Inflation and Economic Growth in Iran: Evidence from ARDL & Rolling Linear Models

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Abstract: Economists pay considerable attention to the influential factors on the economic growth in the framework of the growth models. In the same direction, the relationship between inflation and economic growth in Iran has been investigated during 1978-2008. First, an adjusted model has been designed based on (Barro) model and then the relationship between inflation and economic growth has been estimated using both ARDL and rolling linear regression models. The results derived from the both estimated models showed that the effect of inflation on economic growth is negative and Significance.

Keywords: *Inflation, Economic growth, Standard deviation of inflation, rolling linear Models*

1. Introduction

One of the most important macro variables, which interact as well with inflation, is the performance of real side of the economy. Real rate of economic growth is one of the most distinguished indicators of the performance of real side of the economy. Considering the fact that of most important objectives in huge economic is to achieve to an appropriate rate of economic growth, we must also pay sufficient attention to the influence that these policies exert on the growth rate of the real side of economy, before implementing any form of inflation stabilizing strategies. The existence of a correlation between inflation and economic growth is a subject of debate among economists of different countries, and a variety of theoretical and empirical topics have been presented in this regard. A review on these numerous topics reveals that it is impossible to reach a conclusive result concerning the impact of inflation on economic growth. In addition, for every country it depends on the 0particular conditions and characteristics of that country. For example, using optimization of economic agents' behavior method and taking into account the real residual money and utility function, Stockman reached the conclusion that the negative effect of inflation on growth is associated mainly to cash payment models, and Tobin, by assuming money as a substitute for capital, proved the positive effect of inflation on growth.

The present study tries to investigate the relationship between inflation and economic growth in Iran. In addition, In fact will be compiled after raising the question "what is the relationship between inflation and economic growth? Another vital issue in the present paper that is relevant in the studies concerning the relation between inflation and economic growth is the impact of mutability of inflation rate on economic growth. In other words, theoretical analysis of the relationship between inflation and economic growth is one thing and the effect of mutability of inflation rate is another one. In regard to the fact that the economy of Iran, compared to developed countries, facing with numerous problems on both issues of inflation and growth, it will be helpful to analysis this discussion. In subsequent sections, first, we begin to study different attitudes towards this subject, as well as the studies conducted in this area, and then Barro model will be examined and in the end the relationship between inflation and economic growth will be analyzed in the framework of ARDL and Rolling Linear models.

2. Literature Review

The empirical findings concerning the relationship between inflation and economic growth in developing countries have been mixed. De Gregorio (1992) used a simple single equation model to examine the effects of inflation on economic growth in a sample of Latin American countries. His cross-sectional empirical results confirmed that inflation has been an important factor inhibiting growth in Latin America. Christoffersen and Doyle (1998) reexamine growth in transition economics using panel data from 1990 to 1997. It suggests that output has been strongly affected by export market growth; that inflation has been associated with weaker

output initially, but that stimulates higher growth thereafter; and that rapid disinflation has been associated with output losses only in the presence of pegged exchange rates. Mallik and Chowdhury (2001) used co-integration and error correction models with using annual data for south Asian countries. Evidence shows a long-run positive relationship between GDP growth rate and inflation for all four countries. Their results have important policy implications. Moderate Inflation is helpful to growth, but faster economic growth feeds back into inflation. Thus, these countries are on a knife- edge. Harris, Gillman, Matyas (2002), used a monetary model of endogenous growth. Empirical evaluation of the model is based on a large panel of OECD and APEC member countries over the years 1961-1997. The negative inflation effect on economic growth is found comprehensively for the OECD countries to be significant and one that is stronger at lower levels of inflation. For APEC countries, the results from using instrumental variables also shown significant evidence of a similar behavior.

Li (2004) examined the relationship between inflation and economic growth by using data for 90 developing and 28 developed countries over the period 1961-2003. The evidence supported the view that the relationship between inflation and economic growth was nonlinear. Mubarik (2005) estimated the threshold Level of inflation in Pakistan Using annual dataset from 1973 to 2000. The estimated model suggested 9 percent threshold level of inflation above which inflation is not harmful for economic growth. Unlike high level of prices that may create uncertainty and hamper economic performance, moderate rate of inflation helps in economic growth. Voana and Schiavo (2007) analyzed the long-run relation between inflation and economic growth during (1960-1999) using instrumental variables method for developed and developing countries. As a result, they analyzed the effect of inflation variables; equable portion of domestic asset from domestic product; increased rate of education in the population; governmental price portion; GDP (Gross Domestic Product) on the economic growth. They reached a 12% threshold Level of inflation. Bittencourt (2010) investigated the role of poor macroeconomic performance, in terms of high rates of inflation, in determining economic growth in four Latin American countries between 1970 and 2007. Their empirical results, based on the relatively novel panel time-series analysis, confirmed that inflation has had a detrimental impact on growth in the region.

3. Specification of the Model

In a form of a neo-classical generalized Barro growth model of growth investigated model influencing the economic growth. In his model, the rate of real per capita growth depends on 2 types of variables: one is the primary levels of the situations variable (these are elements like the physical existence of capital and human asset in the forms of education and sanitation) the other one is considering control or environmental variable.¹ Considering the particular limitations existing in Iran economy, the relation of inflation and economic growth might be examined using an adjusted model of Barro during (1978-2008). First, we consider the following models:

$$gGDP(YR) = F(GDPY, IY, T, TOY, O, BMP, CY, P) \quad (1)$$

$$gGDP(YR) = F(GDPY, IY, T, TOY, O, BMP, CY, SE) \quad (2)$$

in which:

gGDP(YR) is the rate of growth in per capita GDP (to the fixed prices of 1997); **GDPY** is the initial level of GDP; **IY** is the ratio of total investment to real gross domestic production; **T** is the rate of literacy for the age group of 6 and higher (which is equal to the ratio of the general population that are under education to the population need to be came under education; **TOY** is the ratio of the Terms of trade to **GDP**; **O** is life expectancy; **BMP** is the difference between exchange rate in black market and that of in official market which is defined as:

$$\text{The margin of exchange rate} = \frac{\text{exchange rate in black market} - \text{exchange rate in official market}}{\text{exchange rate in black market}} + 1$$

CY is the ratio of the government consumption expenditures to GDP; **SE** is the standard deviation of inflation rate; **P** rate of inflation.

¹ - Barro (1995)

4. Empirical Evidence

For co integration between variables of the two introduced models, we do as follows:

A) In model 1 by using the results obtained from the assessment of dynamic equation and the lagged value of a dependent variable the result of which is presented in table 1 (choosing the appropriate lag was done according to Schwarz-Bayesian criteria) the existence of co integration was put to test using Benerjee, Dolado and Mestre test(1992)

$$t = \frac{\text{the sum of the interupter coefficient of dependent variable}-1}{\text{the sum of the standard derivation coefficient}}$$

This test ensures the existence of long-run relation. After the test was conducted, the calculated value was obtained to be (-14.17) and since its absolute value is greater than that of its counterpart in Banerjee-Dolado-Mestre table, namely (-4.43), Zero hypothesis, which says that there exists no long-run relation even at confidence interval of 99%, will be rejected and long-Run relation will exist.

Table 1: the estimated results of dynamic equation

variable	Coefficients	t- statistic
gGDP(YR)(-1)	0.13	2.24
P	-0.9375E-3	-2.43
GDPY	0.19	15.75
GDPY(-1)	-0.21	-20.36
O	0.39	1.81
O(-1)	0.46	1.76
T	-0.0035	-2.11
T(-1)	0.0067	4.66
IY	0.25	5.47
IY(-1)	-0.23	-.3.82
BMP	-0.0065	-0.43
TOY	0.3449E-5	1.26
CY	0.84	3.105
C	-0.18	-1.93
R ²	0.98	-
Durbin's h-statistic	-	-2.17
F- statistic	62.21	-

Source: Authors Calculations

Table 2: Results of long-Run relation

Variables	Coefficient	t- statistic
P	-0.001	-2.37
GDPY	-0.025	-2.72
O	0.088	0.33
T	0.003	2.57
IY	0.029	0.46
BMP	-0.007	-0.43
TOY	0.3449E-5	1.26
CY	0.98	2.67
C	-0.212	-1.83

Source: Authors Calculations

The calculated value obtained for error correction model coefficient (ECM(-1)) was -0/86 which shows that in each period, 0/86 of short run instability in economic growth is moderated in order to arrive at a long run stability. B) For model 2, first by using the results obtained from the assessment of dynamic equation and the lagged value of a dependent variable the result of which is presented in table (3). After the test was

conducted, the value was calculated to be (-17.35) and since its absolute value is greater than that of its counterpart in Banerjee- Dolado- Mestre table, namely (-4.43), Zero hypothesis which says there exist no long-run relation even at confidence interval of 99%, will be rejected and long-Run relation will exist.

Table 3: Results of dynamic equation

Variables	Coefficients	t- statistic
gGDP(YR)(-1)	0.11	2.34
SER	-0.448E-3	-1.85
SER(-1)	-0.0011	-2.96
GDPY	0.19	22.22
GDPY(-1)	-0.22	-23.83
T	-0.0049	-3.62
T(-1)	0.0051	4.62
O	0.33	2.18
TOY	0.3507E-6	0.16
CY	0.58	2.8
BMP	-0.018	-1.84
IY	0.28	7.25
IY(-1)	-0.24	-4.02
DUM85	0.039	3.3
C	-0.19	-2.73
R ²	0.98	-
Durbin's h-statistic	-	1.95
F- statistic	90.94	-

Source: Authors Calculations

Table 4: the results obtained from long-Run relation

Variables	Coefficients	t- statistic
SER	-0.0022	-2.81
GDPY	-0.029	-4.24
O	0.38	2.23
T	0.2823E-3	0.206
TOY	0.3980E-6	0.16
CY	0.66	2.509
BMP	-0.0208	-1.8
IY	0.048	0.707
DUM85	0.045	3.35
C	-0.22	-2.62

Source: Authors Calculations

The error correction model (ECM (-1)) shows that in each period, what percent of dependent variable instability modulate towards long-Run relation. Based on the existing variables, the value obtained for ECM (-1) coefficient was -0.88 which shows that in each period, 0.88 of short run instability modulates towards long-run relation.

Rolling linear regression Method: One of the approaches, according to which the gradual (linear) changes of a variable during a period might be obtained, is Rolling Linear Regression. In linear regression models, we assume that parameters remain unchanged as time goes by, in the sense that parameters won't change upon the occurrence of structural changes, that is to say, economic agents won't change their expectations upon the occurrence of these changes; In real world, however, the expectations of economic agents will change in the course of time upon the occurrence of these developments. Therefore, it seems necessary to investigate changes of parameters in the course of time.

Figure 1: Inflation coefficients and confidence interval

Source: Authors Calculations

Table 5: Inflation coefficients obtained for Rolling Linear Model

Year	inflation coefficient
1987	-0.0035
1989	-0.0048
1990	-0.0052
1991	-0.0042
1992	-0.0039
1993	-0.0035
1994	-0.0037
1995	-0.0023
1996	-0.0027
1997	-0.0023
1998	-0.0018
1999	-0.0017
2000	-0.00065
2001	-0.00033
2002	-0.00062
2003	-0.0008
2004	-0.00055
2005	-0.0012
2006	-0.0037
2007	-0.0021

Source: Authors Calculations

5. Conclusion

The result of ARDL model shows that 1 percent increase in inflation rate causes a short Run reduction of 0.0009 percentages in economic growth and a long run reduction of 0.001 percent. Taking into account the obtained t- statistic, we can conclude that inflation has a negative and Significance effect on economic growth. The result of Standard deviation of inflation confirms that one percent increase in Standard deviation of inflation leads to a reduction of 0.0008 in economic growth in short-term and 0.002 percent in long Run. Regarding the obtained t-statistic, we can conclude that inflation has negative and Significance effect on economic growth.

The relationship between inflation and economic growth for each year during the period under consideration is negative as shown in table (5). This finding is consistent with the negative relationship between inflation and per capita GDP presented in diagram (1). Our findings indicate that in order to experience higher rates of economic growth in Iran, policy makers should do their best to mitigate inflation in the country. Perhaps reducing the rate of growth in liquidity caused by monetizing budget deficit would be a suitable suggestion for the country to combat inflation so that a higher rate of economic growth might be achieved.

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