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The Effect of Exchange Rate on Inflation: Iraq as a Case Study

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A R T I C L E I N F O

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Abstract: This study examines the effect of exchange rate fluctuations on inflation in Iraq from 2005 to 2023. Using an ARDL model, the results demonstrate a significant short-term relationship between exchange rate movements and inflation, indicating that changes in the exchange rate exert immediate pressure on price levels. The Bound Test confirms the presence of a long-term equilibrium relationship, supported by the Fully Modified Least Squares (FMOLS) method, which shows a modest yet positive long-term effect of exchange rates on inflation. Diagnostic tests, confirm the robustness of the model and the absence of serial correlation and heteroscedasticity.

The findings highlight that while exchange rate volatility is a key driver of inflation, its long-term effects are moderated by structural economic factors such as Iraq's heavy reliance on oil revenues and external financial policies. These results underscore the importance of maintaining exchange rate stability and implementing effective monetary policies to mitigate inflationary pressures and support economic stability in Iraq.

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أثر سعر الصرف على التضخم: العراق كدراسة حالة

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المستخلص

تبحث هذه الدراسة في تأثير تقلبات سعر الصرف على التضخم في العراق من عام 2005 إلى عام 2023. وباستخدام نموذج ARDL، تظهر النتائج وجود علاقة قصيرة الأجل مهمة بين تحركات سعر الصرف والتضخم، مما يشير إلى أن التغيرات في سعر الصرف تمارس ضغطًا فوريًا على مستويات الأسعار. ويؤكد اختبار الحدود وجود علاقة توازن طويلة الأجل، بدعم من طريقة المربعات الصغرى المعدلة بالكامل (FMOLS)، والتي تظهر تأثيرًا متواضعًا ولكنه إيجابي طويل الأجل لأسعار الصرف على التضخم. وتؤكد الاختبارات التشخيصية على قوة النموذج وغياب الارتباط التسلسلي وعدم التجانس.

وتسلط النتائج الضوء على أنه في حين أن تقلب سعر الصرف هو محرك رئيسي للتضخم، فإن آثاره طويلة الأجل معتدلة بسبب العوامل الاقتصادية البنيوية مثل اعتماد العراق الشديد على عائدات النفط والسياسات المالية الخارجية. وتؤكد هذه النتائج على أهمية الحفاظ على استقرار سعر الصرف وتنفيذ سياسات نقدية فعالة للتخفيف من الضغوط التضخمية ودعم الاستقرار الاقتصادي في العراق.

الكلمات المفتاحية: أسعار الصرف، التضخم، العراق، السلاسل الزمنية، نموذج ARDL.

1. Introduction

Since 2003, the Iraqi economy has changed greatly, especially with the independence of the Central Bank of Iraq in accordance with Law No. 56 of 2004, which gave way to formulating monetary policy and adopting tools with a view to stabilizing local prices, thereby combating inflation. Iraq is considered one of the developing rentier economies that depends mainly on its oil exports, with the Iraqi dinar as its currency. It took measures such as daily currency auctions to stabilize the value of the dinar against the US dollar.

Recently, high demand for and low supplies of dollars, political uncertainty, inflation, and a lack of economic diversification have confronted the dinar with depreciation. Besides that, financial corruption and US sanctions against Iraqi banks impede access to hard currency and complicate financial transfers. These challenges mount pressure on the dinar and make the Central Bank implement moves to stabilize the exchange rate and curb inflation.

The rest of this article is organized as follows. Section 2 presents the literature review. The econometric methodology is described in Section 3.

The results are presented in Section 4. Conclusions and discussions are offered in the last section.

Research problem: One of the most prominent challenges to the stability of the Iraqi economy is the fluctuation in exchange rates, where the Iraqi dinar records big fluctuations against foreign currencies, especially the US dollar. This directly influences the rate of inflation, as with the decline in the value of the dinar, import costs rise and local prices of goods and services increase. The research problem, therefore, lies in analyzing the impact of exchange rate fluctuation on inflation in Iraq and determining the magnitude of influence this will have on price stability.

Accordingly, the research problem can be formulated with the following question: What is the effect of exchange rate fluctuations on inflation rates in Iraq during the time period (2005-2023)?

Research Hypothesis: In completion of the research requirements, the following research hypotheses were formulated:

A. The exchange rate has a statistically significant short-term effect on inflation.
B. The exchange rate has a statistically significant long-term effect on inflation.

Research Importance: The exchange rate of any country's currency is considered one of the most important economic and monetary variables that express the strength and size of an economy in terms of its use as a tool in directing its economic policies directly through some indicators. Standard analysis has shown that there is a significant effect of the exchange rate on inflation in Iraq.

Research objectives:

A. Analyze the impact of exchange rate fluctuations on inflation rates in the Iraqi economy during the period from 2005 to 2023.
B. Measure the extent of the impact of the Iraqi dinar exchange rate on inflation rates, and determine whether this impact is statistically significant.
C. Evaluate the strength of the causal relationship between exchange rate fluctuations and inflation, identifying the factors that exacerbate or mitigate this impact.
D. Provide recommendations to improve exchange rate management policies with the aim of achieving greater economic stability and reducing inflation rates.

2. Literature Review

2-1. The exchange rates: The exchange rate serves as a fundamental economic instrument utilized to address various imbalances encountered by countries. It is extensively employed in numerous structural adjustment initiatives globally and is also wielded as a strategic political tool to channel economic resources towards import and export sectors. However, for this to foster sustainable economic growth and ensure stability in development, it is imperative to uphold the exchange rate regime consistently (Schaling, 2008: 2).

Furthermore, a significant concern in international economic relations is the interaction between domestic and foreign currencies. Referred to as the foreign exchange dilemma, it arises due to the absence of a universally accepted international currency that accommodates all countries' needs. A foreign exchange rate denotes the value of a domestic currency relative to a foreign currency, representing the amount of national currency required to acquire one unit of the foreign currency(Qadi,2005:104).

As (Perpetua, 2014:168), the exchange rate signifies the value of one currency relative to another, with fluctuations indicating the strength or weakness of a currency compared to foreign currencies. Furthermore, it serves as a gauge to assess the competitiveness of domestic industries in the global market.

In addition, as noted by (Hamilton, 2018:2), an exchange rate signifies the value of one currency in relation to another or a group of currencies, bearing considerable importance as a fundamental economic indicator. Variations in exchange rates exert broad-ranging influences, shaping decisions undertaken by individuals, businesses, and governmental bodies. These collective choices play a pivotal role in molding diverse facets of economic activity, encompassing inflation rates and the equilibrium of payments.

2-2. Inflation: inflation is a widely discussed concept in economics, but it's often misunderstood. While there are differing views on inflation among economists, there is general agreement that it refers to a sustained increase in prices. Inflation occurs when there is a widespread uptick in the prices of goods and services, leading to a decrease in the purchasing power of a currency. (Okhiria & Saliu, 2008: 5).

This phenomenon is often described as "too much money chasing too few goods." (Voznyuk, 2010: 3). In addition, Inflation affects all countries, regardless of their level of development, and it entails a general rise in the overall price level, signaling a decline in the value of money. This indicates an inverse relationship between the value of money and the general price level (Dahim, 2022: 5).

(Purnomo, 2017: 44) characterized inflation as the ongoing escalation of goods prices, highlighting that this doesn't necessarily entail uniform rate increases across all items. It's emphasized that a singular price surge, even if substantial, does not qualify as inflation.

Inflation has been defined by (Wamucii, 2010: 8) as a continual increase in the overall price level of goods and services within an economy over an extended duration. As prices ascend, the purchasing power of currency diminishes, leading to each unit of currency being able to procure a reduced quantity of goods and services. Consequently, inflation is often referred to as the erosion of the purchasing power of money.

2-3. Inflation-exchange rate relationship: When significant inflationary impacts arise from fluctuations in exchange rates, policymakers must deploy monetary and fiscal measures to counteract the inflationary repercussions of such changes. Monetarist theories assert that the exchange rate between two currencies is primarily determined by the dynamics of supply and demand in the money market. Consequently, an oversupply of currency typically leads to depreciation. Monetarists also posit that a rise in prices triggers increased demand for currency, thus fostering currency appreciation. Additionally, the stimulation of demand through GDP growth plays a pivotal role in determining currency appreciation (Moroşan & Zubaş, 2015: 152)

Sanchez (2005: 32) elucidated through his model that inflation tends to escalate annually as the money supply expands through lending activities, thereby necessitating interest rate hikes. Furthermore, his research revealed that countries borrowing in foreign currency experience inflation rates approximately 0.16% higher than those borrowing domestically. This underscores the exchange rate's utility as a mechanism to mitigate inflationary pressures.

In addition, (Monfared & Akın,2017) outlined four primary channels through which fluctuations in exchange rates impact inflation:

Firstly, exchange rate movements directly influence the prices of imported substitute goods and trade-sensitive products within an open economy. Secondly, exchange rate fluctuations can indirectly raise the costs of final goods by affecting the prices of imported inputs. Thirdly, variations in exchange rates introduce uncertainties in foreign currency pricing, potentially prompting domestic price setters to adjust their prices upward, thereby contributing to inflationary pressures. Finally, exchange rate fluctuations may also lead to wage increases, further exacerbating inflationary tendencies.

Furthermore, (Woo, 1984: 515) delineates four channels through which exchange rates influence domestic inflation:

A. Imported goods' prices directly affect the consumer price index.
B. The pricing of imported goods directly impacts the cost structure of domestic products.
C. Exchange rate fluctuations directly impact the current account, thereby influencing total demand and its fluctuations.
D. Foreign commodities exert upward pressure on prices, contributing to inflationary trends.

2-4. Empirical Literature Review: One of the factors affecting exchange rates is inflation, and it may also be a factor affected by exchange rates. Both perspectives have been tested and examined in the literature:

Hoanga et al. (2020) investigated the influence of exchange rates on inflation and economic growth in Vietnam from 2005 to 2018, utilizing a VAR self-regression vector model. Their study encompassed six endogenous variables in the VAR model: bilateral real exchange rate, imports, exports, money supply, GDP at 2010 comparative prices, and the consumer price index. Additionally, they included two exogenous variables: US Federal Reserve interest rate and international price. The findings revealed significant effects of exchange rates on exports, imports, money supply, production, and prices within the economy. Notably, previous inflation levels largely accounted for current inflation variations. Moreover, the volatility of money supply emerged as a key factor influencing inflation volatility, followed closely by output variation, predominantly in the first quarter. Additionally, export and import fluctuations played vital roles in explaining growth volatility. An increase in the exchange rate not only facilitated export expansion but also contributed to increased imports.

Lowe (2019) conducted an analysis on the impact of exchange rates on inflation in The Gambia spanning the period 1978-2016. The study specifically focused on investigating the relationship between the exchange rate regime and inflation sources. Several variables influencing inflation levels in The Gambia were examined, including interest rates and gross domestic product (GDP). The study employed the augmented Dickey-Fuller (ADF) test to assess the cointegration of variables. Stationarity was tested using order integration, revealing that inflation and interest rates were stationary at levels, whereas the exchange rate and GDP did not exhibit stability at their levels. Additionally, the Johansen cointegration test was utilized to explore the presence of a long-run relationship between the series. The findings indicated an absence of a long-run relationship between the exchange rate and inflation variables. Through the analysis of annual data from 1978 to 2016, it was observed that factors such as money growth and exchange rate fluctuations typically associated with fiscal effects, held greater significance in countries with floating exchange rate regimes compared to those with fixed exchange rates.

Maamari et al. (2017) conducted an analysis on the impact of exchange rates on inflation rates in Algeria spanning the period from 1990 to 2015. The study utilized statistical programs such as EViews 9 and Microsoft Excel 2007. Regression analysis was employed to investigate the relationship between the exchange rate (independent variable) and inflation (dependent variable). Simple linear standards were used to assess the extent of the exchange rate's impact on inflation. The findings revealed an inverse relationship between the two variables, indicating that fluctuations in exchange rates affect inflation levels. The study concluded that there is a significant influence of exchange rates on inflation, with changes in the exchange rate explaining a notable percentage of the variations in inflation rates. This relationship is attributed to Algeria's heavy reliance on imports, which amplifies the impact of exchange rate fluctuations on inflation dynamics.

Masouda and Marzouk (2016) investigated the influence of exchange rate fluctuations on inflation in Algeria from 1980 to 2014. They utilized the vector autoregressive (VAR) model implemented through the EViews 8 program to analyze the impact of exchange rate changes on inflation. The study's findings indicated a direct relationship between the exchange rate and

inflation variables. Specifically, any shock or disturbance in the exchange rate was observed to have a direct and immediate effect on inflation levels.
Okhiria and Saliu (2008) investigated the influence of the exchange rate on inflation and examined the interrelationships among revenue from oil, money supply, government expenditure, inflation, and exchange rates in the Nigerian economy from 1970 to 2007. The study utilized the Augmented Dickey-Fuller test for unit root analysis and the Johansen test for cointegration. The findings revealed strong correlations among most variables, indicating that each variable's impact on inflation rate in the economy is interrelated. Moreover, the study identified a robust long-term relationship among the variables, although inflation and exchange rates did not exhibit a long-term relationship. However, a short-term relationship between inflation and exchange rates was observed.

2-5. Analysis of the impact of exchange rate on inflation in Iraq for the period 2005 to 2023

2-5-1. Analysis of the development of the exchange rate in Iraq for the period (2005-2023): From Table (1) it is clear that the changes in the exchange rate of the Iraqi dinar against the US dollar are unstable and volatile during the period used in the research, as it is clear that the exchange rate in the year (2004) was (1453) dinars for each dollar due to the replacement of the old currency with a new currency and its entry into circulation and general acceptance due to its security and difficulty of counterfeiting, which increased the demand for the new currency as a store of value, as well as the start of the currency auction. In the year (2005), the exchange rate of the Iraqi dinar against the dollar deteriorated to become (1472) with a growth rate of (1.31%). This deterioration is due to the deterioration of the security situation and the difficulty of moving between the governorates, which led to an increase in the costs of materials such as oil, gasoline and other materials, and this is considered a slight deterioration. In 2007, it decreased to reach 1267 dinars compared to 2006, with an annual growth rate of (14.1-%), and continued to decrease until 2011. This stability is due to the role of the Central Bank of Iraq in supporting the Iraqi dinar through the currency window. The exchange rate of the dinar against the dollar remained at its level from 2006 to 2011, and remained at this level with slight changes until 2016, when the exchange rate reached (1275) with a growth rate of (2.25%). In 2017, the exchange rate decreased to reach (1190) dinars compared to

2016, with an annual growth rate of (6.67-%), and the exchange rate of the Iraqi dinar against the US dollar maintained its level with slight changes until 2020. This indicator indicates the success of the monetary policy followed by the Central Bank of Iraq during these years in achieving a high percentage of stability and improvement in the exchange rate of the dinar. However, the exchange rate rose to reach (1474) dinars, with an annual growth rate of (19.45%) for the year 2021 compared to the year (2020), when the exchange rate reached (1,234). This is due to the fact that the quantities of dollars sold in the foreign currency sales window at the Central Bank for the year 2021 recorded a decrease of (15.8-%) compared to the year 2020, to record (37.1) billion dollars compared to (44.1) billion dollars.

The exchange rate data from 2021 to 2023 shows a gradual depreciation of the Iraqi dinar (IQD) against the US dollar (USD). In 2021, the exchange rate was 1,474 IQD/USD, which increased to 1,482 IQD/USD in 2022, and further to 1,531 IQD/USD in 2023. This represents an overall depreciation of approximately 3.87% over the three years. The dinar's weakening could be attributed to several factors, including changes in monetary and fiscal policies by the Central Bank of Iraq (CBI), fluctuations in global oil prices, and external pressures such as a strong US dollar driven by rising interest rates. Additionally, U.S. sanctions imposed on certain Iraqi banks have disrupted dollar flows, limiting access to international markets and putting additional pressure on the dinar. Domestic challenges like political instability and economic reforms might also have contributed to this trend. The depreciation has significant implications, such as increasing the cost of imports and potentially driving inflation

2-5-2. Analysis of the development of inflation in Iraq during the period (2005-2023): Inflation is an economic phenomenon that affects the economies of developing and developed countries alike. Inflation is one of the most important obstacles to economic growth and problems suffered by global economies in general and developing economies in particular due to the serious economic and social effects it causes. Table (1) shows the changes in the inflation rate index during the period (2005-2023). In (2005), the inflation index reached a growth rate of (37.09%). The biggest factor influencing the fluctuation of inflation rates was the fuel crisis due to the continued deterioration of the security situation and the momentum at fuel filling stations, which led to an increase in their prices on the black market,

in addition to the continuous power outages. The inflation index recorded a rate of (53.11%), recording in (2006) the highest inflation rate in the studied period. The reason for this was the rise in fuel prices, which played a role in increasing the cost of production and transportation and increasing consumer demand, in addition to the expansion of current government expenditures. In addition to that, the rise in the foreign exchange rate compared to the Iraqi dinar. In 2009, the inflation rate decreased to 8.34%. The decline in the inflation rate is due to the success of the monetary policy followed by the Central Bank through the gradual increase in the exchange rate of the Iraqi dinar against foreign currencies (the dollar) through the optimal use of the bank through the currency selling window. While we find a decrease in the annual inflation rate, this came as a result of the Central Bank's policy, which was able to improve the exchange rate of the Iraqi dinar against the dollar, and the inflation rates continued to decrease during the years (2018, 2017, 2016, 2015, 2014, 2013, 2012, 2011, 2010)to reach)0.4%, 0.2%, 0.5%, 1.44%, 2.24%, 1.86%, 6.06%, 5.60%, 2.46%) respectively. This decrease in annual inflation rates reflects the success of the monetary policy in targeting the stability of the general price level. In 2019, the inflation rate declined to (-0.2%), due to the decline in domestic demand and changes in global oil and raw material prices. Inflation rates increased during 2021 to (6.0%) compared to (0.6%) in 2020. This increase is attributed to supply chain bottlenecks, the shift in demand from services to goods, and the labor supply shock.

The inflation rates from 2021 to 2023 show a gradual decline, moving from 6.0% in 2021 to 5.0% in 2022, and further decreasing to 4.4% in 2023. This downward trend indicates a steady improvement in controlling price levels within the economy over the three-year period. This decline can be attributed to improved inflation dynamics in Iraq, partly due to the Central Bank of Iraq's tighter monetary policy, which helped curb inflationary pressures. Additionally, the decrease in global food prices during this period played a significant role in reducing costs for consumers and stabilizing the economy.

While the declining inflation rates reflect progress in economic stabilization, other factors likely influenced this trend, such as relative stability in global oil prices and potential adjustments in domestic fiscal policies. However, challenges remain, including the economy's reliance on

oil exports and its vulnerability to external shocks. Continued efforts to diversify the economy and maintain effective monetary policies will be critical in ensuring sustainable low inflation levels and long-term economic stability

Table (1): Evolution of exchange rate and inflation trends in Iraq for the period 2005-2023

Years	exchange rate	Exchange rate change	Consumer Price Index 100=2007	Inflation rate%
2004	1453	-	36.4	-
2005	1472	1.31	49.9	37.09
2006	1475	0.2	76.4	53.11
2007	1267	-14.1	100	30.89
2008	1203	-5.05	112.7	12.70
2009	1182	-1.75	122.1	8.34
2010	1170	-1.02	125.1	2.46
2011	1196	2.22	132.1	5.60
2012	1233	3.09	140.1	6.06
2013	1231	-0.16	142.7	1.86
2014	1214	-1.38	145.9	2.24
2015	1247	2.72	148	1.44
2016	1275	2.25	104.1	0.5
2017	1190	-6.67	104.3	0.2
2018	1209	1.60	104.7	0.4
2019	1196	-1.08	104.5	-0.2
2020	1234	3.18	105.1	0.6
2021	1474	19.45	111.5	6.0
2022	1482	0.54	117.0	5
2023	1531	3.31	122.2	4.4

Source: Prepared by researchers based on data published in the Central Bank of Iraq

3. Econometric Methodology:

The present study has made an attempt to investigate the relationship between the exchange rate and inflation in Iraq covering the period from 2005 to 2023 using the econometric approach. In order to conduct the empirical investigation, the following regression model is estimated.

$$y_t = \beta_0 + \beta_1 x_t + e_t \quad (1)$$

Where y_t represents the inflation rate, which is the dependent variable. The variable x_t denotes the foreign exchange rate, which is the independent variable in the model. The parameter β_0 is the intercept and β_1 symbolizes the slope. The error term is denoted by e_t, which is assumed to fulfill the desirable statistical assumptions for a good model. The time index is represented by t (t=1, …, T). Equation (1) is going to be estimated by:

3-1. Stationarity Testing: The Augmented Dickey-Fuller test is conducted for the stationarity of the variables concerned. All non-stationary variables were thereby differenced if necessary.

3-2. Model Selection: The ARDL model is chosen for this analysis to capture the short-run as well as the long-run relationship of exchange rates with inflation. Optimal lag lengths were determined by the Akaike Information Criterion.

3-3. Cointegration Testing: The Bound Testing Approach was used to check if there is a long-run equilibrium relationship between exchange rates and inflation.

3-4. Error Correction Model (ECM): After the cointegration test, an ECM was estimated to model short-term dynamics and fix the long-term disequilibrium.

3-5. Diagnostic Tests: In order to check the robustness of the model diagnostic Tests were conducted. These results were checked to ensure that the estimated model satisfied all the required econometric assumptions.

The EViews software was used in conducting all the econometric estimations.

The sample period covers the years 2005-2023. The frequency is yearly. The choice of the sample period is determined by data availability. The source of the data for both inflation and exchange rate data were obtained from official publications by the Central Bank of Iraq

4. Empirical Results

4-1. Summary of stability results: The stability of the study variables was tested using the Eviews.10 program using the expanded Dickey-Fuller (ADF) test in order to know whether the variables are stable (stationary) or unstable (non-stationary), i.e. they contain a unit root with the determination of the integration order. After conducting the test for the variables, the following outputs were obtained:

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Table (2): Augmented Dickey-Fuller (ADF) Test Results for Stationarity

Variable	Test Level	Specification	ADF Statistic	p-value	Stationary	Significance
Exchange Rate	Level	Constant	-1.211406	0.6455	No	Not
		Constant, Linear Trend	-1.470828	0.8014	No	Not
		None	0.060749	0.6894	No	Not
	First Difference	Constant	-3.184191	0.0391	Yes	*
		Constant, Linear Trend	-4.561933	0.0110	Yes	**
		None	-3.285203	0.0027	Yes	***
Inflation Rate	Level	Constant	-1.211406	0.6455	No	Not
		Constant, Linear Trend	-1.470828	0.8014	No	Not
		None	0.060749	0.6894	No	Not
	First Difference	Constant	-3.184191	0.0391	Yes	*
		Constant, Linear Trend	-4.561933	0.0110	Yes	**
		None	-3.285203	0.0027	Yes	***

 *****: Significant at 5% ($p \leq 0.05$).******: Significant at 1% ($p \leq 0.01$). *******: Significant at 0.1% ($p \leq 0.001$).

Source: Prepared by researchers based on EViews program outputs.

The table (2) shows that the results of Augmented Dickey-Fuller for both the exchange rate and inflation rate indicate that both variables are non-stationary at the level because the p-values are above (0.05), suggesting no significant evidence of stationarity. However, when the first difference is applied, both variables become stationary at 5%, 1%, and 0.1% significant levels, since the p-values are considerably below 0.05, showing that the series is significant and stationary. That means the data for exchange rate and inflation rate would follow a trend, and differencing is needed to make it stationary and prepare it for further time series analysis.

4-2. Bounds Test: The next step is to test the existence of a cointegration relationship, i.e. the existence of a long-term equilibrium relationship, by means of the Bounds Test, which is shown in the table (3):

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Table (3): Bounds Test for the Estimated Model

F-Bounds Test		**Null Hypothesis: No levels relationship**		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
F-statistic	3.937347	10%	3.02	3.51
k	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58
Actual Sample Size	18		Finite Sample: n=35	
		10%	3.223	3.757
		5%	3.957	4.53
		1%	5.763	6.48
			Finite Sample: n=30	
		10%	3.303	3.797
		5%	4.09	4.663
		1%	6.027	6.76

Source: Prepared by researchers based on Eviews program outputs

Table (3) shows that since the F-statistic (3.937347) is greater than the critical value at 5 percent level of significance (3.62), we reject the null hypothesis. That implies, there exists a long-run relationship between dependent variable, inflation rate and the independent variable, exchange rate

4-3. ARDL Long Run Form and Bounds Test:

Table (4): ARDL Long Run Form and Bounds Test results

ARDL Long Run Form and Bounds Test				
Dependent Variable: D(Y)				
Selected Model: ARDL(1, 0)				
Case 2: Restricted Constant and No Trend				
Date: 11/19/24 Time: 23:30				
Sample: 2005 2023				
Included observations: 18				
Conditional Error Correction Regression				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-38.2439	17.29611	-2.21113	0.043
Y(-1)*	-0.28041	0.108613	-2.58174	0.0208
X**	0.030622	0.013552	2.259514	0.0392

* p-value incompatible with t-Bounds distribution.				
** Variable interpreted as Z = Z(-1) + D(Z).				
Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
X	0.109203	0.060134	1.816004	0.0894
C	-136.385	78.60722	-1.73502	0.1032
EC = Y - (0.1092*X -136.3853)				

Source: Prepared by researchers based on Eviews program outputs

From Table (4) the following is noted: Error Correction Term (ECT): Y (-1) Coefficient was (-0.280411) The negative coefficient of the error correction term (ECT) indicates that the model is correcting for disequilibrium between the variables over time.

Short-run Coefficient of X (exchange rate) (0.030622) with p-value (0.0392) implies that there is a positive and statistically significant relationship between variable exchange rate and inflation in the short run, which denotes those alterations in exchange rate result in temporary positive responses to inflation, which implies that exchange rate immediately shocks inflation in the short term.

The long-term coefficient of X(exchange rate) was (0.109203), which shows the positive relationship between exchange rate and inflation, meaning exchange rate contributes positively to inflation over time. This was supported by the associated p-value, which at (0.0894), was above the conventional threshold of (0.05) though it could be considered significant at the 10% level, indicating this long-term relationship is marginally less significant. This relatively low level of statistical significance can result from several causes, including:

Stronger Short-Run Effects: The estimation results indicate that the short-run effect of exchange rate on inflation is stronger and significant. This implies that the immediate effects of exchange rate on inflation are more rapid and apparent, while the longer-run effects of exchange rate on inflation may take a longer time to build up and are less strong.

Data Characteristics: The dataset consists of a small sample size, 18 observations, which can constrain the statistical power of the model in capturing long-run relationships.

Economic Dynamics: Long-term effects might show up diluted due to economic turbulences, structural changes, or other factors that could affect the stability of the relationship over time.

4-4. Estimation of the research model using autoregressive distributed lag (ARDL):

Table (5): Summary of ARDL estimation results for the research model for the period (2005-2023)

Dependent Variable: Y				
Method: ARDL				
Date: 11/19/24 Time: 22:22				
Sample (adjusted): 2006 2023				
Included observations: 18 after adjustments				
Maximum dependent lags: 1 (Automatic selection)				
Model selection method: Akaike info criterion (AIC)				
Dynamic regressors (1 lag, automatic): X				
Fixed regressors: C				
Number of models evaluated: 2				
Selected Model: ARDL(1, 0)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
Y(-1)	0.719589	0.108613	6.625247	0
X	0.030622	0.013552	2.259514	0.0392
C	-38.2439	17.29611	-2.21113	0.043
R-squared	0.7812	Mean dependent var		7.866667
Adjusted R-squared	0.752026	S.D. dependent var		13.41133
S.E. of regression	6.678438	Akaike info criterion		6.786657
Sum squared resid	669.023	Schwarz criterion		6.935052
Log likelihood	-58.0799	Hannan-Quinn criter.		6.807119
F-statistic	26.77781	Durbin-Watson stat		1.464513
Prob(F-statistic)	0.000011			

Source: Prepared by researchers based on Eviews program outputs

The ARDL results in table (5) show that the lagged value of the dependent variable, (Y (-1)), is highly significant p (0.0000) with a positive coefficient of (0.7196); this thus implies that Y displays strong persistence

over time. The independent variable, (exchange rate), is statistically significant p (0.0392), with a coefficient of (0.0306), and, therefore, has positive short-run effects on (Y. C) is the constant term, which is significant at p(0.0430) and negative, thus providing an offset to the dependent variable. The model fit is strong since the R2 value is 0.7812, with an adjusted R2 of 0.7520; hence, about 75% of the variation in Y may be explained by the model.

The overall significance of the model is further confirmed by the F-statistic at p (0.000011). Diagnostic criteria such as Akaike Information Criterion-AIC (6.7867) and Schwarz Criterion-SC (6.9351) suggest that the model is well specified. However, the Durbin-Watson statistic is (1.4645), indicating possible autocorrelation that needs further investigation with more diagnostic tests.

4-5. Augmented Dickey-Fuller (ADF) Test Results for Residuals of the ARDL Model:

Table (6): Augmented Dickey-Fuller (ADF) Test Results for Residuals of the ARDL Model

Statistic/Test	Value	Critical Value	Conclusion
ADF t-statistic	-4.651691	1%: -4.616209	The test statistic is less than the 1% critical value.
		5%: -3.710482	Significant at 1% and 5% levels.
		10%: -3.297799	
p-value	0.0094		p-value < 0.05, reject the null hypothesis.
RESID01(-1) Coefficient	-0.580237		
R-squared	0.689616		
Adjusted R-squared	0.617989		
Durbin-Watson Statistic	2.461975		

Source: Prepared by researchers based on Eviews program outputs

table (6) shows the results from the Augmented Dickey-Fuller (ADF) test for residuals of the ARDL model that indicates the residuals from the regression model are stationary, as the ADF t-statistic (-4.6517) is lower than

the critical values at the 1%, 5%, and 10% significance levels. The associated p-value (0.0094) is less than (0.05), allowing to reject the null hypothesis of a unit root. The regression model shows a fairly good fit, given the R-square of (0.6896) and an Adjusted R-square of (0.6180). The Durbin-Watson statistic is (2.462), which means that the residuals are not significantly serially correlated and hence uphold the stability of the results. The results prove that there is a long-run relationship between the exchange rate and inflation rates in the dataset

4-6. ARDL Error Correction Regression:

Table (7): ARDL Error Correction Regression results

ARDL Error Correction Regression				
Dependent Variable: D(Y)				
Selected Model: ARDL(1, 0)				
Case 2: Restricted Constant and No Trend				
Date: 11/23/24 Time: 22:02				
Sample: 2005 2023				
Included observations: 18				
ECM Regression				
Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
CointEq(-1)*	-0.28041	0.07664	-3.65882	0.0023
R-squared	0.411325	Mean dependent var		-1.81611
Adjusted R-squared	0.411325	S.D. dependent var		8.176327
S.E. of regression	6.2733	Akaike info criterion		6.564435
Sum squared resid	669.023	Schwarz criterion		6.6139
Log likelihood	-58.0799	Hannan-Quinn criter.		6.571255
Durbin-Watson stat	1.464513			
* p-value incompatible with t-Bounds distribution.				

Source: Prepared by researchers based on Eviews program outputs

Results of the ARDL Error Correction Regression-Table (7) suggest the existence of a dynamic relation between inflation (dependent variable) and the exchange rate (independent variable). The coefficient of error correction term CointEq (-1) (-0.280411), p. (0.0023) implies that there is a

statistically significant mechanism to adjust deviations from the long-run equilibrium, with about (28%)of any disequilibrium corrected in each period. Supporting diagnostics include the ARCH Test and FMOLS analysis, which confirmed the adequacy of the model with robust results, further establishing the presence of a statistically significant, positive long-run influence of X(exchange rate upon Y(inflation)

4-7. Diagnostic Tests for Model Validation:

4-7. 1Test of homogeneity of variance ARCH

Table (8): Results of the test of the stability of the variance of the error limits (homogeneity of variance)

Heteroskedasticity Test: ARCH				
F-statistic	0.014479	Prob. F(1,16)		0.9057
Obs*R-squared	0.016274	Prob. Chi-Square(1)		0.8985
Test Equation:				
Dependent Variable: WGT_RESID^2				
Method: Least Squares				
Date: 11/20/24 Time: 22:54				
Sample (adjusted): 2006 2023				
Included observations: 18 after adjustments				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	2.921987	0.925179	3.158295	0.0061
WGT_RESID^2(-1)	-0.03192	0.265236	-0.12033	0.9057
R-squared	0.000904	Mean dependent var		2.826047
Adjusted R-squared	-0.06154	S.D. dependent var		1.932525
S.E. of regression	1.991101	Akaike info criterion		4.319691
Sum squared resid	63.43171	Schwarz criterion		4.418622
Log likelihood	-36.8772	Hannan-Quinn criter.		4.333333
F-statistic	0.014479	Durbin-Watson stat		1.873609
Prob(F-statistic)	0.90572			

Source: Prepared by researchers based on Eviews program outputs

Table (8) shows the results from the ARCH (Autoregressive Conditional Heteroscedasticity) test and suggest that there is no significant evidence of heteroskedasticity in the data. Specifically, the F-statistic of (0.014479) with a p-value of (0.9057) indicates that failing to reject the null hypothesis, which implies that there is no heteroscedasticity in the residuals.

Doi: www.doi.org/10.25130/tjaes.21.70.2.23

The Chi-Square statistic further presents a very high p-value of (0.8985), hence confirming the fact that residuals are not affected by a systematic pattern of heteroskedasticity. In the variance equation, the coefficient for WGT_RESID^2(-1) is insignificant, since its p-value stands at (0.9057), which indicates that previous squared residuals do not contribute significantly to explaining the variance. These results are indicative that, indeed constant variance is assumed in this model.

4-7-2. Jarque-Bera test for normal distribution:

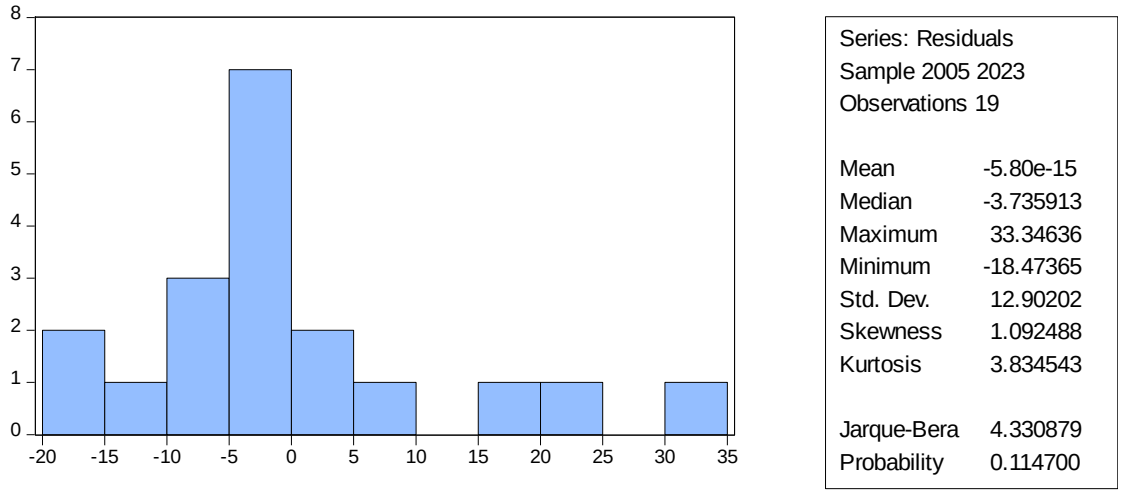

Figure (1): Jarque-Bera test for normal distribution

The figure (1) the residual analysis shows that the residuals are approximately normally distributed; the Jarque-Bera test has a test statistic of (4.33) and a p-value of (0.1147), greater than the (5%) significance level. The histogram of residuals is roughly symmetrical and most values are centered on zero. The mean of the residuals is approximately zero (actually, -5.8e-15), indicating no bias; the skewness is (1.092) and kurtosis equals approximately (3.83) skewness and kurtosis close to normality benchmarks. These results support the normality assumption concerning the model residuals and argue that estimates obtained by this model will be reliable**.**

4-7-3. Breusch-Godfrey Serial Correlation LM Test:

Table (9): Breusch-Godfrey Serial Correlation LM Test results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	37.51261	Prob. F(1,16)	0
Obs*R-squared	13.3191	Prob. Chi-Square(1)	0.0003
Test Equation:			
Dependent Variable: RESID			
Method: Least Squares			

Doi: www.doi.org/10.25130/tjaes.21.70.2.23

Date: 11/21/24 Time: 00:47				
Sample: 2005 2023				
Included observations: 19				
Presample missing value lagged residuals set to zero.				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-25.7438	18.70819	-1.37607	0.1878
X	0.01929	0.014433	1.336484	0.2001
RESID(-1)	0.914506	0.149313	6.124754	0
R-squared	0.701005	Mean dependent var		-5.80E-15
Adjusted R-squared	0.663631	S.D. dependent var		12.90202
S.E. of regression	7.482831	Akaike info criterion		7.007039
Sum squared resid	895.8842	Schwarz criterion		7.156161
Log likelihood	-63.5669	Hannan-Quinn criter.		7.032276
F-statistic	18.7563	Durbin-Watson stat		1.068209
Prob(F-statistic)	0.000064			

Source: Prepared by researchers based on Eviews program outputs

Table (9) presents the results of the Breusch-Godfrey Serial Correlation LM Test, which support the presence of serial correlation in the model residuals. The F-statistic stands at (37.51) with a p-value of (0.0000), while the Obs*R-squared statistic is (13.32), also with a p-value of (0.0003). These are highly significant at 1%. This confirms that the null hypothesis of no serial correlation is rejected, indicating the autocorrelation of residuals.

It is noted from Table (9) that the ARDL model suffers from the problem of autocorrelation. In order to get rid of the problem of autocorrelation, the Fully Corrected Least Squares (FMOLAS) methodology will be used. This method is characterized by its ability to solve the problem of autocorrelation and parameter bias. This method works to select the values of the estimated parameters from some spurious ones. This method is compatible and provides better results with large samples. This method also requires the estimation processes to achieve the condition of joint integration between the study variables (Al-Farra, 2012:126), (Aziz & Hassan,2021:243). After achieving the existence of long-term joint integration between the study variables, moving to the second plan by estimating the study model using this method as in Table (10).

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4-8. Fully Modified Least Squares (FMOLS):

Table (10): Fully Modified Least Squares (FMOLS) results

Dependent Variable: Y				
Method: Fully Modified Least Squares (FMOLS)				
Date: 11/21/24 Time: 02:54				
Sample (adjusted): 2006 2023				
Included observations: 18 after adjustments				
Cointegrating equation deterministics: C @TREND				
Long-run covariance estimate (Prewhitening with lags = 1 from AIC				
maxlags = 2, Bartlett kernel, Newey-West fixed bandwidth = 3.0000)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
X	0.092875	0.023368	3.974403	0.0012
C	-89.1161	28.40291	-3.13757	0.0068
@TREND	-2.28896	0.527267	-4.34118	0.0006
R-squared	0.804814	Mean dependent var		7.866667
Adjusted R-squared	0.778789	S.D. dependent var		13.41133
S.E. of regression	6.307766	Sum squared resid		596.8187
Long-run variance	114.1122			

Source: Prepared by researchers based on Eviews program outputs

From table (10) of the FMOLS estimation results, the long-term impact of the exchange Rate-X on Inflation-Y in Iraq is significantly positive. The estimated coefficient of the exchange rate is (0.092875), implying that for every unit increase in the level of the exchange rate, the inflation rate increases by about (0.0929) units, ceteris paribus. This is a statistically significant relationship because the p-value of (0.0012) is way below the (0.05) threshold, indicating that the exchange rate does have a meaningful effect on inflation in the long run.

Also, the R-square of (0.8048) indicates that it explains about (80%) in the variation of inflation, indicating a pretty strong explanatory power. The adjusted R-square of (0.7788) shows that the model is also a good fit because the loss of degrees of freedom was compensated for by accounting for the trend variable

The FMOLS test provides stronger evidence for accepting the long-term hypothesis, emphasizing the robustness of the positive relationship between X (exchange rate) and Y(inflation) over time

5. Conclusions and recommendations:

5-1. Conclusions:

A. the findings of a long-run relationship existing between the exchange rate and inflation in Iraq. The error correction term estimated at (-0.280411) shows the speed at which short-run disequilibria adjust toward restoring long-run equilibrium, thus indicating that over a long time the relationship will be stable.

B. These tests showed the contribution of the exchange rate as positive and significant towards changes in inflation over time, indicating that the coefficient of the independent variable (exchange rate) was positive and significant. This proved that changes in the rate of exchange affect inflation rates directly.

C. statistic value was supporting the cointegrating relation, which also supported that there exists a significant long-run impact of the exchange rate on inflation.

D. There were no significant problems of conditional heteroscedasticity in the data, which justifies the robustness of the models utilized in explaining the relationship between the variables.

E. Residual normality and statistical distribution tests showed that residuals are normally distributed, hence increasing the efficiency and accuracy of the models used in estimating the relationship.

F. Through ECM, it was noticed that the exchange rate influenced inflation in the short run, while it had a gradual adjustment process that linked both the variables in the long run.

5-2. Recommendations:

A. The Central Bank of Iraq should adopt such policies that stabilize the exchange rate so as to have a lesser negative effect on inflation. It may include maintaining satisfactory foreign currency reserves and taking necessary measures to reduce speculation in currency markets.

B. Reliance on the exportation of oil as the main source of income predisposes the economy to the effects of fluctuation in exchange rates. Diversification into other sources of income, such as agriculture, manufacturing, and tourism, reduces the sensitivity of the economy to volatility in the exchange rate.

C. CB should strengthen its monetary policy instruments to control inflation effectively. It includes perfection of interest rate policies and inflation-targeting measures.

D. Stricter regulation in the form of preventing illegal currency outflows and eradicating corruption in the financial system can provide stability to the exchange rate and reduce the inflationary pressures.

E. Better development and modernization of the financial markets in Iraq could improve the management of fluctuating exchange rates. It would be easier to minimize volatility and inspire confidence in the financial system if there were greater market transparency and efficiency.

F. Governments should work to curb black market currency trading, as it fuels instability in the exchange rate and adds to inflationary pressures.

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