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Research Article

A SURVEY OF THE RELATIONSHIP BETWEEN INTEREST RATE AND INFLATION IN IRAN (1981-2012)

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ABSTRACT
Decreasing bank interest rates is one of the policies to reduce the rate of inflation that have been paid close attention in recent years. In order to investigate the efficiency of above policy, this research has been conducted to investigate the relationship between inflation rate and interest rate (one-year deposits and loan interest rates and market interest rate) during 1981-2012 using autoregressive vector model with distributed lags and vector error correction model via Granger causality test. The results showed that there is a long-term relationship between bank interest rates and inflation rate. In order to reduce inflation in a long term, it is recommended to manage the decreasing trend of loan interest rate so that it could be possible to control inflation index and reduce it within the country.

Keywords: *The Nominal Interest Rate; Inflation; Autoregressive Distributed Lags (ARDL); Error Correction Model (ECM); Granger Causality*

INTRODUCTION
Reducing interest rates encourages investment, enhances tendency to invest, reduces production cost, increases national production, and creates oversupply in the country. Oversupply the main factor in controlling the prices, preventing the increase of prices, and causing exports top boom. By influencing the production cost, interest rate reduction results in reduction in the price of different goods and inflation. In this regard, the present study was aimed at investigating the relationship between bank interest rate and inflation rate in Iran during 1981-2012.
The study objectives are:
1. Specifying the relationship between one-year interest rate and inflation rate,
2. Specifying the relationship between loan interest rate and inflation rate, and
3. Specifying the relationship market interest rate and inflation rate.

2. The study hypotheses are:
1. There is a positive relationship between one-year interest rate and inflation rate.
2. There is a positive relationship between loan interest rate and inflation rate.
3. There is a positive relationship between market interest rate and inflation rate.

3. Theoretical Foundations of the Relationship between Interest rate and Inflation
Macroeconomic theories can be utilized in order to investigate the relationship between inflation and interest rate. In so doing, the influence mechanisms of interest rate on inflation and of inflation on interest rate will be discussed. If prices rise, the real money balance is the first variable to increase; in other words, as the level of prices increases, real supply of money drops. According to Keynesian analyses, reduction in real money supply (excess demand for money) results in some disorders in economy. According to Walrasian Equilibrium and in general to create balance in economy, the incidence of excess demand for money in money market results in oversupply in securities market. Therefore, it is expected that interest rate rises with an increase in prices. So, theoretically, there is a positive causal relationship from inflation rate to nominal interest rate. In other words, increase in the rate of interest causes interest rate to rise. How interest rate affects inflation can be explained in different ways. One of the influence mechanisms of interest rate on inflation is cost of capital, such that increase in interest rate causes cost of capital to rise, which ultimately increases production costs (Branson, 1993).
An increase in production prices or transmission to the left of the aggregate supply curve finally leads to an increase in inflation. In addition, changes in interest rate affect inflation by influencing the volume of

money. According to quantity theory of money, money supply increases the level of prices in long and short terms. However, money supply in extensive recess is less likely to have a significant effect on inflation. In normal status and at least in medium and long term; however, the volume of money has a positive significant effect in inflation (Asgharpour, 2005).
Therefore, it is theoretically expected that increase in interest rate cause the level of prices to rise; therefore, it is argued that there is a causal relationship from interest rate to inflation. Another mechanism to explain the relationship between interest rate and inflation is the well-known relationship between nominal and real interest rates, and large body of economic literature has long been allotted to this issue (Mehrgan *et al.*, 2006).
According to Mundell theory, increase in the expected inflation rate reduces real money balance, as a result, wealth drops. Reduction of wealth decreases consumption and increases savings, which results in reduction in real interest rate. Mundell theory states that an increase of one unit in expected inflation reduces real interest rate and the effect of expected inflation on nominal interest rate will be less that that unit. This relationship is known as "Mundell effect".

$$i = r + \beta\pi \quad , \quad \beta \langle 1 \qquad (1\text{-}3)$$

Mundell effect implies that inflation changes caused by monetary policy are non-neutral (Mundell, 1963).
Marshall (1980) investigated the relationship between nominal interest rate and inflation rate as follow:

$$IR_r = IR_n - I_n - np \qquad (2\text{-}3)$$

Where, IR_r is real interest rate, IR_n is nominal interest rate, in is inflation rate, and np cross effect of nominal interest rate and inflation rate. Therefore, Marshall believed that nominal interest rate and inflation rate have a direct relationship (Marshall, 1886).
Unlike Marshall, Clark (1895) believes that real interest rate is fixed. He studied the effect of inflation rate on nominal interest rate. He believes that nominal interest rate should change proportional to inflation rate. In other words, interest rate has a direct relationship with inflation rate and if inflation rate increases/decreases 2%, then nominal interest rate should increase/decrease 2 %, too (Clark, 1895).
A review of the related literature, it can be argued that inflation rate has a positive effect on nominal interest rate. However, the relationship between real and nominal interest rates did not have a precise analysis framework until before Irving Fisher. By taking advantage of the studies conducted by others, Fisher (1896) expanded the theory of inflation and interest in a systematic way.
Fisher effect states that an increase of one unit in expected inflation rate causes nominal interest rate to have a one-unit increase and that real interest rate which plays the main role in investment behavior and saving remains constant. A highly significant conclusion that is drawn from Fisher effect is that monetary policies are neutral and although they cause inflation expectations, they cannot affect real variables of economy. Therefore, Fisher effect can be considered as one important result of classical school and indicated in a classical model. In short, Fisher model stipulates that an increase of one unit in expected inflation rate enhances nominal interest rate one unit and expected real interest rate remains constant as indicated in the following equation:

$$IR_r = IR_n - In \qquad (3\text{-}3)$$

Where, IR_r is real interest rate, IR_n is nominal interest rate, and In is expected inflation rate.
Therefore, it can be stated that theoretically the relationship between nominal interest rate and inflation rate is positive and there is a causal relationship between the two variables (Fisher, 1930).

MATERIALS AND METHODS

Method

To investigate the relation between interest rate and inflation rate, autoregressive vector model with distributed lags was utilized. The advantages of this method include considering the problem of static variables, avoiding the risk of spurious regression problem (meaningless correlations), and differentiating

between the long- and short-term relationships of variables. For short-term relationship, Toda-Yamamoto causality procedure and error correction model were applied and for long-term relationship, Auto Regressive Distributed Lag (ARDL) method was utilized. First, Augmented Dickey-Fuller (ADF) is utilized to figure out the unit root of the variables. If there is unit root, criteria of Akaike, Schwarz-Bayesian, and Hanan Quinn are applied to calculate the amount of lag. Any lag that maximizes the abovementioned criteria is considered as the optimal lag. To investigate the causality relationship in long term, error correction model and Shane and Sons' ARDL model were applied.
The study data for statistical population, sampling method, sample size, index of inflation rate, bank deposit interest rate, loan interest rate, gross domestic production, volume of money, and exchange rate were retrieved from periodic databases of Central Bank of Iran during 1981-2012.
The method used in the present study was analytical-documentary. Different Persian and English resources have been utilized in the study. Econometric tests and Microfit software were applied to investigate the relation between interest rate and inflation.
First, a summary of the conducted domestic and foreign studies is presented in Table (4-1) and Table (4-2), below.

Table 4-1: Domestic studies

Researcher(s)	Title	Technique	Results
Jafreh *et al.*, (2012)	The effect of reduction in bank interest rate on inflation index in Iran during 1996-2007 and presentation of a suitable model to manage and control it	ARDL method	There is a significant long-term relationship between loan interest rate and inflation rate. As bank loan interest rate decreases, inflation rate drops.
Saeedi *et al.*, (2012)	The relationship between inflation rate and interest rate in Iran's economy based on Fisher Effect Theory	OLS method	There is a positive significant relationship between one-year interest rate and inflation rate. There is no significant relation between inflation rate and three- and five-year interest rate.
Ahmadi and Khosravi (2011)	Hsiao Causality relationship between interest rate and inflation for MENA countries	Hsiao Causality Test	Causality relationship between interest rate and inflation exists only in Qatar and Djibouti. But it does not exist in other countries including Iran.
Tajjali and Mirshamsi (2010)	The effects of reduction in bank interest rate on inflation, employment, and investment	ARDL method	The policy of reducing interest rate in Iran decreases inflation only in long run. Its effects on investment and employment will be adverse in both short and long runs.
Taherifard and Mousa (2008)	The effectiveness of monetary policy on macroeconomic variables in Iran	structural pattern	The policy of reducing loan interest rate results in increase in liquidity, prices, investment, and inflation but its effect on production is marginal.
Atabaki (2007)	A survey of effective	Hausman test	Inflation rate, operating costs of banks, and

	factors in the difference between bank receive and pay interest rates in Iran's economy		legal deposits of banks at Central Bank have a positive effect on inflation changes and a reverse effect on bank interest rate changes.
Kamijani and Bahramirad (2008)	Examining the long-term relationship between bank loan interest rate and inflation rate	Johansen Cointegration	A long-term relationship between bank loan interest rate and inflation is obvious. In Iran's economy, changes in inflation rate can in long run explain changes in nominal interest rate.
Kahzadi and Nowforsati (2006)	A survey of the effect of interest rate changes on inflation	ARDL and ECM methods	Bank interest rate in long and short runs affects inflation significantly. This effect; however, is marginal.
Mehrgan and Asgharpour (2006)	Investigating the causal relationship between interest rate and inflation: Using Panel Data	Hsiao Causality Test	Rise in interest rate leads to increase in inflation or the there is a one-direction causal relationship from interest rate to inflation
Bidabad (2006)	The effect of reduction in bank loan interest rate on Iran's economy	Simulation of Iran's macro-econometric pattern	Reduction in interest rate leads to increase in inflation rate, employment, and interest rate in unorganized money market.

Table 4-2: Foreign studies

Researcher(s)	Title	Technique	Results
Imran and Nishat (2013)	Determinantes of bank credit in Pakistan: A supply side approach	ARDL and Error Correction	In long run, variables of foreign debts, economic growth, exchange rate, and volume of money have a significant relation with private sector credit
Qaisar *et al.*, (2012)	Relationship between GDP, inflation and real interest rate with exchange rate fluctuation of African countries	Ordinary least squares	There is a significant relationship between GDP and exchange rate. There is no significant relationship between inflation and real interest rate and exchange rate in African countries.
Utami and Inanga (2009)	Exchange rates, interest rates, and inflation rates in Indonesia: The Fisher Effect Theory	Cointegration	Changes in inflation rate have a positive effect on changes in interest rate.
Obi *et al.*, (2010)	An empirical investigation of the Fisher Effect in Nigeria: A co-integration and Error Correction Approach	Cointegration and Error Correction	Presence of a tendency to a long-term trend made Fisher Effect obvious in Nigeria.
Tillman (2007)	Do interest rates drive inflation dynamics? An analysis of the cost channel of monetary transmission	Vector Autoregressive Approach	According to cost channels, higher interest rates and higher final production costs lead to higher inflation rates.
Gul and Ekinci	The causal relationship	Granger	There is a long-term constant

(2006)	between nominal interest rates and inflation: The case of Turkey	causality test	relationship between nominal interest rates and inflation rates, i.e. nominal interest rate and inflation in long run change proportional to each other. An there is a one-direction causal relationship from nominal interest rate to inflation.
Kasman and Turgutlu (2005)	Fisher hypothesis revisited: A fractional cointegration analysis	Cointegration method	There is no long-terms relationship between nominal interest rate and inflation. In this study, fractional cointegration test proves the correctness of Fisher hypotheses for most countries.
Clementi and Rees (2003)	Structural failure, inflation and interest rates: A case study of the G7 countries	Bai and Peron method	Fisher hypotheses are acceptable for America, France, and Japan's economy.
Maki (2003)	Nonparametric cointegration analysis of the nominal interest rate and expected inflation rate	Johansen Cointegration	Compared to Breitung test, Johansen cointegration provides clear evidence for the balanced relationship between nominal interest rate and inflation rate. Adjustment of real interest rate in Japan is nonlinear.
Laric and Valerie (2003)	Fractional cointegration between nominal interest rates and inflation: A re-examination of the Fisher relationship in the G7 countries	Granger cointegration	Based on Fisher's hypotheses, there is a fractional relationship that is a long-term balance relationship between interest rate and inflation. The normal cointegration test does not prove the presence of this relationship.
Brazozoza (2001)	The relationship between real interest rate and inflation	Johansen cointegration	There is a constant long-term relationship between interest rate and inflation rate.
Booth and Ciner (2001)	The relationship between nominal interest rates and inflation: International evidence	Johansen cointegration	There is a one-to-one relation between common European interest rates and inflation rates since inflation rate has a more predictable role in the market compared to nominal interest rate.
Bullock and Rider (1991)	The cross-country relationship between interest rates and inflation over three decades	OLS method	In the 1970's, the relationship between interest rates and inflation was negative while in the 1980's there was a positive relationship between them in short run. However, the applied test cannot prove the certainty of the hypotheses.

In domestic studies – like studies conducted by Jafreh *et al.,* (2012), Saeedi *et al.,* (2012), Ahmadi *et al.,* (2011), Kamijani *et al.,* (2008), and Mehrgan, *et al.,* (2006) – the effects of interest rate and inflation rate have been analyzed.

However, first they did not include other variables that can affect interest rate and inflation rate and second they did not simultaneously analyze loan interest rate and long-, medium-, and short-term deposit interest rate. However, the present study in addition to inflation rate investigated three other interest rates (loan interest rate, one-year deposit interest rate, and five-year deposit interest rate). Inclusion of other control variables like volume of money and GDP and their effects on interest rate and inflation rate differentiates the present from similar ones.

Bearing in mind the abovementioned discussion, it can be concluded that most scholars and policy makers agree over Irving Fisher's Theory, known as Fisher Effect (i.e. an increase of one unit in expected inflation results in an increase of one unit in nominal interest rate, and real interest rate that has the main role in investment behavior and savings remains constant) and that its reliability and validity in most countries have been proved. In the following section, studies that have applied different methods like cointegration to affirm the validity of Fisher Theory are summarized. Only Kandel *et al.,* (1996) have not confirmed validity of this theory.

Table 4-3: A summary of domestic and foreign studies

Studies that have affirmed Fisher Theory	Studies that have rejected Fisher Theory
Bullock and Rider (1991), Saeedi *et al.,* (2012), Ahmadi and Khosravi (2011), Kamijani and Bahramirad (2008), Mehrgan and Asgharpour (2006), Kahzadi and Nowforsati (2006), Gul and Ekinci (2006), Utami and Inanga (2009), Obi *et al.,* (2010), Kasman and Turgutlu (2005), Clementi and Rees (2003), Maki (2003) Laric and Valerie (2003), Booth and Ciner (2001), and Jafreh *et al.,* (2012).	Kandel *et al.,* (1996)

Following tables and figures indicate the trend of short-term and one-year deposit interest rates and the weighted average loan interest rates during 1981-2012.

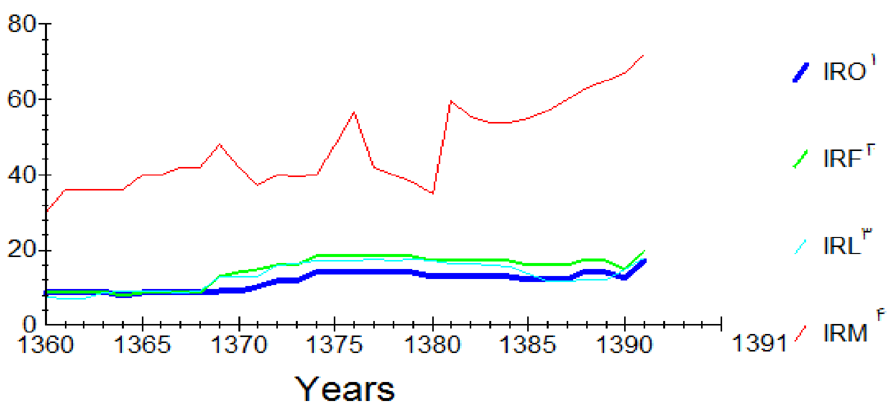
Table 4-4: One-year deposit interest rate, weighted average loan interest rate, market interest rate, and inflation rate during 1981-2012 (percent per year)

Year	one-year interest rate	weighted average loan interest rate[1]	market interest rate	inflation rate
1981	8.5	7.3	36	22.8
1982	8.5	7.2	36	19.2
1983	8.5	7.2	36	14.8
1984	9	8.8	40	10.4
1985	8	9	40	6.9
1986	8.5	9	42	23.7
1987	8.5	8.9	42	27.7
1988	8.5	8.8	48	28.9
1989	8.5	9	42	17.4
1990	9	12.8	37.2	9
1991	9	12.9	40	20.7
1992	10	13	39.7	24.4
1993	11.5	16.1	40	22.9
1994	11.5	16.5	47.7	35.2
1995	14	17.2	56.7	49.4
1996	14	17	42	23.2
1997	14	17	40	17.3
1998	14	17.3	38	18.1
1999	14	17.1	35	20.1
2000	14	17.3	57.7	12.6
2001	13	17.1	55.5	11.4
2002	13	16.4	54	15.8

2003	13	16.3	54	15.6
2004	13	15.9	55	15.2
2005	13	15.4	57	10.4
2006	7-16	13.5	56	11.9
2007	7-16	11.8	57	18.4
2008	7-16	11.7	60	25.4
2009	14.5	12	62	10.8
2010	14	12	65	12.4
2011	12.5	15	67	21.5
2012	17	18	72	30.5

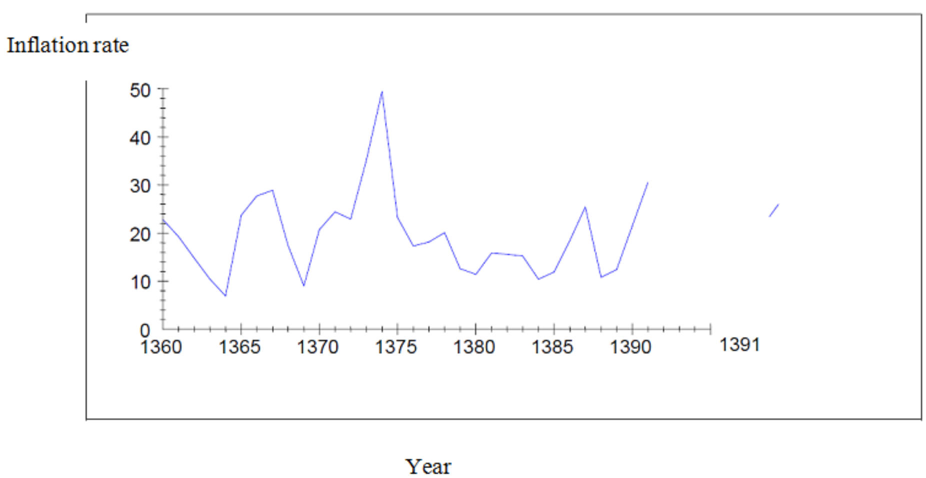
Source: Economic Reports of Different Years, The Central Bank's Balance Sheet, Central Bank of the Islamic Republic of Iran

[1]Calculation of weighted average loan interest rate: First the interest rate of each section is multiplied by the amount of the loan in the same section, then by adding them up and dividing them by the number of economic sections, the weighted average is calculated



Source: Economic Reports of Different Years, The Central Bank's Balance Sheet, Central Bank of the Islamic Republic of Iran

Diagram 4-1: The trend of interest rate in Iran during 1981-2012



Source: Economic Reports of Different Years, The Central Bank's Balance Sheet, Central Bank of the Islamic Republic of Iran

Diagram 4-2: The trend of inflation in Iran during 1981-2012

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Explanation of the Model

Following models have been utilized in order to investigate the relationship between interest rate and inflation.

To examine the relationship between one-year deposit interest rate and inflation, the following model is applied.

$$rio_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} rio_{t-i} + \sum_{i=1}^{n} \beta_{2i} \inf_{t-i} + \sum_{i=1}^{n} \beta_{3i} \mathrm{Lg}dp_{t-i} + \sum_{i=1}^{n} \beta_{4i} Lm_{t-i} + \sum_{i=1}^{n} \beta_{5i} Lex_{t-i} + dw + u_t$$

$$\inf_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \inf_{t-i} + \sum_{i=1}^{n} \alpha_{2i} rio_{t-i} + \sum_{i=1}^{n} \alpha_{3i} \mathrm{Lg}dp_{t-i} + \sum_{i=1}^{n} \alpha_{4i} Lm_{t-i} + \sum_{i=1}^{n} \alpha_{5i} Lex_{t-i} + dw + u_t \qquad (1\text{-}5)$$

To examine the relationship between loan interest rate and inflation, the following model in used.

$$ril_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} ril_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \inf_{t-i} + \sum_{i=1}^{n} \gamma_{3i} \mathrm{Lg}dp_{t-i} + \sum_{i=1}^{n} \gamma_{4i} Lm_{t-i} + \sum_{i=1}^{n} \gamma_{5i} Lex_{t-i} + dw + u_t$$

$$\inf_t = \delta_0 + \sum_{i=1}^{n} \delta_{1i} \inf_{t-i} + \sum_{i=1}^{n} \delta_{2i} ril_{t-i} + \sum_{i=1}^{n} \delta_{3i} \mathrm{Lg}dp_{t-i} + \sum_{i=1}^{n} \delta_{4i} Lm_{t-i} + \sum_{i=1}^{n} \delta_{5i} Lex_{t-i} + dw + u_t \qquad (2\text{-}5)$$

To examine the relationship between market interest rate and inflation, the following model is applied.

$$rim_t = \lambda_0 + \sum_{i=1}^{n} \lambda_{1i} rim_{t-i} + \sum_{i=1}^{n} \lambda_{2i} \inf_{t-i} + \sum_{i=1}^{n} \lambda_{3i} \mathrm{Lg}dp_{t-i} + \sum_{i=1}^{n} \lambda_{4i} Lm_{t-i} + \sum_{i=1}^{n} \lambda_{5i} Lex_{t-i} + u_t$$

$$\inf_t = \pi_0 + \sum_{i=1}^{n} \pi_{1i} \inf_{t-i} + \sum_{i=1}^{n} \pi_{2i} rim_{t-i} + \sum_{i=1}^{n} \pi_{3i} \mathrm{Lg}dp_{t-i} + \sum_{i=1}^{n} \pi_{4i} Lm_{t-i} + \sum_{i=1}^{n} \pi_{5i} Lex_{t-i} + dw + u_t \qquad (3\text{-}5)$$

Therefore, the study variables are defined as follows:

inf: inflation rate, rio: one-year deposit interest rate, ril: loan interest rate, rim: market interest rate, Lm: logarithm of liquidity, Lgdp: logarithm of gross domestic production, Lex: logarithm of exchange rate, dw: dummy variable, u_t: error term, t: time, and i: number of lags

As one of the most common tests, unit root test is that is used to distinguish whether a time series process is stationary. In so doing, Augmented Dickey-Fuller (ADF) test has been applied for all of the variables of

1981-2012, where the null hypothesis H_0: $|\rho| = 1$ (presence of unit root) and first hypothesis H_A: $|\rho| < 1$ (absence of unit root) are tested. If the absolute value of augmented Dickey-Fuller statistic bigger than the critical value, the null hypothesis is rejected and the variable will be stationary, otherwise it is non-stationary and the stationary test should be applied on the first-order difference of the variable. Tables (5-1), (5-2), and (5-3) indicate the results of stationary test of the variables through augmented Dickey-Fuller method.
The results of the test for the model variables at surface and with intercept and trend are showed in Tables (5-1) and (5-2). Among all model variables, inflation variable is stationary.

Table 5-1: The results of stationary test for at surface and with intercept

Variables	Test statistic	Test result
One-year deposit interest rate	- 1.80	Non-stationary
Loan interest rate	- 1.66	Non-stationary
Market interest rate	- 2.52	Non-stationary
Inflation rate	- 2.41	Non-stationary
Logarithm of GDP	- 0.51	Non-stationary
Logarithm of liquidity	- 0.50	Non-stationary
Logarithm of exchange rate	- 1.61	Non-stationary
Critical value at significance level of 5% = -2.97		

Dickey-Fuller additional regression with four lags and without trend has been calculated using Microfit 4.1 and the test statistics have been selected based on Schwarz Bayesian Criterion.

Table 5-2: The results of stationary test for variables at surface and with intercept and trend

Variables	Test statistic	Test result
One-year deposit interest rate	- 1.24	Non-stationary
Loan interest rate	- 1.33	Non-stationary
Market interest rate	- 1.76	Non-stationary
Inflation rate	- 2.73	Non-stationary
Logarithm of GDP	- 2.32	Non-stationary
Logarithm of liquidity	- 1.86	Non-stationary
Logarithm of exchange rate	- 0.76	Non-stationary
Critical value at significance level of 5% = - 3.59		

Table (5-3) indicates that the variables that were not stationary at surfaces became stationary by conducting their first-order difference.

Table 5-3: The results of the stationary test in first-order difference and with intercept

Variables	Test statistic	Test result
One-year deposit interest rate	- 4.34	stationary
Loan interest rate	- 3.57	stationary
Market interest rate	- 4.77	stationary
Inflation rate	- 3.37	stationary
Logarithm of GDP	- 3.97	stationary
Logarithm of liquidity	- 3.59	stationary
Logarithm of exchange rate	-5.87	stationary
Critical value at significance level of 5% = - 2.98		

As was observed in Tables (5-1), (5-2), and (5-3), the calculated absolute values of augmented Dickey-Fuller statistic for variables of inflation rate at surface and trend is bigger than the absolute critical value.

And for variables of one-year deposit interest rate, five-year deposit interest rate, loan interest rate, and market interest rate, this statistic becomes bigger that the critical values after conducting difference once; therefore, it is concluded that the variables are stationary.
Total results of the stationary test for the variables are presented in Table (5-4).

Table 5-4: Final results of the stationary test for the variables

Variable	The result of the stationary test
One-year deposit interest rate	I(1)
Loan interest rate	I(1)
Market interest rate	I(1)
Inflation rate	I(1)
Logarithm of GDP	I(1)
Logarithm of liquidity	I(1)
Logarithm of exchange rate	I(1)

Estimation of the Model Based on Autoregressive Model with Distributed Lags and its Results
Since all of the variables are stationary in an equal order, Autoregressive Distributed Lags (ARDL) model is applied to estimate the relationship between long-term and error correction. At this stage, after it is assured that there is a long-term relationship, ARDL model with lags that are specified using Schwarz Bayesian Criterion is estimated. According to Schwarz Bayesian Criterion, the optimal lag of the model is selected to be 2. The reason for applying this equation is that Schwarz Bayesian Criterion saves determining the lags; therefore, it has a higher degree of freedom.
The Results of estimating on-year Interest Rate Pattern
6.1.1. Estimating the Short-term Dynamic Pattern
In estimating the model in autoregressive distributed lags pattern, first its short-term dynamic model is represented as indicated in Table (6-1). And according to Schwarz Bayesian Criterion, the optimal lags of the variables are ARDL (1, 1, 0, 0, 1). T is trend variable and c is intercept.

Table 6-1: The results of one-year deposit interest rate test ARDL (1, 1, 0, 0, 1)

Variable	Coefficient	t statistic	Probability
rio(-1)	0.40	6	0.00
Inf	- 0.11	-0.46	0.64
Inf(-1)	0.049	2.22	0.037
LGDP	- 0.14	-2.27	0.03
LM	0.12	2.97	0.006
LEX	0.26	3.25	0.004
LEX(-1)	- 0.78	-2.23	0.036
DW	- 0.013	1.97	0.08
C	- 0.49	-2.23	0.031

R^2: 0.91
F-Stat : 44.1108(0.000)
D.W: 2.25

According to Table (6-1), it is concluded that the dependent variable of one-year deposit interest rate and the independent variable of inflation rate have appeared with one lag. The variable of interest rate with one lag has a positive effect on the dependent variable of interest rate, which is significant at 1%. That is, the interest rate of one year ago has a positive effect of the interest rate of the next year, such that if in short run the interest rate of tone year ago increases 1%, the interest rate of the next year will have an increase of 0.40%.

The coefficient of the independent variable of inflation rate with one lag has a positive effect on one-year deposit interest rate and statistically is significant at 10%. The coefficient of the independent variable is 0.049, i.e. if in the short run inflation rate (%Δρ) increases 1%, interest rate will increase 0.049%. Therefore, the effect of inflation rate in short run does not cause a significant change in one-year deposit interest rate.
Moreover, it can be concluded that an increase of 1% in GDP causes a decrease of 0.14% in one-year interest rate and that if volume of money increase 1%, one-year interest rate increases 0.12%. And if exchange rate increases 1%, one-year interest rate increases 0.26%.
Index R^2 equals 0.91, i.e. the independent variable explains 91% of changes in the dependent variable (one-year deposit interest rate). F statistic is a reason for the whole regression to be significant. At a significant level of 1%, the null hypothesis rejects that all coefficients of the pattern are zero. Durbin-Watson statistic is related to the cointegration regression of bigger than critical values at 1%.; therefore, a long-term balanced relationship exists among the variables.
Statistics related the diagnostic tests of the model structural form admit classical assumptions and lack of structural failure. In the short-term relationship, there are not serial autocorrelation and variance anisotropy, the consequential form is appropriate, and the distribution is normal.

Table 6-2: The results of the diagnostic tests

F statistic	Null hypothesis
1.81(0.17)	Lack of serial autocorrelation
2.16(0.14)	Presence of consequential appropriate form
1.30(0.52)	Presence of normal distribution
0.71(0.39)	Variance anisotropy

6.2. The Test of Long-term Relationship
Immediately after the dynamic equation is estimated and before the balanced long-term relationship between the variables of the model is determined, cointegration test should be conducted for the variables. If one of the methods affirms long-term relationship between the variables, the method can be selected as the efficient model. In the present study, Shane and Sons (1996) method is selected to determine the long-term relationship. If the calculated F statistic is more than the critical value I(1), the null hypothesis is rejected and a long-term relationship among the variables will be proved. The results of this test are presented in Table (6-2). In so doing, following equations where rio and inf are respectively one-year deposit interest rate and inflation rate are estimated.
The equation in which rio is the dependent variable is as follow:

$$\Delta rio_t = a_1 + \sum_{i=1}^{k} b_{i1}\Delta rio_{t-i} + \sum_{i=1}^{k} c_{i1}\Delta \inf_{t-i} + \sigma_1 rio_{t-1} + \sigma_2 \inf_{t-1} + \varepsilon_{1t}$$

The equation in which inf is the dependent variable is as follow:

$$\Delta \inf_t = a_2 + \sum_{i=1}^{k} b_{i2}\Delta rio_{t-i} + \sum_{i=1}^{k} c_{i2}\Delta \inf_{t-i} + \omega_1 rio_{t-1} + \omega_2 \inf_{t-1} + \varepsilon_{2t}$$

The null hypothesis on the absence of long-term relationship among the variables tests $H_0 : \sigma_1 = \sigma_2 = 0$ in relation to the opposite hypothesis $H_1 : \sigma_1 \neq \sigma_2 \neq 0$. In this test, F statistics is utilized as $Frio_t(rio_t \mid \inf_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$. As indicated in Table (6-3), F statistic exceeds the critical values at %5 when $F \inf_t(\inf_t \mid rio_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$. Therefore, in these conditions, there will be a long-term relationship among the variables at this critical level.

Table 6-3: The test of long-term relationship

the range of critical values at 5% significance level*		F statistic	the relationship between the variables
I(0)	I(1)		
2.85	4.049	12.69	$Frio_t(rio_t \mid \inf_t, Lgdp_t, Lm_t, \text{Lex}_t)$
2.85	4.049	5.26	$F\inf_t(\inf_t \mid rio_t, Lgdp_t, Lm_t, \text{Lex}_t)$

** Critical values with intercept an without trend*

Since the calculated F is more than the critical value of I(1) at 5% significance level, the long-term relationship between inflation rate and one-year deposit interest rate is affirmed and the null hypothesis is rejected at a level of 5%.
After it is assured that there is a long-term relationship, it can be interpreted. The results of the long-term relationship among the variables of ARDL model with lags that are determined by Schwarz Bayesian Criterion are indicated in Table (6-4).

Table 6-4: The results of estimating the long-term relationship in the model

Variable	Coefficient	T statistic	Probability
inf	0.41	2.05	0.04
lgdp	0.25	2.34	0.028
lm	0.021	2.46	0.021
lex	0.50	2.72	0.002
dw	-0.022	- 2.56	0.02
c	-7.59	- 1.93	0.06

According to the results presented in Table (6-4), it can be stated that in long term inflation rate is statistically significant at 5% significance level and has a positive effect on one-year deposit interest rate. In long run, an increase of 1% in inflation rate results in an increase of 0.41% in one-year deposit interest rate, assuming all other variables to be constant. This issue is in line with economic theories.
In long run, the variable of GDP is statistically significant at 5% significance level and has a positive effect on one-year deposit interest rate. In long run, an increase of 1% in GDP causes an increase of 0.25% in one-year deposit interest rate, assuming all other variables to be constant. This issue is in line with economic theories.

Table 6-5: The results of error correction model

Variable	Coefficient	T statistic	Probability
Dinf	-0.11	-0.46	0.64
DLgdp	-0.14	-2.27	0.03
DLm	0.12	2.97	0.006
DLex	0.26	3.25	0.004
DW	-0.013	1.97	0.08
DC	-0.49	-2.23	0.031
ecm(-1)	-0.59	-3.55	0.002

In long run, the variable of money volume is statistically significant at 5% significance level and has a positive effect on one-year deposit interest rate. In long run, an increase of 1% in money volume causes an increase of 0.02% in one-year deposit interest rate.

In long run, an increase of 1% in long-term interest rate causes an increase of 0.5 in one-year deposit interest rate.

6.3. Error Correction Model of one-year Interest Rate

In following section, the estimation of error correction model that relates short-term fluctuations to their long-term balance values is presented. To regulate the error correction model, it is enough to put the error term related to the cointegration regression of estimating the log-term model with one lag as the explanatory variable beside the first-order difference of other variables of the model. Afterwards, the coefficients of the model should be calculated. The results of error correction model are presented in Table (6-5). D and ecm(-1) stand for first-order difference and the coefficient of the error correction model, respectively.

What is the most important issue is the coefficient of the correction term that indicates the adjustment speed of imbalance process toward balance in long run. As was observed in Table (6-5), this coefficient is significant and negative. Since ECM coefficient is located between 0 and -1 and is significant, presence of long-term cointegration relationship between the variables is confirmed. Since the coefficient of error correction term is – 0.59, it can be concluded that the coefficient of ecm(-1) in short run is equal to – 0.59. This coefficient is statistically meaningful and indicates the adjustment speed in short run toward long-term balance. In fact, this coefficient indicates that in each period 59% of imbalance of the previous period will be adjusted (corrected). This period lasts less than two years.

6.4. The Results of Estimating Loan Interest Rate Model

6.4.1. Estimating the Short-term Dynamic Model

In estimating the autoregressive model with distributed lags, first its short-term dynamic model is represented in Table (6-6). Based on Schwarz Bayesian Criterion, the optimal lag of the variables is ARDL (1, 1). The results of the dynamic model indicate that all of the variables are significant at 5% significance level.

Table 6-6: The results of loan interest rate test ARDL (1, 0, 2, 0, 1)

Variable	**Coefficient**	**T statistic**	**Probability**
ril(-1)	0.61	4.45	0.000
inf	-0.048	-2.79	0.002
lgdp	0.44	1.60	0.12
lgdp (-1)	-0.45	-1.78	0.089
lgdp (-2)	-0.43	-2.78	0.002
lm	0.042	2.17	0.004
lex	0.56	4.35	0.000
lex(-1)	-0.38	-2.86	0.001
dw	0.34	0.36	0.72
c	-0.23	-1.12	0.27

R^2: 0.94
F-Stat : 82.977 (0.000)
D.W: 2.17

According to Table (6-6) the dependent variable of loan interest rate and the independent variable of inflation rate appeared with one lag. The variable of interest rate with one lag has a positive effect on the dependent variable of interest rate and statistically is significant at 5% significance level. That is, interest rate of one year ago has a positive effect on the interest rate of the next year. So, if in short run the interest rate of one year ago increases 1%, the interest rate of the next rate increases 0.61%.

The coefficient of the independent variable of inflation rate has a positive effect on loan interest rate and statistically is significant at 5% significance level. The coefficient of the independent variable is equal to 0.048, i.e. if in short run inflation rate (%Δρ) increases 1%, interest rate will experience an increase of 0.048%. Therefore, the effect of inflation rate in short run does not cause a significant change in loan interest rate. Moreover, it can be concluded that an increase of 1% in GDP of two years ago results in a reduction of 0.43% in loan interest rate. If volume of money increases 1%, an increase of 0.042% occurs in loan interest rate. An increase of 1% in exchange rate leads to a reduction of 0.56% in loan interest rate.

As was observed, the sign of the estimated coefficients is in line with theoretical principles and all of them are statistically significant at 5% significance level. The index of R^2 is equal to 0.94, which means that 94% of the changes in the dependent variable (loan interest rate) can be explained trough the independent variable. F statistic is a reason for the whole regression to be significant.

The statistics of the diagnostic test and the structural form of the model indicate the provision of classical assumptions and lack of structural failure. In short run, serial autocorrelation and variance anisotropy do not exist and the consequential form is appropriate and the distribution is normal (see Table 6-7).

Table 6-7: The results of the diagnostic tests

F statistic	Null hypothesis
0.10 (0.19)	Lack of serial autocorrelation
0.07 (0.32)	Presence of consequential appropriate form
0.58 (0.45)	Presence of normal distribution
1.87 (0.17)	Variance anisotropy

6.4.2. Long-term Relationship Test

Right after the dynamic equation is estimated and before the long-term balance relationship between the variables of the model is dealt with, cointegration test should be administered for the variables. In the present study, Shane and Sons (1996) method is used to check the presence of long-term relationship. If the calculated F statistic is bigger than the above critical value I(1), then the null hypothesis will be rejected and a long-term relationship exists among the variables. These results are presented in Table (4-12). For this purpose, following equations where ril and inf are respectively loan interest rate and inflation rate are estimated.

The equation where ril is a dependent variable:

$$\Delta ril_t = a_1 + \sum_{i=1}^{k} b_{i1}\Delta ril_{t-i} + \sum_{i=1}^{k} c_{i1}\Delta \inf_{t-i} + \sigma_1 ril_{t-1} + \sigma_2 \inf_{t-1} + \varepsilon_{1t}$$

The equation where inf is a dependent variable:

$$\Delta \inf_t = a_2 + \sum_{i=1}^{k} b_{i2}\Delta ril_{t-i} + \sum_{i=1}^{k} c_{i2}\Delta \inf_{t-i} + \omega_1 ril_{t-1} + \omega_2 \inf_{t-1} + \varepsilon_{2t}$$

These equations test the null hypothesis, i.e. there is no long-term relationship among the variables, ($H_0 : \omega_1 = \omega_2 = 0$) and the opposite hypothesis ($H_1 : \sigma_1 \neq \sigma_2 \neq 0$). In this test, F statistic is applied as $F\inf_t(\inf_t | ril_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$. As is observed in Table (6-8), the calculated F statistic $Fril_t(ril_t | \inf_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$ exceeds the critical value at 5% significance level. Therefore, there is a long-term relationship between loan interest rate and inflation rate at this critical level.

Table 6-8: Long-term relationship test

the range of critical values at 5% significance level*		F statistic	the relationship between the variables
I(0)I(1)			
9.85	4.204	8.54	$Fril_t(ril_t \mid \inf_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$
9.85	4.204	7.49	$F\inf_t(\inf_t \mid ril_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$

** Critical values with intercept an without trend*

Since the calculated F is more than the critical value of I(1) at 5% significance level, the long-term relationship between inflation rate and loan interest rate is affirmed.
After it is assured that there is a long-term relationship, it can be interpreted. The results of the long-term relationship among the variables of ARDL model with lags that are determined by Schwarz Bayesian Criterion are indicated in Table (6-9).

Table 6-9: The results of estimating the long-term relationship in the model

Variable	Coefficient	T statistic	Probability
inf	-0.12	2.42	0.02
lgdp	-0.45	-2.19	0.040
lm	0.11	3.24	0.000
lex	0.71	2.68	0.014
dw	0.90	-3.87	0.000
c	-0.48	-1.34	0.19

According to the results presented in Table (6-9), it can be stated that in long run the variable of loan interest rate is statistically significant at 5% significance level and has a positive effect on inflation rate. In long run, an increase of 1% in inflation rate results in an increase of 0.12% in loan interest rate. This issue is in agreement with economic theories. In long run, the variable of GDP is statistically significant at 5% significance level and has a negative effect on loan interest rate. In long run, if GDP increases 1%, loan interest rate will reduce 0.45%.
In long run, volume of money is statistically significant and has a positive effect on loan interest rate. In long run, if volume of money rises 1%, loan interest rate increases 0.11%.
In long run, an increase of 1% in exchange rate causes loan interest rate to increase 0.71%.
6.4.3. Error Correction Model of Loan Interest Rate
In following section, the estimation of error correction model that relates short-term fluctuations to their long-term balance values is presented. Afterwards, the coefficients of the model should be calculated. The results of error correction model are presented in Table (6-10).

Table 6-10: The results of error correction model

Variable	Coefficient	T statistic	Probability
Dinf	-0.048	-2.79	0.002
DLgdp	0.44	1.60	0.12
DLm	0.042	2.17	0.004
DLex	0.56	4.35	0.000
DW	0.34	0.36	0.72
DC	-0.23	-1.12	0.27
ecm(-1)	-0.38	-2.83	0.001

What is the most important issue is the coefficient of the correction term that indicates the adjustment speed of imbalance process toward balance in long run. As was observed in Table (6-5), this coefficient is significant and its sign is negative. Since ECM coefficient is located between 0 and -1 and is significant, presence of long-term cointegration relationship between the variables is confirmed. Since the coefficient of error correction term is – 0.59, it can be concluded that the coefficient of ecm(-1) in short run is equal to – 0.38. This coefficient is statistically meaningful and indicates the adjustment speed in short run toward long-term balance. In fact, this coefficient indicates that in each period 50% of imbalance of the previous period will be adjusted (corrected). This period lasts more than two years.

6.5. The Results of Estimating Market Interest Rate Model

6.5.1. Estimating the Short-term Dynamic Model

In estimating the autoregressive model with distributed lags, first its short-term dynamic model is represented in Table (6-11). Based on Schwarz Bayesian Criterion, the optimal lag of the variables is ARDL (0, 2). The results of the dynamic model indicate that all of the variables are significant at 5% significance level.

Table 6-11: The results of market interest rate test ARDL (1, 0, 0, 0, 0)

Variable	Coefficient	T statistic	Probability
rim(-1)	0.44	4.98	0.000
inf	0.023	3.87	0.000
lgdp	0.26	1.97	0.064
lm	0.65	2.10	0.04
lex	0.90	5.47	0.000
dw	-2.42	-3.50	0.002
c	-0.27	-2.43	0.02

R^2:0.932
F-Stat : 91.1688(0.000)
D.W: 2.02

The coefficient of the independent variable of inflation rate with two lags has a positive effect on market interest rate and is statistically significant at 10%. The coefficient of the independent variable is equal to 0.44. That is, if in short run inflation rate (%Δρ) increases 1%, the interest rate rises 0.44%. Moreover, it can be concluded that an increase of 1% in GDP of two years ago, market interest rate will experience an increase of 0.26%. And if volume of money increases 1%, market interest rate will rise 0.90%. With an increase of 1% in exchange rate, market interest rate will rise 0.90%.

As was observed, the sign of the estimated coefficients is in line with theoretical principles and all of them are statistically significant at 5% significance level. The index of R^2 is equal to 0.92, which means that 92% of the changes in the dependent variable (loan interest rate) can be explained trough the independent variable. F statistic is a reason for the whole regression to be significant and at a level of 1% rejects the null hypothesis, i.e. all coefficients are zero.

The statistics of the diagnostic test and the structural form of the model indicate the provision of classical assumptions and lack of structural failure. In short-term relationship, serial autocorrelation and variance anisotropy do not exist and the consequential form is appropriate and the distribution is normal (see Table 6-12).

Table 6-12: The results of the diagnostic tests

F statistic	Null hypothesis
0.23 (0.22)	Lack of serial autocorrelation
2.20 (0.15)	Presence of consequential appropriate form
3.60 (0.15)	Presence of normal distribution
0.49 (0.48)	Variance anisotropy

6.5.2. Long-term Relationship Test

Right after the dynamic equation is estimated and before the long-term balance relationship between the variables of the model is dealt with, cointegration test should be administered for the variables. In the present study, Shane and Sons (1996) method is used to check the presence of long-term relationship. If the calculated F statistic is bigger than the above critical value I(1), then the null hypothesis will be rejected and a long-term relationship exists among the variables. These results are presented in Table (4-

13). For this purpose, following equations where rim and inf are respectively market interest rate and inflation rate are estimated.
The equation where rim is a dependent variable:

$$\Delta rim_t = a_1 + \sum_{i=1}^{k} b_{i1} \Delta rim_{t-i} + \sum_{i=1}^{k} c_{i1} \Delta \inf_{t-i} + \sigma_1 rim_{t-1} + \sigma_2 \inf_{t-1} + \varepsilon_{1t}$$

The equation where inf is a dependent variable:

$$\Delta \inf_t = a_2 + \sum_{i=1}^{k} b_{i2} \Delta rim_{t-i} + \sum_{i=1}^{k} c_{i2} \Delta \inf_{t-i} + \omega_1 rim_{t-1} + \omega_2 \inf_{t-1} + \varepsilon_{2t}$$

These equations test the null hypothesis, i.e. there is no long-term relationship among the variables, ($H_0 : \sigma_1 = \sigma_2 = 0$) and the opposite hypothesis ($H_1 : \sigma_1 \neq \sigma_2 \neq 0$). In this test, F statistic is applied as $Frim_t(rim_t \mid \inf_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$ $F\inf_t(\inf_t \mid rim_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$. As is observed in Table (6-13), the calculated F statistic exceeds the critical value at 5% significance level. Therefore, there is a long-term relationship from inflation rate to interest rate at this critical level.

Table 6-13: Long-term relationship test

the range of critical values at 5% significance level*		F statistic	the relationship between the variables
I(0)I(1)			
9.85	4.204	5.06	$Frim_t(rim_t \mid \inf_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$
9.85	4.204	17.32	$F\inf_t(\inf_t \mid rim_t, Lgdp_t, Lm_t, \mathrm{Lex}_t)$

** Critical values with intercept an without trend*

Since the calculated F is more than the critical value of I(1) at 5% significance level, the long-term relationship between inflation rate and market interest rate is affirmed. Therefore, the null hypothesis is rejected.
After it is assured that there is a long-term relationship, it can be interpreted. The results of the long-term relationship among the variables of ARDL model with lags that are determined by Schwarz Bayesian Criterion are indicated in Table (6-14).

Table 6-14: The results of estimating the long-term relationship in the model

Variable	Coefficient	T statistic	Probability
inf	0.041	2.04	0.04
lgdp	0.67	2.46	0.03
lm	0.17	2.86	0.012
lex	-0.02	2.73	0.01
dw	-0.37	-4.39	0.001
c	-0.49	-0.023	0.98

According to the results presented in Table (6-14), it can be stated that in long run the variable of inflation rate is statistically significant at 5% significance level and has a positive effect on loan interest rate. In long run, an increase of 1% in inflation rate results in an increase of 0.80% in market interest rate. This issue is in agreement with economic theories.
In long run, the variable of GDP is statistically significant at 5% significance level and has a negative effect on market interest rate. In long run, if GDP increases 1%, market interest rate will reduce 0.67%.

In long run, volume of money is statistically significant and has a positive effect on market interest rate. In long run, if volume of money rises 1%, market interest rate increases 0.17%. In long run, an increase of 1% in exchange rate causes market interest rate to decrease 0.02%.

6.5.3. Error Correction Model of Market Interest Rate

In following section, the estimation of error correction model that relates short-term fluctuations to their long-term balance values is presented. Afterwards, the coefficients of the model should be calculated. The results of error correction model are presented in Table (6-15).

Table 6-15: The results of error correction model

Variable	Coefficient	T statistic	Probability
Dinf	0.023	3.87	0.000
DLgdp	0.26	1.97	0.064
DLm	0.65	2.10	0.04
DLex	3.90	5.47	0.000
DW	-2.42	-3.50	0.002
DC	-0.27	-2.43	0.02
ecm(-1)	-0.64	-4.14	0.001

What is the most important issue is the coefficient of the correction term that indicates the adjustment speed of imbalance process toward balance in long run. As was observed in Table (6-15), this coefficient is significant and its sign is negative. Since ECM coefficient is located between 0 and -1 and is significant, presence of long-term cointegration relationship between the variables is confirmed. Since the coefficient of error correction term is – 0.64, it can be concluded that the coefficient of ecm(-1) in short run is equal to – 0.38. This coefficient is statistically meaningful and indicates the adjustment speed in short run toward long-term balance. In fact, this coefficient indicates that in each period 64% of imbalance of the previous period will be adjusted (corrected). This period lasts less than two years.

6.6. Short- and Long-term Granger Causality Test using Error Correction Model

Table 6-16 represents the results of short- and long-term Granger causality test using an error correction model as the following equation. The first model shows a situation in which one-year interest rate (rio) is a dependent variable and variables of inflation rate (inf), GDP, volume of money, and exchange rate are independent.

$$Drio = \alpha + \sum_{i=1}^{k} \beta_i Drio_{t-i} + \sum_{i=1}^{k} \gamma_i D\inf_{t-i} + \sum_{i=1}^{k} \delta_i DL\,g\,dp_{t-i}$$

$$+ \sum_{i=1}^{k} \lambda_i DLm_{t-i} + \sum_{i=1}^{k} \nu_i DLex_{t-i} + \theta ECT_{t-1} + \varepsilon_t$$

The following equation indicates the first model in a situation where inflation rate is a dependent variable and other variables of one-year interest rate, GDP, volume of money, and exchange rate are independent.

$$D\inf = \alpha + \sum_{i=1}^{k} \beta_i Drio_{t-i} + \sum_{i=1}^{k} \gamma_i D\inf_{t-i} + \sum_{i=1}^{k} \delta_i DL\,g\,dp_{t-i}$$

$$+ \sum_{i=1}^{k} \lambda_i DLm_{t-i} + \sum_{i=1}^{k} \nu_i DLex_{t-i} + \theta ECT_{t-1} + \varepsilon_t$$

Short- and long-term Granger causality test using an error correction model is indicated as the following equation. The following equation indicates the second model in a situation where loan interest rate (ril) is a dependent variable and other variables of inflation rate (inf), GDP, volume of money, and exchange rate are independent.

$$Dril = \alpha + \sum_{i=1}^{k} \beta_i Dril_{t-i} + \sum_{i=1}^{k} \gamma_i D\inf_{t-i} + \sum_{i=1}^{k} \delta_i DL\,g\,dp_{t-i}$$
$$+ \sum_{i=1}^{k} \lambda_i DLm_{t-i} + \sum_{i=1}^{k} \nu_i DLex_{t-i} + \theta ECT_{t-1} + \varepsilon_t$$

The following equation indicates the second model in a situation where inflation rate is a dependent variable and other variables of loan interest rate, GDP, volume of money, and exchange rate are independent.

$$D\inf = \alpha + \sum_{i=1}^{k} \beta_i Dril_{t-i} + \sum_{i=1}^{k} \gamma_i D\inf_{t-i} + \sum_{i=1}^{k} \delta_i DL\,g\,dp_{t-i}$$
$$+ \sum_{i=1}^{k} \lambda_i DLm_{t-i} + \sum_{i=1}^{k} \nu_i DLex_{t-i} + \theta ECT_{t-1} + \varepsilon_t$$

Short- and long-term Granger causality test using an error correction model is indicated as the following equation. The following equation indicates the third model in a situation where market interest rate (rim) is a dependent variable and other variables of inflation rate (inf), GDP, volume of money, and exchange rate are independent.

$$Drim = \alpha + \sum_{i=1}^{k} \beta_i Drim_{t-i} + \sum_{i=1}^{k} \gamma_i D\inf_{t-i} + \sum_{i=1}^{k} \delta_i DL\,g\,dp_{t-i}$$
$$+ \sum_{i=1}^{k} \lambda_i DLm_{t-i} + \sum_{i=1}^{k} \nu_i DLex_{t-i} + \theta ECT_{t-1} + \varepsilon_t$$

The following equation indicates the third model in a situation where inflation rate is a dependent variable and other variables of market interest rate, GDP, volume of money, and exchange rate are independent.

$$D\inf = \alpha + \sum_{i=1}^{k} \beta_i Drim_{t-i} + \sum_{i=1}^{k} \gamma_i D\inf_{t-i} + \sum_{i=1}^{k} \delta_i DL\,g\,dp_{t-i}$$
$$+ \sum_{i=1}^{k} \lambda_i DLm_{t-i} + \sum_{i=1}^{k} \nu_i DLex_{t-i} + \theta ECT_{t-1} + \varepsilon_t$$

The results presented in Table (6-16) indicate that in short run there is a Granger causality relationship between one-year interest rate and inflation rate. On the other hand, that the coefficient of error correction with the lag of (ECT_{t-1}) is significant means this relationship exists in long run, too. This result is confirmed through the test and that the coefficients are simultaneously significant $ECT_{t-1}, D\inf, DLgdp, DLm, DLex$ and $ECT_{t-1}, Drio, DLgdp, DLm, DLex$ with x^2 statistic.

In long run, there is a Granger causality relationship from loan interest rate to inflation rate. In Iran, loan interest rate is determined by Money and Credit Council and due to the disassociation, there is no mechanism that actualizes interest rate and leads to balance in economy. Therefore, inflation cannot be due to loan interest rate because interest rate cannot be affected by inflation in long run. However, interest rate can influence inflation. Research indicated that interest rate fluctuations in long run affect inflation in a significant manner. A decrease of 1% in interest rate leads to a reduction of 0.12% in inflation. However, this effect is not significant in short run.

6.7. Stability of Coefficients

In order to check the stability of the model and determine presence or absence of structural failure, cumulative square test of Cumulative Sum of Recursive Residuals (CUSUM) and remaining squares test (CUSUMSQ) that have long been paid attention in econometric literature are applied.

In CUSUM and CUSUMSQ tests, the null hypothesis and the stability of the parameters are tested at 5% significance level. The confidence interval of these two tests includes two straight lines that indicate a confidence level of 95%. If the statistic of CUSUM and CUSUMSQ tests locates within these lines, the null hypothesis of stability of the coefficients cannot be rejected.

6.7.1. The Stability of the Calculated Coefficients for one-year Interest Rate Model

The stability of the calculated coefficients of the model is tested through cumulative square test of CUSUM. The results of this test indicate that the calculated coefficients are stable and due to locating a confidence interval of 95%, structural failure does not exist (see Diagram 6-17).

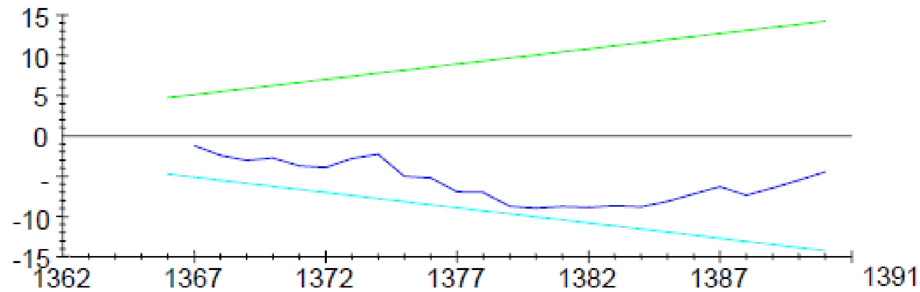

Diagram 6-17: Stability of the coefficients (CUSUM)

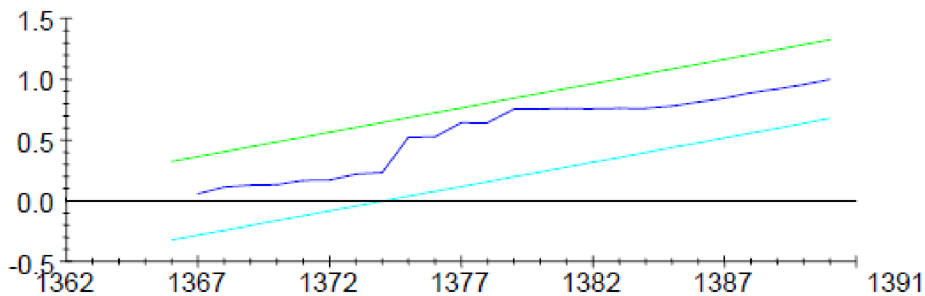

Diagram 6-18: Stability of the coefficients (CUSUMSQ)

6.7.2. The Stability of the Calculated Coefficients for Loan Interest Rate Model

The stability of the calculated coefficients of the model is tested through cumulative square test of CUSUM. The results of this test indicate that the calculated coefficients are stable and due to locating a confidence interval of 95%, structural failure does not exist (see Diagram 6-19).

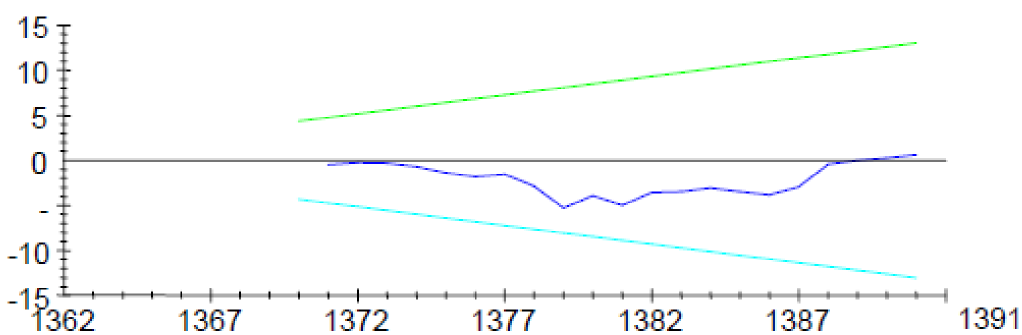

Diagram 6-19: Stability of the coefficients (CUSUM)

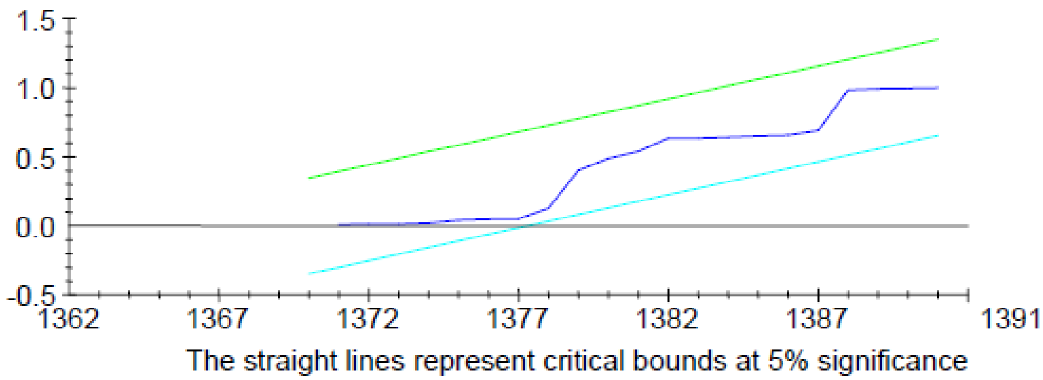

Diagram 6-20: Stability of the coefficients (CUSUMSQ)

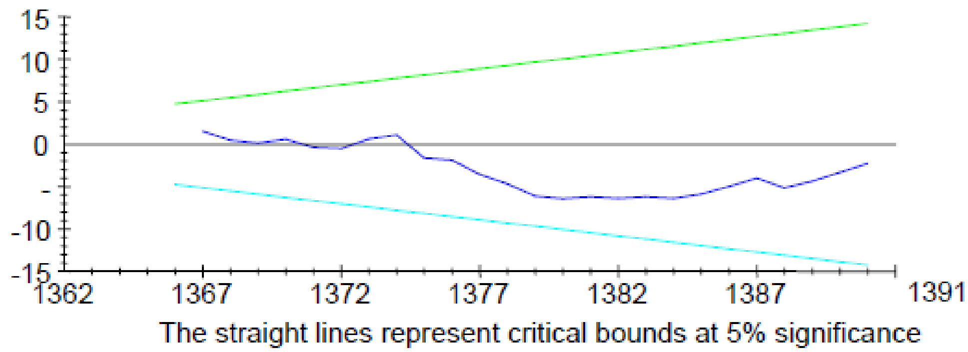

Diagram 6-21: Stability of the coefficients (CUSUM)

6.7.3. The Stability of the Calculated Coefficients for Market Interest Rate Model

The stability of the calculated coefficients of the model is tested through cumulative square test of CUSUM. The results of this test indicate that the calculated coefficients are stable and due to locating a confidence interval of 95%, structural failure does not exist (see Diagram 6-21).

Conclusion

In the present study, ARDL method was used to investigate the short- and long-term relationships and Error Correction Causality Test was applied to check the Granger Causality relationship. First, characteristics of time serial stationary were examined using Augmented Dickey-Fuller (ADF) Test.

Here, autoregressive method with distributed lags was utilized to estimate dynamic, long-terms, and error correction relationship and following findings were achieved.

1. In short and long runs, inflation rate has a positive significant on one-year interest rate.
2. In short and long runs, inflation rate has a negative significant effect on loan interest rate.
3. In short and long runs, inflation rate has a positive significant on market interest rate.

In Granger causality relationship, error correction long-term causality relationship between interest rate and inflation rate was confirmed.

The results that were achieved for the study hypotheses (first, second, and third hypotheses) are in line with those reported by Jafreh *et al.*, (2012), Saeedi *et al.*, (2012), Tajjali *et al.*, (2010), Sameti *et al.*, (2009), Gul and Ekinci (2006), Maki (2003), Laradic and Mignon (2003), and Brazozoza (2001). These researchers reported that there was a positive relationship between inflation rate and interest rate.

Because an increase in interest rate exerts pressure on production units regarding their access to liquidity, it causes the cost prices and inflation rate rise.

High risk of investment and lack of advanced financial markets in Iran have caused interest rate control to become one of the most important tools to motivate the real sectors of economy. Therefore, the Central Bank should reduce economic risks by motivating the real sector of economy and rationalizing interest rates. In this case, the Central Banks will be able to use interest rate as an effective tool to manage liquidity and put it in investment and production cycles in order to reduce inflation.

By reducing loan interest rate, liquidity gets out of the bank but it is not used in stock market or investment, it goes into non-productive market (coins and currency), which finally results in inflation.

In general, it can be stated that the policy of reducing interest rate in Iran's economy will have favorable effects on inflation rate.

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