

Test of Real Business Cycle Theory in Iran's economy

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Abstract

This paper tests the importance of real shocks as sources of fluctuations in Iran's economy. For this purpose, based on the work of Boschen and Mills, a set of non-monetary variables which can affect economic growth have been selected and by using an illustrative business cycle model in which the production depends on the past and current value of real shocks, the influence of these variables have been studied. Based on the obtained results, the selected non-monetary variables have had a significant effect on the business cycles in Iran at the time period of ۱۹۵۹-۱۹۹۹, and introducing the monetary variables into a model with the presence of real variables have not increased the explanatory power of the model considerably.

Key word: real business cycle.

۱- Introduction

In the late ۱۹۷۰s, the leading economists of major schools of thought such as Tobin, Friedman and Lucas all agreed that the rate of growth of the money supply has a real effect on the economy and plays an important role in the explanation of the output fluctuation. Of course there was a considerable disagreement on the nature and the strength of the relationship between money and output and on the relative

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power of the monetary and fiscal policy. But economists believed that monetary phenomena were crucial to business cycle research and money is a leading variable of business cycles.

In the early ۱۹۸۰s, some empirical evidence on the lack of significance of influence on output and employment was found which we can point to the studies of Sims (۱۹۸۰, ۱۹۸۲) and Litterman and Wies (۱۹۸۵) which showed that in the system of Vector Autoregressive Models (VAR), when the interest rate is added to the variables of the system, monetary shocks have a low explanatory power on output variation.

The work of Kydland and Prescott (۱۹۸۲) showed that several business cycle colorations can be mimicked reasonably well with a competitive equilibrium model in which neither the money nor government policy plays any role.

Finally there is a line of argument developed primarily by Nelson and Plosser (۱۹۸۲) that relies entirely on the univariate time series properties of aggregate output, employment and other real variables. Briefly, the Nelson and Plosser argument is that most of the fluctuations in these variables should be attributed to the trend component, in trend versus cyclical decomposition, which would presumably be unaffected by monetary shocks.

The above studies along with supply shocks associated with the two oil price increases of the ۱۹۷۰s and failure of the demand oriented Keynesian models to account adequately for rising unemployment accompanied by accelerating inflation stimulated the transition from monetary to real theories of business cycles.

۲- Real Business Cycles Theory

In this theory, the economic agents have rational expectations and their aim is to maximize the utility or profit subject to prevailing resources constraint. Price flexibility ensures continuous market clearing and the economy is always at a state of equilibrium.

The fluctuation in output and employment are due to changes in the technology of production, and the monetary policy leaves no influence on the real variables. The fluctuations of employment reflect voluntary

changes in the numbers of the working hours of people who desire to work and it is assumed that working and leisure are highly substitutable.

In this theory, the business cycle arises when real shocks change real economic productivity or wealth and these changes set in motion economy-wide adjustment in consumption, output, labor supply and savings that ultimately re-establish a new equilibrium.

From the viewpoint of real business cycle theorists, the positive relation between money and output may indicate that the money supply is responding to economic activity. In such a situation money is endogenous and the money and output correlation that we observe is evidence of reverse causation. That is to say the expectation of future output expansion leads to current increase in the money supply.

In order to explain the close relationship between the monetary variables and real output, they focused on the connection between the level of output and transaction demand for money services. For this reason, in most of the real business cycle models there is no money. One of the real business cycle models which suggests the inclusion of money in the analysis and deals with the relationship of money and output is the work of King and Plosser (۱۹۸۴). In their model, it is assumed that money reduces the transaction costs of the goods purchased. The transaction service is intermediate goods, which is produced by the financial industry and used by firms and households. The amount of these transaction services varies with the real state of the economy. By fitting some regressions they have tested the relationship between production and monetary measures including demand deposits, currency and high power money and concluded that the most of the relationship between money and real activities are via inside money, which is compatible with real business cycle models. Boschen and Mills (۱۹۸۸) have conducted an empirical investigation on the relationship between monetary variables and real activities within the real business cycle model. Their method is based on the study of the relationship between money and output, presented by King and Plosser (۱۹۸۴) and Bernanke (۱۹۸۶). An illustrative business cycle model is used in which the output depends on the past,

current and expected future real shocks and by estimating that, they have concluded that the set of real variables explain the most of the variation in the GNP growth; however, there remains substantial variation in GNP growth unaccounted for by these real variables. But much of the remaining variation in output growth is not related to various measures of monetary policies.

Cooley and Hansen (۱۹۸۹) have described, calibrated and simulated a one-sector stochastic growth model identical to that studied by Hansen (۱۹۸۵). Money is introduced to the model by using cash in advance constraint, which is applied only to the consumer goods. They concluded that the volatility of the money supply had a small but significant effect on the cyclical characteristics of the economy and most important money influence on the short run fluctuations are likely to stem from the influence of the money process on relative price expectations.

Ramey (۱۹۹۲) investigated the sources of shock on real money by studying the co-movement between money and trade credit. The model has been presented based on the production framework used by King and Plosser. His contribution is to identify the issue that the trade credit between firms also provides transaction services and represents a substitute for bank transaction services. His analysis is: if economy-wide technology shocks are the source of economic fluctuation, money and trade credit should be related to each other positively, because the influence of shocks on both of them are the same. On the other hand, if shocks to the financial sector are the source of economic fluctuations, money and trade credit can be negatively related, because the two types of transaction services are interchangeable. Based on the estimation of the model, it has been observed that trade credit and money are negatively related both in short run and long run. So it has been concluded that the main source of fluctuations of money is shock on financial sector.

۳- Test of the model for Iran

The business cycles in the economy of Iran have been studied within the real business cycle framework. For this purpose, based on the

work of Boschen and Mills, a set of monetary variables which can have effect on economic growth have been selected. By using an illustrative business cycles model in which the production depends on past and current quantities of the real shocks, the influence of these variables has been studied. Boschen and Mills have used the variables of world oil price, government purchases, change in the average marginal tax rate on income, the growth rate in working age people and change in the real export as the set of variables which have effect on the output. The effect of variables of the world oil price, government purchases, change in the average marginal tax rate on income and the growth rate of working age people were significant, but the effect of the real export was not.

In this paper, based on the specific condition of Iran's economy, the variables of world oil price, government expenditures, population above ۱۴ years of age, the import of intermediate and capital goods, tax revenue, and the ratio of tax revenue to GNP have been considered as the non-monetary variables. Also, the variables of the difference between the free and official market exchange rate divided by the official exchange rate multiplied by one hundred as the proxy variable for the non-economic factors, and four dummy variables for the increase of the world oil price in ۱۹۷۴, Islamic Revolution ۱۹۷۹, imposed war in ۱۹۸۰ and the beginning of adjustment policies in ۱۹۸۹ have been used. Then, the effect of monetary variables on the output growth, the effect of the currency, demand deposits and total deposits of individuals at the banks have been tested.

The model has been estimated by using the annual data during the period of ۱۹۵۹-۱۹۹۹. The most important finding of the research was that the set of real variables explains the most of variations in the growth of GNP and introducing monetary variables into the model does not increase its explanatory power. Therefore the main factors for the business cycles in Iran's economy are the non-monetary and supply side factors.

3-1- The model

The framework of the model is as follows[†]:

The technology of the production is a simplified two period production function such as the work of King and Plosser (1984). The log-linear aggregate production function is:

$$y_{t+1} = l_t + \varepsilon_t + \xi_{t+1}$$

Where y_{t+1} is the output at the time $t+1$, l_t is employment at the time t and ε_t and ξ_{t+1} are the real shocks to production.

The log-linear efficiency condition for employment is:

$$w_t - p_t = \varepsilon_t - r_t + E_t \xi_{t+1}$$

Where w_t is the average nominal wage, p_t is the price level; r_t is the real interest rate, E_t is the expectational operator referring to the economy-wide average expectation.

Future wages are determined similarly. The current expectations of $t+1$ nominal wage is:

$$E_t w_{t+1} = E_t p_{t+1} + E_t \varepsilon_{t+1} - E_t r_{t+1} + E_t \xi_{t+1}$$

The log-linear aggregate supply function is:

$$l_t = \beta \cdot (w_t - p_t) - \beta \cdot (E_t w_{t+1} - E_t p_{t+1} - r_t) + \beta \cdot r_t$$

Where $\beta_i > 0$ for $i = 0, 1, 2$

The equilibrium in the goods market is given by:

$$r_t = -\Phi_0 y_t^d + \Phi_1 \varepsilon_t + \Phi_2 \eta_t + \Phi_3 E_t \xi_{t+1}$$

and $y_t^d = y_t^s$

[†] - For comprehensive illustration refer to Boschen and Mills (1988).

The variable η_t represents the current observable real shocks of demand side.

By taking the expectation from the equilibrium condition of the goods market, substituting equations, (3-2), (3-3), (3-4) and (3-5) for y_{t+1} in the equation of (3-1), taking the expectation from the obtained equation and arranging and placing that in the equation of y_{t+1} we will have:

$$y_{t+1} = a_1 y_t + a_2 \varepsilon_t + a_3 \eta_t + a_4 E_t \varepsilon_{t+1} + a_5 E_t \eta_{t+1} + a_6 E_t \xi_{t+1} + a_7 E_t \xi_{t+2} + \xi_{t+1} \quad (3-6)$$

The equation (3-6) is studied empirically. As has been observed, the influence of the monetary measure on output has been excluded. The exclusion of monetary measures from output determination is the central characteristic of the real business cycle models.

3-2- The reaction of the monetary variables to real shocks

If we define the vector of real shocks in the form of $z'_t = [\varepsilon_t, \eta_t, \xi_t, \varepsilon_{t+1}]'$ and the vector of other variables in the form of $x'_t = [p_t, y_t, p_{t-1}, y_{t-1}, R_t, z_t, \dots]'$, the log-linear expression for currency and nominal inside money are:

$$D_t = d_z z_t - d_r R_t + d_D(L) D_{t-1} + d_x x_t + v_{Dt} \quad (3-7)$$

$$C_t = c_z z_t - c_r R_t + c_c(L) D_{t-1} + c_x x_t + v_{Ct} \quad (3-8)$$

Where v_{Dt} and v_{Ct} are the shock of inside money and currency, respectively, and the expression of $d_D(L)$ and $c_c(L)$ are polynomial in the lag operator of (L) .

The output equation together with the above equation shows the contemporaneous correlation of y_t , C_t and D_t (since y_t is one of the components of the vector x_t). In addition, D_t and C_t are both functions of z_t , which contain shocks such as ε_t , which influence the future output. But this correlation does not imply that the monetary variables have explanatory power in the equation of output. The correlation

between the monetary variables and output does not alter the form of the output equation.

۳-۲-۱- Reserves and interest rates

Supply and demand equations for reserves and nominal interest rate equations, which have been modified for Iran, are:

$$B_t = m_t + D_t = m_t + d_z z_t - d_R R_t + d_D(L)D_{t-1} + d_x x_t + v_{Dt} \quad (3-9)$$

Where $m_t = m_R R_t + v_{mt}$ is the reverse of money multiplier.

$$R_t = (m_R + d_R)^{-1} \{-B_t^z + m_t + d_z z_t + d_D(L)D_{t-1} + v_{mt} + v_{Dt}\} \quad (3-10)$$

$$B_t^z = B + B_{t-1} + b_z z_t + b_x x_t + v_{Bt} \quad (3-11)$$

Equilibrium condition is:

$$R_t = (m_R + d_R)^{-1} \{-B - B_{t-1} + m_t + (d_z - b_z)z_t + d_D(L)D_{t-1} + (d_x - b_x)x_t + v_{mt} + v_{Dt} - v_{Bt}\}$$

By using the vector z_t which shows the real shocks and M_t for monetary variables, the econometrics version of equation (3-11) is:

$$Y_{t+1} = A_Y(L) + A_Z(L)z_t + A_M(L)M_t + A_R(L)R_t + U_{t+1}$$

Where U_{t+1} is the error term with the mean of zero and serially uncorrelated. $A_i(L)$ is the polynomial of lag operator. In this equation, the coefficients of A_m and A_R have explicitly introduced which are zero under null hypothesis.

۳-۳- Introducing the variables

The annual data for the period ۱۹۵۸-۱۹۹۹ are used. The variable of GNP in ۱۹۹۰ prices (GNP_{90}) used as the criterion of output and the variables of world oil price (POO_{90}), the government expenditures including the current and development expenditures in ۱۹۹۰ prices

(GE_{t-1}), population over ۱۴ years of age (POP_{14t}), imports of the capital and intermediate goods in ۱۹۸۴ prices (MKV_{14t}), the ratio of taxes to the GNP ($TINTPY$), tax revenue in ۱۹۹۰ prices ($TINT_{90}$) have used as the variables related to the real shocks and currency (M_{90}) and demand deposits of individuals at banks (DM_{90}) and the total demand deposits (saving deposits and time deposits) of individuals at banks (DM^T_{90}) have been used as monetary measures. The variable of the difference in the exchange rate of the free market and official market divided by the official exchange rate multiplied by ۱۰۰ (EXD) as a proxy variable for non-economic factors which have effect on economy and the dummy variables (D^1) for the oil price increase (۱۹۷۴), (D^2) for Islamic Revolution (۱۹۷۹), (D^3) for the imposed war (۱۹۸۰) and (D^4) for the adjustment policies (۱۹۸۹) have also been used.

With regard to the lack of a time series data of the population over ۱۴ years of age-by using the census of the years ۱۹۵۶, ۱۹۶۶, ۱۹۷۶ and ۱۹۹۶, first the average growth rate of the population over ۱۴ years was calculated and then by using the mentioned method in the national accounts of the years ۱۹۵۸-۱۹۷۸, the time series of the population over ۱۴ years of age has been made as follows:

If r_1 and r_2 are the calculated growth rates for the interval between two consecutive periods of census, those growth rates are more acceptable for the middle years of the period, thus the fall or rise of the population growth rate in the time period of the middle points of two census (۱۰ years) are as follows:

$$a = (r_2 - r_1) / 10$$

If the trend of increase of the population is a linear function of time:

$$r_t = r_1 + at$$

The differential equation of population is:

$$dp/p = (r_1 + at)dt$$

And its primary function is:

$$\int dp/p = \int (r_1 + at)dt$$

$$P_t = P_0 e^{r_t + (\frac{1}{2}a)t^2}$$

Therefore the equation of time change of the population would be:

By using the above equation, the growth rate of population and the rates of raise and fall in the growth rate in different census periods, the time series data of the population over ۱۴ years of age has been estimated.

۴- Empirical test

At first, the logarithms of the variables were calculated and then the stationary test was performed on the logarithm of all the variables. Based on the Augmented Dicky-Fuller (ADF) test, none of the variables were stationary. Thus, their first order difference was calculated and once again were tested, where the first order difference of all variables were stationary. Table (۴, ۱) shows the average growth, standard deviation and correlation coefficients of the real variables with other variables under consideration. It is observed that variables of the world oil price, government expenditures, imports of intermediate and capital goods and demand deposits of individuals at banks have a high correlation with Gross National Product.

Table ۴-۱

i) Average rate of growth and standard deviation of variables

Variables	Average Growth	Standard Deviation
DLNNP _۱ .	۰,۴۳	۱۰,۹۹
DLGE _۱ .	۶,۳۳	۱۷,۷۸
DLPOO _{۱,۴}	۱,۳	۲۹,۲۷
DLMKV _{۱,۴}	۴,۰	۲۶,۶۳
DLPOP _{۱,۴}	۳,۰۴	.۷۲
DLM _{۱,۴} .	۰,۳۴	۱۴,۱۴
DLDM _{۱,۴} .	۷,۴	۱۳,۲۶
DIDM _{۱,۴} .	۲۰,۶۲	۴,۷۰

ii) Correlation coefficients of the variables:

	DLGNP _۱	DLGE _۱	DLPOO _۸	DLMKV _۸	DLPOP _۱
DLGNP _۱	۱	-	-	-	-
DLGE _۱	.۷۴	۱	-	-	-
DLPOO _۸	.۴۹	.۳۳	۱	-	-
DLMKV _۸	.۰۸	.۰	.۲۶	۱	-
DLPOP _۱	-.۱۶	-.۲۴	.۰۷	-.۲۱	۱
DLM _۱	.۰۹	.۰۹	.۱	.۰	.۰۰
DLDM _۱	.۶۴	.۰۱	.۴۲	.۳۷	.۰۱
DLDM _۲	.۲۳	.۱۶	.۳۰	.۰۹	-.۰۳

۴-۱- Estimation of the model

According to the results obtained from the Augmented Dickey-Fuller test, entailing the non-stationary characteristics of all variables in the various levels, and being stationary in their first order difference, all regressions were fitted on the first order difference of the variables. Based on the significance of coefficients and taking the other considerations while selecting a model, the best models have been selected and the results are reported in table (۴-۲).

In order to study the effect of the lagged growth rate of GNP, first we assumed it as the explanatory variables.

The first column shows the results of using two lags of the growth of GNP as the explanatory variable. It is observed that the first lag of growth of GNP is significant and the second lag is also significant at the ۸٪ level. Effect of these lags is positive on the growth of GNP.

The R^۲ of the model is trivial (۱۶٪) which indicates that these variables only explain ۱۶٪ of the growth of GNP.

The second column shows the effect of the world oil price variable together with the first lag of GNP on the growth rate of GNP. The effect of these variables are significant with R^2 of ۲۸%.

In the third column the variables of government expenditures and its lags have been added to the model. The current quantities and the first to fourth lags of this variable have been significant. The effect of the current quantities and the first and second lags of this variable on the GNP have been positive and the effect of third and fourth lags are negative. It can be argued during this time; that the intensity of the effect of the variable is reduced. Since the regression is conducted on the growth rate of the variable, the negative coefficient does not mean the reduction of GNP, but it reduces the intensity of the growth rate of GNP. The positive effect of government expenditures on GNP in the long run and under certain conditions may be reduced due to the reduction of other components such as private investment. This issue depends to a great extent on the method of financing government expenditures. In Iran, the share of tax revenue in financing government expenditures is trivial and the main financing means is oil revenue and borrowing from the Central Bank. The procurement of government expenditures through these methods expands the monetary base and increases the money stock, which by itself causes the increase of price levels and inflation.

Creation of inflation on one hand brings about the increase of the interest rate of the (non-official) market and reduction of the investment in the private sector and on the other hand, gives rise to the lack of confidence and instability in the economic environment which in turn diverts the orientation of private sector savings from productive and long term activities toward short term and speculative activities.

The significance of these two lags (third and fourth) was tested by omitting them from the regression equation and performing the F test. The null hypothesis concerning the zero coefficient of these two variables has been rejected.

The great effect of the government expenditures on the growth of GNP can be attributed to the vast role of the government in the

economy of the country during the past ۴۰ years. By adding this variable into the model R^2 rose to ۷۲%.

By adding the variable of the population growth over ۱۴ years age into the model, the effect of current and lagged quantities of this variable was studied. The results are reported in column ۶. As it is observed, the effect of the current value of this variable on the growth of GNP is significant. The growth of the population over ۱۴ years of age can be studied with regard to the labor supply as a real influential variable. The size of the coefficient of this variable as compared with other coefficients seems to be large; however, in the models in which this variable has been used, a large coefficient was obtained. But based on the conducted studies, it seems that there is a less variable part in the growth of GNP whose effect is reflected in the population coefficient. Therefore one should deal with the real size of this coefficient cautiously.

Other real variables which were added to the model were the variables of tax revenue and the ratio of tax revenue to GNP as the criteria for the effect of government tax policies on the output growth. Each of them was added to the model separately and due to the fact that the effect of neither of them was significant, they were excluded from the report.

Lack of statistical significance of these variables can be sought in the lack of influence of private sector in the economy and the petty portion of tax revenue in the government income. In column (۷), the effect of adding the variable of growth of capital and intermediate imported goods has been recorded. The current value of the variable of growth of intermediate and capital imported goods is significant and has a positive effect on the growth of GNP. With regard to the nature of Iranian industries and their dependence on foreign imports of raw materials and investment equipment, the positive effect of the growth of import of capital and intermediate goods on the growth of GNP is justifiable and the fluctuations of this variable can have effect on the supply side.

The effect of the variable of the difference of foreign exchange rate in the free and official market divided by official rate multiplied by one

hundred, and also four dummy variables were not statistically significant and their results were not reported.

Table (۴-۲)
The effect of the growth of real variables on the growth of GNP

Explanatory Variables	(۱)	(۲)	(۳)	(۴)	(۵)	(۶)
DLGNP _t . (-۱)	.۳۹۱۲ (۲,۴)	.۴۸۷۳ (۳,۸۹)	-	-	-	-
DLGNP _t . (-۲)	.۲۶۹۳ (۱,۶۶)	-	-	-	-	-
DLPOO _t	-	.۱۶۳۴ (۳,۱)	.۰۸۰۰ (۲,۰۷)	.۰۵۰۸ (۱,۲۹)	.۰۹۶۳ (۲,۶)	.۰۷۷۳ (۲,۲۷)
DLGE _t .	-	-	.۳۶۶۸ (۵,۰۶)	.۲۵۸۰ (۳,۰۸)	.۳۴۲ (۵,۲۲)	.۰,۲۵۲۷ (۳,۷۸)
DLGE _t . (-۱)	-	-	.۱۳۶۶ (۱,۸۴)	.۰۰۳۷ (.۴)	.۱۳۰۹ (۲,۰۴)	.۱۱۱۱ (۱,۸۴)
DLGE _t . (-۲)	-	-	.۲۶۰۹ (۳,۰۵)	.۱۹۰۴ (۲,۶)	.۲۴۹۳ (۳,۷)	.۲۷۶۸ (۴,۰۲)
DLGE _t . (-۳)	-	-	-.۱۶۶ (-۲,۴)	-	-.۱۸۲ (-۲,۹)	-.۱۳۹ (-۲,۴)
DLGE _t . (-۴)	-	-	-.۱۱۰ (-۱,۷)	-	-.۱۴۶ (-۲,۳)	-.۱۰۰ (-۲,۸)
DLPOP _t	-	-	-	-	.۹۳۷۶ (۲,۸۴)	.۸۸۸۹ (۳)
DLMKV _t	-	-	-	-	-	.۱۰۸۲ (۲,۸)
R ^۲	.۱۶	.۲۸	.۷۲	.۶۱	.۷۶	.۸۱
F	۷,۶۷	۱۵,۶	۱۷	۲۰,۲۴	۱۹	۲۱,۴۶
D-W	۱,۹۴	۱,۸۹	۱,۲۴	۱,۲۴	۱,۶۸	۱,۸۷

The figures inside the parentheses are the t statistic.

The column (۶) is the final result of this section. It indicates that the real variables explain ۸۱% of the changes of the growth of GNP. The growth of variables of the world oil price, the government

expenditures and its lags, the population over ۱۴ years of age and the imports of capital and intermediate goods have a significant effect on the growth of GNP.

One of the reasons for insignificance of lags of variables can be related to annual presentation of this data. If seasonal data were available; the results might have been different.

۴-۲- Monetary variables

In order to study the effect of outside and inside money on the growth of the GNP, the variables of demand deposits ($DM^1_{i,t}$), and the total deposits of individuals in the banks (demand deposits, saving and time deposits) ($DM^2_{i,t}$) were used as the criterion for inside money and the variable of currency ($DM^3_{i,t}$) as the criteria for outside money. Once the model was estimated by using these variables and the lags of the GNP to study the effect of these variables in the absence of real shocks. Then once again the model was estimated with the presence of these variables and real variables to consider the effect of these variables.

Table (۴-۲) shows the best results from the usage of above mentioned monetary variables and lag variable of the GNP. Column (۱) shows the related results by using the variable of growth of currency in the model. The first and second lags are significant and the current value is also significant at the level of ۱۹%. The sum of these coefficients are trivial which is compatible with the real business cycle theory concerning the lack of relation between outside money and output. The whole variables justify ۲۰% of the changes of output growth. Column (۲) shows the respective results of using the variable of demand deposits of individuals in banks. The current value of this variable is statistically significant and has a positive effect on the growth of GNP. The large and positive coefficient of this variable can be due to the change of the composition of money stock in favor of demand deposits within the period of study, at the beginning of the period to the end of the period. These variables explain ۲۲% of the variation of output growth.

Column (۳) shows the results related to using the variable of growth of total deposits of individuals in banks. The current value and the second lag of this variable are statistically significant and its first and third lags are also significant at ۱۹% and ۲۲% respectively. Totally, these variables explain ۲۶% of the change of output growth.

Column (۴) shows the obtained results of using the two variables of currency and demand deposits of individuals in banks. The effect of the current value of the variable of currency is not statistically significant, but the effect of the first and second lags of this variable is significant. These variables totally explain ۵۳% of the variation of output growth.

Column (۵) shows the results with the presence of the variable of currency and the total deposits of individuals in banks. The effect of these variables is not statistically significant.

Table (۴-۳)

The effect of the growth of monetary variables on the growth of GNP

Explanatory Variables	(۱)	(۲)	(۳)	(۴)	(۵)
DLGNP _t . (-۱)	.۶۴۶۲ (۴,۲۴)	.۲۴۹۲ (۱,۵۷)	.۴۷۳۲ (۳,۲۷)	.۴۵۶۴ (۳,۴۲)	.۶۷۸۱ (۴,۸۶)
DLM _t .	.۲۰۳۱ (۱,۳۴)	-	-	-.۰۲۳۵ (-۰,۱۷)	-.۲۲۵۷ (-۱,۶۷)
DLM _t . (-۱)	.۴۵۶۷ (۲,۹۸)	-	-	.۱۰۸۴ (.۶۹)	.۴۱۹۷ (۳,۰۵)
DLM _t . (-۲)	.۲۹۱۲ (۲,۱)	-	-	.۲۹۵۶ (۲,۶۹)	.۲۹۶۵ (۲,۳۸)
DLDM _t .	-	.۴۷۷۱ (۲,۹۳)	-	.۵۳۰۱ (۴,۵۳)	-
DLDM _t .	-	-	.۲۶۵۹ (۳,۵۵)	-	.۳۵۰۸ (۲,۴۷)
DLDM _t . (-۱)	-	-	.۰۲۸۳ (۱,۳۳)	-	.۰۱۷ (.۹۸)
DLDM _t . (-۲)	-	-	.۰۵۴۱ (۲,۲)	-	.۰۳۶۴ (۲,۳۳)
DLDM _t . (-۳)	-	-	.۰۲۴ (۱,۲۶)	-	-
AR(۱)	-	-	-	.۳۱۷۷ (۱,۶۴)	-

R ^۲	.۲۰	.۲۷	.۲۷	.۰۳	.۰۴
F	۰	۱۴,۴۶	۴,۲۱	۸,۹	۰
D-W	۲,۰۸	۱,۹	۲,۲۲	۱,۸۱	۲,۰۶

The figures inside the parentheses are the t statistic.

As it is observed, with the presence of real variables in the regression equation, the maximum level of significance of monetary variables is just ۹% and introducing the monetary variable into the model does not add to its explanatory power considerably.

Table (۴-۴)
The effect of the growth of monetary and non- monetary variables on the growth of GNP

Explanatory Variables	(۱)	(۲)	(۳)	(۴)	(۵)
DLPOO _{Δt}	.۰۷۶۶ (۲,۲۵)	.۰۶۸۶ (۲,۰۷)	.۰۷۳۱ (۲)	.۰۶۷۷ (۲,۰۴)	.۰۷۳۵ (۲)
DLGE _{Δt}	.۲۶۶۹ (۳,۸۹)	.۲۲۱۱ (۳,۳۱)	.۲۴۶۴ (۳,۵)	.۲۳۵۶ (۳,۴۵)	.۲۶۱۸ (۳,۶)
DLGE _{Δt} (-۱)	.۰۹۳۵ (۱,۴۷)	.۱۲۷۲ (۲,۱۶)	.۱۱۱۸ (۱,۸۲)	.۱۰۸۸ (۱,۷۷)	.۰۹۴۵ (۱,۴۶)
DLGE _{Δt} (-۲)	.۲۷۲۶ (۴,۴۳)	.۲۴۳۴ (۳,۹۳)	.۲۷۸۲ (۴,۴۶)	.۲۳۸۴ (۳,۸۴)	.۲۷۳۸ (۴,۳۶)
DLGE _{Δt} (-۳)	-.۱۶۱۶ (-۲,۹)	-.۱۴۸ (-۲,۵۶)	-.۱۲۹۹ (-۲,۰۴)	-.۱۷۲۵ (-۲,۸۴)	-.۱۵۴۴ (-۲,۲۱)
DLGE _{Δt} (-۴)	-.۱۷۵ (-۲,۹)	-.۱۴۰۴ (-۲,۵۶)	-.۱۶۰۶ (-۲,۷۱)	-.۱۶۱۳ (-۲,۷۶)	-.۱۷۸۶ (-۲,۸۴)
DLMKV _{Δt}	.۱۰۴۴ (۲,۶۸)	.۰۹۴ (۲,۴۷)	.۱۱۰۲ (۲,۷۸)	.۰۸۹۷ (۲,۳۴)	.۱۰۵۹ (۲,۶۴)
DLPOP _{Δt}	.۸۵۴ (۲,۸۵)	.۶۳۶۹ (۱,۹۹)	.۸۸۲۶ (۲,۹۳)	.۵۹۴۹ (۱,۸۵)	.۸۵۰۴ (۲,۷۹)
DLM _{۰Δt}	.۰۸۰۵ (.۹۳)	-	-	.۰۸۵۶ (۱,۰۳)	.۰۷۸۱ (.۸۸)
DLM _{۱Δt}	-	.۱۴۲۳ (۱,۷۶)	-	.۱۴۱۵ (۱,۷۹)	-
DLM _{۲Δt}	-	-	.۰۰۳ (.۳۵)	-	.۰۰۲۲ (.۲۶)
R ^۲	.۸۱	.۸۲	.۸۰	.۸۲	.۸
F	۱۸,۷۸	۲۰,۶۱	۱۸,۱۸	۱۸,۴۷	۱۶,۲
D-W	۲,۰۲	۱,۹۷	۱,۸۷	۲,۰۷	۲,۰۲

The figures inside the parentheses are the t statistic.

۵- Concluding remarks

The motivation to conduct this research was to determine the factors affecting the business cycles in the economy of Iran. For this purpose, based on the Boschen and Mills study (۱۹۸۸), within the framework of the theory of the RBC, a series of variables affecting the business

cycles in the economy of Iran were identified and estimated. Based on the obtained results, the variables of world oil price, government expenditures, population over fourteen years of age, the imports of intermediate and capital goods all have had a significant effect on the business cycles in Iran at the time period of ۱۹۰۹-۱۹۹۹. The set of these variables have explained ۸۲٪ of the growth of the GNP. Introducing the monetary variables including currency, demand deposits and total deposits of the individuals in the banks into a model with the presence of real variables have not increased the explanatory power of the model considerably. Therefore, it is concluded that the factors affecting on the economic fluctuation of Iran in the time period under investigation have been non-monetary factors and supply side parameters.

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