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MEASURING THE IMPACT OF INFLATIONARY PRESSURES ON FOREIGN TRADE IN AGRICULTURAL COMMODITIES AND LIVE ANIMALS: A CASE STUDY OF IRAQ

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Abstract

This paper investigated the impact of inflationary pressures on foreign trade in agricultural commodities and live animals for the Iraqi economy for 2004-2022. The standard vector error correction model (VECM) was used to estimate the relationship between the variables. The results showed a long-term equilibrium relationship between the inflationary pressures variable (X) and the trade balance in agricultural commodities and live animals (Y), meaning there is a long-term equilibrium causal relationship between the two variables. The results indicate the presence of a positive effect (direct relationship) between the two variables in the long run. Achieving monetary stability will increase the value of the agricultural trade balance. The paper recommends that monetary policy should aim to control the rate of money supply (money supply) to limit the high rates of inflation and make its growth rate parallel that of the gross domestic product to achieve monetary stability. This would support a higher growth in agricultural production and raise the competitiveness of local products for export as well as reduce agricultural imports to achieve balance in its trade balance.

Keywords: Monetary stability, Agricultural exports, Agricultural imports, VECM.

قياس إثر الضغوط التضخمية على التجارة الخارجية للسلع الزراعية والحيوانات الحية: دراسة حالة العراق

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الخلاصة

تهدف هذه الورقة الى قياس وتحليل إثر الضغوط التضخمية على التجارة الخارجية للسلع الزراعية والحيوانات الحية في الاقتصاد العراقي للمدة 2004–2022. تم استخدام الانموذج القياسي متجه تصحيح الخطأ (VECM) لتقدير العلاقة بين المتغيرات. وضحت النتائج أن هناك علاقة توازنيه طويلة الاجل بين متغير الضغوط التضخمية (X) والميزان التجاري الزراعي للسلع الزراعية والحيوانات الحية (Y). اي ان هناك علاقة سببية توازنية طويلة الاجل تتجه من المتغير (X) الى المتغير (Y). وتشير النتائج الى وجود إثر موجب (علاقة طردية) بين المتغيرين في الاجل الطويل. ان تحقيق الاستقرار النقدي سيزيد من قيمة الميزان التجاري الزراعي. توصي الورقة على ضرورة ان تعمل السياسية النقدية للسيطرة على معدل الكتلة النقدية (عرض النقد) للحد من ارتفاع معدلات التضخم، وجعل معدل نمو الكتلة النقدية يوازي معدل النمو في الناتج المحلي الاجمالي لتحقيق الاستقرار النقدي الذي يدعم زيادة نمو الإنتاج الزراعي ورفع القدرة التنافسية للمنتج المحلي امام المنتج الأجنبي والتهيئة للتصدير وخفض الاستيرادات الزراعية لتحقيق التوازن في الميزان التجاري الزراعي.

كلمات مفتاحية: الاستقرار النقدي، الصادرات الزراعية، الاستيرادات الزراعية، VECM.

Introduction

Inflation is a continuous increase in the general level of prices. Since the 1970s, the monetary policies of central banks have played a fundamental role in combating inflation. Price stability is the main objective, and inflation targeting mechanisms are used to ensure that it has no detrimental effects on economic activity. High levels of inflation have a negative impact on long-term development, equitable income distribution, returns on investment projects, competitiveness in foreign trade of agricultural and non-agricultural goods, distribution of tax burdens, food prices and macroeconomic variables (4).

The relationship between inflation and agricultural economic growth remains controversial both in theory and empirical results. This issue has arisen in several economies worldwide and sparked an ongoing debate among critics. Some believe that inflation is necessary for economic growth, which is reflected in the agricultural trade balance, while others consider it to be harmful to economic progress and is reflected

negatively in the agricultural trade balance. This dispute has two sides: the direction of causation and the nature of the link, if any. The economist Friedman summarized the nature of the inconclusive relationship between inflation and economic growth stating that historically, it has challenged all possible combinations: inflation with and without development and non-inflation with and without development (12).

With the rise in prices, costs, wages, and profits in production units for agricultural and investment goods, inflationary pressures shift capital towards economic activities that do not generate economic development in its early stages. Agricultural economic growth is affected by several factors, including monetary factors (inflation) from the point of view of monetary policy, and at the same time, agricultural exports and imports affect economic growth (7). Directing monetary policy to improve the trade balance is not easy, and some adjustments are required before any improvement appears, as these adjustments are initially through the deterioration of the trade balance during the decline in the currency's value (17). Agricultural exports are essential for improving national incomes and increasing foreign exchange earnings. They can increase the ability to finance development, especially in financing agricultural imports and other goods and foreign debts (20).

According to studies, the practice of currency devaluation is strongly influenced by local inflation, which means that the state will continue to implement its existing policy in an effort to weaken the currency's value owing to economic factors and how they interact. Inflation is primarily caused by the practice of currency depreciation (16) as seen in the rise in agricultural commodity prices. Given that the majority of the goods traded in the local economy are imported and their value paid in dollars, it has increased in relation to the value of the local currency. This explains why general price levels readily adjust to the prices of these commodities.

Due to inflationary pressures caused by a depreciation in the local currency, the costs of agricultural imports rise but their foreign exchange costs stay the same. As a result, import volume will decline and less foreign exchange will be needed. As for consumer goods, devaluation affects the number of imports and increases the volume of these goods lowering real disposable income and the value of the currency, followed by consumption, which reduces the import of commodities. Imported raw materials and capital goods typically make up a sizable portion of the components of the domestic product. The degree to which developing nations can substitute imported raw materials and adapt their production methods to take advantage of local resources will determine how the devaluation affects their imports. Even if there is a chance, this is not simple, and takes time, which can be costly. However, raw resources have a higher chance of being substituted than capital items.

A rise in the value of the currency or the state's decision to raise it in order to lessen the impact of its imports on the trade balance will result in higher agricultural imports, raising the supply of goods locally and drive down prices. Additionally, it will lower production costs by lowering the cost of raw material imports. When local importers and overseas exporters have similar goals, the demand for foreign exchange is established (5). The reduction or increase in the currency's value, the inflationary or deflationary pressures it generates, and its impact on agricultural goods depend on the

volume of agricultural production and the flexibility of the sector. Under these conditions, the impact will then become effective.

Inflationary pressure, a composite metric used to assess the many aspects of the economic inflation process, is measured by the monetary stability factor. This criteria is predicated on the quantitative theory of money analysis within a relative framework, which compares the evolution in the supply and demand for money. The rate of change in the broad money supply (public currency plus current deposits, time deposits, and savings deposits) divided by the rate of change in real GDP yields the monetary stability factor. The monetary stability factor represented by the following equation is used by the International Monetary Fund to identify inflationary and deflationary tendencies (6):

$$B = (\Delta M/M)/(\Delta GDP/GDP) = \geq 1 \text{ or } \leq 1 \text{ or } = 1$$

Inflation or inflationary forces are indicated by a monetary stability factor result of more than 1, whereas economic contraction shows results of less than 1. Outcomes that equal 1 indicate monetary stability.

This paper investigates the extent of inflationary pressures and its impact on foreign trade in agricultural commodities and live animals. The importance of studying price levels by examining inflation rates lies in its impact on the agricultural sector and the need to increase production and exports as seen in the low production levels, inability to meet local demand, low export volumes, and reliance on imports. The research problem includes several questions: Does the Iraqi economy suffer from inflationary pressures? Do those pressures affect the agricultural trade balance, and whether they contribute in achieving deficits or surpluses in the sector? This research measures the level of inflationary pressures in the economy, analyzes their impact on the trade balance in agricultural commodities and live animals, and determines the relationship between them using econometric models.

Various studies have investigated the relationship between inflation, exports, imports, and agricultural growth. (2) examined the relationship between inflation and foreign trade between Turkey and the European Union for 2005-2017 using the cointegration method. The results indicated no cointegration relationship between imports and inflation and a causal relationship in both directions between exports and inflation. Also, there was a causal one-way directional relationship from imports to inflation but not the reverse (2). The study by (9) addressed the effects of fluctuations in the terms of trade (agricultural export values exceeding that of imports) on inflation in Pakistan for 1972-2012. The generalized difference method (GMM) was used as the appropriate method compared to the Cutco least squares method (OLS). The results showed that fluctuations in the terms of trade had a significant negative impact on inflation in Pakistan; output growth negatively affected inflation while export prices positively impacted inflation, and declines in the nominal exchange rate and money supply raised inflation rates. It was also found that fiscal deficits and world oil prices increased domestic inflation (9).

(13) identified the impact of exchange rate volatility, money supply, population, and foreign direct investment on regional trade within the East African Community. The results of the Hausman test indicated that the fixed effect model was appropriate and

that exchange rates, money supply, population, and foreign direct investment significantly limited regional trade among its member countries (13). (19) demonstrated the impact of exports and imports on inflation in Indonesia from 1990-2016. Using multiple linear regression, they showed that exports did not affect inflation, and imports had a significant and positive impact on inflation in Indonesia (19). (18) investigated the impact of monetary policy on international trade in Nigeria by analyzing data using the cointegration mechanism and error correction vector. The former method showed a long-run relationship between international trade and monetary policy, and the latter found that all variables were statistically significant at the 5% level. The study did not address other non-monetary instruments that affect international trade (18).

(11) calculated how currency rates and inflation affected exports in five ASEAN nations—Indonesia, Singapore, Thailand, Malaysia, and the Philippines—between 2010 and 2020. Panel data regression was used to evaluate the dependent variable (exports) and two independent variables (inflation and currency rates). The results showed inflation and exchange rates having a negative impact on exports, meaning that if either increases, exports will decrease and vice versa (11). (10) examined the impact of inflation on imports in Bangladesh using an empirical approach to clarify the effect. Theoretically, there was a positive association between domestic inflation and imports; and this study also shows a positive association, at a minimal level (10).

Materials and Methods

Data from the Central Bank of Iraq (General Directorate of Statistics and Research) were used to determine the effect of the monetary stability factor on the trade balance of agricultural commodities and live animals in the economy for 2004-2022. Time series data were converted from annual to semi-annual data in their natural 38 samples to enable the application of econometric methods (VECM) to achieve more accurate and objective results by expanding the sample size to reflect the actual situation. This was necessary due to the limited size of the study sample from the original data and the lack of quarterly variables data for each year to help in determining the relationship between the economic variables (6). The econometric program Eviews 9 was used. Two variables were taken: inflationary pressures (monetary stability factor) as the independent variable and the trade balance in agricultural commodities and live animals as the dependent variable. The economic model was based on the following formula:

$$Y_t = \beta_o + \beta_1 X_t + U_t \quad \ldots.(1)$$

where (Y) is the trade balance in agricultural commodities and live animals,
(βo) is the intercept,
(X_t) is the monetary stability coefficient criterion,
(U_t) is the random variable, and
(t) is the time.

To apply the steps of the econometric model, the unit root test was first used through the Augmented Dickey-Fuller (ADF) test to determine the stability of the time series, followed by the determination of the optimal lag period for the lagged periods.

The Johansen–Juselius cointegration test methodology determined the joint integration, including the trace and maximum eigenvalues tests. The model's integrity was tested using the heterogeneity of variance test (ARCH), the autocorrelation test (LM), and the Ramsey test. The structural stability of the estimated model parameters was also tested using the cumulative sum of residuals (CUSUM) and the cumulative sum of squares of residuals (CUSUM-of-square) tests.

Results and Discussion

Table 1 and Figure 1 show the developments in inflationary pressures and the trade balance in agricultural commodities and live animals in the Iraqi economy for 2004-2022 (3).

For the period under study, the monetary position of Iraq fluctuated between equilibrium, contraction, and inflationary pressures. As seen in Table 1, monetary stability was attained in 2009, 2012, and 2018 when its coefficient was 1. In contrast, deflationary forces occurred in 2004, 2005, 2013, 2015, 2017, and 2020 with a coefficient of less than 1. For 2006, 2007, 2008, 2010, 2011, 2014, 2016, 2019, 2021, and 2022 the coefficient was >1, indicating inflationary pressures from rising government expenditures and the money supply.

The lack of monetary stability and the occurrence of inflationary pressures in some years was due to money supply exceeding the size of the real GDP. The existence of inflationary pressures in some years was due to the decrease in the money supply by a percentage less than the size of the real GDP. However, in the case of monetary stability for the three years, it was due to a balance in money supply and real GDP. The trade balance for agricultural commodities and live animals recorded chronic deficits during the study period, meaning that agricultural imports exceeded exports. In most cases, local production was not sufficient to meet demand, with the gap being met by imports (15). The reason for this is the lack of monetary stability, low government support, neglect of the agricultural sector, weak infrastructure supporting the sector, and the lack of foreign investments. This is also due to population growth, which often exceeded agricultural sector growth rates (1). All these factors limited local agricultural production.

Table 1: Monetary stability coefficients and trade balance in agricultural commodities and live animals in the Iraqi economy, 2004-2022.

Years	Monetary Stability Factor	Monetary Stability	Agricultural Trade Balance (Million US$)
2004	0.9	Deflationary pressures	-6948
2005	-0.9	Deflationary pressures	-7470
2006	3	Inflationary pressures	-6300
2007	37	Inflationary pressures	-9370
2008	2.4	Inflationary pressures	-1726
2009	1	**Monetary stability**	-1966
2010	5.3	Inflationary pressures	-2226
2011	2.1	Inflationary pressures	-2358
2012	1	**Monetary stability**	-2922
2013	0.09	Deflationary pressures	-2995
2014	15	Inflationary pressures	-2701
2015	-3	Deflationary pressures	-2448
2016	1.1	Inflationary pressures	-1737
2017	0.03	Deflationary pressures	-2017
2018	1	**Monetary stability**	-2464
2019	13.3	Inflationary pressures	-3123
2020	-1.3	Deflationary pressures	-2588
2021	2.8	Inflationary pressures	-2945
2022	8	Inflationary pressures	-2147

Figure 1 shows the relationship between the monetary stability coefficient and the value of the trade balance in agricultural commodities and live animals in the Iraqi economy for 2004-2022, based on the data in Table 1. The fluctuations, especially the monetary stability coefficient, were due to the large growth in money supply, i.e., money supply exceeded real gross domestic product for most of the study period, which generated major shocks in the economy as reflected in a rise in the general inflation rate.

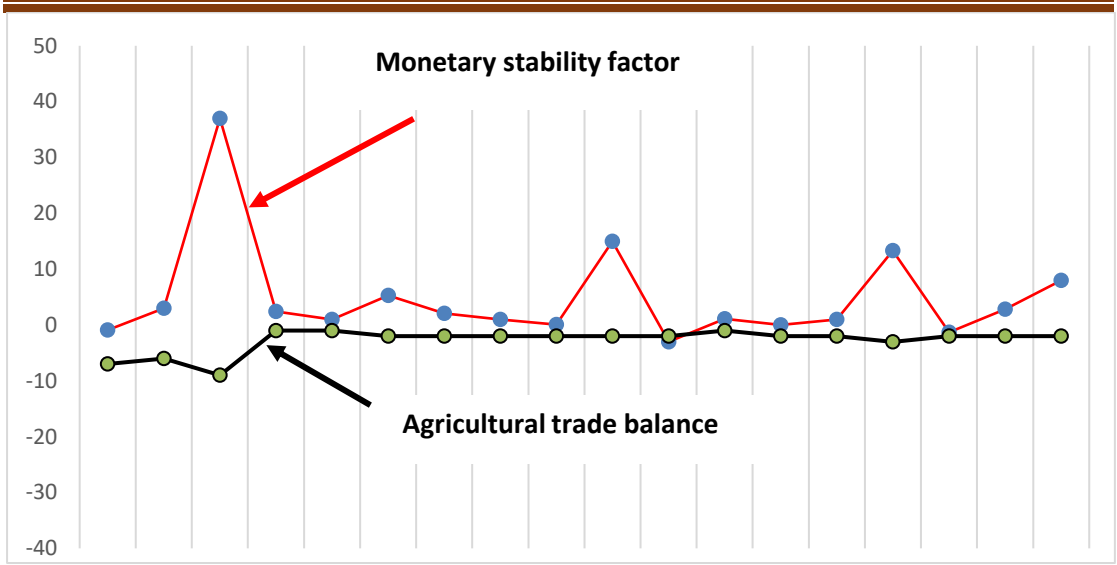

Figure 1: Monetary stability coefficients and agricultural trade balance.

Econometric Model Quality Tests: Unit Root Test: involves time series of the variables at three levels: difference with a constant term; a constant term with a general trend; and without a constant term and general trend. Table 2 shows the results using the Augmented Dickey-Fuller ADF test (14).

Table 2: Augmented Dickey-Fuller (ADF) test.

	Level	**X**	**Y**
With constant	t-Statistic	-3.3269	-1.8358
	Prob.	0.0216	0.3578
		**	n0
With constant and trend	t-Statistic	-3.3057	-1.3602
	Prob.	0.0829	0.8556
		*	n0
Without constant and trend	t-Statistic	-2.5948	0.0594
	Prob.	0.0111	0.6953
		**	n0
	At first difference		
		d(X)	d(Y)
With constant	t-Statistic	-5.3857	-2.771
	Prob.	0.0001	0.0745
		***	*
With constant and trend	t-Statistic	-5.291	-3.1891
	Prob.	0.0008	0.1056
		***	n0
Without constant and trend	t-Statistic	-5.452	-5.293
	Prob.	0.0000	0.0000
		***	***

Since certain variables had a unit root, meaning they were not stationary at the first data level, their first difference was calculated. They are integrated of order (1) [I], meaning that they all become stationary at a significance level of 1%. This means that the alternative hypothesis (HI), which states that the time series are stationary at the first difference, is accepted, and the null hypothesis (H0), which states that the time series is not stationary at the first difference, is rejected.

Optimal lag test: Table 3 shows the results of the optimal lag test for the VECM model for the relationship between inflationary pressures (monetary stability factor) and the trade balance for agricultural commodities and live animals (14). The optimal lag periods chosen according to the LR, FPE, AIC, SC, and HQ tests are the first lag periods, and the lowest value of these criteria is chosen. This result is consistent with the SC test result adopted in most economic studies.

Table 3: Optimal deceleration test results.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2726.09	NA	4.12E+61	156.0622	156.2844	156.1389
1	-2665.2	100.9009*	5.39e+60*	154.0115*	155.3446*	154.4717*
2	-2654.16	15.1426	1.31E+61	154.8091	157.2532	155.6528

Table 4 shows the value of the trace coefficient (14) from the joint integration test for the relationship between monetary stability and the trade balance for agricultural commodities and live animals. These tests reveal whether there is joint integration between the variables.

Table 4: Trace coefficient according to Johansen test.

Hypothesized	Eigenvalue	Trace statistic	Critical Value	Prob.**
None *	0.40576	19.06485	15.49471	0.0139
At most 1	0.090193	2.930195	3.841466	0.0869

If the calculated value of the trace test is greater than the critical value at a significance level of (5%) it indicates the presence of joint integration. As Table 4 shows, the trace test indicates the presence of an integrated equation at a significance level of less than (5%). This means rejecting the null hypothesis that there is no joint integration vector (r=0) and accepting the alternative hypothesis (H1) that there are some joint integration vectors greater than zero (r=1), indicating a long-term equilibrium relationship between the inflationary pressure variables and the agricultural trade balance.

Analysis of the results of the vector error correction model (VECM): The results from the model on the relationship between inflationary pressures (X) and the agricultural trade balance (Y) can be explained according to the equations in Table 5 (14).

Table 5: Results of the short-term and long-term VECM model.

Cointegrating Eq:	CointEq1	
Y (-1)	1	
X(-1)	448000000	
	-1.50E+08	
	[2.99372]	
C	-4.57E+09	
Error Correction:	D(Y)	D(X)
CointEq1	-0.00000000167	-0.017713
	-6.00E-10	-0.02467
	[-2.79004]	[-0.71810]
D(Y (-1))	-0.171282	6.50E-10
	-0.25303	-6.10E-09
	[-0.67692]	[0.10603]
D(Y (-2))	-0.115926	-6.51E-09
	-0.26338	-6.40E-09
	[-0.44014]	[-1.02123]
D(X(-1))	-4934555	0.367276
	-8615415	-0.20866
	[-0.57276]	[1.76019]
D(X(-2))	-1768561	-0.10525
	-8525949	-0.20649
	[-0.20743]	[-0.50972]
C	1.08E+08	1.280201
	-8.00E+07	-1.94733
	[1.33839]	[0.65741]

The VECM equation results show a clear long-term equilibrium relationship between the inflationary pressures and the agricultural trade balance, i.e., there is a long-term equilibrium causal relationship going from variable X to variable Y because the error correction term parameter takes a negative sign. It is significant according to the (t) test (0.05 >p). The error correction coefficient was equal to -0.00000000167, meaning that about 1.6% of the shocks can be explained in the long run. This supports the effect of the inflationary pressure variable on the agricultural trade balance in the short- and long-term dynamic models. The study found a significant long-term positive relationship between monetary stability (X) and the trade balance in agricultural commodities and live animals (Y), where higher monetary stability leads to a balanced agricultural trade balance.

The results indicate a positive effect (direct and significant relationship) of inflationary pressures (X) on the trade balance of agricultural commodities and live animals (Y) in the long run, as the error correction parameter for inflationary pressure for the balance reached 448000000 in the long run. This means that raising the monetary stability coefficient X by 1 will lead Y to increase by 448000000 in the long run. That is, achieving monetary stability will increase the value of the agricultural trade balance. The transition from a state of deflation to a state of monetary stability and the decline of inflationary pressure to a state of monetary stability has positive effects on achieving a balance in the trade of agricultural commodities and live animals. This is because the statistical significance of the relationship between the two variables

is consistent with the logic of economic theory and conforms to the hypothesis of the paper.

ARCH heterogeneity of variance test: This test shows that the estimated model is free from the problem of heterogeneity of variance. As the computed F value reached 1.499895 at the 0.2412 probability level and is not significant at the 5% level, the result demonstrates that the model is not affected by the heterogeneity of variance issue (14).

Serial Autocorrelation Test (LM): Here, the computed F value reached 0.026514 at a probability level of 0.9739, which was not significant at a level of 5%, demonstrating the validity and quality of the estimated model. This indicates that the issue of serial correlation between the residuals is not present in the calculated model (14).

Ramsey Test: It is evident that at the 5% significance level, the computed t-statistic value of 1.566838 and its probability value of 0.1314, as well as the computed F value of 2.454982, were not significant. The calculated model's functional form was valid, as indicated by the probability value of 0.1314, which was not significant at the 5% level (14).

Structural stability tests of the estimated model parameters (CUSUM): These indicated that the calculated parameters' structural stability was attained since, at a significance level of 5%, the graphs for the CUSUM and CUSUM-of square tests fall within the upper and lower critical limits, since all calculated parameters are structurally stable (Figure 2) (14).

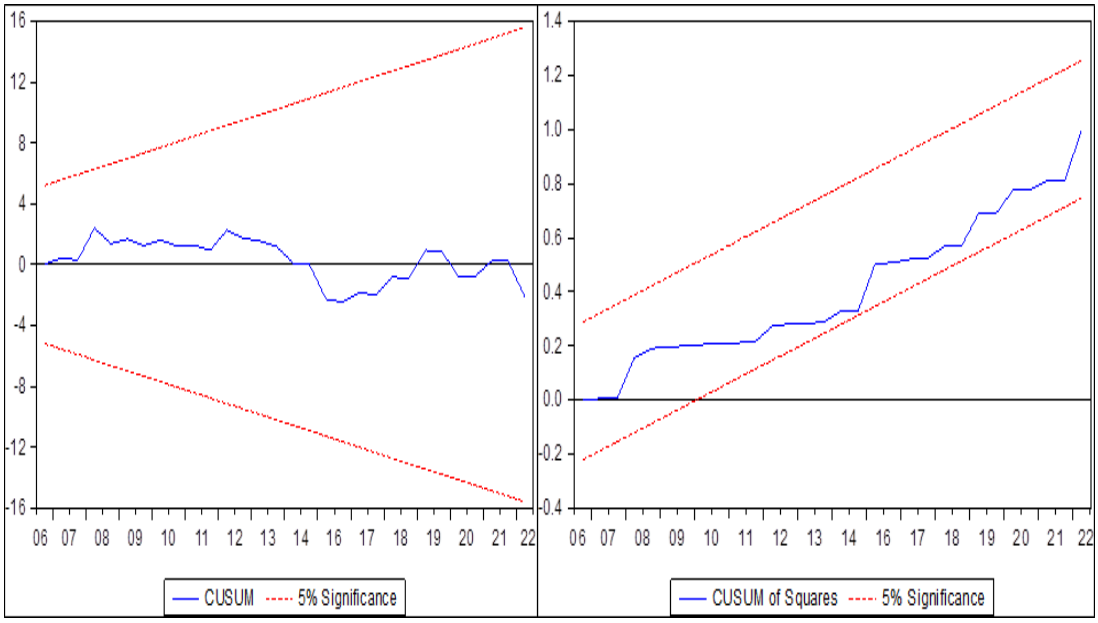

Figure 2: Structural stability test of the estimated model parameters.

Testing for the normal distribution of residuals: Testing the problem of the distribution of the model's residuals depends entirely on the result of the Bera probability. If this probability is greater than 5%, then the model is free from the problem of the normal distribution of residuals. However, if less than 5%, the model contains the problem of the normal distribution of residuals, which can be observed in Figure 3 (14):

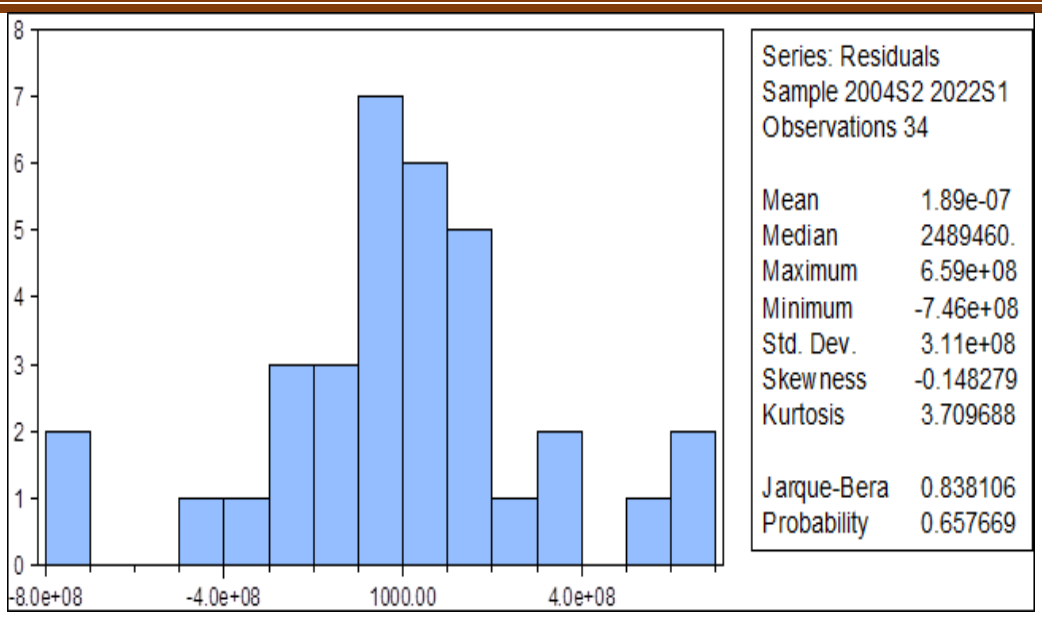

Figure 3: Testing the problem of normal distribution of residuals.

The figure shows the results of the probability (Jarque-Bera test) was greater than 5%, actually reaching (65%). Thus, the model is free from the problem of normal distribution of residuals.

Conclusions

Measuring inflationary pressures through the monetary stability coefficient criterion is essential to determine their levels, as it enables monetary policy, whether expansionary or contractionary, to direct itself in correcting imbalances for promoting monetary stability. Monetary stability in the Iraqi economy was characterized by fluctuations and volatility between equilibrium, contraction, and inflationary pressures during the study period. The characteristic that dominates the results of measuring monetary stability is the presence of inflationary pressures in the economy. Monetary stability is one of the most essential conditions necessary to achieve stability in the external value of the national currency against foreign currencies, which is reflected in achieving balance in the agricultural trade balance.

The agricultural trade balance in Iraq recorded chronic deficits throughout the study period and for all years. Foreign trade in agricultural commodities and live animals is imbalanced in favor of imports. Obstacle to achieving monetary stability and other factors deepened the structural imbalances of economic policies, which were reflected in the decline in agricultural production and the preference for imported food commodities. Agricultural exports fluctuated markedly between high and low, and there were no clear policies designed to increase export volumes with the sector's share of total exports remaining below 0.3% for 2004-22. The monetary value of agricultural exports did not exceed 1% of total exports due to the dominance of crude oil exports which formed 99.6% of total exports in 2022. Meanwhile, imports of agricultural imports and live animals remained high reflecting the decrease in domestic agricultural production and the inability to meet local demand. Agricultural imports covered the gap between the demand and supply of agricultural commodities and live animals.

The study objective was achieved as it enabled the measurement and analysis of the impact between variables, as the data became stationary at the 1% significance, i.e., they were integrated into order [(1) I]. The VECM results revealed a long-term equilibrium relationship between the inflationary pressures variable (X) and the agricultural trade balance (Y) as the 0.2412 probability model's parameter assumed a negative sign and was significant according to the t test (0.05 >p). The results also indicated a positive effect (direct and significant relationship) of inflationary pressures (X) on the trade balance of agricultural commodities and live animals (Y) in the long run. The statistical significance of the relationship between the two variables is according to the logic of economic theory.

The model's performance and its freedom from standard problems were tested after estimating the heterogeneity of variance tests, the serial autocorrelation test, the suitability of the validity of the functional form, the structural stability test of the estimated model parameters, and the normal distribution problem test of the residuals. These results are based on the assumption that other economic factors are constant, which is consistent with economic theory, because any monetary stability leads to increased agricultural production, exports, and reduced imports.

Based on these results, the research recommends that monetary policy should aim to control the rate of money supply to limit inflationary pressures and match its growth rates with that of the gross domestic product to achieve stability between money and real markets. It should also strive to activate monetary variables affecting the macroeconomy. Monetary policy should promote the development of financial markets to include indirect measures that target price volatility (inflation-deflation) and manage monetary policy instruments for promoting growth in agricultural production. It should also seek to raise the competitiveness of local products in the export market and reduce agricultural imports to achieve balance in the trade balance. Long-term plans should also be developed to address the issues facing the agricultural sector and reform its infrastructure, as well as to ensure monetary stability towards achieving sustainable agricultural development.

Supplementary Materials:

No Supplementary Materials.

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Nabras M. Kokaz and Saad A. Hammad: designing and reviewing the study idea and writing the results.

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The authors declare no conflict of interest.

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