

RELATIONSHIP AND CAUSALITY BETWEEN INTEREST RATE AND INFLATION RATE CASE OF JORDAN

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ABSTRACT

This study attempts to examine and study the possible of existing relationship between Interest rate and Inflation within Jordan economy over the period of time (1990-2012), firstly by testing the impact of inflation, economy growth, money supply and budget deficit on the interest rate in order to determine the relationship between interest rate and inflation, secondly by investigating the causal relationship between these two variables, using multiple regression, correlation, unit root tests, co-integration tests and causality tests, as well as the trends, graphs and charts of the variables to analyze the variables under study. The empirical results of this study show that there is a positive relationship between inflation and interest rate also there is a bidirectional causality relationship between inflation and interest rate in Jordanian economy over the period of time (1990-2012). Thus the policy makers should pay attention to this kind of relationship between these two such important economic variables.

Keywords: RELATIONSHIP ; CAUSALITY ; INTEREST RATE ; INFLATION RATE ; CASE; JORDAN

1. INTRODUCTION.

Interest rates impacts on both individuals and the economy, and the impact of interest rates depends upon the current level of economic activity. An increasing interest rates can also lead to unexpected inflation, reduced investment and lower confidence among households and investors .

The economic factors: inflation, economy growth, money supply and budget deficit influence the interest rate by affecting and influencing the supply and demand of loanable funds.

The object of this study is to test the impact of inflation, economy growth, money supply and budget deficit on the interest rate in order to determine the relationship between interest rate and inflation, secondly by investigating the causal relationship between these two variables using multiple regression, correlation, unit root tests, co-integration tests and causality tests, as well as the trends, graphs and charts of the variables to analyze the variables under study.

2. Theoretical and literature review.

Interest rate may be defined as the rate charged for the use of money, and this is often expressed as an annual percentage of the principal. Interest rate really affects purchasing and consumption decisions made by consumers, firms and government. This is because individuals may base their consumption decisions on the current interest rate.

The most known economic factors⁽¹⁾ affecting the interest rate are:

(1) Inflation: Inflation is a persistent and appreciable increase in the general price-level over a period of time, usually a year. the interest rate gives important information to investors and dealers on the financial market. Inflation is the cost of holding cash while the rate of interest is the cost of holding wealth in any other asset. Thus as the rate of inflation rises those holding their wealth in the form of cash lose. On the other hand capital becomes more costly as the interest rate rises. An investor will normally like to balance out his options for gaining or losing by holding cash and or alternative assets. Such an investment decision involves planning, which depend on expectations. Fixing of interest rates by the central bank is to influence such expectations.

Fisher equation shows that the real interest rate is the difference between the nominal interest rate and the inflation rate. it is often written as equality:

$$i = r + \pi$$

If inflation rate is expected to increase , the supply of loanable fund decreases and the demand for of loanable fund increases.

(2) Economic growth: As the economic growth increases, causes more demand for loanable fund , thus increases interest rate.

(3) Money supply: An increase in the money supply, causes less demand for loanable fund , thus decreases interest rate.

(4) Budget deficit: As the Budget deficit increases, causes more demand for loanable fund , thus increases interest rate.

So the interest rate can be expressed as a function of the Inflation rate, economic growth, money supply and budget deficit as the following equation:

$$INT = a + b_1 INF + b_2 GDP + b_3 MS + b_4 BUD \dots\dots\dots(1)$$

Where INT is the Interest rate , *INF is the inflation rate, GDP is the economic growth, MS is the money supply, BUD is the budget deficit.*

Also the direct relationship between the interest rate and Inflation rate can be expressed in the following equation:

$$INF = a + b_1 INT \dots\dots\dots(2)$$

Where a is the intercept, INT is the Interest rate and INF is the inflation rate.

3. Research models

Two theoretical models generally accepted for estimating the relationship existing between the dependent and independent variables to be used and can be specified as:

$$INT = a + b_1 INF + b_2 GDP + b_3 MS + b_4 BUD + u \dots\dots\dots(1)$$

$$INF = a + b_1 INT + u \dots\dots\dots(2)$$

Where a is the intercept, which shows sensitivity of a change in interest rate to a change in the independent variables(Inflation rate, economic growth, money supply, budget deficit) . INT is the Interest rate (dependent variable), *INF is the inflation rate, GDP is the economic growth, MS is the money supply, BUD is the budget deficit and u is the error or disturbance term,*

The first equation(1) will be used in the regression analyses while the second equation(2) will be used in the causality analyses to predict the relationships between the variables under study.

⁽¹⁾ Jeff Madura, Financial Markets and Institutions, 7th ed. (Florida: Abridgal, 2007), pp 3,32.

4. Data collection.

The annual time series data over a twenty-three year period from 1990 to 2012 of the selected variables as shown in the Table-1 below, which represents data on inflation , interest rate, economic growth,

money supply and budget deficit of Jordanian economy were collected from international financial statistics , Jordan department of statistics and central Bank of Jordan. Time series data is used due to its flexibility in analysis and comparison.

YEAR	INT	INF	GDP	MS	BUD
1990	8.50	16.20	2760	4200	49
1992	8.50	8.20	2958	4300	21
1991	8.50	4.00	3130	4450	369
1993	8.50	3.30	3335	4500	145
1994	8.50	3.50	3692	4650	116
1995	8.50	2.40	4019	5025	152
1996	8.50	6.50	4143	5180	56
1997	8.30	3.30	4451	5420	64
1998	8.20	3.10	4720	5760	75
1999	8.70	.60	4864	6300	96
2000	6.80	.70	5153	7100	69
2001	5.60	1.80	5470	7658	66
2002	5.00	1.80	5849	8250	45
2003	3.20	1.60	6301	8952	102
2004	2.80	3.40	7195	9858	121
2005	4.80	3.50	7963	11550	249
2006	7.20	6.20	9362	13156	129
2007	7.40	4.70	10805	14856	220
2008	6.70	14.50	13971	17200	307
2009	5.50	.00	15044	19300	1062
2010	4.30	4.70	16417	20900	660
2011	4.40	4.50	17987	23300	972
2012	5.00	4.80	19298	24800	1238

Table-1:Data

5. METHODOLOGY

This study includes a descriptive analysis of the data, the trends or pattern of the variables(INT,INF) will be will be examined and the Augmented Dickey-Fuller test will be run to test for unit root for all variables, a correlation test between the variables will be looked at, then data will be regressed through the regression equation (1) to predict the relationship between the variables the variables involved in equation (1). Moreover a co-integration test in order to be able to perform Granger Causality test to evaluate the causality relationship between INT and INF by using equation (2) to verify the main objectives of the study, which are to determine the relationship and the causality relationship between interest rate and inflation rate in the Jordanian economy.

6. Analysis.

To analyze relationship and the causality between interest rate and inflation, multiple and various approaches are used, such as descriptive, graphical, , multiple regression, correlation, unit root tests, co-integration tests and causality tests analysis as follows:

6-1 Descriptive analysis.

The mean, standard deviation, minimum values and maximum values of the interest rate and inflation rate are in Table-2 below:

		INF	INT
N	Valid	23	23
	Missing	4	4
Mean		4.4913	6.6696
Std. Deviation		3.94990	1.93964
Minimum		.00	2.80
Maximum		16.20	8.70

Table -2: Descriptive analysis

The mean for the variable Inflation Rate(INF) is 4.4913, meaning on the average, Inflation rate is 4.4913 annually. Inflation exhibiting the min value 0.00 and the max value 16.2, means that the mean is closer to the min value thus most of the values for Inflation are skewed to the min value. The standard deviation (Std Dev) for Inflation is 3.9499, showing that about 3.9499 of the values deviate from the mean 4.4913.

Furthermore the mean for the variable Interest Rate(INT) is 6.6696, meaning that on the average, Interest rate is 6.6696 annually Interest Rate exhibiting the min value 2.8 and max value 8.7, means that the mean is closer to the min value thus most of the values for Inflation are skewed to the min value, and the standard deviation (Std Dev) for Interest rate is 1.93964 showing that about 1.93964 of the values deviate from the mean 6.6696.

6-2 Graphical analysis.

Graphical analysis of the trends, graphs and charts of the main variables (INT, INF) as follows:

6-2-1 Interest and Inflation rate trend.

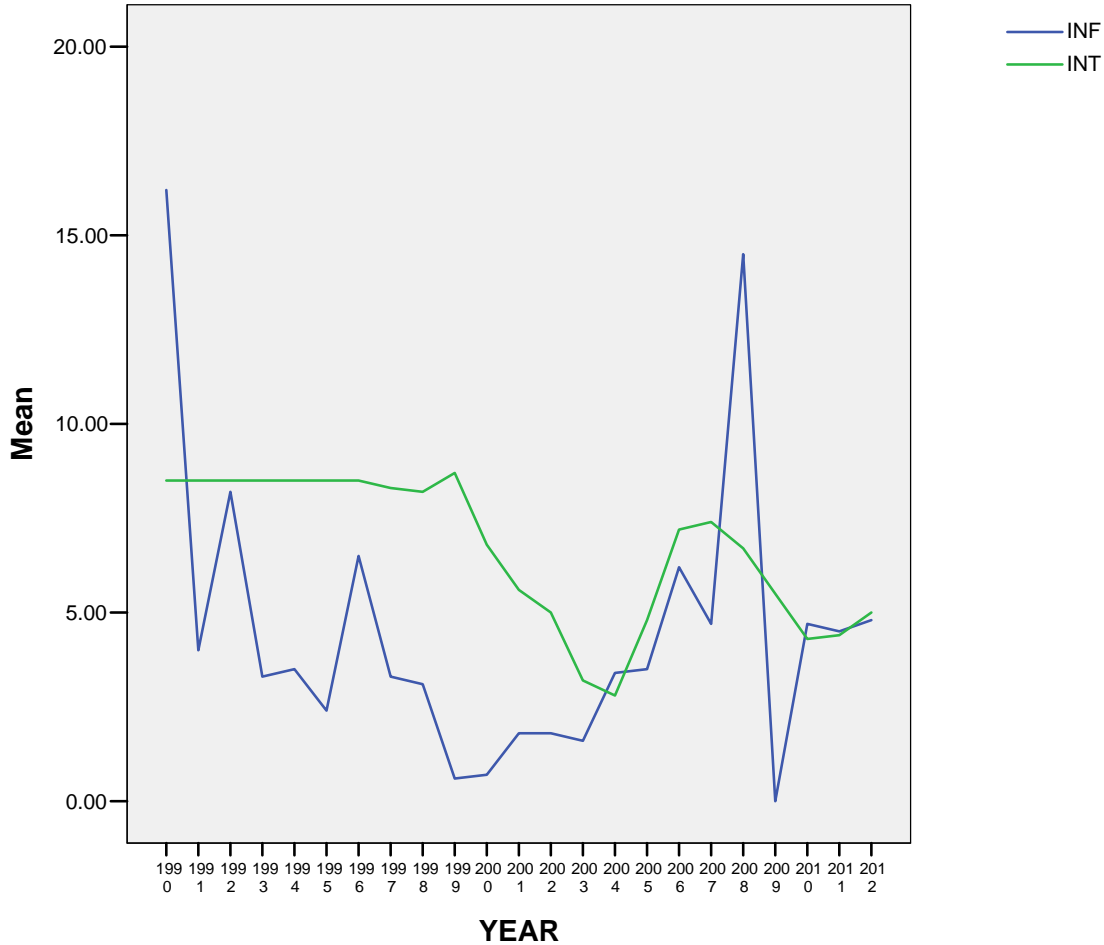


Fig.1:Interest and Inflation rate trend

It can be seen from the graph above that during the early years that as Inflation rate decreased, Interest rate also decreased though not as much as inflation rate. During the subsequent years (2004-2012) it is clearly seen from the graph that Inflation rate saw a high level of increase and decrease with Interest rate also following the pattern of increase and decrease. Year 2008 and year 2009 show a sharp up and fall in the rate of Inflation.

6-2-2 Pattern of Interest and Inflation Rates.

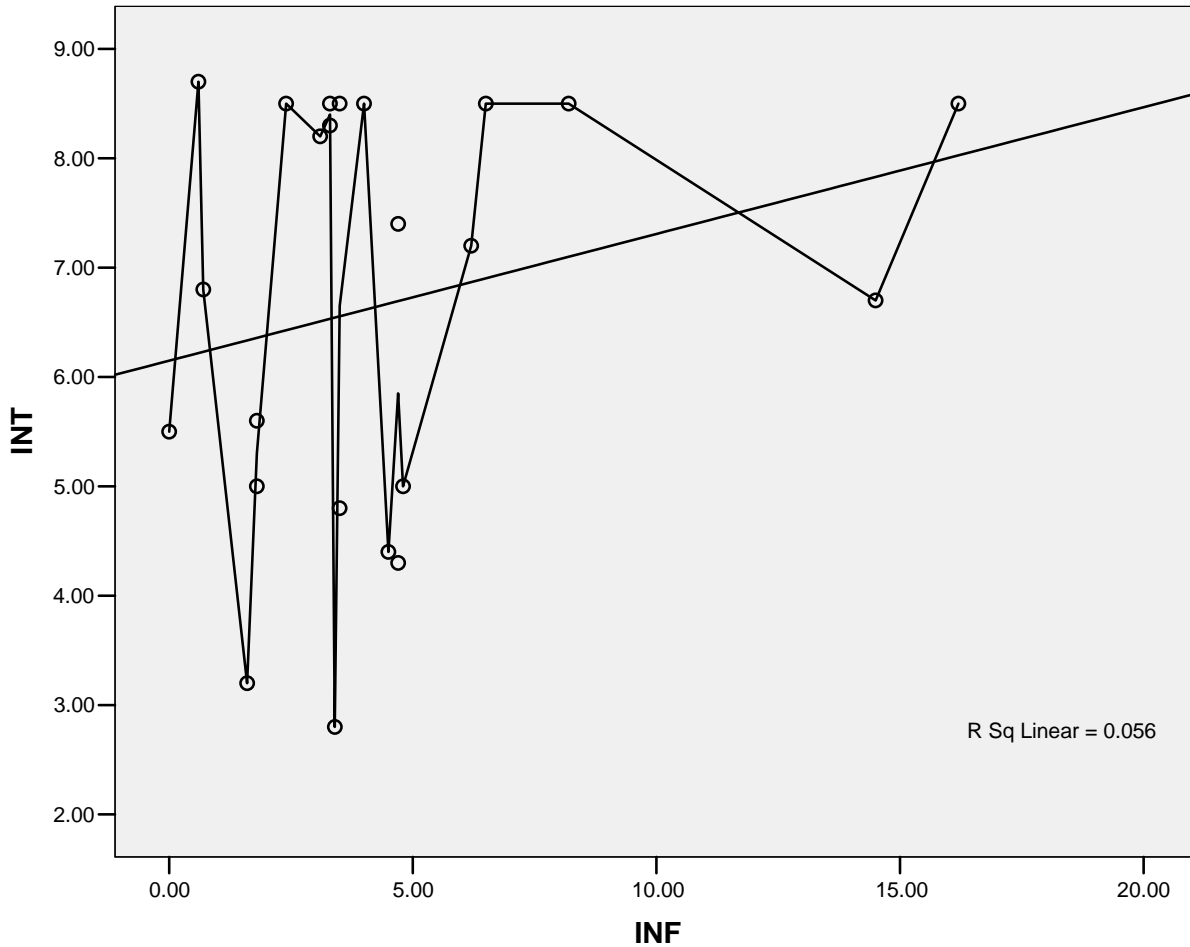


Fig.1-2 Scattered diagram of inflation and interest rates

The diagram above represents a scattered diagram that further explains how much of variations in interest rate is explained by Inflation. From the graph, it can be clearly seen that the plotting is somewhat concentrated on the left corner. This means that the independent variable (inflation rate), explains some portions of the variations in the dependent variable (interest rate), though a greater part of the deviation is included in the error term (U). To conclude, the diagram exhibits a positive weak correlation between Inflation and Interest Rates.

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It can be concluded that Interest Rate (INT) and Inflation rate(INF) are positively related. This means that an increase in Inflation rate leads to an Increase in Interest rate, and a decrease in Inflation rate leads to a decrease in Inflation rate.

6-3 Regression analysis.

In order regress the data through the regression equation (1), an Augmented Dickey-Fuller test will be run to test for unit root for all variables then correlation test will be performed.

6-3-1 Augmented Dickey- Fuller unit root test.

Augmented Dickey- Fuller test was carried out to test for the presence of stationarity of all variables with no intercept and with intercept, the results are in in Table-3 .

From the Dickey- Fuller test as shown in table-3 below, for the interest rate series, the ADF t-statistics with no intercept (-2.934) which is smaller than the critical value at 5% (-1.958), and the ADF t-statistics with intercept (-5.160) which is smaller than the critical value at 5% (-3.012), thus the interest rate series is stationary at second difference. Again it can be concluded from table3, that the inflation series is stationary at level, the GDP series is stationary at second difference, the budget deficit series is stationary at first difference and the money supply series is stationary at second difference.

SERIES	t-statistic with no intercept	Critical(5%) with no intercept	t-statistic with intercept	Critical(5%) with intercept	No. of differential
INT	-1.074 -2.934	-1.957 -1.958	-1.208 -2.907 -5.160	-3.003 -3.011 -3.012	Level First difference second difference
INF	-3.296	-1.958	-5.048	-3.011	Level
GDP	0.342 -3.832	-3.633 -3.645	4.147 -2.274 -7.926	-3.003 -3.001 -3.012	Level First difference second difference
BUD	0.494 -6.284	-1.957 -1.958	-0.261 -6.713	-3.003 -3.011	Level First difference
MS	-13.337 -0.213 -5.849	-1.957 -1.958 -1.959	7.683 -1.273 -6.218	-3.766 -3.011	Level First difference Second difference

Table -3: Result of ADF Test

6-3-2 correlation between and Interest rate Inflation rate.

The correlation between Interest rate and Inflation rate is 0.236 as shown in Table-4 below. This exhibits a weak positive relationship between the variables.

		Int	inf
INT	Pearson Correlation	1	.236
	Sig. (2-tailed)		.278
	N	23	23
INF	Pearson Correlation	.236	1
	Sig. (2-tailed)	.278	
	N	23	23

Table-4: Correlation

6-3-3 Regression of interest rate its determinants.

By estimating equation (1) in the period 1990-2012, the results are in

Model Summary

Mode	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.755(a)	.570	.474	1.40632

a Predictors: (Constant), INF, MS, BUD, GDP

ANOVA(b)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	4.609	1	4.609	1.238	.278(a)
	Residual	78.160	21	3.722		
	Total	82.769	22			

a Predictors: (Constant), INF

b Dependent Variable: INT

Coefficients(a)

t	model	coefficients	std.error	beta	sig.
1	(Constant)	8.708	.713	12.210	.000
	GDP	.001	.001	3.473	.121
	MS	-.001	.001	-4.394	.046
	BUD	.002	.002	.372	.273
	INF	.132	.080	.268	.116

a Dependent Variable: INT

Table-5: Multiple regression results

The significant from the ANOVA analysis is 0.278 as shown in Table-5 , which is greater than 0.01, so the null hypothesis is rejected of no explanatory power for the regression at better than 1% level of significance, i.e the model fits the data. The correlation between the interest rate and the four independent variables is 0.755(R) ,which indicates a good correlation, also the four independent variables jointly account for 57%(R²) of the change in the interest rate ,which means that 57% of the change in the interest rate is explained by these four independent variables. Also the estimated coefficients B₀ , B₁,B₂, B₃ and B₄ of the intercept and the independent variables(inflation rate, economic growth, money supply and budget deficit) are 8.708, 0.132 ,0.001, - 0.001, and 0.002 as shown in Table-5. So the estimation of equation(1) is : INT =8.708+0.132 INF+0.001 GDP-0.001 MS+0.002 BUD

The estimation (R²=57%) explain the weak positive relationship between inflation rate, economic growth and budget deficit and interest rate and weak negative money supply and interest rate, which means that there must be other variables affecting the interest rate not accounted in this model . The inflation has the most impact factor on the interest rate out the four factors and the relationship between interest rate and inflation rate is positive and 1% increase in the inflation rate will cause 13.2% increase in the interest rate period.

6-4 Causality relationship tests.

In order to test the causality between the interest rate series and the inflation rate series, it is necessary to verify that the two series are stationary and co-integrated.

6-4-1 Co-integration test.

Two or more variables are said to be co-integrated, if the share a common trend and are linked with long-run relationship i.e exhibit the same stochastic trend. Therefore equation (2) is co-integrated and gives the results in Table-6 below:

H ₀	Trace statistic	Max.Eigenvalue Statistic
R=0	23.88483 (18.17)	15.5337 (16.87)
R≤1	8.351137 (3.74)	8.351137 (3.74)

Terms in() indicates 5% level critical value

Table-6:Co-integration test

The result in Table-6 shows that the null hypothesis of no co-integration (r=0) on both trace test and maximum eigenvalue test between INT and INF could not be rejected at 5%, However, the null hypothesis of no co-integration (r≤1) could be rejected at 5% meaning that there is only one co-integration vector.

6-4-2 Granger causality test.

The concept of causality assumes a different meaning with respect to the more common use of the term, the statement interest rate(INT) ganger causes inflation rate(INF) or vice versa represents how much of the current (INT) and(INF) can be explained by past values of (INT) and (INF). In order to determine which variable causes the other a Granger causality test is used and the results of is shown in Table-7 below:

Pairwise Granger Causality Tests

Date: 11/09/13 Time: 03:51

Sample: 1990 2012

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
INF does not Granger Cause INT	21	0.34765	0.56277
INT does not Granger Cause INF		0.00109	0.97405

Pairwise Granger Causality Tests

Date: 12/28/13 Time: 08:22

Sample: 1990 2012

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
INF does not Granger Cause INT	20	0.00220	0.99780
INT does not Granger Cause INF		0.80458	0.46567

Granger causality test
Table-7

As shown in Table-7, all probabilities are greater than the significant level(0.05), so all null hypothesis can be rejected, implying that there is a bidirectional causality running from interest rate(INT) to inflation(INF) and vice versa. Therefore there is a causality relationship between interest rate and inflation rate in Jordanian economy over the 1990-2012.

7. Conclusion

The main objective of this study is to test and analyze the relationship between interest rates and inflation in Jordanian economy over the 1990-2012. It can now be concluded that the trend of the variables Inflation and Interest rate are positive sloped,. From the regression analyses between interest rate(dependent variable) and inflation rate, economic growth, money supply and budget deficit (independent variables), the results show that there are weak positive relationships between interest rate and inflation rate, economic growth and budget deficit and a weak negative relationship between interest rate and money supply . This finding is compatible with the influence of these economic factors on the supply and demand of loanable funds and therefore influence and interest rate. Also the results show that a 1% increase in the inflation rate will cause 13.2% increase in the interest rate. Again the regression results show a low estimation of 57% (R^2) explain the weak relationship between interest rate and inflation rate, economic growth, money supply and budget deficit, this result may be due to the unfavorable economic conditions that were present during the period in which the data was collected (1990 – 2012) or due to other variables affecting the interest rate that not accounted in this model. Furthermore, Granger causality test shows that there is a bidirectional causality relationship running from interest rate to inflation rate and vice versa in Jordanian economy over the 1990-2012.

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