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The Relationship between Inflation and Unemployment in Iraq: Testing the Phillips Curve for (2004–2024) Using the ARDL Approach

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Abstract

This paper attempts to investigate the nexus between inflation and unemployment rates in Iraq for the period (2004–2024) based on Phillips curve paradigm, with an application of involves in autoregressive distributed lag ARDL bounds testing methodology. Results reveal a negative relationship between inflation and unemployment in the long run as well as in the short run, but it is weaker than expected because of specific features of the Iraqi economy, given that Iraq is a dominated country depending on oil revenues.

Keywords: JEL Classification: E31, J64 Inflation, Unemployment, Phillips Curve, Stagflation

1.Research Problem

The Iraqi economy suffers from several macroeconomic (numerical) disequilibria, such as continuing high unemployment and inflation rates over successive periods. This leads to question the relevance of the classical Phillips Curve in an economy like Iraq, which is non-diversified rentier and oil revenue-based.

Research Hypothesis

The paper assumes that there is a statistically significant negative relationship between inflation and unemployment rates in Iraq known as the Phillips Curve for) (2004 – 2024).

Research Objectives

The aim of this study is:

- To examine whether the Phillips Curve applies to the Iraqi economy.
- To investigate the short- and long-run dynamic relationship between inflation and unemployment by ARDL model.
- "To recommend policy for a law of balance between inflation and employment.

Research Significance

This study is relevant because it studies the interaction of inflation and unemployment — a very core topic in macroeconomics—but with sound empirical analysis based methodology, using a

proper econometric technique.

Research Methodology

Descriptive-analytical with econometric-cum approach is used in the study using Autoregressive Distributed Lag (ARDL) model to determine the sign and magnitude of inflation-unemployment nexus. The study is based on annual official statistics for the period **(**2004–2024**)**.

Research Scope

Temporal Scope: (2004–2024).

Geographical Scope: Republic of Iraq.

First Section

Algebraic model as a framework for theories of inflation, unemployment and Phillips curve

First: The Concept of Inflation

Definition of Inflation

Inflation as its name suggests is a condition where the price of goods and services are seeing rising prices or in more precise definition to say over a period time, implying an increase in the price level of goods and services.Such increase would cause a decrease in the money's value when purchasing things. This results in an erosion of the purchasing power of a given unit of money, vis-à-vis earlier periods (Samuelson 2010, p. 392). Inflation typically occurs due to a rise in aggregate demand that is greater than aggregate supply, higher production costs or a devaluation of the domestic currency. It usually coincides with a general increase in the money supply and credit. Hence, inflation contains two sub-elements: appreciation of the general price index and uninterrupted increase in prices over time (khoo lie, 2019, p. 73). It is caused by such factors as demand-pull inflation, cost-push inflation, monetary policy and credit expansion (Ismet, 2020, p. 77).

Types of Inflation

Inflation can sub-divided into various, kinds as follows (Samuelson, 2010, p. 401):

A. Hyperinflation: Always associated with viciously high inflation (over 50% in any month or 100% per year).

B. Galloping Inflation: With annual price growth between 50% and 200%, with minor negative economic effects when inflating at 3% to 10% per year

C. Moderate Inflation: A steady (≤ 3% per year) rise in prices, but one that has little effect on incomes and prices.

D. Stagflation: According to Ali (1985, pp. 12-14), Stagflation happens when economic stagnation (low, or no, output growth) is observed, along with upward inflation and unemployment, which violates the traditional determinants of the Phillips Curve framework

Second: The Concept of Unemployment

1- Definition of Unemployment

Unemployment can be defined as a situation when a person who is able and willing to work is not able to find a job. Different types of unemployment are structural unemployment, cyclical unemployment, frictional unemployment and disguised unemployment.

Unemployment is one of the major socio-economic problems that Iraq has continued to face, primarily due to the public sector being the main source of employment, coupled by the fact that the private sector is weak (Iraqi, 2023, p. 39).

2- Types of Unemployment

Unemployment refers to the situation when part of the workforce who are willing and able to work are unable to find a job. It is divided into various types on the grounds of whereupon, it is being caused or due its nature, The following, in this manner (Blanchard O. &, 2017, p33);

A. Cyclical Unemployment

- Linked to economic business cycles.
- Expands/Contraction in Economic Downturns and Rebounds
- Fully-Quantified (E.g — Increased unemployment during the global financial crisis in 2008)

B. Structural Unemployment

- Proxy contingent to workers' skills not being aligned with labor market demands.
- Commonly due to advances in technology or change in the nature of the economy.
- Example: Drop in the number of print media jobs caused by the growing popularity of digital media.

C. Frictional Unemployment

- Comes from the gap zero-day that takes place wherever you leave one job and later on find another.
- Usually transitory and seen as a normal part of economies (Al-Saeed, 2019, pp. 15–20).

D. Seasonal Unemployment

- Applies to employment linked to particular seasons.
- For instance: seasonal job losses in agriculture post-harvest, or in tourism during off-peak seasons.

E. **Disguised Unemployment**

- Includes surplus labor that does not produce.
- Typical of unsustainable agricultural sectors or bloated public institutions

F. Technological Unemployment

- R replacement of human labor by machines/technology
- For instance, replacing ticket office personnel with electronic booking systems.

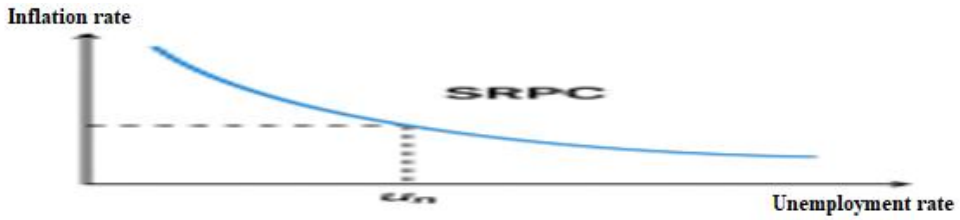
G. Voluntary Unemployment

- Happens when people do not want to work when there is a job available to them, usually due to personal reasons or dissatisfaction with wage (Mankiw N. G., 2021, pp. 372–375)

3rd: The Philips curve

1- Evolution of the Phillips Curve

The Phillips Curve was first described in 1958 by the economist Alban Phillips who found an inverse relation between nominal wage change and unemployment rate in the UK for the period (1861–1957). Then the model was further generalized to relate inflation, and unemployment which indicates that high employment is at the expense of high inflation and inverse relation is also true. Yet, for the monetarist school led by Milton Friedman, the relationship breaks in the long run and the Phillips Curve is believed to be vertical.



Short-Run Phillips Curve (figure 1)

Source: Blanchard, O. (2017), Macroeconomics, 7th ed. an increase in the price of Oil Pearson. 2017, p. 149.

2- The Modern Phillips Curve

However, during the 1970s — the neo-classical economics also criticize the traditional Phillips Curve model because of the stagflation — The emergence of "stagflation" — rising inflation and unemployment during the 1970s led Milton Friedman to write a powerful critique of the traditional Phillips Curve model, and to a modified Phillips Curve model that includes inflation expectations. From there, the model was updated to incorporate aspects of new macroeconomic theory. The contemporary Phillips Curve, often thought of as the short-run aggregate supply curve, has a functional representation of the following form (Mankiw N. G., 2021, pp. 147–148):

$$\pi_t = \pi_t E_t - \beta(u_t - u_n) + v_t$$

Where:

There are no mathematical symbols in it: Πt = Inflation rate in period t ΠtEt = Expected Inflation rate in Period t β = A coefficient that shows the response of the inflation rate to the unemployment gap. Un = The rate of unemployment consistent with economic stability. Actual unemployment rate (Ut) Vt = Shock in Supply, for example, increase in oil prices, interruptions in supply chains, and/or disasters.

A positive supply shock (Vt

increasesinflationateveryunemploymentlevel→ short-run Phillips Curve shifts upwards. We obtain then the most unpleasant combination of higher unemployment and higher inflation: stagflation, represented in Figure (2) (Blanchard O., 2017, p. 149).

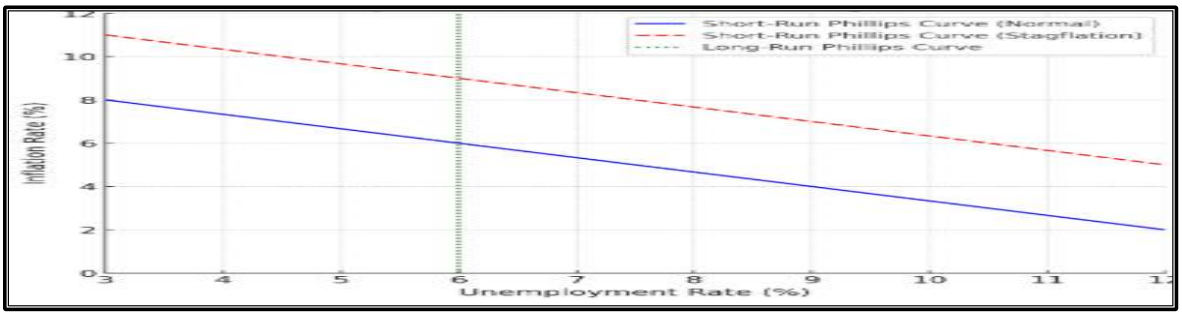


Figure 2: Phillips Curve in the Short and Long Run (Stagflation)

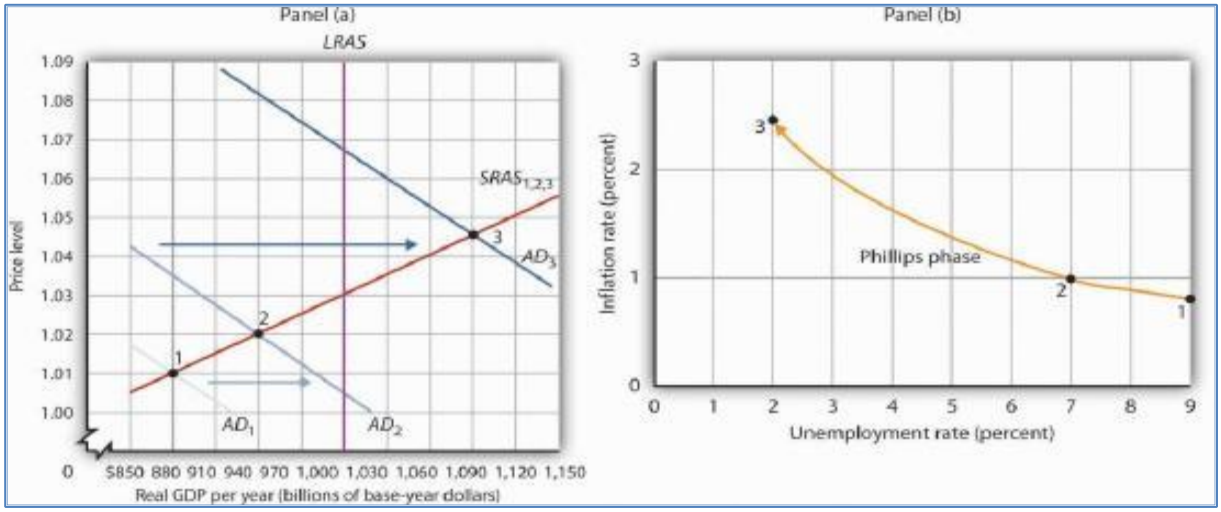
Source: Blanchard, O. Macroeconomics,"An Increase in the Price of Oil, 7th ed.Pearson.2017, p. 149.

The inflation-unemployment dynamic is determined primarily by macroeconomic policy choices (p. 45, Al-Hamid, 2010) and by the degree of beliefs regarding future economic conditions. Each of the next three sections describes a particular stage of the inflation-unemployment cycle, and each stage arises from different developments on the aggregate demand and short-run aggregate supply side. In this context, one must be particularly cautious about interpreting movements in inflation in reading this cyclical relationship (Mankiw, 2021, p. 250).

- Phillips Stage: This stage of inflation is a signal not just of a higher price level, but that the price level is increasing at an accelerating rate. In other words, inflation is growing ever larger.
- Stage 2: Recovery – It is important to realize that while inflation ratemay slow down in this stage, this should not be confused with deflation. That instead means prices are still rising, just at a slower pace — falling, not decelerating, prices.
- Phillips Phase: Phillips curve dynamics consistent with classic Phillips curve representation whereby inflation is increasing, and unemployment is decreasing, simultaneously.

The Phillips phase can be depicted through two connected panels as illustrated in Figure 3: Panel (a) features the aggregate demand–aggregate supply model and Panel (b) shows the related path of inflation and unemployment rates on the Phillips curve.

The Aggregate Demand and Aggregate Supply Model vs the Phillips Curve (Figure 3)



Source: Blanchard, O. Macroeconomics, "An Increase in the Price of Oil, 7th ed.Pearson.2017, p. 149.

As shown in Figure 3, the Phillips phase consists of growing aggregate demand, with real GDP and the price level increasing along rising short-run aggregate supply curves ($SRAS_1$, $SRAS_2$, $SRAS_3$). As unemployment decreases, the result is higher inflation. The points shown on panels (a) and (b) are directly related; for example, Point 1 on each panel corresponds to Point 1 on the other panel, and so on for each pair of labeled points.

3- Criticism of the Phillips Curve

The Phillips curve has been one of the most popular concepts in macroeconomic literature but several critiques have been leveled against it, namely (Al-Jarrah, (2020)., pp. 137–144).):

A. It neglects the importance of inflation anticipations (as pointed out by the "expectations-augmented Phillips Curve").

B. The instability of it throughout time, especially with hide stagflation scenario(s).

C. At times, economies contend with high levels of inflation and unemployment, at the same time (the stagflation situation).

This means that the expectations-augmented Phillips Curve used today — which relates inflation, not only to the unemployment rate, but also to future expectations and lagged inflation as well — is, at best, a kind of kludge.

Second Section: Testing the Phillips Curve in Iraq

First: Study the correlation of inflation and unemployment in Iraq

Contrary to the information mentioned in the Phillips Curve that shows the inverse relation between inflation and the unemployment level in Iraq, it is surprisingly different than expected. Although unemployment remains high, inflationary rates may remain moderate or high which may be inconsistent with the traditional Phillips Curve in the Iraqi economy. Even so, the Phillips Curve seems not to be a traditional one in Iraq, and influences of many factors on unemployment — inflation relationship in Iraq can be seen in (IMF, 2023):

- Political and economic volatility.
- Dependence on rentier sectors (such as oil in Iraq).
- Weakness of statistical data.
- Government intervention in price controls and the labor market.
- Underdeveloped private sector and labor market.

As seen in Table (1) and Figure (4), inflation was super high the years after 2003 then began to slowly settle down. On the other hand, unemployment has been increasing consistently, especially after 2014, culminating at its highest level in 2022

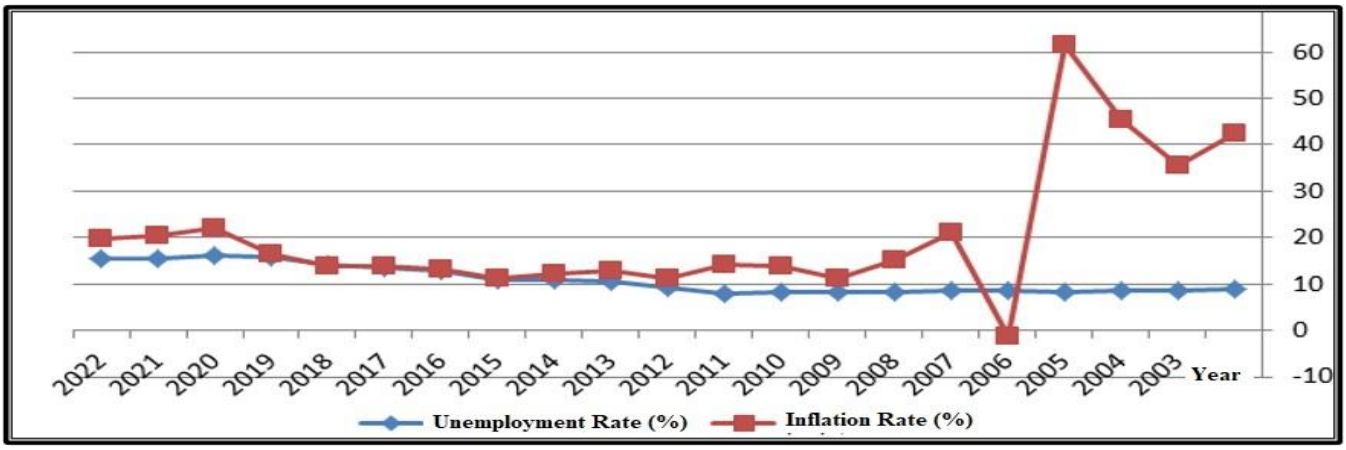
Table (1): Development of Inflation and Unemployment Rates in Iraq for the Period of (2004–2024)

Year	Inflation Rate	Unemployment Rate (%)
2004	26.96	8.72
2005	36.96	8.58
2006	53.23	8.42
2007	-10.07	8.65
2008	12.66	8.47
2009	6.87	8.41
2010	2.88	8.27
2011	5.80	8.19
2012	6.09	7.96
2013	1.88	9.20
2014	2.24	10.59
2015	1.39	10.84

2016	0.56	10.82
2017	0.18	13.02
2018	0.37	13.49
2019	-0.20	14.11
2020	0.57	15.78
2021	6.04	16.17
2022	4.99	15.51
2023	4.36	15.45
2024	3.4	15.50

Source: Prepared by the researcher based on data from the World Bank and the Central Bank of Iraq.

Figure 4: Evolution of Inflation and Unemployment Rates



Source: Prepared by the researcher based on data from Table (1).

Second: Measuring the Impact of Inflation on Unemployment Rates in Iraq Using the ARDL Model1

1- Specification of the Inflation-Unemployment Function Using the ARDL Model

In this context, the study first uses the Augmented Dickey-Fuller (ADF) unit root test to examine the stationarity characteristics of the series and find the order of integration of the variables. We then implement the Autoregressive Distributed Lag (ARDL) approach to investigate whether inflation and unemployment have a long-run equilibrium relationship with the Bounds Testing procedure formally testing for cointegration. EViews 12. The data used for macro-economic periods for Iraq are used for 2004–2024. Here, the ARDL specification is designed so as to reflect the interaction between the inflation rate and the unemployment rate. Thus, we have: The set of variables to be used in the study is defined as follows:

Y = Rate of unemployment (dependent variable) X = Inflation rates (as an independent variable)

The inflation rate (X) is an explanatory variable for changes in unemployment, so Y can be written on the dependent variable side, according to the following specification, consistent with the Phillips Curve formulation.

- **Unemployment function (Y)**

$$Y = f(x) \quad \ldots\ldots\ldots\ldots(1)$$

$$\Delta Y = c + \lambda x_{t-1} + \beta_1 x_{t-1} + \sum_{i=1}^{n} a_1 \Delta x_{t-i} + \sum_{i=0}^{m} a_2 \Delta x_{t-i} + \mu_t \ldots\ldots\ldots\ldots\ldots(2)$$

2- Unit Root Tests: Augmented Dickey-Fuller (ADF) Test

The Augmented Dickey–Fuller (ADF) test will be implemented for checking the stationarity of variables of the study via EViews 12 software [13]. It tests the presence of unit root or non-stationary among the variables and can identify the order of integration. Table (2) gives the result of ADF test for variables.

Table 2: Unit Root Test Results

At Level			
		x	y
With Constant	t-Statistic	-3.1176	0.0961
	Prob.	*0.0414*	*0.9571*
		**	n0
With Constant & Trend	t-Statistic	-3.5965	-1.9866
	Prob.	*0.0560*	*0.5730*
		*	n0
Without Constant & Trend	t-Statistic	-2.8708	2.0060
	Prob.	*0.0065*	*0.9858*
		***	n0
At First Difference			
		d(x)	d(y)
With Constant	t-Statistic	-5.8634	-3.4104
	Prob.	*0.0002*	*0.0237*
		***	**
With Constant & Trend	t-Statistic	-7.9985	-3.3371
	Prob.	*0.0000*	*0.0904*
		***	*
Without Constant & Trend	t-Statistic	-5.4641	-2.9413
	Prob.	*0.0000*	*0.0056*
		***	***

Source: Prepared by the researcher based on the results of EViews 12.

As shown in Table(2), the time series variable (X) became stationary at its level (with the constant and trend), because the calculated Tau value is higher than all the critical values observed at the 1%, 5% and 10% level of significance respectively. Accordingly, the variable (X) is integrated of order I(0). On the other hand, variable (Y) is non-stationary at level but stationary at first difference test with or without a constant, with or without a linear trend at 5% significance level. Thus, the (Y) variable is of order I(1). As a result, we reject the null hypothesis and accept the alternative hypothesis, suggesting that the time series variables are unit root free and stationary. Given these findings, the ARDL (autoregressive distributed lag) model will be used.

3- Testing the ARDL Model

Table 3: Estimation of the ARDL Model

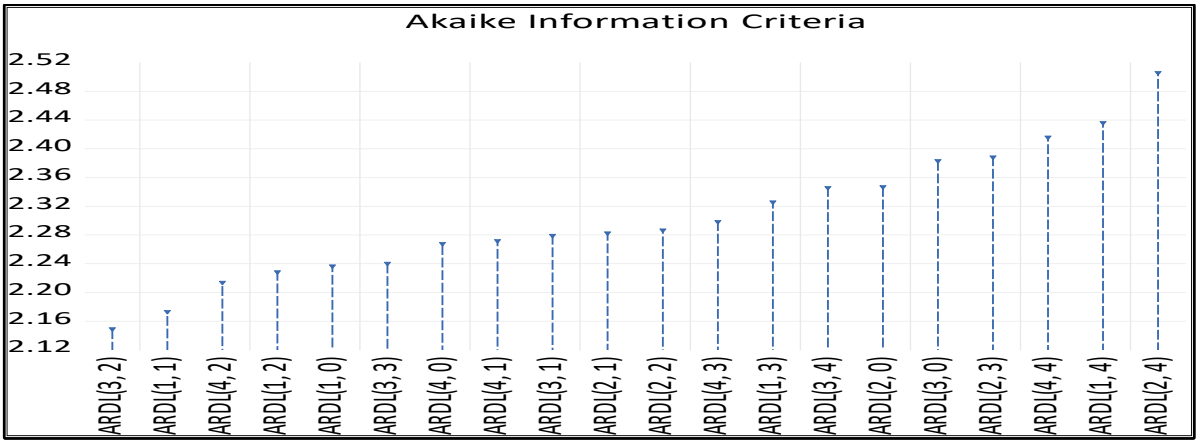
Variable	Coeffici	Std.	t-Statistic	Prob.*
Y(-1)	0.89192	0.236682	3.768463	0.0031
Y(-2)	-	0.332803	-0.687142	0.5062
Y(-3)	0.30001	0.238574	1.257526	0.2346
X	-	0.056352	-3.054029	0.0110
X(-1)	-	0.021516	-2.588315	0.0252
X(-2)	-	0.012304	-0.382669	0.7093
C	1.76567	0.762783	2.314779	0.0410
R-squared	0.97187	Mean dependent		11.698
Adjusted R-	0.95654	S.D. dependent var		3.1546
S.E. of regression	0.65763	Akaike info		2.2849
Sum squared	4.75735	Schwarz criterion		2.6312
Log likelihood	-	Hannan-Quinn		2.3327
F-statistic	63.3617	Durbin-Watson stat		2.1433
Prob(F-statistic)	0.00000			

Source: Prepared by the researcher based on the results of EViews 12.

The results of the estimation of the Autoregressive Distributed Lag (ARDL) model are given in Table (3) The model shows little to regress response (R-squared 0.97—meaning 97% of the variance of the dependent (used as an index of the efficiency of the model) is explained by the independent variable (s)) The Adjusted R-squared, which accounts for the number of predictors in the model, is 0.95. Likewise, the F-statistic (63.36177) is significant at the 5% confidence interval indicating global significance of the model as well. Therefore, the null hypothesis of no joint explanatory power is rejected against the opposite hypothesis

4- Testing for the Optimal Lag Length

Figure 5: Optimal Lag Length Test



Source: Prepared by the researcher based on the results of EViews 12.

From Figure (5), which illustrates the optimal lag length test, it is determined that the optimal lag length is (3,2), based on the Akaike Information Criterion (AIC).

5- Bounds Test

The Bounds Test was utilized to analyze whether there exists a long-run existing equilibrium relationship, and the findings are shown in Table (4) The calculated upper F-statistic (F-statistic value) is 230.8468, which is above the upper critical bound (5.73) at the 5% significance level. Thus, we cannot reject this null hypothesis and accept the alternative hypothesis, i.e., there is no long-run equilibrium relationship Exists.

Table 4: Bounds Test Results

Test Statistic	Value	k
F-statistic	176.0548	1
Critical ValuE Bounds		
Significance	I0 Bound	I1
10%	3.02	3.51
5%	3.62	4.16
2.5%	4.18	4.79
1%	4.94	5.58

Source: Prepared by the researcher based on the results of EViews 12.

6- Testing for Autocorrelation and Heteroskedasticity

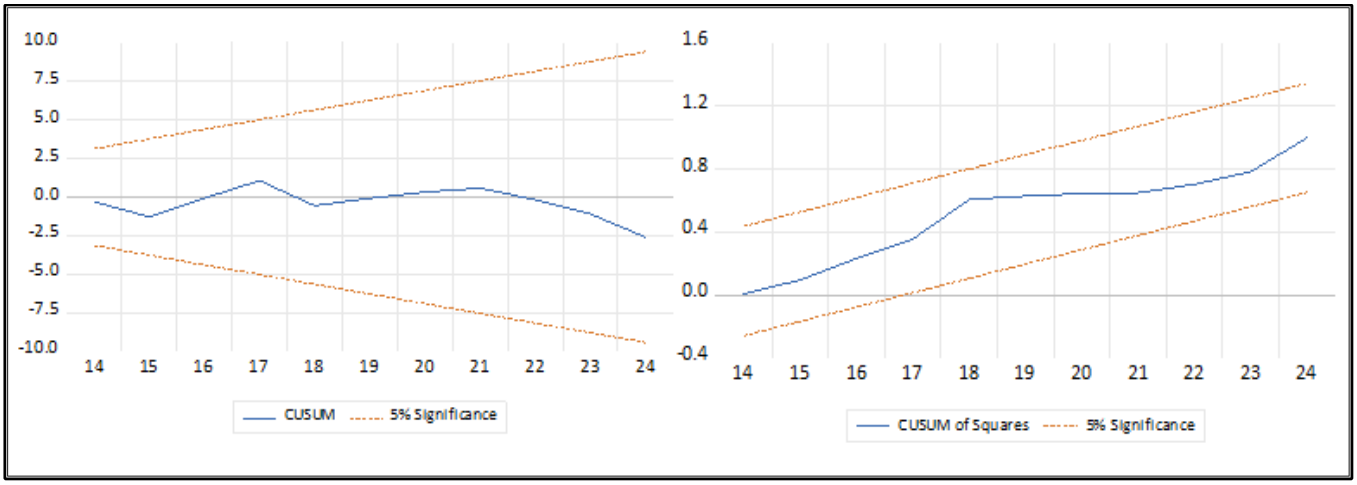
Table 5: LM Test for Serial Correlation and Heteroskedasticity

Breusch-Godfrey Serial Correlation Test:			
F-statistic	1.119949	Prob. F(2,9)	0.3678
Obs*R-squared	3.587057	Prob. Chi-Square(2)	0.1664
Heteroskedasticity Test: ARCH			
F-statistic	0.453174	Prob. F(1,15)	0.5111
Obs*R-squared	0.498536	Prob. Chi-Square(1)	0.4801

Source: Prepared by the researcher based on the results of EViews 12.

The results of using the Breusch-Godfrey Serial Correlation LM Test is presented in Table 5 where the chi-square statistic is not significantly different from 0 at the 5% level emphasizing no presence of autocorrelation in the model residual. This means the model is good with respect to this. In addition, a diagnostic test of heteroscedasticity—namely the ARCH heteroskedasticity test—achieved a non-significant result at the 5%, indicating that the error terms are homoscedastic. Among evidence of no autocorrelation is visualized in Figure 6 which corroborates the tests results as it shows a generalized random pattern of the residuals.

Figure 6: Test for Autocorrelation

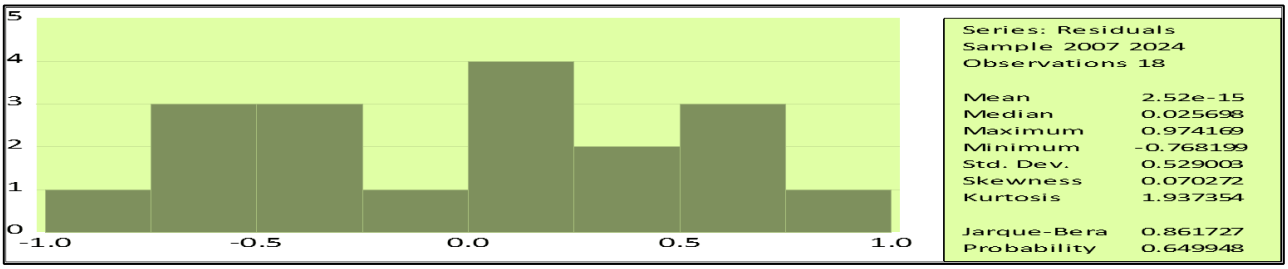


Source: Prepared by the researcher based on the results of EViews 12.

From Figure (6), it is evident that the model is stable, as the graphical representation falls within the upper and lower bounds.

7- Normality Test

Figure 7: Normal Distribution of Residuals in the Regression Model



Source: Prepared by the researcher based on the results of EViews 12.

From Figure (7), the results show a Jarque-Bera statistic of 0.861727 with a probability of 0.649984. This indicates that the probability is greater than 5%, confirming that the data follow a normal distribution for the random errors.

8- Analysis of the Error Correction Model and Long-Run Relationship (Estimation of the Error Correction Model - ECM)

Table 6: Error Correction Model (ECM)

Variable	Coefficien	Std.	t-Statistic	Prob.
D(Y(-1))	-0.071330	0.21161	-0.337083	0.7424
D(Y(-2))	-0.300013	0.20130	-1.490356	0.1642
D(X)	-0.172100	0.04191	-4.105597	0.0017
D(X(-1))	0.004708	0.01054	0.446544	0.6639
CointEq(-1)*	-0.036743	0.00904	-4.064660	0.0019

Source: Prepared by the researcher based on the results of EViews 12.

Once the validity of our estimated model in terms of stability is confirmed, we then estimate short-run parameters, the Error Correction Model (ECM) and long-run parameters via the ARDL methodology. These data results have been estimated and are presented in Table (6) below:

- As shown in column 1, the estimated coefficient on unemployment is negative and statistically significant, thereby supporting the inverse relation between inflation and unemployment associated with a Phillips curve. To put it simply, it suggests the higher the inflation rate (X) during this period, the lower the unemployment rate (Y) during this period & the reverse is also true & this relationship is significant at a 10% significance level. More specifically, a 1% drop

in the inflation rate raises the unemployment rate by 17% in that period, consistent with economic theory.

- If the error correction term is negative and statistically significant, then this indicates the long-run equilibrium relationship running in that direction. Positive and significant at the 1% significance level − CointEq(−1) = −0.036743. This means that about 0.36% of the inflation disequilibrium is eliminated over the span of a year, suggesting a weak long-run adjustment speed.

Table 7: Long-Run R#elationship

Variable	Coefficient	Std. Error	t-Statistic	Prob.
X	-6.327744	10.34319	-0.611779	0.5531
C	48.05503	60.98820	0.787940	0.4474
EC = Y - (-6.3277*X + 48.0550)				

Source: Prepared by the researcher based on the results of EViews 12.

We can see from Table (7) that (X) is not significant at the 5% level ($p > 0.05$); thus, we conclude that inflation has weak significance in making changes to unemployment rates in the long run, but this effect is limited to the short run. This finding contradicts economic theory. The findings also indicate that in the case of Iraq, the relationship between rising unemployment and inflation is weak, which could be due to the nature of the rentier economy, government intervention, weak adjustment between aggregate supply and demand, and that unemployment could be affected by non-monetary factors such as security instability and weakness in the private sector.

Conclusions and Recommendations

First: Conclusions

1. While the overarching forces that may contribute to Phillips Curve behavior in Iraq are likely to differ from those in the more stable industrialized economies, the econometric model is consistent with the action in both the short and long run. Iraq's Phillips Curve does not always look conventional
2. To examine the relationship between inflation and unemployment, we note that the estimated coefficient on unemployment is negative and statistically significant (confirming the presence of inverse relationship between inflation and unemployment). The results are suggestive of a

countercyclical relationship between the current-period inflation rate (X) and the current-period unemployment rate (Y) at the 10% significance level. In particular, a 1% decrease in inflation is linked to a 17% increase in unemployment over the same time frame—a result that comports closely to economic theory, in particular the short-run Phillips Curve dynamics.

3. In contrast, we find that the independent variable (X) inflation is indeed statistically insignificant at a 5 % rate: this means that the inflation has a weak significant impact on the unemployment rates over the long run with its effect mainly limited to the short run in direct opposition to the economic theory. The results indicate that increasing unemployment in Iraq is accompanied by declining inflation, although the relation is not statistically strong enough because of the rentier nature of the economy, the intervention of the government, the weakness of aggregate supply-demand responsiveness and the non-monetary causes of unemployment represented by security instability and the weakness of the private sector.
4. Stagnant economic development will not keep a lid on inflation at all, unlike recent decades when the inflation associated with business cycles was due to economic expansion – the inflation from stagflation is monetary inflation, due to the processes of monetary circulation.
5. All sectors of the economy have become non-productive due to the "Dutch Disease" effect on the economy which has become a rentier economy with profitability based on financing the resulting losses from the budget, leading to greater unemployment.

Second: Recommendations

1. Developing a monetary policy that is flexible, and aligned with fiscal policies capable of simultaneously managing the inter-temporal dynamics of unemployment and inflation.
2. C→ Encourage the private sector to generate high GDP growth to lower unemployment without stoking inflation.
3. Target economic diversification and modernize keen to shift from a rentier economy to a knowledge economy that corresponds to the latest trend in the global and regional environment.
4. Implement measures to help where these people can work – and hence their productivity – to be reintegrated.
5. Create independent research centers to monitor global and regional economic trends and their likely impact on the currency market and, thus, improve the quality of statistical data.