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Measuring and Analyzing the Impact of monetary policy on Inflation in Iraq for the Period (2004-2023)

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ABSTRACT:

This study examines the impact of monetary policy on the inflation rate in Iraq during the period 2004–2023. Annual data was used, the analysis models inflation rate as the dependent variable, while money supply (M2), interest rate, and exchange rate as the independent variables. Also tries to measure and analyze the impact of monetary policy on inflation in Iraq during the period from 2004 to 2023. To achieve this objective of fulfilling its full potential, present paper adopts FMOLS approach, and the secondary data was used during the period of (2004 -2023). The results are consistent with economic theory and some other studies in the sense that there is a positive relationship between money supply (M2) and inflation. Specifically, a 1% increase in M2 is related with a 9.47% increase in inflation rate, highlighting its significant effect. On the other hand, the analysis exposes a negative relationship between interest rates and inflation rate: a 1% increase in the interest rate leads to a 5.47% decrease in inflation rate in Iraq. Furthermore, the coefficient of exchange rate (EXR) is 0.0574 suggests that a rise of the exchange rate results in a 0.057% increase in inflation rate. Depended on the results, the study achieves that relying only on monetary policy is insufficient for controlling inflation rate. It recommends a coordinated method that includes fiscal policy and other non-monetary tools to effectively manage inflation rate in Iraq.

Key words: Inflation rate, Money Supply (M2), Interest Rate, Exchange Rate, Iraq, Time Series Analysis

1 INTRODUCTION

The economic and financial stability of a country is depended on monetary policy, typically implemented by the central bank. Commonly approved that monetary policy plays an important role in sustainable economic growth by maintaining price stability [1]. Monetary policy refers to the process through which a country's monetary authority regulates the money supply and often targets interest rates to influence economic activity.

By using several tools, central banks apply monetary policy, most remarkably open market operations, throughout which the supply of base currency is adapted by buying or selling government securities. These operations effect interest rates, liquidity in the banking system, broader economic indicators like inflation rate and exchange rates (Lipsey et al., 2001, as cited in [1].

Reserve requirements are Fed regulations that require banks to hold a minimum reserve-deposit ratio. If Fed decreases reserve requirements, then banks are able to lend more loans and “create” more money from each deposit.

The discount rate is the interest rate that Fed levies on loans the interest rate that Fed levies on loans is the discount rate. While some banks borrowing money from the Fed, their funds raise, entitle them to grant more loans and “generate” more money. Also, by reduction the discount rate to prompt banks to borrow more reserves, the Fed can increase B [2].

Inflation as a term has been described by many economists in different ways but one thing runs through all. Economists agree that inflation is; it’s increasing for overall prices over time [2]. Furthermore, Mishkin (2003) [3], the rate at which the general level of price for goods and services is rising, consequently, purchasing power is falling. Emerenini and Eke (2014) [4], in any economy, the problem of inflation has always remained an issue due to its effect on economic activities. This could partly be that, as prices rise, the real value of the money falls because each unit of a currency can buy less things. In country, that is experiencing an inflationary trend a lot of reasons have been offered that could be its causes. Some of these reasons due to excess demand over supply, increase in the cost of production and some other structural

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problems in the economy. The two main indices used to measure inflation are the Consumer Price Index (CPI) and Producer Price Index (PPI). The CPI shows the change in the purchasing power of a consumer; the PPI measures the change in the purchasing power of the producers of those goods. Additional perspectives link inflation to rising production costs or to structural transformations in the economy that naturally lead to higher prices [5].

Economic theory declare that the money supply has a main effect on inflation. This means that increase in money supply because of growth in production and employment; this creates an inflationary condition in an economy. "The monetarist explaining that this phenomenon using the theory of natural rate of unemployment and believes that increases in the money supply will exert an increasing impact production and employment in the short run and not in the long run" [4]. Thus, the relationship between inflation and money supply will be a positive. Nevertheless, the natural rate of unemployment provided that given resources of employment, the type of technology and the number of firms in use, the equilibrium output and employment level are certainly definite. Subsequently, an increasing the supply of money will decrease the natural rate of unemployment and increase production, in the short run. While, in the long run this will lead to an increasing inflation [4].

Hence, the management of price and control are the fundamental aspects of the economic planning, ordinarily conducted by the Central Bank of Iraq [6]. Nonetheless in achieving stability, the efficiency of the monetary policy of Iraq, faced the crucial challenges, mainly as a result of lengthy periods of the conflict. These conditions have donated to peculiar inflation rates, high unemployment rate and inactive economic growth.

The Iraqi economy experienced an important development in the 1970s, however, it was dramatically declined during the first Gulf War in the 1980s. In 1990, the Iraqi invasion of Kuwait (Second Gulf War) cause military strikes and economic sanctions by multinational forces against Iraq. Furthermore, U.S. forces and its allies occupied Iraq in 2003 (third Gulf war). These events changed the infrastructure of the Iraqi economy. During these events, inflation played a main role [7]. In this regard, the aim of current study is to examine the relationships among inflation, money supply (M2), interest rate (IR) and exchange rate in Iraq, using annual data for the period (2004-2023).

The rest of the paper is going to be structured in the following way, beginning with chapter two that deals with the contextual empirical literature review, while chapter three represents methodology and data collection. Chapter four provides the empirical results for the impact of monetary policy on inflation and discussion based on economic theory and statistical indicators. Finally, chapter five concludes the study and offers policy recommendations

1.1 PROBLEM STATEMENT

Inflation is the most powerful and complicated economic challenge that faces the Iraqi government, mainly in the aftermath of decades of political uncertainty, war, oil-dependency and economic sanction. In spite of many efforts of Iraqi Central bank to apply some monetary policies that focused on stabilizing the economy condition, but inflationary pressures carry on to make threaten on the macroeconomic stability, ruin the purchasing power of citizens, and obstruct long-term development.

1.2 HYPOTHESIS

H1: Money supply has a positive impact on inflation in Iraq.

H2: Interest rate has a negative impact on inflation in Iraq.

H3: Exchange rate has a positive impact on inflation in Iraq.

1.3 SIGNIFICANCE OF THE STUDY

This study holds substantial importance as it empirically measures and analyzes the impact of monetary policy on inflation in Iraq during the period 2004 to 2023. Given Iraq's single economic challenges—including oil-dependency, political instability, and structural weaknesses—understanding how the tools of monetary policy can impact on inflation rate is important for evidence-based policymaking.

1.4 RESEARCH OBJECTIVE

The main objective of this study is to measure and analyze the impact of monetary policy on inflation in Iraq during the period from 2004 to 2023. It aims to evaluate the extent to which monetary policy tools have influenced inflation trends and to identify the strengths and limitations of these tools in managing inflation rate in Iraq for the study time.

2 LITERATURE REVIEW

The empirical evidences from different countries approve that the monetary policy has an effect on inflation in developing and developed countries. The outcomes however, are varied as different analyses, data samples and techniques are adopted. For instance, Ratnasiri (2009) [8] examined the main determinants of inflation rate in Sri Lanka during 1980 to 2005. Vector autoregressive analysis was used. The results showed that growth of money supply and rising prices were the primary drivers of inflation in Sri Lanka in the long run. On the other hand, exchange rate depreciation and the output

gap were not statistically significant. In the short run, rise prices remained the most powerful factor, while exchange rate and money supply were weakly exogenous, and the output gap had no statistically significant influence.

Odusanya and Atanda (2010) [9] investigated the dynamic and simultaneous inter-relationship between inflation rate and its determinants in Nigeria over the period 1970 to 2007. Annual data was used. The result exposed that money supply growth, first lagged of inflation rate, growth rate of GDP, import, and interest rate exert positive impact on inflation. However, only the growth of GDP and the previous year's inflation rate were found to have a significant effect.

Ahiabor (2013) [1] investigated the impact of monetary policy on inflation in Ghana for the period 1985-2009. Selected variables are inflation as a dependent variable while money supply, interest rate and exchange rate were independent variables. The outcomes showed a positive long-run relationship between money supply and inflation, negative relationship between the rate of interest and inflation, however, a positive relationship between exchange rate and inflation.

Hossain and Islam (2013) [10] examined the determinants of inflation in Bangladesh for the period 1990 to 2010. The ordinary least square method was used. The empirical result showed that money supply, one year lagged value of interest rate have a positive and significant influence on inflation. The result also indicated that one year lagged value of money supply and one year lagged value of fiscal deficit have a significant and negative effect on inflation rate. There was an insignificant relationship between interest, fiscal deficit and nominal exchange rate. The explanatory variables accounted for 87 percent of the variation of inflation in during the period.

Iya and Aminu (2014) [11] explored the determinants of inflation rate in Nigeria from 1980 to 2012. The Ordinary Least Squares (OLS) method was used. Their outcomes showed that both the supply of money and interest rate had a positive effect on inflation rate, while government expenditure and exchange rate have a negative impact on inflation. They recommended that price stability in Nigeria could be enhanced by reducing the supply of money and interest rates while increasing government expenditure and exchange rate in the country.

In another study, Emerenini and Eke (2014) [4] that examined the determinants of inflation rate in Nigeria using a monthly data from January 2007 to August 2014. The ordinary least square (OLS) method was used. The result showed the effect of expected inflation, money supply and exchange rate on inflation. However, interestingly the policy interest rate (monetary policy rate} used for macroeconomic stability does not have any statistical relationship with inflation rate as an independent variable during the study period.

This study examines the relationship between money supply (M2) and inflation in Iraq during the post-2003 period. Hasoon (2015) [7] find a strong positive relationship between the money supply growth and inflation. The results suggest that approximately 60% of the increase in inflation can be attributed to increased liquidity, particularly in times of political instability.

Abd et al. (2025) [12] purpose to measure and analyze selected monetary policy indicators and their effects on inflation rates in Iraq for the period 2004 to 2024. The Autoregressive Distributed Lag (ARDL) model was used. The finding showed that there is a positive and significant relationship between monetary policy and inflation rates in Iraq throughout the analyzed period.

To the best knowledge of these researchers, there is not any study that focus on this issue during 2004-2023. Furthermore, no current literature on Iraqi monetary policy used new approach, such as FMOLS. Therefore, the current study is going to fill up some gap by adding at least one more empirical study to the existing number of articles. Our empirical results enable us to find how much inflation is influenced by monetary policy in Iraq.

Thus, it could be said that the relationship between money supply and inflation rate is positive; conversely, the relationship between interest rate and inflation rate is negative. Only a few studies that did not find conclusive evidence supporting these hypotheses.

3 METHODOLOGY

3.1 RESEARCH DESIGN

This study uses an econometric method to measure and analyze the impact of monetary policy on inflation in Iraq for the period 2004–2023. The analysis is depended on secondary time-series data and aims to identify causal relationships and trends using macroeconomic models.

3.2 DATA COLLECTION

- **Source**: Data will be collected from reliable sources such as the Central Bank of Iraq (CBI).
- **Period**: Annual data for the period **2004 to 2023** will be used, depending on availability.
- **Variables**:

- **Dependent variable** is the inflation rate (INF)
- **Independent variables** are (Monetary policy indicators):
  - Is the Money supply (M2)
  - Is the interest rate (IR)
  - Is the exchange rate (IQD/USD)

3.3 ECONOMETRIC MODEL

To measure the impact of monetary policy on inflation, the following model may be used:

Using (FMOLS) Approach: The **Fully Modified Ordinary Least Squares (FMOLS)** model is used to measure and analyze the impact of monetary policy on inflation in Iraq during 2004 to 2023. Moreover, the Fully Modified Ordinary Least Squares (FMOLS) regression is one of the most models for analyzing the study's data. It is mainly well-suited for the variables under examination and yields more reliable outcomes compared to alternative models.

$$INF_t=\alpha+\beta_1 M2t+\beta_2 IR_t+\beta_3 EXR_t+\varepsilon_t$$

Where:

INF_t : is the inflation rate in year t;

$LM2_t$: is the log of the broader money in year t; (The logarithm function is used to compress large ranges of values into a smaller scale)

IR_t : is the interest rate in year t.

EXR_t : is the exchange rate in year t.

t:is the time.

ε_t : is the error term(Or other factors that affect).

4 DATA ANALYSIS TOOLS

- **Software**: EViews 12, will be used for statistical and econometric analysis.
- **Steps**:
- Using Unit root test for Stationary.
- Co-integration Test.
- Using **(FMOLS)** approach for Estimation Coefficients.
- Using Diagnostic Checking for Accurate Estimation.

4.1 TESTING FOR STATIONARY USING THE UNIT ROOT TEST

To avoid misleading results, the **Augmented Dickey-Fuller (ADF) test** (Dickey & Fuller, 1979)[13] and the **Phillips-Perron (PP) test** can be employed to check the stationarity of the data. The null hypothesis shows that there is a unit root (not stationary) against the alternative, which shows no unit root (stationary).

- **Null Hypothesis (H_0):** there exists a unit root (not stationary).
- **Alternative Hypothesis (H_1):** there is no unit root (stationary).

Table 1. Result of Stationary Test for Variables (INF, LM2, IR and EXR)

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)statistics test						
Variables	**Level, first difference and second difference**	**ADF t-statistic**	**Critical value with the constant**			
			%1	**%5**	**%10**	**Prob.***
INF	Level	-3.672091	-3.857386	-3.040391	-2.660551	0.0145
LM2	Level	-3.906994	-3.857386	-3.040391	-2.660551	0.0090
IR	Level	-1.441549	-3.886751	-3.052169	-2.666593	0.5376
	1st Difference	-4.246686	-3.886751	-3.052169	-2.666593	0.0049
EXR	Level	-2.796206	-3.857386	-3.040391	-2.660551	0.0785

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Statistics Test						
Variables	**Level, first difference and second difference**	**ADF t-statistic**	**Critical value with the constant and Trend**			
			%1	**%5**	**%10**	**Prob.***
INF	Level	-4.757268	-4.667883	-3.733200	-3.310349	0.0086
LM2	Level	-3.890376	-4.571559	-3.690814	-3.286909	0.0350
IR	Level	-4.563437	-4.571559	-3.690814	-3.286909	0.0102
EXR	Level	-1.754695	-4.532598	-3.673616	-3.277364	0.6859
	1st Difference	-5.245757	-4.616209	-3.710482	-3.297799	0.0033

Source: Made by author

The results show that the variables inflation rate and the supply of money (tested with intercept, besides intercept and trend) are stationary at level in both the ADF and PP tests. This recommends that these variables can reject the null hypothesis of a unit root (H_0: Unit root exists), as t-statistics exceed the critical values.

However, the exchange rate displays mixed stationarity: it is stationary at level when tested with an intercept, but come to be stationary only at first difference when including both intercept and trend. Likewise, the interest rate illustrates differing outcomes: it is stationary at level with intercept and trend, but needs to take a first difference when tested with only an intercept.

After applying the first difference, these variables achieve stationarity at 1%, 5%, and 10% the levels of significance under both specifications (intercept only, and intercept with trend).

4.2 COINTEGRATION TEST

Often, the economic theory suggests that certain subset of variables should be linked by a long-run equilibrium relationship. Engel Granger's methodology is one of the most important methods used in the test of cointegration. This study examines the presence of cointegration among **inflation (INF), money supply (M2), interest rate (IR), and exchange rate (EXR)**. The hypotheses for the cointegration test are specified as follows:

- **Null Hypothesis (H_0):** *$\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$* (No cointegration exists)
- **Alternative Hypothesis (H_a):** $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$ (A cointegrating relationship is present).

Table 2. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
INF	0.919372	88.40763	47.85613	0.0000
M2	0.863863	43.08535	29.79707	0.0009
IR	0.312557	7.191716	15.49471	0.5555
EXR	0.024459	0.445738	3.841465	0.5044

Source: Made by author

The above results illustrate that Trace test shows that there is 2 cointegrating eqn(s) at the 0.05 level of significant to reject the null hypothesis. Accordingly, there is a long run co-integration relationship among (INF, M2, IR and EXR)

Table 3. Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
INF	0.919372	45.32228	27.58434	0.0001
M2	0.863863	35.89363	21.13162	0.0002
IR	0.312557	6.745978	14.26460	0.5196
EXR	0.024459	0.445738	3.841465	0.5044

Source: Made by author

The above results display that Max-Eigen test indicates that there is 2 cointegrating eqn(s) at the 0.05 levels of significant to reject the null hypothesis. Consequently, there is a long run co-integration relationship among (INF, M2, IR and EXR).

4.3 GRANGER CAUSALITY TEST

Granger Causality tests should be run in order to find the direction of the causal relationship among variables (Granger, 1988) [14]. Findings are shown in Table 4 below.

Table 4. Pairwise Granger Causality Tests, Sample:2004 2023, Lag 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LM2 does not Granger Cause INF	19	4.83119	0.0430
IR does not Granger Cause INF	19	9.16113	0.0080
EXR does not Granger Cause INF	19	5.11038	0.0381
LM2 does not Granger Cause IR	19	6.97326	0.0178
EXR does not Granger Cause IR	19	9.65559	0.0068

Source: Made by author

According to Granger causality in Table 4 above, there is a causal relationship running among these variables with taking 1 lag. Therefore, there is a unidirectional relationship running from LM2 to INF, IR to INF, EXR to INF, LM2 to IR, EXR to IR and no bidirectional relationship is observed.

4.4 USING (FMOLS) APPROACH FOR ESTIMATION COEFFICIENTS

Fully Modified Ordinary Least Square (FMOLS) objects to estimate the cointegrating relationship between variables. This is accomplished by modifying the OLS estimation process to integrate added variables that capture the trend (Phillips & Hansen, 1990) [15].

Table 5. Estimates for Measuring and Analyzing the Impact of monetary policy on Inflation in Iraq for the Period (2004-2023) by Applying FMOLS

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LM2	9.469231	0.223309	42.40413	0.0000
IR	-5.466933	0.026918	-203.0961	0.0000
EXR	0.057449	0.000617	93.09185	0.0000
INF(-1)	1.672563	0.008025	208.4128	0.0000

(*), (**), (***) denotes Significance at 1%, 5% and 10%, respectively
Source: Made by author

Table 5 illustrates that the coefficient for money supply (M2) is 9.4692, meaning that a 1% increase in money supply (M2) leads to a 9.4692% increase in inflation rate in Iraq. This outcome is significant, with a p-value below 5%.

Historical data from the Central Bank of Iraq show that after the 2003 invasion, the growth in money supply (M2) was driven by increased foreign exchange earnings from oil exports. This increase in money supply contributed to higher public expenditure and a surge in imports of goods and services, more exacerbating inflationary pressures.

The coefficient of interest rate is (-5.4669), suggesting that a 1 percentage increase in interest rate is affiliated with a 5.4669% percentage decrease inflation rate in Iraq. This result further shows that the p-value of interest rate is significant that is consequently lower than % 5. (p-value < 0.05) is consistent with Grigorian and Kock's (2014) [16] analysis of Iraq's monetary policy transmission, where structural weaknesses in the financial system might amplify the effect of interest rate changes on inflation rate. While this finding brings into line with conventional monetary theory (Taylor, 1993) [17].

The coefficient of exchange rate is 0.0574, suggesting that 1% depreciation of the Iraqi dinar against the dollar (EXR) rises inflation rate by 0.0574%. This relatively small influence may be attributed to Iraq's high import dependency and economic openness, as a weaker dinar increases the cost of imported goods. Moreover, the p-value of exchange rate is significant that is consequently lower than 5%.

Additionally, the coefficient of lagged inflation is positive, indicating inflation persistence—a common phenomenon explain that the last inflation has effects on current inflation. The p-value of lagged inflation is significant, consequently lower than 5%.

Conclusion: among the variables analyzed, the supply of money (M2) has the strongest effect on inflation rate in Iraq, exceeding the effects of interest rates and exchange rate fluctuations.

4.5 DIAGNOSTIC TESTING FOR MODEL VALIDATION

The main aim of diagnostic checking is to check the adequacy of the estimation. In current study, diagnostic test is useful to ensure the appropriateness of the FMOLS estimation relied on both theory and statistics tools; this study employed several diagnostic tests, including:

- The Lagrange Multiplier (LM) test for serial correlation.
- The Variance Inflation Factor (VIF) test for multicollinearity,
- The Heteroscedasticity / Breusch-Pagan-Godfrey test
- The Foundation form /ramsey test
- The Jarque-Bera test for normality, and
- The CUSUM and CUSUMSQ tests for structural stability.

These tests were conducted to estimate the rightness of the FMOLS model and the findings are presented in Table 6.

Table 6. Diagnostic Checking for Measuring and Analyzing the Impact of monetary policy on Inflation in Iraq for the Period (2004-2023)

Test statistic	Model (Monetary policy, inflation)	Decision
Serial correlation/LM test*	Pro. F-statistic = 0.21> 0.05 Prob. R-squared =0.11> 0.05	good fit
Heteroscedasticity / Breusch-Pagan-Godfrey test	Pro. F-statistic= 0.25 > 0.05 Prob. R-squared =0.22> 0.05	good fit
Foundation form /ramsey test	Prob. t= 0.29> 0.05 Prob. F= 0.29> 0.05	good fit
Normality	Jarque- Bera 0.63 Prob.J.B=.073 > 0.05	good fit
VIF	Centered 1 <VIF<8 Variable Centered VIF LM2 2.04 IR 7.75 EXR 1.61 C NA INF(-1) 8.32	good fit
S.E. of regression	**R^2**	**Adjusted R-squared**
7.41	0.81	0.71

Source: Made by author

Table 6 shows that the Breusch-Godfrey Serial Correlation LM Test does not reject the null hypothesis at the 5% level of significance, then the model can be accepted and we make sure that the model has not serial correlation. This shows that the model is statistically fit to be estimated.

The FMOLS tests recommend that the errors are homoscedastic and independent of the repressors. The model passes the normality tests. Consequently, the FMOLS model is correctly specified. Additionally, table 4.5 also demonstrates the value of S.E regression given its minimal value, is small. The R^2 indicates that the model is well fitted.

The above debate related to the diagnostic test, and for stability test, the figures show that the statistic plots of CUSUM and CUSUMSQ are within the critical range. Accordingly, there is no real evidence of any substantial structural instability is discovered. The model can be used decision making of policy. The stability tests are presented as follows:

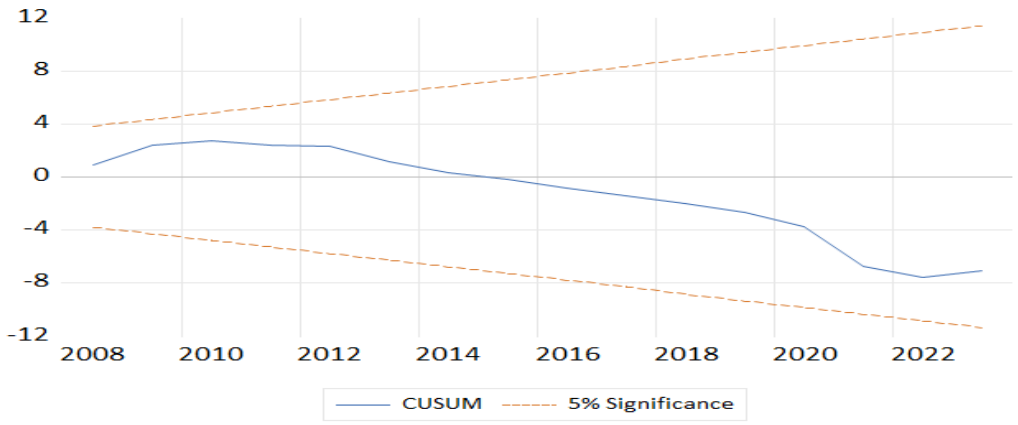

FIGURE 1. Stability Test for the Impact of monetary policy on Inflation in Iraq (CUSUM)

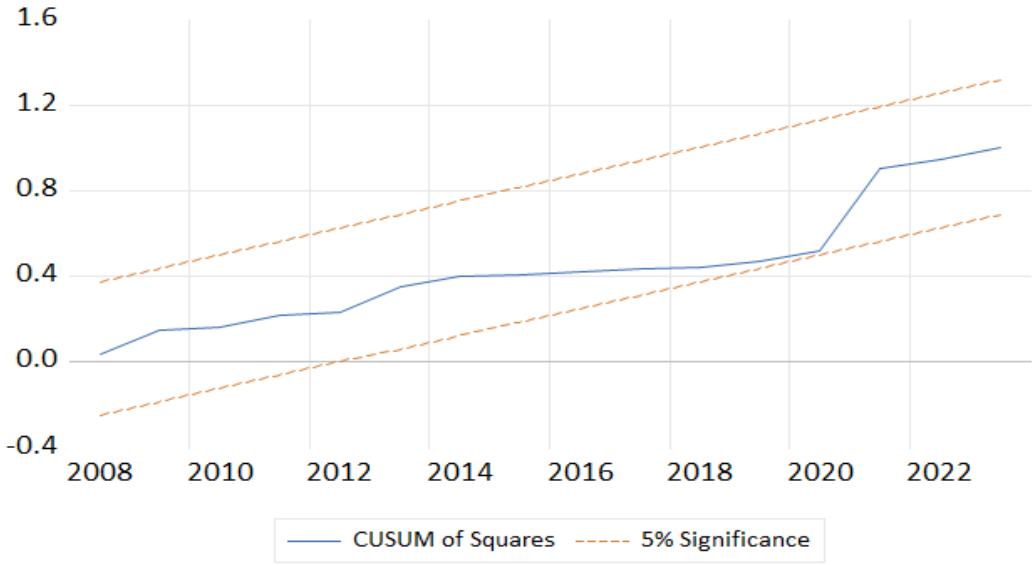

FIGURE 2. Stability Test for the Impact of monetary policy on Inflation in Iraq (CUSUMSQ)

CONCLUSION

Iraq's economy has experienced extended periods of high inflation, particularly during the after the 2003 invasion. In these early decades, these strong inflationary pressures have posed crucial challenge for economic governance. This study, titled *"Measuring and Analyzing the Impact of Monetary Policy on Inflation in Iraq during 2004 to 2023),"* explores how monetary policy tools—the supply of money, interest rates, and the exchange rate—have influenced inflation rate in Iraq during the study period.

The results are consistent with established economic theory and previous empirical study, including Ahiabor (2013) [1]. There is a positive relationship between the broad money supply (M2) and inflation rate, indicating that a 1% increase in money supply (M2) leads to a 9.4692% increase in inflation rate. Conversely, the interest rate showed a negative relationship with inflation rate, where a 1% increase in interest rate related to a 5.4669% reduction in inflation rate.

Based on these outcomes, the study achieves that solely relying on monetary policy to control inflation rate in Iraq is inadequate. It recommends a coordinated approach that includes both fiscal policy and non-monetary policies. Specially, the government should prioritize improving the economy productive capacity — In particular in the agricultural sector— to enhancement the aggregate supply of crucial goods. These efforts could make lessen inflationary pressures and provide better economic stability.

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Data Source: Iraqi Central Bank, available on: https:// www.cbi.iq.