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The Relationship between Nominal Interest Rates and Inflation in Iraq

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ABSTRACT

The main objective of this paper is to investigate the relationship between the nominal interest rates and inflation rate, and to verify the presence of the Fisher effect in Iraq during the period 2005M01 to 2016M12. Using the Johansen cointegration analysis and error correction model (VECM). The empirical results of this paper indicate that there is a long-run equilibrium relationship between nominal interest rates and expected inflation and existence of the partial Fisher effect in the long run . But, Fisher effect did not exist in the short run. Thus, there is the effectiveness of monetary policy in the short run, and the weakness of its effectiveness in the long run .

Keywords: nominal interest rates, inflation rate, Fisher effect, cointegration, VECM

1.INTRODUCTION

One of the important results in classical economic theory is the neutrality of nominal variables in influencing real economic variables. Including that the changes in the quantity of money in circulation , which occur in accordance with the policy of the Central Bank translated in the economic fact simply to changes in the rate of inflation in the same percentage and direction, which is called the neutrality of money . These changes in the rate of inflation have no effect on the real interest rate, but have a full impact on the nominal interest rate. In the same proportion and also in the same direction, this is called the Fisher effect after economist (Irving Fisher) in his study in 1930 by distinguishing between nominal interest rate and real interest rates. The first variable is analyzed according to two separate variables : the expected inflation rate and the real interest rate. As such, the high inflation rate of 1% leads to a nominal interest rate rise of 1%, given that the real interest rate constant is not changed and is determined by other variables . Such as, the rate of return, portfolio risk, uncertainty and indicators of future saving and investment balances (Orr, Edey, & Kennedy, 1995).

By using the expectation operator, the mathematical representation of Fisher's effect is as follows :

$$(1 + R_t) = (1 + r_t).(1 + E_{t-1}\,\pi_t) \quad (1)$$

By multiplying the brackets on the right side of the equation (1), we get :

$1 + R_t = 1 + r_t + E_{t-1}\pi_t + r_t . E_{t-1}\pi_t$ (2) Thus , we obtain the following Fisher equation :

$R_t = r_t + E_{t-1}\pi_t + r_t . E_{t-1}\pi_t$ (3) Where R_t = nominal interest rate

r_t = real interest rate

π_t= the rate of inflation

E_{t-1} = expectations operator conditional on information at time t-1

Hence, $E_{t-1}\pi_t$ = expected inflation rate held in period t-1 for period t.

The term ($r_t . E_{t-1}\pi_t$) is usually very small; thus it can be neglected . So, the equation (3) can be rewritten as :

$R_t = r_t + E_{t-1}\pi_t$ (4) So, Fisher effect can be written as follows ($\Delta R_t = \Delta E_{t-1}\pi_t$) which proposes a complete (one to one) relationship between the expected inflation rate and the nominal interest rate .

Thus, Fisher's equation includes a number of cases as follows (Benazić, 2013) :

First : if the expected inflation rate equals zero $E_{t-1}\pi_t = 0$, then $R_t = r_t$. In this case the money will not be lose or earn any value. Thus , the cost of holding money is equal to the opportunity cost and real return on assets .

Second : if $E_{t-1}\pi_t > 0$, then $R_t > r_t$. Where the expected inflation rate is positive , nominal interest rates will always exceed real interest rates .

Third : if $E_{t-1}\pi_t < 0$, then $R_t < r_t$. Where the expected inflation rate is negative, the nominal interest rates will be lower than the real interest rates .

When the central bank makes a fixed nominal interest rate at a certain rate, especially when inflation increases and production costs rise in the productive sectors, the rise in the inflation rate will have a negative effect on real interest rates. This is what can be read economically from the differential formulation of Fisher's equation :

$$\frac{\partial r_t}{\partial\, E_{t-1}\,\pi_t} = -1$$

Assuming the existence of rational expectations so that the expected inflation is different from the actual inflation by a white noise stationary error term (v_t) , which can be specified due to (Muth, 1961) as :

$$\pi_t = E_{t-1}\pi_t + v_t \text{ (5) and } \pi_{t+1} = E_t\pi_{t+1} + v_{t+1} \text{ (6)}$$

where v_{t+1} is the forecast error term of inflation at period (t+1), which are independently and identically distributed with zero mean and variance σ^2. As in Lahiri & Lee (1979), and Booth & Ciner (2001) and Cooray (2002) we have argued proxied the expected inflation to the next period's inflation rate (i.e. inflation rate at period t+1) . Consequently, we can estimate the Fisher equation in the form :

$$R_t = \alpha + \beta\pi_{t+1} + \varepsilon_t \text{ (7)}$$

Where (α) constant, according to Fisher hypothesis represents the real interest rate . (β) coefficient of the expected inflation proxy, according to the Fisher hypothesis it is equal to unity .

Several economic studies indicate that Fisher effect is a phenomenon in the long run that may not exist in the short run . By the hypothesis neutrality of money and based on (one to one) principle between inflation rate and nominal interest rate provided by Irving Fisher , changes in money supply should not have an impact on real interest rates , but their effects are fully reflected on the nominal interest rates through changes in the inflation rate, because the long-term real interest rate is determined in the real sector through societal preferences and productive opportunities. Thus, Fisher effect which is the key pillar of monetary models, is more neutral than the neutrality of changes in the quantity of money in circulation. So, the central bank has to take potential monetary policy options to influence the behavior of the interest rates and the efficiency of financial markets . When inflation is targeted by monetary authorities to prevent it from rising, nominal interest rates should be kept at low levels so as not to discourage borrowing .

This paper is organized into five sections . After this introduction , a review of relevant literature is presented in section 2 . Section 3 describes data and methodology, while section 4 provides and discusses the empirical results . Section 5 closes the paper with a review of the most important conclusions .

2. LITERATURE REVIEW

There are many applied studies that have tested the Fisher effect in different countries, that have yielded mixed results, and this difference in results may be due to the difference in the econometric techniques used or the time difference in the concerned country.

In this part of this study, we try to briefly review a number of research on the Fisher effect across countries in chronological order.

Darby (1975) in his analysis of the relationship between inflationary expectations and nominal interest rates, supported Fisher's effect on a long run in economies without taxes. But taking into account the effect of the tax on interest income, the response to change in nominal interest rates would be greater than the change in expected inflation to keep the real interest rate constant as in the previous period. And that a 1% increases in the nominal interest rate by 1 /(1-Ʈ) assuming that is the marginal tax rate, and this is so- called Darby effect.

Barsky (1987) presented one of the empirical studies on inflation dynamics that has provided evidence of Fisher effect long run. The purpose of his study was to explain the difference in the presence of the Fisher effect by the time period of the data. Using the correlation relationships and the corrected determinant coefficient, the results showed that nominal interest rates could be used as basic indicators to predict real interest rates .

Daniels, Nourzad, & Toutkoushian (1996) targeted test Fisher effect at the level of the US economy using quarterly data for the period (1957:1 to 1992:4) by applying modern methods of testing the unit root test and the cointegration test method by Johansen. Moreover, it is found that in the long run there is a unidirectional causality from the inflation rate to the rate of interest. But, in the short-run, the results indicate a bi-directional causal relationship between the two variables .

Crowder & Hoffman (1996) investigated the long-term equilibrium relationship between the nominal interest rate and inflation rate consistent with Fisher's equation in the US economy using the error correction vector model (ECM) and quarterly data for the period March 1952 to December 1991. The results indicated a common long-term trend of Granger's causality which is from the inflation rate to the nominal interest rate, highlighting that changes in inflation rate give information about the future path of nominal interest rates. In addition , they found that when a nominal interest rate tax is imposed, the Fisher effect involves a response to nominal interest rates greater than the change in the expected inflation rate in order to maintain the real interest rate stability in the previous period , that is consistent with Darby's effect (1975) .

Weidmann (1997) introduced a verification of existence a long run equilibrium relationship between the nominal interest rates of treasury bonds and inflation by using the cointegration tests and the error correction model (ECM) for monthly data on the German economy for the period from January 1967 to June 1996 . However, the obtained results refuted the idea of a Fisher effect .

Booth & Ciner (2001) examined the long-run bivariate relationship between the interest rate of the European currency and the rate of inflation in nine European countries and the US by applying the technique of cointegration. The results of this study indicate that there is evidence of the Fisher effect in the European countries on the interest rate of European currencies and the expected inflation. Thus, the interest rate contains information about the future path of inflation .

Atkins & Coe (2002) examined the long-run Fisher effect in the US and Canada using ARDL techniques for monthly post-World War II data samples. They found evidence to support the long-run relationship in which the nominal interest rate response to the change in inflation is consistent and close (one to one) evidence supporting Darby effect, especially in Canada .

Jareño & Tolentino (2012) tested the Fisher effect on the Spanish economy by using Ordinary Least Squares (OLS) Method for monthly data on the expected inflation rate and the yields of government bonds for one year during the period from (1993:2 to 2004:12). The results indicated that the Fisher effect was partially in Spain .

İncekara, Demez, & Ustaoğlu (2012) aimed to test the Fisher effect of the positive relationship between nominal interest rates and inflation without any effect on the real interest rate ,using quarterly data on the Turkish economy for the period (1989:Q1 to 2011:Q4).By applying the VAR model and cointegration tests, they found evidence of the Fisher effect on the Turkish economy in the long run .

Fatima & Sahibzada (2012) analyzed, tested, presented the long-term and short-term relationship between money supply ,nominal interest rates and the inflation rate at the level of the Pakistan economy for the period (1980-2010). They applied the cointegration tests for Johansen method and the Error Correction Model (ECM). This study used the variance analysis model to explain the error correction model and Granger's causality in determining the direction of the relationship. The results confirmed the Fisher effect in the Pakistan's economy on both the long and short term.

Benazić (2013) examined the Fisher effect in Croatia using cointegration and vector error correction model (VECM) for quarterly data for the period from March 1996 to September 2012. The results indicated that the full Fisher effect was achieved in the long run. In the short term, however, the results showed the partial Fisher effect and very small .

Laiboni, Jagongo, & Ph, D. (2015) investigated the bivariate relationship between monthly inflation rates and monthly yields for three months Treasury bills from January 2009 to August 2015. They found that the time series of the variables were integrated in the first order. However, the results of the cointegration test indicated that there was no long-run equilibrium relationship between interest rates and inflation. Thus, the Fisher effect was not achieved in Kenya during the study period.

Nemushungwa (2016) tested the validation of Fisher effect and the dynamic relationship between nominal interest rates and the inflation in South Africa for quarterly data during (2001Q1 to 2014Q4), using autoregressive distributed lag (ARDL) bounds tests and the Granger causality test . The empirical results of this study indicated an equilibrium relationship between the nominal interest rates and the expected inflation in the long run, not according to Fisher's rule (one to one) and this shows that full Fisher effect is not achieved in South Africa, but rather the presence of the partial Fisher effect .

Uyaebo et al. (2016) tested the Fisher hypothesis in Nigeria using monthly data for the period (1970M01 to 2014M07) by applying the cointegration tests and the error correction model (ECM), that confirmed the relationship between nominal interest rates and inflation in the long run. However, the estimated value of the Fisher coefficient (0.08) in the cointegration relationship indicated a weak Fisher effect . On the basis of these results, they supported a weak Fisher effect in the long-run and nonexistence of the Fisher effect in the short-run .

Clemente, Gadea, Montañés, & Reyes (2017) used the cointegration approach to test the Fisher effect in the G7 economies for quarterly data for 1970-2015. The preliminary results of the study indicated that nominal interest rates and inflation rate were stationary at the level I (0). Later, they used Bai-Perron procedure to see structural changes in the Fisher equation. The final results of their study confirmed the relationship between nominal interest rates and expected inflation, but not in line with Fisher effect and the hypothesis of monetary neutrality. As the estimated values of Fisher parameters in G7 countries indicated that changes in rates of inflationary expectations included the effect on real interest rates .

Dritsaki (2017) tested the equilibrium relationship between inflation and nominal interest rates on long-run in the three European countries, Germany, Britain and Switzerland for the period from (January 1995 to May 2015), using the ARDL approach of cointegration, as well as using the Toda-Yamamoto causality test in the VAR model. The results of bounds test in ARDL approach showed the cointegration of the two variables in the three countries and existence the Fisher effect in the long run. The results obtained using the Toda-Yamamoto method showed that the nominal interest rate had a positive relationship and affects the inflation in a wide range in the three countries, inflation affected the nominal interest rate in Germany only .

ALTUNÖZ (2018) examined the Fisher effect on the Chinese economy by testing the long-run relationship between the interest rates and the inflation rates, using monthly data for the period (1996:01 to 2015:03) by applying the (ARDL) model after knowing the stationarity degree of the time series of the variables, using Augmented Dickey – Fuller (ADF) test . According to the study results, he found the presence of the Fisher effect in China .

3. Data and Methodology

3.1 Data

In this study , monthly data for the period (2005M01 to 2016M12) were used for nominal interest rates for primary credit and inflation rates from the annual statistical bulletins issued by the Central Bank of Iraq. After consolidating the base year (1993=100) data on inflation rates issued on the Central Bank's website with different base years .

The time series plot of the variables shown in the following Figures revealed that the monthly data of nominal interest rates and inflation rate in Iraq could be non-stationary and susceptible to the structural breaks in the period (2007-2008).

These observed characteristics of the two variables were helpful in selecting the appropriate econometric techniques for our analysis.

Figure (1)
Interest Rates for Primary Credit in Iraq for Preiod (2005M01 - 2016M12)

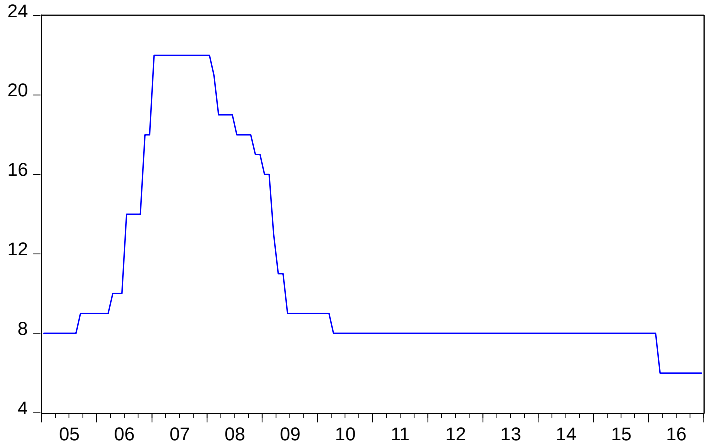
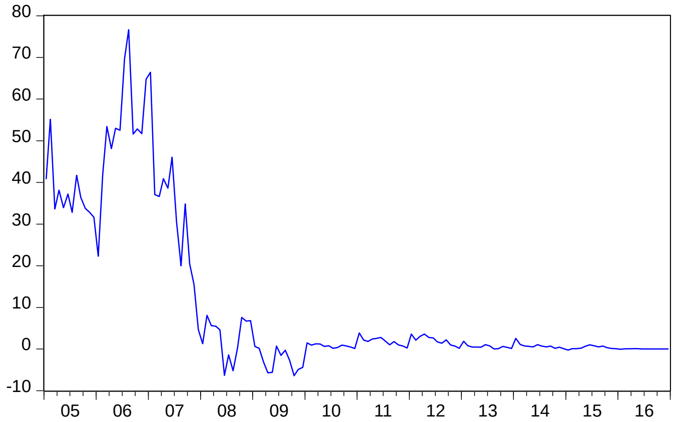


Figure (2)
Inflation Rate in Iraq for Period (2005M01 - 2016M12)



3.2 Methodology

3.2.1 Unit Root Test

The first step in analyzing the time series of the variables is to conduct the stationary test and determine its degree of integration . The absence of stationary time series in the linear combinations between the variables leads to shaded results through what is known as the spurious regression. In this case, the calculated values of t statistic for the estimated parameters are highly significant, the coefficient of determination R^2 close to one. Then, in cases of non-stationary time series the t and F tests are not reliable, for they assume that the underlying time series are stationary (Gujarati, 2011,p: 217). It is therefore, necessary to use unit root tests to verify the presence of stationary or non stationary at the time series of variables to avoid spurious regression . For this purpose , the Augmented Dickey – Fuller test (ADF) proposed by Dickey & Fuller (1981) was used as the most common , which includes testing the following models :

$$\Delta y_t = \gamma\, y_{t-1} + \sum_{i=2}^{p} \beta_i\, \Delta\, y_{t-i+1} + \varepsilon_t \quad (8)$$
$$\Delta y_t = a_0 + \gamma\, y_{t-1} + \sum_{i=2}^{p} \beta_i\, \Delta\, y_{t-i+1} + \varepsilon_t \quad (9)$$
$$\Delta y_t = a_0 + \gamma\, y_{t-1} + a_2 t + \sum_{i=2}^{p} \beta_i\, \Delta\, y_{t-i+1} + \varepsilon_t \quad (10)$$

Dickey & Fuller (1981) provided three F–statistics $(called\ \emptyset_1, \emptyset_2 and\ \emptyset_3)$ to test joint hypotheses on the coefficients .Using the equation (9), the null hypothesis is $\gamma = a_0 = 0$ is tested using the $\emptyset_1$ statistic . Including a time trend in the regression so that equation (10) is estimated the joint hypothesis $a_0 = \gamma = a_2 = 0$ is tested using the $\emptyset_2$ statistic and the null hypothesis $\gamma = a_2 = 0$ is tested using the $\emptyset_3$ statistic (Enders, 2015,p:207). When rejecting the null hypothesis, we conclude the stationary of the time series. Unlike that, we can conclude non-stationary of the data and the existence of the unit-root problem. In this case, all previous models must be re-estimated in the differences formula until we reach the stationary time series of the variables under study. Then, we say that the time series is integrated in order (d) , commonly denoted as $y_t \sim I\,(d)$.

3.2.2 Cointegration Test

In the next step, to determine the long-run relationship between the variables in the model I use the cointegration test .

This study employs the cointegration approach proposed by (S. Johansen & Juselius, 1990),(Johansen, 1992) which sets up a non stationary time series as a vector autoregressive process of order k in re-parameterized form as given in the following equation (Asteriou & Hall, 2011,p:368) :

$$Z_t = A_1\, Z_{t-1} + A_2\, Z_{t-2} + \cdots + A_k\, Z_{t-k} + u_t \quad (11)$$

Thus , the VAR (11) above can be reformulated in a vector error correction model (VECM) as follows :

$$\Delta\, Z_t = \Gamma_1\, \Delta Z_{t-1} + \Gamma_2\, \Delta Z_{t-2} + \ldots + \Gamma_{k-1}\, \Delta Z_{t-k} + \Pi\, Z_{t-1} + u_t \quad (12)$$

Where $\Gamma_i = (I - A_1 - A_2 - \cdots - A_k) = I - \sum_{i=1}^{k-1} A_i$, (i=1,2,…,k-1) and $\Pi = -(I - A_1 - A_2 - \cdots - A_k) = \sum_{i=1}^{k} A_i - I$. At the same time, the Π matrix contains information regarding the long-run relationships. We can decompose $\Pi = \alpha\,\beta'$ where α will include the speed of adjustment to equilibrium coefficients, while β' will be the long run matrix of coefficients. To find the number of cointegration vectors (S. Johansen & Juselius, 1990) used two likelihood ratios, trace statistic λ_{trace} and maximum eigenvalue statistic (denoted by λ_{max}). The first statistic using to test for the trace of the matrix , where the null hypothesis is that the number of cointegration vectors is $\leq r$ against the alternative hypothesis is that the number of cointegration vectors $> r$, [(r= 0, 1, 2, … , n-1) where n refers to the number of the endogenous variables in VAR]. This statistic is calculated by :

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n}\ln(1-\lambda_{r+1}) \quad (13)$$

The second statistic (λ_{max}) using to test the null hypothesis , that Rank $(\Pi) = r$ against the hypothesis that the Rank is r+1 . In other words , it is used to test how many of the numbers of the characteristic roots are significantly different from zero . This statistic is calculated by :

$$\lambda_{max}(r, r+1) = -T\ln(1-\lambda_{r+1}) \quad (14)$$

4. Empirical Results

4.1. Unit Root Test Results

To determine the order of integration of the variables, must be tested the null hypothesis of a unit root on the nominal interest rates and expected inflation rate . The results of the Augmented Dickey Fuller (ADF) test are reported in Table 1, which contains the values of t-statistic are calculated from estimates the models of this test on the level and on the first difference. By comparison with the critical values proposed by MacKinnon (1996), it is clear that the both of the two variables are not stationary in the level, but they are stationary in first difference formula at the 1% level of significance. This means that the variables are integrated of order one, i.e. I (1). The numbers in the parentheses refer to the optimal lag length based on the SC criterion .

Table (1) ADF Unit Root Test Results

Variable	Level		First Difference	
	Constant	Constant & Trend	Constant	Constant & Trend
R_t	-1.258700 (2)	-2.197242 (2)	-5.829944 *** (1)	-5.903069 *** (1)
π_{t+1}	-1.761212 (5)	-1.908879 (5)	-4.323447 *** (6)	-4.401146 *** (6)

The numbers in the parentheses show the optimal length of the lags based on the SIC criteria .
*** refers to as significant statistical within the 1% interval due to (MacKinnon, 1996) .

In the modeling of time series, after determining the order of integration of data, testing the existence of the cointegration relationship by Johansen procedure requires selecting the optimal lags order which is one of the challenges facing researchers in applied economic studies. Using a few lags can reduce the accuracy of predictions due to the loss of valuable information, but the addition of many lags increases the uncertainty in the estimation. Therefore, the choice of lags should balance the benefits of using additional information against the cost of estimating the additional coefficients (Stock & Watson,2011,p:545). For this purpose, the study used five standard information criteria to select the optimal lag length after sitting the maximum lag period of the eighth order. These criteria are as follows: Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion (HQ). The results are reported in Table 2, which shows the varying lag order selected by the criteria. When the lag length chosen by (SC) criterion at order one and the lag length chosen by (HQ) criterion at order sixth , but the other three criteria agreed to choose the same period of lag at the eighth order. So, this lag length (Lags=8) will be used for both the cointegration test and error correction model .

Table (2) Optimal Lag Order Selection

Lag	LR	FPE	AIC	SC	HQ
0	NA	7051.597	14.53676	14.57980	14.55425
1	828.7327	14.04133	8.317744	8.446868*	8.370217
2	8.400848	13.96697	8.312382	8.527587	8.399835
3	19.41443	12.73556	8.219966	8.521254	8.342401
4	4.801393	13.01055	8.241119	8.628489	8.398535
5	22.93676	11.47733	8.115404	8.588856	8.307802
6	29.47770	9.568591	7.933043	8.492577	8.160422*
7	9.435377	9.391101	7.913674	8.559291	8.176034
8	11.93209*	9.013719*	7.871814*	8.603513	8.169156

(*) indicates lag order selected by the criterion .

4.2. Cointegration Tests Results

In order to determine the numbers of cointegration vectors in the Johansen technique between the cointegrated variables in the first order, appropriate model must be chosen for the deterministic components (the intercept and/or trend) of the multivariate dynamic system enter either the long run or short run, or both . The Johansen cointegration test includes five distinct models as follows(Asteriou & Hall, 2011,p:372-373) :

Model 1 : No intercept or trend in Cointegration Equation (CE) or Vector Autoregressive (VAR) model .

Model 2 : Intercept (no trend) in CE , no intercept or trend in VAR .
Model 3 : Intercept in CE and VAR , no trends in CE and VAR .
Model 4 : Intercept in CE and VAR , linear trend in CE , no trend in VAR
Model 5 : Intercept and quadratic trend in the CE , intercept and linear Trend in VAR .

So, the problem lies in the five models one of which is appropriate in the test of cointegration, but the first model and the fifth model are unrealistic and are not believable in economic theory; therefore, the problem is reduced to choosing one of others three models .

Johansen(1992), indicates that the joint hypothesis of both order rank (number of coitegration relations) and deterministic components needs to tested, is to apply the so-called Pantula principle which includes the estimation of the three models and the presentation of the results from the most restrictive hypothesis (r=0 and model 2) to the least restrictive hypothesis (r = n-1 and model 4) . So, the process of choosing the appropriate model involves moving from the most restrictive model to the other models .At each stage, the calculated value of the trace statistic is compared to the critical value. The test is stopped only when it is obtained at the first time, when the null hypothesis which states that there is no cointegration relation is accepted (Asteriou & Hall, 2011,p: 373) .

On this basis , when applying Johansen System Cointegration Test in Eviews Program (taking into consideration the optimal lag interval (lag=8)) , 'option 6' was chosen to select the best model according to AIC criterion and SC criterion, for use in the (VECM) Vector Error Correction Model as in Table (3), which shows the number of cointegrating relations with the statistical significance between the nominal interest rate and the expected inflation by testing the joint hypothesis (rank of Π and model) using the tow statistics provided by S. Johansen & Juselius (1990). According to the AIC criterion , the appropriate model is in Rank 1 and Model 2, this means r = 1 and intercept (no trend) in CE , no intercept or trend in VAR. This is due to the fact that this appropriate model has given the lowest value for this criterion (AIC = 7.847312) .

Table (3) Number of Cointegrating Relations by Model

	Model 1	Model 2	Model 3	Model 4	Model 5
Trace	1	1	2	1	2
Max-Eig	1	1	2	1	2

The numbers in the Table denotes to the selected number of cointegrating relations by model at 0.05 level (**) .
(**) Critical values based on (MacKinnon-Haug-Michells,1999).

Hence, the cointegration relation between the variables under study was tested as the best model (according to the AIC criterion) described above. The results were summarized in Table 4 which shows rejection of the null hypothesis that r = 0 at the 5% level, because the calculated value of both the trace statistic and the max-eigen statistic is greater than its critical value. This is evidence of a one cointegration vector between the nominal interest rates and the expected inflation rate in Iraq .

Table (4) Unrestricted Cointegration Rank Test

No. of $CE_{(s)}$	Eigenvalue	Trace Statistic	0.05 Critical Value	Max-Eigen Statistic	0.05 Critical Value
None	0.165272	28.83651**	20.26184	24.20700**	15.8921
At most 1	0.033959	4.629506	9.164546	4.629506	9.164546

** denotes rejection of the hypothesis at the 0.05 level

4.3. Error Correction Model Estimation Results

In the next step, the error correction model should be estimated and tested for one of cointegration relationship VECM (1), in which the dependent variable is ΔR_t and the matrices formula . The results were summarized as shown in the Table 5 .

Table (5) Parameters Estimates of The Long Run Relationship and Adjustment

Variable	coefficient	Standard Error	T-value
R_{t-1}	1.0000		
π_t	-0.319749	0.05645	-5.66471***
C	-6.928253	0.90352	-7.66810***
Adjustment of ΔR_t	-0.060581	0.01770	-3.42252***
Adjustment of $\Delta\pi_{t+1}$	-0.15015	0.10272	-3.06671***

***refer to as statistical significance at 0.01 level .

Table 5 shows the significance of the parameters of the long-term relationship, and proves that the values and signs of the adjustment coefficients are reasonable, as being less than one and negative at a significant level of 1%. ($\Pi = \alpha\beta'$) is the mechanism of the error correction, where α is the coefficient that indicates the speed of return from disequilibrium to long-term equilibrium, meaning that (α) shows the speed at which nominal interest rates change to remove the shocks in inflation during the month. According to the adjustment mechanism, we conclude that the adjustment coefficient drives the long–term interest rate by 6% per month to eliminate the long-term disequilibrium, so it takes more than 16 months to reach the full adjustment .

The results of cointegration analysis can be represented in the following equation of the long-term equilibrium relationship :

$$R_t = 6.928253 + 0.319749\ \pi_{t+1} \qquad (15)$$

Where $(\alpha = 6.928)$ it is the intercept, and according to Fisher's hypothesis, this coefficient represents the real interest rate. The coefficient β is (0.319749) with statistical significance at 0.01 levels. It is indicated that the expected inflation and the long-term nominal interest rates are moving in the same direction, but not the same percentage because it is less than one. This indicates that the partial Fisher effect is achieved in the long run .

4.4. Weak Exogeneity Test

After confirming the long–term equilibrium relationship between the nominal interest rates and the expected inflation in Iraq . The weak exogeneity test should be conducted for expected inflation , to establish the long-term causation trend of expected inflation to nominal interest rates, as well as seeing whether the observed variable in the short-term model can be used , or excluded from the short-term model and remains in the long-term equation only (Benazić, 2013) .

In error correction models, the observed variable is said to be weakly exogeneity if the correction coefficient for this variable in error in the model is statistically insignificant (Opolot & Mpagi, 2017). Therefore, the weak exogeneity is investigated by the test of term α which to represent to the coefficient of speed adjustment to equilibrium , is it equal to zero? this is done by imposing appropriate constraints on the previously estimated error correction model VECM(1). The results are presented in Table 6 .

Table (6) Cointegration Restrictions and Weak Exogeneity Tests

Restrictions	B(1,1)=1 , A(1,1)=0	B(1,1) =1 , A(2,1)=0
Chi-square (1)	10.42487	8.461371
P-value	0.001243	0.003628

Table 6 contains two constraints on the cointegration relation and the calculated value of the χ^2 statistic according to the Likelihood Ratio (LR) test for each constraint. Stating that the second column of the Table a null hypothesis test that states a weak exogeneity of nominal interest rates, the third column is a test of the null hypothesis that states the weak exogeneity of the expected inflation in the model. As it can be seen from the Table, the statistical significance of χ^2 statistic at 0.01 levels, which can reject the null hypothesis for each variable . Thus, it indicates the non weak exogeneity, and supports this result is the high statistical significance of the error correction coefficients in Table 5 .

Based on this, I conclude that there is a long-run and the two-way causal relationship between the two variables, but they have little effect. In addition, although the parameters estimated in the VAR were not significant in the error correction model VECM, it was not possible to exclude the expected inflation from the short-term model .

According to the above results, by using the expected inflation as an explanatory variable in the short-term dynamic model as :

$$\Delta R_t = \beta_0 + \beta_1 \Delta \pi_{t+1} + \alpha ECM_{t-1} + e_t \qquad (16)$$

Where Δ is the first difference operator, β_0 is the intercept, β_1 is the estimated coefficient, α refers to the coefficient of error correction and e_t is the error term (white noise process). The results of the short-term dynamic model estimation were shown in the Table below .

Table (7) Short Run Conditional Dynamic Model [(1)]
Dependent Variable : ΔR_t

Variable	coefficient	Std. Error	t-Statistic	Prob.
Constant	0.025032	0.058473	0.428091	0.6693
$\Delta \pi_t$	-0.008667	0.012958	-0.668880	0.5048
$\Delta \pi_{t-1}$	-0.015926	0.011715	-1.359429	0.1764
$\Delta \pi_{t-3}$	-0.027279**	0.011614	-2.348873	0.0204
$\Delta \pi_{t-5}$	-0.010191	0.012922	-0.788645	0.4316
$\Delta \pi_{t-7}$	-0.024612**	0.010821	-2.274409	0.0246
ECM_{t-1}	-0.074450***	0.010814	-6.884434	0.0000

The results in the Table after excluding the estimated coefficients less significant.
*** indicates statistical significance at the 1% level, ** indicates significance at the 5% level .

The results in Table 7 indicate the significance of the short-term adjustment coefficient at the 1% probability level, but most short-term expected inflation coefficients are not statistically significant, although their values are very low. This can be explained by the fact that the monetary authorities in Iraq during the period under the study were working within the policy of the inflation targeting. One of the requirements of this policy is to determine nominal interest rates in the short run by the central bank and not through the market mechanism . Therefore, there may be fluctuations in real interest rates that will not remain constant, which is not consistent with Fisher effect .

5. Conclusions

This paper aimed to investigate the relationship between the nominal interest rates and the inflation rate, and to test the Fisher effect in Iraq during the period 2005M01 to 2016M12. Using the Johansen technique in the cointegration analysis and error correction model . The first result was non-stationary of the two variables in the level , but they are integrated in first order, i.e. stable in the form of the first difference . When testing the rank of the cointegration, we found that there is a stationary equilibrium relationship between nominal interest rates and expected inflation in the long run . The increase in inflation of 1% leads to nominal interest rates increases of 0.319 % over the long run. Thus, achieving long-run partial Fisher effect and absence of the Fisher effect in the short run. The most likely reason is that the monetary authorities in Iraq after 2003 are operating within the framework of the targeting inflation policy , and accordingly it should be determined interest rates centrally and not to let them according to the market mechanism .

These results have led to a partial and small partial neutrality of the inflation affecting real interest rates in the long run and non-neutrality inflation in the short run . At the same time, due to the existence of the partial Fisher effect in the long run, and its absence in the short run, I conclude the effectiveness of monetary policy in Iraq in the short run and the weakness of its effectiveness in the long run. As the Fisher effect is weaker, as the credibility of monetary policy increased.

Using the weak exogeneity test, by imposing the necessary constraints on the estimated model, I found that both nominal interest rates and expected inflation are not weak exogeneity. Thus, there is a bidirectional causal relationship between these two variables in the long run .

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The role of green financial institutions in achieving sustainable development: A vision in the possibility of its application in Iraq

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Abstract

Since the second half of the 1980s, after the publication of the ICRC's report on environment and development (1987), the issue of sustainable development has occupied a prominent place in economic literature. Over the past few decades, the shifts in the global economy from the liberalisation, opening up and accelerating the pace of globalisation. Globalisation has increased competition among countries without considering the adverse effects and serious consequences on the environment and the depletion of resources, which deprives the right of future generations.

The international financial institutions have tried to address this imbalance by seeking sources of financing and investment in economic activities that preserve the environment. Additionally, it works to achieve a balance between the interests of present and future generations, thus making development and sustainable growth.

The research seeks to show the role played by green financial institutions to achieve sustainable development through the provision of financial resources with the Iraqi perspective.

Keywords: sustainable development, sustainable growth, green financial institutions, green bonds.

Introduction:

Sustainable development is a guarantee of steady progress and the best alignment of resources and needs. Over the past few decades, the transformation of the global economy from the liberalisation towards globalization has intensified competition among countries. It has increased production without considering the adverse effects and serious concerns on the environment and the depletion of resources, which robs the right of future generations. Putting the economy on a sustainable development track requires an unprecedented shift in investments away

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