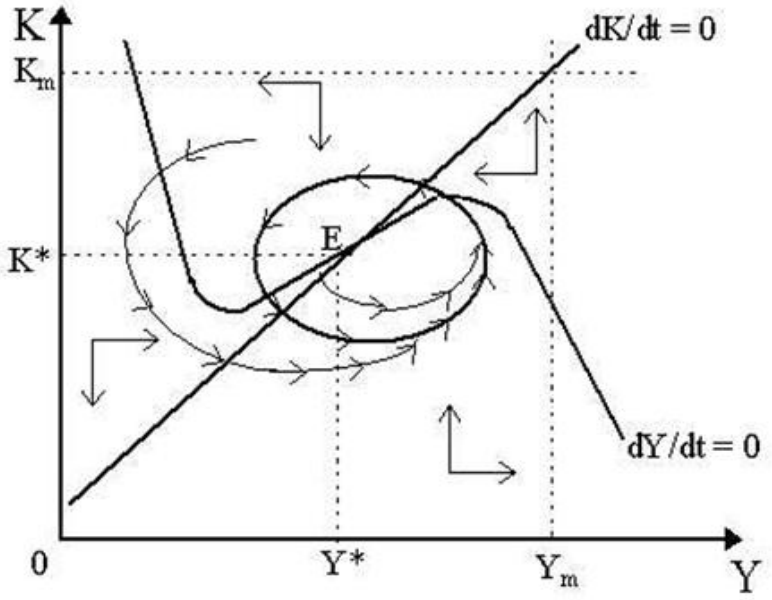
It is clear from the above that the general economic objectives of economic balance are represented by its internal and external aspects. The monetary sterilization policy seeks to achieve a set of general objectives. It aims to influence the amount of money in circulation and interest rates to influence economic performance and achieve internal economic balance represented by achieving stability in the general price level, reducing inflation rates, achieving full employment while reducing the unemployment rate and achieving economic growth, and reaching external balance represented by balance in the balance of payments and stability in the value of the local currency against foreign currencies.

These objectives can be expressed through what is known as the Kaldor square, which is a four-headed diagram containing the main objectives of economic policy (Daoud Hana Sultan, 2019: 134). It was called the magic square due to the great difficulty of achieving these objectives together, which are represented by the following: (Jubar, Sarah and Muhammad Qwaidri, 2021: 93)

1- Achieving full employment: According to Kaldor, the unemployment rate should reach 0%, or the unemployment rate should equal zero when the labor force is 100% employed. This means fully utilizing all of society's productive capacities. It should be noted that economic policy's pursuit of full employment does not necessarily mean that the unemployment rate should be zero (Ma'an, Ramadan Al-Sayed Ahmed, and Shahata, 2020: 174).

2- Achieving External Balance: The external trade balance shows the position of the economy's foreign trade sector and reflects the economy's ability to compete internationally. If an economy experiences a trade deficit, this indicates weak international competitiveness and its inability to match the value of its exports to the value of its imported goods and services. This results in a shortage of foreign currency and a deterioration in the value of the local currency. A large surplus in the external trade balance reflects a high ability to compete internationally, but this will result in an abundance of foreign currency and a decline in the exchange rate against the local currency. It is preferable for the overall balance of payments surplus to be within 4% and not exceed the deficit percentage. 2- (As a percentage of GDP, it is expressed as the role of imports and exports as a percentage of GDP. An imbalance in the balance of payments, which often expresses a deficit, leads to economic indebtedness, which negatively impacts the economy's internal balances and economic exchange rates (Salah Mohammed, 2016: 267).

Figure 1: Nonlinear Kaldor business cycle

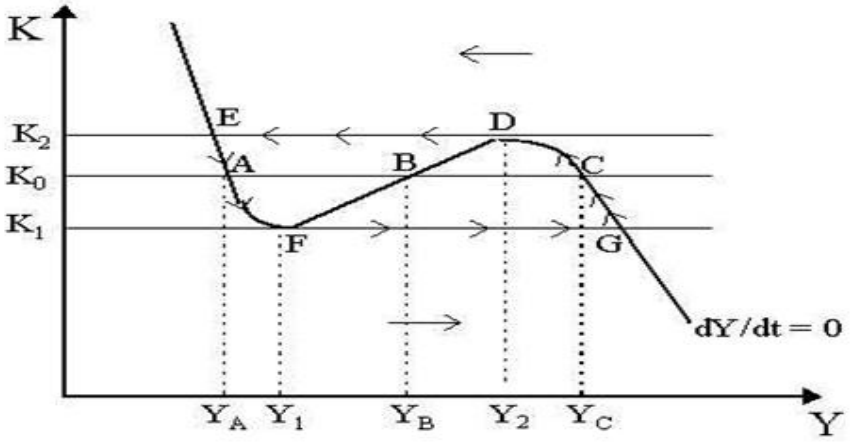


Source: Fatiha Brouba, A Study of Employment, Investment Spending Policy and Growth through Kaldor's Magic Square, Data on Development Programs in Algeria during the Period: 2010-2019, Academy of Social and Human Studies, Volume 12, Issue 2, p. 108.

3- Achieving economic growth: Targeting specific growth rates poses a significant challenge for any economy, as aiming to raise growth rates necessarily ensures improving the standard of living, providing job opportunities to reduce unemployment, and stimulating economic performance by stimulating investment and increasing production. There is no doubt that achieving acceptable rates of economic growth means raising it at a rate greater than population growth rates, while enhancing the utilization of available resources and productive capacities. According to Kaldor, the growth rate should reach (6%) of the gross domestic product (GDP). (Jaafar Abdul Amir Al-Husseini, 2024: 26)

4- Achieving price stability, according to Kaldor, requires an inflation rate of 0%. Controlling the inflation rate, which represents a continuous and persistent rise in the price level, requires that the gross domestic product grow with an increase in the money supply at the same rate, thus preventing the economy from being exposed to economic fluctuations. (Ahmed Mazen et al., 2018: 34) In addition to what was mentioned, Kaldor's thesis has cycles, including linear and non-linear ones, and this is through the dynamics and movement of the total variables that comprise it, which are the following variables: I, S, K, dY. (-Fatiha Brouba, 2020, p. 108)

Figure 2: Kaldor Cycle Dynamics - Nonlinear Cycle



Source: Fatiha Brouba, A Study of Employment, Investment Spending Policy and Growth through Kaldor's Magic Square, Data on Development Programs in Algeria during the Period: 2010-2019, Academy of Social and Human Studies, Volume 12, Issue 2, p. 108.

The above demonstrates the importance of the Kaldor square in achieving economic stability. However, it must be noted that there is a potential conflict between the aforementioned objectives, which could lead to the possibility of several contradictions. It is difficult to reduce the inflation rate and achieve full employment at the same time. Similarly, the goal of achieving accelerated economic growth and reducing the inflation rate is difficult. Adopting an expansionary monetary policy can lead to achieving high economic growth rates, but this usually comes at the expense of high inflation rates. It can be said that achieving economic development through what the central bank does, which is price stability using central banking tools such as expanding central bank credit, which includes lending support, must be consistent with financial policies such as contributing to raising general commercial operations. The latter is best achieved through financial tools such as taxes, transfers, and subsidies (Amin, Wafaa Jaafar, Hamdan, Ahmed Abdel Zahra, 2018: p. 5).

2.ECONOMETRICS SIDE

2.1.Specification the Research Variables

This is one of the most important steps through which the relationship between the independent variables and the dependent variable is determined. In this research, the relationship between the variables is described as follows:

A. The dependent variable is represented by exports (Ex).

B. The independent variables are represented by the following:

- Growth Economic rate (Gr).
- Inflation (In).
- Trade balance (Tb).
- Unemployment rate (Une).

According to the interpretation of economic theory, there is a direct relationship between the growth rate and the volume of exports, as opposed to a negative inverse relationship between the inflation rate and exports. Regarding the relationship between the trade balance and exports, the positive relationship between the two variables is demonstrated based on the state of the trade balance, whether the volume of exports is greater than the volume of imports or vice versa. In addition to the direct relationship between the unemployment rate and exports, as high unemployment rates are reflected in a decrease in productivity, and consequently a decrease in the volume of exports, the standard formula for the model is as follows:

$Y_i = \beta_0 + \beta_1 X_1 - \beta_2 x_2 + \beta_3 X_3 - \beta_4 X_4 + Ui$ ……(1)

$Ex = \beta_o + \beta_1 Gr - \beta_2 In + \beta_3 Tb + \beta_4 Une + Ui$……..(2)

Where: Gr: Growth Economic rate. In: Inflation. Tb: Trade balance. Une: Unemployment rate. Ui: Random variable.

2.2. Stationarity Test

The stationarity test is one of the most important steps prior to estimating the relationship between research variables. In this regard, the ADF test was used to determine the degree of stationarity of the independent variables: the growth rate (Gr), inflation (In), trade balance (Tb), and unemployment (Une), and the dependent variable (exports), represented by the symbol (Ex). Table (1) shows that some time series were stationary at the level and first difference, while others were stationary when taking the first difference (I~(1)), as follows:

Table (1): ADF test

Variable	Level		1st difference	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
Ex	**5.964	**8.372	**10.517	**10.883
Gr	**6.115	**8.392	**12.117	**12.195
In	*3.209	**5.401	**9.517	**9.947
Tb	**8.431	**11.475	**11.006	**10.993
Une	1.424	3.379	**8.106	**8.964

Source: Prepared by researchers based on the outputs of the Eviews10 program. (**) Significant at the 1% level, (**) Significant at the 5% level.

After conducting the stationarity test for the time series of the dependent variable and the independent variables, the Autoregressive Distributed Lag (ARDL) model test was used to measure the effect of the independent variables represented by the growth rate, inflation, trade balance, and unemployment rate (Gr), (In), (Tb), and (Une), respectively, on the volume of exports (Ex) as a dependent variable in Iraq. Table (2) shows the effect of the Kaldor square components on I raqi exports for the period (2003-2023).

Table (2): estimation results of the (ARDL) model

Variable	Coefficient	Std.Error	t-Statistic	Prob
Ex(-1)	3.183	0.095	33.479	0.0000
Gr(-1)	-0.299	0.142	-2.105	0.0400
In(-1)	0.158	0.088	1.801	0.078
Tb(-1)	-0.003	0.001	-8.192	0.000
Une(-1)	-0.216	0.156	-1.385	0.172

C	0.759	0.278	2.728	0.0086
R-squared	0.99	Mean dependent var	66.289	
Adjusted R-squared	0.99	S.D.dependent var	24.984	
S.E. of regression	0.1866	Akaike info criterion	-0.291	
Sum squared resid	1.8470	Schwarz criterion	0.3365	
Log likelihood	30.6236	Hannan-Quinn criter	-0.0409	
F-statistic	67872.93	Durbin-Watson stat	2.048	
Prob(F-statistic)	0.000000			

Source: The work of the researchers based on the outputs of the Eviews10 program.

Table (2) shows the model's autoregressive distributed lag test. It is clear that the model is acceptable, as the coefficient of determination reached (R2=0.99), meaning that the independent variables included in the model explain (99%) of the changes in the dependent variable (exports), and the remaining (1%) is due to other variables not included in the model.

The value of the Durbin-Watson (D-W) statistic reached (2), indicating that the model is free of the problem of autocorrelation. The value of the Fisher statistic reached (67872.93) with a high significance of (0.000000), indicating that the model is fully acceptable.

2.3. Error Correction Model According to the ARDL Methodology

The model consists of two parts: the first includes short-term parameters, and the second part explains long-term parameters. Table (3) illustrates this as follows:

Table (3): Error correction model (short and long term) according to the ARDL methodology

Variable	**Coefficient**	**Std.Error**	**t-Statistic**	**Prob**
D(Gr,-3)	-0.1366	0.0425	-3.2114	0.0022
D(In)	-0.1206	0.0347	-3.4794	0.0010
D(Tb)	0.0009	8.03	11.0751	0.0000
D(Une)	0.2094	0.1186	1.7652	0.0833
CointEq(-1)*	-0.009606	0.001706	-5.630660	0.0000
Long Run Coefficients				
Variable	**Coefficient**	**Std.Error**	**t-Statistic**	**Prob**
Gr	1.2075	0.8425	1.4332	0.1577
In	-2.7373	1.3375	-2.0466	0.0457
Tb	-0.0006	0.0014	-0.4019	0.6894
Une	-0.7315	1.1409	-0.6412	0.5242
C	79.0824	22.6734	3.4879	0.0010
EC = EX - (1.2075*GR -2.7373*IN -0.0006*TB -0.7315*UNE + 79.0824)				

Source: The work of the researchers based on the outputs of the Eviews10 program.

Table (3) shows that there is a negative significant relationship between economic growth and exports at a significance level of (1%), which is contrary to economic theory. However, it shows the extent of Iraq's reliance on increasing the volume of exports for the purpose of achieving an increase in growth rates in the short term, in addition to the inverse relationship between inflation and exports at a significance level of (1%), which is consistent with the content of economic theory. As for the trade balance, the relationship appeared to be directly proportional to exports, which is consistent with the content of economic theory at a significance level of (1%), in addition to the direct relationship between unemployment and the volume of exports at a significance level of (10%), which is consistent with the content of economic theory.

As for the error correction factor CointEq(-1), it is noted that the error correction parameter or the speed of adaptation reached (-0.009606) and the probability value Prob reached (0.0000), i.e. negative and significant, which confirms the existence of a correction from the short term to the long term, and approximately (1%) of the errors that occur in exports in the short term can be automatically corrected through the components of the Kaldor square to restore balance in the long term, but this requires a very long period of time, which indicates a low speed of adaptation in the model.

2.4.Cointegration Test According to the ARDL Methodology

The cointegration test, also known as the bound test, demonstrates the cointegration relationship between the independent variables (growth rate Gr, inflation In, trade balance Tb, unemployment rate Une), and the dependent variable (exports Ex). It relies on the value of the Fisher statistic (F) by comparing it with the lower and upper bounds at different significance levels (1%, 2.5%, 5%, 10%). Table (4) illustrates the cointegration test (f-bound test).

Table (4): Cointegration Test (f-Bound Test)

f-Bound Test	Null Hypothesis: No levels relationship	
Test Statistic	**Value**	**K**
F-statistic	**4.828533**	**4**
Critical Value Bounds		
Significance	**I(0) Bound**	**I(I) Bound**
10%	**2.2**	**3.09**
5%	**2.56**	**3.49**
2.5%	**2.88**	**3.87**
1%	**3.29**	**4.37**

Source: Prepared by researchers based on the outputs of the Eviews10 program.

Table (4) shows that the calculated value of (f) which reached (4.828533) is greater than the minimum table values I(0) and the maximum I(I) at all levels (10%, 5%, 2.5%, 1%), and accordingly we accept the alternative hypothesis of the research which states that there is a long-term joint integration between the components of the Kaldor square and exports in Iraq for the period (2003-2023) and we reject the null hypothesis.

2.5.ARDL Model Quality Tests

A- Heteroskedasticity Test

The ARCH test is used to demonstrate the homogeneity of error variance. It shows the probability value of the chi-square ($\chi 2$) which reached (33.38198), which is greater than (0.05), indicating acceptance of the null hypothesis, which states that the model's errors are variance-consistent, and rejection of the alternative hypothesis, which states that the model's errors are not variance-consistent. Table (5) illustrates this.

Table (5): Heteroskedasticity Test

Heteroskedasticity Test: ARCH			
F-statistic	**1.763721**	**Prob. F(1,18)**	**0.1069**
Obs*R-squared	**33.38198**	**Prob. Chi-Square(1)**	**0.1848**

Source: Prepared by researchers based on the outputs of the Eviews10 program.

B- Serial Autocorrelation Test for Model Residuals:

The (LM) test is used, which relies on the probability value of (2χ). Table (6) shows the acceptance of the null hypothesis based on the probability value of (2χ), which reached (2.365599), which is greater than (0.05), indicating that the model is free of serial autocorrelation of errors, and the rejection of the alternative hypothesis.

Table (6): Autocorrelation test

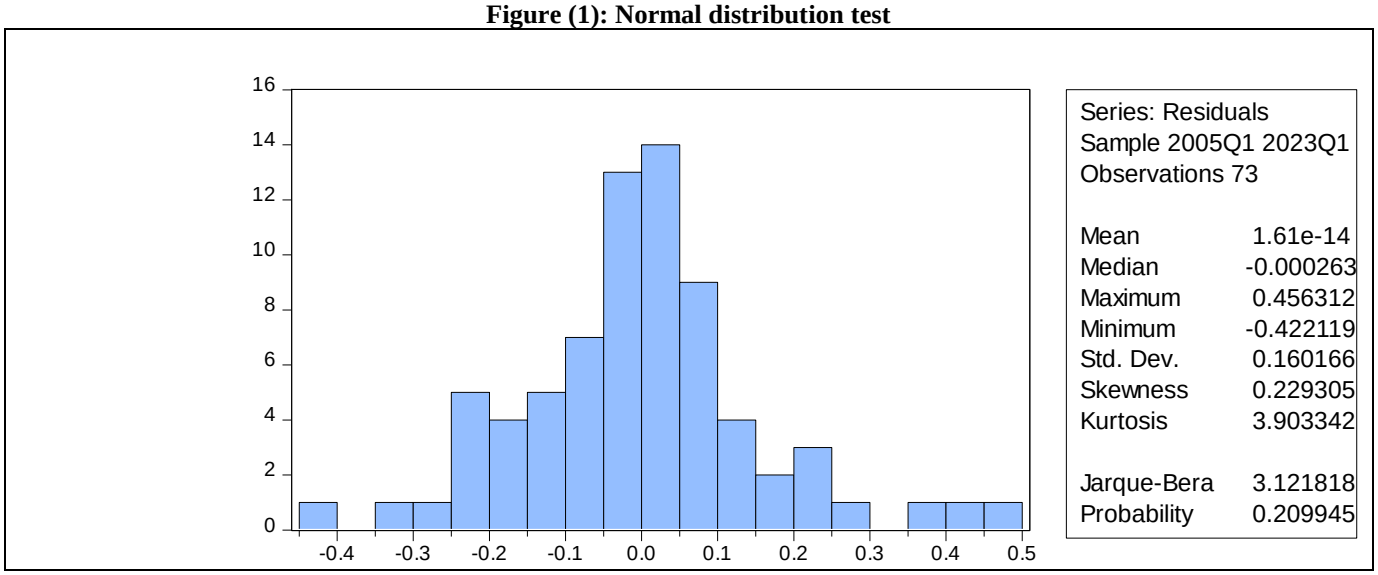
Breusch-Godfrey Serial Correlation: LM Test			
F-statistic	**0.854014**	**Prob(2,51)**	**0.4317**
Obs*R-squared	2.365599	**Prob. Chi-Square(2)**	**0.3064**

Source: Prepared by researchers based on the outputs of the Eviews10 program.

C- Normal distribution test

Figure (1) shows that the probability level for the Jarque-Bera test is greater than (0.05), indicating the acceptance of the null hypothesis, which indicates that the residuals of the regression equation are normally distributed.

Figure (1): Normal distribution test

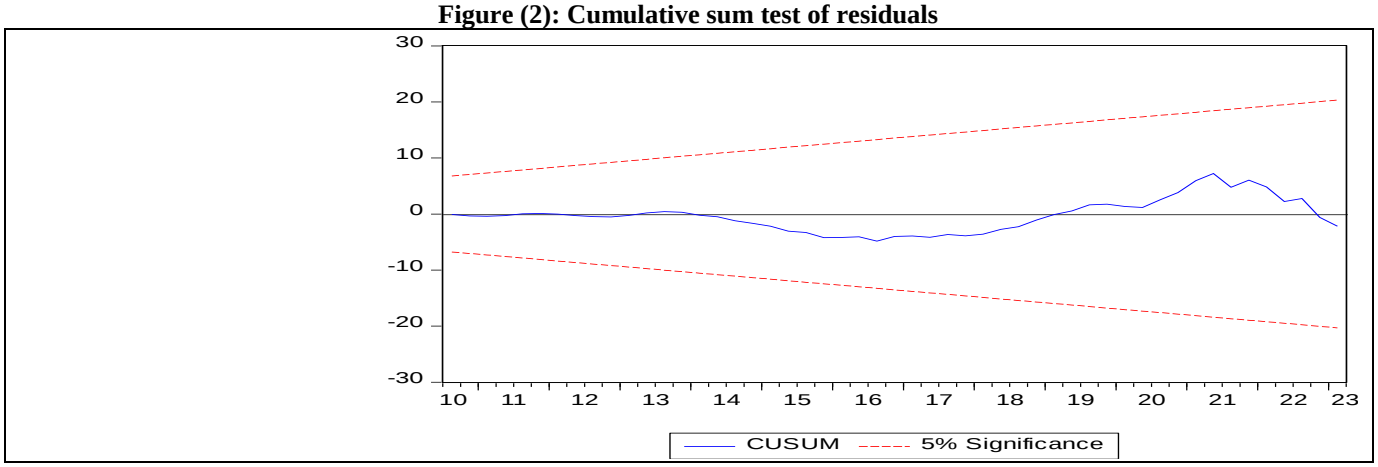


Source: Prepared by researchers based on the outputs of the Eviews10 program.

D- Model Stability Test

Figure (2) shows the cumulative sum test of the model's residuals (Cusum Test), which shows that the cumulative sum of the residuals is within the critical limits at a significance level of (0.05), indicating the stability of the estimated parameters.

Figure (2): Cumulative sum test of residuals



Source: Prepared by researchers based on the outputs of the Eviews10 program.

3. CONCLUSIONS:

1. There is a long-term cointegration relationship between the Kaldor square components (growth rate, inflation, trade balance, unemployment) and exports in Iraq during the period (2003-2023).
2. The empirical results demonstrated a short-term inverse and significant relationship at a significance level of 1% between the independent variables (growth rate, inflation) and the dependent variable (exports). In addition, there is a short-term direct and significant relationship between the independent variables (trade balance, unemployment) and the dependent variable (exports) at a significance level of 1% and 10%, respectively.
3. The empirical results demonstrated the insignificance of the model in the long run.

4. RECOMMENDATIONS

1. Increasing the share of non-oil exports, particularly industrial and agricultural exports, due to their long-term positive impact on industrial output and productivity, as demonstrated by the ARDL model.
2. Stimulating export-related productive sectors and supporting manufacturing sectors by providing incentives to exporting manufacturers.
3. Encouraging the establishment of free or export industrial zones, wh ere privileges are granted to exporting companies, will contribute to stimulating industrial investment and directly boosting exports.

4. Adopting an industrial policy based on econometric analysis: The government must adopt economic policies based on realistic econometric results, such as ARDL models, to achieve alignment between economic reality and adopted policies.

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