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Credit Expansion and Inflation in Iran: An Unrestricted Error Correction Model

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Abstract

This paper pursues two goals. First, it uses an unrestricted error correction model and the bounds testing approach proposed by Pesaran, Shin, and Smith (2001) to study the short- and long-run effects of bank credit on inflation in Iran, a country with some history of interest-free banking system. Second, this paper examines how institutional and cultural changes resulted from bank nationalization and the implementations of interest-free banking have affected price level movement in Iran. The approach used in this paper is capable of testing the existence of long run relations regardless of whether the underlying variables are stationary, integrated, or mutually cointegrated. The result indicates that there exists a long-run relationship between inflation and its main determinants, namely, bank credit, import price, real GNP, and black market exchange rate. However, bank credit has no short-run effect on price level movement in Iran. Furthermore, the paper shows that the nationalization of banks and the implementation of interest-free banking system in Iran have caused a structural change in the behavior of inflation.

Keywords: Inflation; Bank credit; Iran; Banks nationalization; Interest-free banking; UECM; Bound test.

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1- Introduction

Iran has experienced high level of inflation in the last three decades. Inflation in Iran has accelerated throughout the 1970s. It has reached to 22 percent in 1977. After the Islamic revolution, the inflation has reached a peak of 40 percent in 1995. This country has witnessed two important structural changes in its banking sector after the revolution of 1979. First, in June 1979, the government passed a law to nationalize all banks and insurance companies. As a result, 36 commercial and specialized banks were put under state ownership and were incorporated into six state-owned commercial and four specialized banks. These state owned banks are now operating under the full control of Iran's central bank, Bank Markazi.[1]

Second, the law of usury-free banking was implemented in 1984 and as a result all interests on financial transactions were forbidden.[2] The implementation of the free-interest banking system has changed the type and the size of bank credit in Iran. Under the no-interest banking system the payment and receipt of interest is prohibited in this country. However, under the new law people can hold different types of transaction and investment deposits with banks. The investment deposits allow their holders to earn profit. On the asset side of their balance sheets, banks can give interest-free loans or have income-earning assets. This allows banks to finance different activities on the basis of profit-sharing methods and other modes of finance. The main modes of financing are Garz Al-Hasaneh (beneficence loans), Mudarabah, Mosharekat, Bai' Mua'jjal (deferred-payment sales), Installment Sale, Bai' Salaf (purchase with deferred delivery), Lease-Purchase contracts, Mozare'h, Mosaqat, Jo'aleh (service charge) and a variety of other possible methods permitted by Islamic law. [3]

1- The nationalization of the banking system is based on Article 44 of the 1979 constitution law. However, the parliament has used an escape clause in the Constitution and approved the formation of private commercial banking under certain conditions. Since 2001, six private banks have been licensed to operate in Iran. However, their share in the money market during the period of our investigation was relatively small.

2- The Law on Usury-Free Banking which banned all interest-bearing financial transactions was passed in 1983 but adopted on 21 March, 1984.

3- For more details see Khan and Mirakhor (1990).

Given these two structural changes in the banking system of Iran (i.e., the nationalization and Islamization of the system) the question is how inflation rate is affected by these changes? To answer this question we develop an unrestricted error correction model (UECM), and use the bounds testing approach proposed by Pesaran, Shin, and Smith (2001) to study price level movement in Iran for the period 1959-2002. This approach enables us to examine the existence of a level relationship between inflation rate and a set of independent variables irrespective of whether the underlying regressors are I(0), I(1) or mutually cointegrated. We use dummy variable technique to study the impacts of nationalization and Islamization of the banking system on inflation in Iran.

Furthermore, contrary to what many economists believe, the incumbent government in Iran claims that credit expansion stimulates output growth and hence will result in lower inflation and higher employment in this country. As a result the authorities have recently ordered the banking system (which is under their control) to expand credit to private sector. Given the structure of banking system in Iran, another goal of this research is to investigate the short- and long-run impacts of bank credits on price level movement in this country.

The literature on inflation behavior has used monetary and fiscal variables,[1] output level, import prices,[2] market exchange rate,[3] wage index,[4] and a verity of other factors[5] to explain price level movement.

Many empirical papers have studied inflation in developing countries. Among these are de Silva (1977), Sundararajan (1986), Cheng (1997), Hasan (1999), Price (1999), Tang (2001), and Ramakrishnan (2002). However, only a

1- Such as money stock, bank credit and government debt. For example, see de Silva (1977) and Janssen *et al.* (2002).

2- For example, see Hampton (2001).

3- For example, see Sundararajan (1986) and Ramakrishnan and Vamvakidis (2002).

4- See Rassekh and Wilbratte (1990), Cheng and Papi (1997), and Welfe (2000).

5- For example King and Plosser (1984) take the general price level a function of money stock, GDP, interest rate, wage level, bank reserve, and rental price of deposit Services. Dhakal et al (1994) uses a vector autoregressive model to investigate major determinants of the inflation rate in the United States. They show that changes in the money supply, the wage rate, the budget deficit and energy prices are important determinants of the inflation rate in the United States. Droyiannis *et al.* (1998) study inflation-productivity relationship for eight low inflation OECD countries.

few have directly focused on the impact of bank credit on inflation. For example, Liviatan (1985) investigates the impact of bank credit expansion on inflation. This author finds no relationship between expansionary bank credit and price level within the framework of an inflation tax model. Blinder (1987) develops a simple macro model in which the central bank credit policy (through changing credit supply) has real effect on macro variables including general price level.

Tang (2001) investigates the relationship between bank credit and inflation in Malaysia over the period 1973-97. The estimated results indicate that bank lending does affect inflation rate in this country. This study finds that import price and real income are main determinants of inflation in Malaysia.

The issue of price level movement in Iran has also been the focus of some empirical researchers. For example, Sassanpour (1980) studies the impact of foreign inflation on the Iranian economy over the period 1960-1977. Using a simultaneous equation system, he shows that import price explains about 50 percent of price change in Iran. Bahmani-Oskooee (1995) investigates source of Inflation in post-revolutionary Iran. This researcher uses an augmented monetarist model of inflation. His estimation results show that inflation in Iran is affected by money supply, real output, import price, and black market exchange rate.

Liu and Adedeji (2000) examine the major determinants of inflation in Iran. In their model inflation is a function of excess money supply, monetary growth, exchange rate premium, and lagged value of inflation. More specifically, they show that the combined effect of excess money supply and monetary growth are main determinants of inflation.

Celasun and Goswami (2002) study money demand and inflation dynamics in Iran for the period 1990/91-2001/02. They show that the short-run movement of inflation is explained by disequilibrium in the money market.

The literature on inflation lacks an empirical study to examine how changes in the size and the nature of bank credit due to nationalization and Islamization of banking system can affect price level movement. This paper attempts to fill these lacunas by taking Iran, a country with a history of nationalized interest-free banking system, as a case study. This research can have important implication for the use of monetary policy in curbing inflation in an economy with full banks nationalization and Islamization. In addition, the use of bounds testing approach proposed by Pesaran *et al.* (2001) to investigate the level relationship among

variables with different degree of integrations and the application of Unrestricted Error Correction Model (UECM) to inflation determination in Iran are unique to this paper.

The paper contains four sections. After the introduction, Section 2 develops a basic model to study price level movement in Iran. The model estimation is presented in Section 3. Section 4 is the concluding remarks.

2- Model Specification and Method

Using Tang (2001) and Ramakrishnan and Vamvakidis (2002) and following the literature on price level movement in Iran, the rate of inflation is assumed to depend on expected inflation, bank credit, output level, black market exchange rate, and import price. The following model is proposed for inflation determination in Iran: [1]

$$\Pi_t = f(\Pi_{t-i}, BC_t, Y_t, E_t, IP_t), \qquad (1)$$

in which Π_t, BC_t, Y_t, E_t, and IP_t are inflation rate, bank credit, real GNP, black market exchange rate, and import price, respectively.

The presence of lagged inflation, Π_{t-i}, in the model takes care of expectation about price level movement. Bank credit is introduced into the model because the existence of inflationary gap due to presence of excess demand in the economy can also explain part of price level changes in Iran. This excess demand can be a result of an increase in the demand for consumption and investment stimulated by a rise in bank credit.

Indeed, extensive regulations and controls on bank credits and rates of return (or rate of profit) dominate Iran's banking system. The government decides about the mount of subsidized credit for specific sectors and regions, and sets a credit target for some sectors. This direct control of government on the banking system might result in more expansionary monetary policy and hence more inflation in Iran.

Adjustment in goods market is captured by the presence of real output in equation (1). Black market exchange rate is introduced into our model because parallel market for foreign exchange has had a strong presence in the Iranian

1- Cheng and Papi (1997) also use output, money stock, import prices, exchange rate and wage rate as independent variables to study inflation movement in Turkey.

economy since 1979.[1] For example, Bahmani-Oskooee (1995) has shown that black market exchange rate is an important determinant of inflation in Iran. The market exchange rate can affect public expectation of inflation and also prices of smuggled goods.[2] Moreover, some researchers have shown that import price, as a proxy for imported inflation, is also an important determinant of inflation rate in Iran.[3]

We are now ready to specify our basic model. As will be shown shortly, unite root tests shows that we might have a combination of I(1) and I(0) variables in our model. Pesaran *et al*. (2001) proposed a bound testing approach to deal with this problem. Hence, an Unrestricted Error Correction Model (UECM) will be used to model inflation movement in Iran. The general form of an UECM is given by[4]

$$\Delta y_t = c_1 y_{t-1} + c_2 x_{t-1} + \sum_{i=1}^{p-1} c_{3i} \Delta z_{t-i} + c_4 \Delta x_t + c_5 W_t + u_t \ , \qquad (2)$$

in which y_t is dependent variable, x_t is a vector of independent variables, Z_t is vector of dependent and independent variables, and W_t is vector of deterministic variables such as intercept, trend and dummy variables. u_t is a white noise disturbance term.

More precisely, to study price level movement in Iran, the following unrestricted error correction model (UECM) will be estimated:

$$\Delta LnCPI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta LnCPI_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta LnBC_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta LnY_{t-i} +$$
$$\sum_{i=0}^{n} \alpha_{4i} \Delta LnE_{t-i} + \sum_{i=0}^{n} \alpha_{5i} \Delta LnIP_{t-i} + \alpha_6 LnCPI_{t-1} + \alpha_7 LnBC_{t-1} + \alpha_8 LnY_{t-1} +$$
$$\alpha_9 LnE_{t-1} + \alpha_{10} LnIP_{t-1} + \Psi W' + u_t , \qquad (3)$$

1- Tourists, smugglers, pilgrims, foreign workers are among active players in the Iranian black market foreign exchange.

2- Goods smuggled into this country are estimated to account for more than 30 percent of the Iranian imports.

3- For example see Sassanpour (1980) and Bahmani-Oskooee (1995).

4- See Persaran *et al.* (2001) for detail.

In which $lnCPI_t$, $lnBC_t$, lnY_t, lnE_t, and $lnIP_t$, are logarithms of consumer price index, bank credit to private sector, real GNP, black market exchange rate, and import price index, respectively. W is a vector of dummy variables and u_t is a white noise. α's and Ψ are parameters. Δ stands for the first difference of variables.

One should note that the long-run coefficients can easily be obtained from equation (3). For this purpose, the coefficient of the one lagged explanatory variables should be divided by the coefficient of the one lagged dependent variable (i.e., $LnCPI_{t-1}$) multiplied by a minus sign.[1]

Prior to our estimation we must check whether our variables are stationary. If the stationary tests show that we have a combination of variables with different degree of integration, the regular cointeration tests will not be suitable to check for the presence of long-run equilibrium relationships among variables. In this case Pesaran *et al.* (2001) proposed to use the bounds testing approach to examine the existence of level relationships among variables. In this approach the Wald or F-statistic is used to examine the significance of lagged levels of variables in a conditional unrestricted error correction model. Pesaran *et al.* (op. cit.) provides two sets of critical values; one for the case which assumes that all regressors are I(1) and the other for purely I(0) regressors. These two sets provide critical value bounds for all classifications of the regressors. If the computed F-statistic lies outside the critical value bounds, we can draw a conclusive inference without needing to know the integration/cointegration status of the underlying variables. However, if the computed F-statistic is inside these bounds, we need to know the integration order of the underlying regressors before making conclusive inferences.[2]

3- Model Estimation

In this section equation (3) will be estimated for the Iranian economy over the period 1959-2002. The data used for estimation are collected from (a) the central bank of the Islamic Republic of Iran, and (b) PDS published by Management and Planning Organization of Iran and (c) International Financial

1- See Bardsen (1989) for more detail.
2- Pesaran *et al.* (2001, p. 290).

Statistics of International Monetary Fund. Prior to estimating the model we used Dickey-Fuller (DF) unit root test to examine whether our variables are stationary. The result of this test is reported in the appendix. As the result shows we have a combination of I(1) and I(0) variables in our model.[1] Hence, a bounds test proposed by Pesaran *et al.* (2001) will be used to examine the existence of long-run equilibrium relationship among variables with different degree of integrations.[2]

Before estimating the UECM model one should select the optimal lags of variables.[3] Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) have been used to determine the lag order of the model. Given the fact that our model is sensitive to problem of serial correlation, in choosing the lags, Lagrange Multiplier (LM) statistics is used to test the hypothesis of no autocorrelation of stochastic term.

Hence, the model was estimated for different lags to determine the appropriate lag length. The results are presented in Tables (1.a) and (1.b). The Lagrange multiplier (LM) statistics in these tables test the hypothesis of no residual autocorrelation. As AIC and SBC criteria in Table (1.a) show the appropriate lag for our UECM model is 4. However, based on LM statistics, $x^2_{SC}(1)$ presented in the last column of this table, the model suffers from serial correlation problem at this lag. Pesaran et. al. (2001) emphasizes that for validity of the bounds tests it is important to avoid the problem of residual serial

1- According to Dickey-Fuller (DF) unit root test with an intercept and a linear trend lnY, lnBC, lnE, and LnIP are I(1). The DF test with an intercept and a linear trend shows that LnCPI is I(0). The results of these tests are reported in the third column of Table A-1 and A-2 in the appendix.

2- Bahmani-Oskooee (1995) has assumed that LnCPI might be an I(1) variable. In this case all variables would be I(1). Hence, in order to confirm the result of bound test proposed by Pesaran et. al., we also used Johansen technique to examine whether the I(1) variables are cointegrated. The result of this test showed that there are four cointegrated vectors. This result is not reported here but is available upon request. Hence, the results of both tests assure us that there is a long-run relationship among variables.

3- For model selection one should also examine different cases to see whether to include trend and/or intercept in her error correction model. He also had to make decision on whether the coefficients should be restricted. In this paper the unrestricted error correction model is chosen after estimating different cases (with and without intercept and trend). To save space, those estimation results are not reported here.

correlation. To select an appropriate lag length for *ΔLnCPI* in our UECM model, we have estimated equation (3) for different lag orders. The result is presented at Table (1.b). As the table shows, based on AIC and SBC criteria the optimal lag length for *ΔLnCPI* is one. As the last column of Table 1.b indicates there is not autocorrelation problem at lag one. Hence, lag order 1 for *ΔLnCPI* is chosen for the UECM model.[1]

Table 1.a: Statistics for selection of the lag order of the model

Order	AIC	SBC	$x^2_{SC}(1)$
0	88.5819	74.6805	2.0271[0.155]
1	86.9567	68.9642	11.5131[0.001]
2	90.2692	68.8496	6.5207[0.011]
3	90.2476	64.9144	14.6997[0.000]
4	106.1093	76.9970	16.4216[0.000]

Table 1.b: Statistics for selection of the lag order for ΔLnCPI variable in the model

Order	*AIC*	*SBC*	$x^2_{SC}(1)$
1	88.5819	74.6805	2.0271[0.155]
2	87.2556	72.6903	4.4140[0.036]
3	83.2797	68.0798	4.1224[0.042]
4	80.0306	64.2267	2.9726[0.085]
5	77.7083	61.3325	2.8138[0.093]
6	73.9337	57.0191	2.4399[0.118]
7	70.4198	53.001	2.6002[0.107]

1- Indeed, in order to select the lag order for our model, we have used ARDL option in the univariate regression toolbox of Microfit software and estimated many different ARDL models for various combinations of lag lengths for the variables.

Given the above results, we estimate the following UECM model:

$$\Delta LnCPI_t = \alpha_0 + \alpha_1 \Delta LnCPI_{t-1} + \alpha_2 \Delta LnBC_t + \alpha_3 \Delta LnY_t + \alpha_4 \Delta LnE_t + \alpha_5 \Delta LnIP_t + \alpha_6 LnCPI_{t-1} + \alpha_7 LnBC_{t-1} + \alpha_8 LnY_{t-1} + \alpha_9 LnE_{t-1} + \alpha_{10} LnIP_{t-1} + \psi_1 D79 + \psi_2 D80 + \psi_3 D84 + \psi_4 D80LnBC + \psi_5 D84LnBC + u_t . \quad (4)$$

Dummy variables *D79*, *D80*, and *D84* are introduced into the model to capture the impacts of the civil unrest of 1978-79, the nationalization of banking system,[1] and the implementation of no-interest banking[2] on inflation rate in Iran, respectively. These major changes have had important impacts on banks operation regarding their loans and credits to private sector. Moreover, two other dummy variables -- namely *D80lnB*C and *D84lnBC* – are introduced to investigate how bank credit has affected the slope of inflation after the nationalization of the banking system and the implementation of interest-free financial transaction law in Iran. The result of this estimation is presented in Table 2.

Table 2: The estimation of the UECM model

OLS estimation: Dependent variable is ΔLnCPI 42 observations used for estimation from 1961 to 2002			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
C	1.4361	.53128	2.7032[.012]
ΔLnCPI(-1)	.062006	.10876	.57012[.573]
ΔLnBC	.5258E-3	.063810	.0082408[.993]
ΔLnY	-.34090	.088075	-3.8706[.001]
ΔLnE	.045225	.041311	1.0947[.284]
ΔLnIP	.39693	.084197	4.7144[.000]
LnCPI(-1)	-.48621	.12277	-3.9602[.001]
LnBC(-1)	.25290	.058017	4.3590[.000]
LnY(-1)	-.29734	.080754	-3.6820[.001]

1- It equals to zero during the pre-nationalization period and one during the banks nationalization.

2- It equals to zero before 1984 and one during the implementation of no-interest banking system.

LnE(-1)	.091841	.049250	1.8648[.074]
LnIP(-1)	.29387	.070628	4.1608[.000]
D79	-.16249	.037921	-4.2851[.000]
D80	-2.3970	1.1946	-2.0065[.055]
D80LnBC	.28925	.15549	1.8602[.074]
D84	3.3929	1.2203	2.7803[.010]
D84LnBC	-.43606	.15587	-2.7977[.010]
R-Squared .95107 S.E. of Regression .025497 Mean of Dependent Variable .13047 Residual Sum of Squares .016902 Akaike Info. Criterion 88.5819 DW-statistic 2.3053		R-Bar-Squared .92284 F-stat. F(15, 26) 33.6925[.000] S.D. of Dependent Variable .091791 Equation Log-likelihood 104.5819 Schwarz Bayesian Criterion 74.6805 Durbin's h-statistic -1.3947[.163]	

The diagnostic tests reported in Table 3 confirm the validity of the estimated model. Lagrange multiplier test indicates that there is no serial correlation. Ramsey's RESET test shows that there is no functional form problem. A test of skewness and kurtosis confirms the normality of the residuals. The regression of squared residuals on squared fitted values indicates that there is no problem of heteroscedasticity in the model.

Table 3: Diagnostic Tests

Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(1)= 2.0271[.155]	F(1, 25)= 1.2678[.271]
B:Functional Form	CHSQ(1)= .62861[.428]	F(1, 25)= .37986[.543]
C:Normality	CHSQ(2)= 3.2822[.194]	Not applicable
D:Heteroscedasticity	CHSQ(1)= .082162[.774]	F(1, 40)= .078403[.781]
A:Lagrange multiplier test of residual serial correlation B:Ramsey's RESET test using the square of the fitted values C:Based on a test of skewness and kurtosis of residuals D:Based on the regression of squared residuals on squared fitted values		

Before interpreting the results of Table 2 we have to examine the existence of long-run equilibrium relationship among variables. Since we have a combination of I(1) and I(0) variables in our model, we use the bounds test proposed by Pesaran *et al*. (2001) to examine the existence of level relationship among variables. The result of this test is presented in Table 4.

Table 4. The bounds test for LnCPI model

Variable deletion test (OLS case): dependent variable is ΔLnCPI **List of the variables deleted from the regression:** **LnCPI(-1) LnBC(-1) LnY(-1) LnE(-1) LnIP(-1)** **42 observations used for estimation from 1961 to 2002**			
Regressor	**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
C	.044393	.022397	1.9821[.056]
ΔLnCPI(-1)	.34395	.11106	3.0970[.004]
ΔLnBC	.017565	.082512	.21287[.833]
ΔLnY	-.28697	.13726	-2.0907[.045]
ΔLnE	.018083	.052047	.34743[.731]
ΔLnIP	.46501	.084541	5.5004[.000]
D79	-.084704	.043676	-1.9394[.062]
D80	-.90702	1.6778	-.54059[.593]
D80LnBC	.12071	.21705	.55612[.582]
D84	.87334	1.6672	.52385[.604]
D84LnBC	-.11927	.21633	-.55132[.585]
Joint test of zero restrictions on the coefficients of deleted variables: Lagrange Multiplier Statistic CHSQ(5)= 29.3606[.000] Likelihood Ratio Statistic CHSQ(5)= 50.4358[.000] F Statistic F(5, 26)= 12.0793[.000]			

From Pesaran et al. (2001) the critical value bounds for the F-statistic at 0.05 significance level for the unrestricted intercept and no trend case when k=4 are I(0)=2.86 and I(1)=4.01.

From Pesaran *et al.* (op. cit.) the critical value bounds for the F-statistic at 0.05 significance level for the unrestricted intercept and no trend case when k=4 are I(0)=2.86 and I(1)=4.01. As Table 4 indicates our calculated F-statistic is 12.08. Since it falls outside the critical value bounds, the hypothesis of no level

relationship among variables is rejected. It means that there is a long-run equilibrium relationship between inflation and its main determinants in Iran.

Now we are ready to discuss the results of Table 2. The first difference of a variable indicates its short-run impact on inflation. Table 2 shows that the coefficients of *ΔLnBC* and *ΔLnE* are insignificant. This means that in the short-run bank credit and black market exchange rate do not affect inflation rate in Iran.

The result shows that the coefficients of *ΔLny* and *ΔLnIP* are statistically significant. The coefficient of *ΔLny* is negative. Hence, in the short run an increase in real output decreases the inflation rate in Iran. Based on our finding import price has the largest positive impact on price level movement in the short run. It shows that one percent increase in import price raises the inflation rate by about 0.40 percent.

Moreover, the results of Table 2 indicate the coefficients of all dummy variables are significant. The coefficient of dummy variable, *D79* shows that the unrest, capital flight, and the closure of many banks during the course of the revolution in 1979 had negatively affected the inflation rate in Iran. This can be attributed to a decrease in banks credit to public and private sectors in 1978-79. Dummy variable *D80* indicates that the nationalization of the banking system has inversely affected the intercept. However, the coefficient of *D80LnBC* shows that the banks nationalization has increased the positive impact of bank credit on inflation by about 0.29 percent. Indeed, the direct control of banking system by monetary authorities has led to higher inflation rate in Iran. The banks nationalization has given the government the ultimate power to allocate banks' loans to different sectors during this period. The changes in the quality and quantity of new loans due to the nationalization have positively affected the inflation rate in this country.

In contrast, the coefficients of *D84* and *D84LnBC* indicate that the implementation of interest-free banking system has increased the intercept but lowered the slope of inflation rate in the model. As the result shows one percent increase in bank credit after adopting the no-interest banking has decrease the inflation rate by about 0.44 percent.

From the above results one can conclude that the nationalization of the banking system and the implementation of no-interest banking have had completely different impacts on the pace of price level movement in Iran. This

might be attributed to the fact these two structural changes can have diverse effects on the willingness and ability of banks to extend credit.

The long-run coefficients can be obtained from Table 2. Using equation (4), the long-run elasticities are calculated by multiplying α_7 to α_{10} with a negative sign and dividing them by α_6.[1] As Table 2 indicates all of these coefficients are statistically significant. The calculated long-run coefficients are presented in Table 5.

Table 5. The long-run coefficients

Variables	Long-Run Elasticity
LnBC	0.5201
LnY	-0.6115
LnIP	0.6044
LnE	0.1889

As the first row of this table shows the long-run elasticity of inflation with respect to bank credit is positive. More specifically, one percent increase in bank credit raises the inflation rate by about 0.5 percent in the long run. This result has important implication for monetary policy in Iran.

Inflation is found to be negatively affected by output level. Table 5 indicates that one percent increase in real output will decrease the inflation by 0.61 percent. As the result shows, in the long run, the import price has the largest positive impact on inflation rate. In particular, one percent increase in import price causes the inflation to rise about 0.6 percent.

The last row of Table 5 shows that there is a direct relationship between black market exchange rate and inflation rate. One percent depreciation of black market exchange rate raises the inflation rate by 0.18 percent in the long run. This can be due to the impacts of parallel foreign exchange market on the formation of expectations about price level movement. Moreover, black market exchange rate can affect the inflation rate through changing the prices of smuggled goods. One should also note that black market exchange rate shows the opportunity cost of holding national currency. If people expect Rial[2] to

1- See Bardsen (1989) for details.
2- The Iranian national currency.

depreciate in the black market, they might substitute foreign for domestic currencies in their portfolio. This in turn will create excess money supply and hence might trigger the inflation.

Table 2 indicates that the coefficients of all dummy variables are significant. The coefficient of dummy variable, *D79* shows that the unrest, capital flight, and the closure of many banks during the course of the revolution had negatively affected the inflation rate in Iran. This can be attributed to a decrease in banks credit to public and private sectors in 1978-79. Dummy variable *D80* indicates that the nationalization of the banking system has inversely affected the intercept. However, the coefficient of *D80LnBC* shows that one percent increase in bank lending after banks nationalization raises the inflation by about 0.29 percent. Indeed, the direct control of banking system by monetary authorities has led to higher inflation rate in Iran. The banks nationalization has given the government the ultimate power to allocate banks' loans to different sectors during this period. The changes in nature and size of new loans after the nationalization have positively affected the inflation rate in this country.

In contrast, the coefficients of *D84* and *D84LnBC* indicate that the implementation of interest-free banking system has increased the intercept but lowered the slope of inflation rate in the model. As the result shows one percent increase in bank credit after adopting the no-interest banking system decreases the inflation rate by about 0.44 percent. Comparing the effect of banks nationalization with those of no-interest banking one might conclude that these two structural changes have had completely different impacts on the pace of price level movement in Iran.[1]

In brief, the nationalization of the banking system and the implementation of no-interest banking have affected the price level movement in Iran in a very

1- We also introduced a dummy to capture exchange rate unification for the period 1993-1995. However, the estimation results showed that this variable was not significant and its inclusion inversely affected the diagnostic tests and hence was eliminated for the model.

different way by changing the willingness and ability of banks to extend credit and by altering the role banks play in financial markets.

Stability test

Next we use the CUSUM (cumulative sum) and CUSUMSQ (cumulative sum of squares) tests to examine the structural stability of estimated parameters in our UECM model. The first test is used to check whether there is a systematic change in the estimated coefficients. The second test is useful when there is a sudden and randomly departure from the constancy of the parameters. The results of these two tests are presented in figures 1 and 2. Each figure exhibits a pair of straight lines drawn at 5% significance level. If CUSUM or CUSUMSQ crosses either of these lines, the regression equation is not correctly specified.

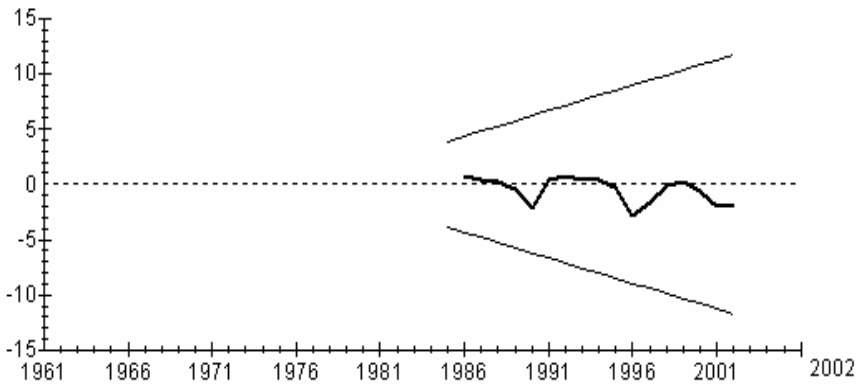

Fig. 1- Plot of Cumulative Sum of Recursive Residuals (CUSUM)

The straight lines represent critical bounds at 5% significance level

As Figure 1 shows the cumulative sum of recursive residuals is inside the critical bounds at 5% significance level and hence the null hypothesis of structural stability is not rejected.

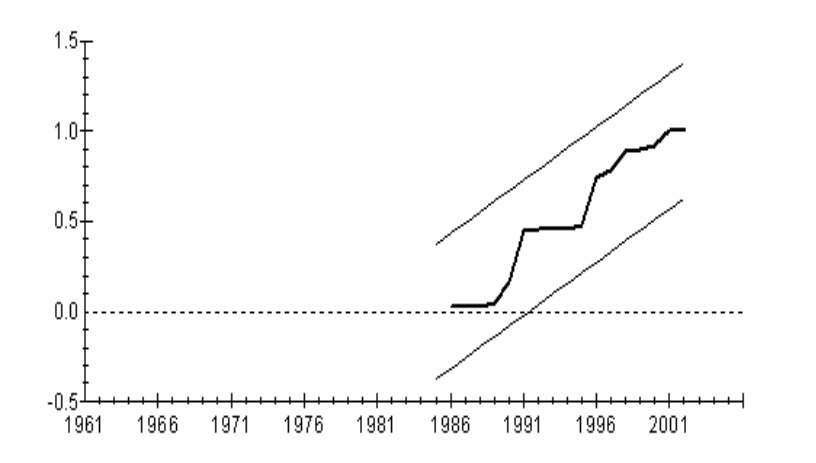

Fig. 2- Plot of Cumulative Sum of Squares of Recursive Residuals (CUSUMSQ)

The straight lines represent critical bounds at 5% significance level

Figure 2 indicates that the cumulative sum of squares of recursive residuals is inside the critical bounds at 5% significance level. Hence, according to both tests the estimated coefficients are stable.

4- Concluding Remarks

This paper pursues two goals. First, it uses an unrestricted error correction model (UECM) and the bounds testing approach proposed by Pesaran et al. (2001), to study the impact of bank credits on inflation rate in a country in which the banks are nationalized and all interests on financial transactions are forbidden. The approach used in this paper allows us to test for the existence of a level relationship between inflation rate and a set of independent variables irrespective of whether the underlying regressors are I(0), I(1) or mutually cointegrated.

Second, this paper examines whether institutional and cultural changes resulted from bank nationalization and Islamization have caused structural breaks on price level movement in Iran

The result confirms the existence of a long-run relationship between inflation and its main determinants, namely, bank credit, black market exchange

rate, real GNP, and import price. The results indicate that, in the short run, bank credit and black market exchange rate do not affect the inflation rate in Iran. However, bank credit, import price and black market exchange rate have positive long-run impacts on inflation rate in this country. More specifically, we found that one percent increase in bank credit raises the inflation rate by more than 0.5 percent. This result has an important policy implication for the Iranian economy. Indeed, we refute the claim of the incumbent government in Iran that the expansion of banks credit has no positive impact on inflation rate in this country. The paper also shows that real output negatively affects general price level both in the short and the long run.

Regarding structural changes in the banking system of Iran, we found that the nationalization of the banking system after the Islamic revolution of 1979 has decreased the intercept but increased the slope of inflation rate equation. On contrary, the implementation of no-interest banking system in Iran has increased the intercept but decreased the slope of inflation rate equation. This indicates how changes in the bank's willingness to lend and the modes of finance can influence the price level movement through affecting aggregate demands. In other words, the banks nationalization and the adoption of interest-free banking system in Iran have changed the structure of price level movement in this country.

Appendix

Table A-1: Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests for variables at level.

Variables	DF test including an intercept but not a trend	DF test including an intercept and a linear trend	ADF test including an intercept but not a trend	ADF test including an intercept and a linear trend
LnCPI	4.7441	**-3.5873***	-.37963(3)*	-3.0824 (2)*
LnY	-2.4795	-2.5582	-2.1309 (2)	-2.8253 (1)
LnBC	2.3613	-.89430	1.4091(1)	-1.9603 (1)
LnE	1.5316	-2.0354	.83679(1)	-2.0008 (1)
LnIP	4.3339	-1.8381	1.2501(1)	-1.8102(1)

95% critical value for the augmented Dickey-Fuller statistic including an intercept but not a trend = -2.93 95% critical value for the augmented Dickey-Fuller statistic including an intercept and a linear trend = -3.51

The numbers in the parenthesis are lags used for ADF test..

*We used up to 5 lags for ADF estimation of LnCPI.

Table A-2: Dickey-Fuller (DF)and Augmented Dickey-Fuller (ADF) tests for the first difference of the variables

VARIABLES	DF test including an intercept but not a trend	DF test including an intercept and a linear trend	ADF test including an intercept but not a trend	ADF test including an intercept and a linear trend
ΔLnCPI	-2.7392*	-2.7392*	-2.0148 (2)*	-3.5502 (1)*
ΔLnY	-3.3609	-3.4985	-3.3107(1)	-2.9463(1)
ΔLnBC	-3.3945	-3.6980	-2.6486(1)	-2.9649(1)
ΔLnE	-4.5443	-3.4873	-4.904991)	-3.8968(1)
ΔLnIP	-2.7332	-3.6857	-2.4282(1)	-3.5277(1)

95% critical value for the augmented Dickey-Fuller statistic including an intercept but not a trend = -2.93 95% critical value for the augmented Dickey-Fuller statistic including an intercept and a linear trend = -3.51.

*We used up to 5 lags for ADF estimation of ΔLnCPI.

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