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THE EFFECT OF A DELAY IN GOVERNMENT RECEIPTS ON THE GOVERNMENT BUDGET DEFICIT AND INFLATION OF IRAN (1963-1992)

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ABSTRACT

This paper examines the idea that the rate of inflation tends to increase nominal government expenditures faster than government revenues. It concludes that while government expenditures rise concurrently with inflation, real government revenues tend to fall based on collection lags. Empirical results using time series data for Iran support our expectations in which the longer is the delay in government domestic revenues, the higher will be the inflation. In addition, the fiscal deficit should increase money supply, resulting in more inflation. The implication of the study conducted here is that a passive fiscal policy based upon inflation is dangerous. To control inflation, budgetary authorities should reduce substantially the government budget deficit. Furthermore, the tax administration is apparently responsible to give priority to reforming the tax revenue system.

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1. Introduction

The major purpose of this paper is to recognize factors that cause economic problems such as the government budget deficit, monetary supply growth, and inflation. The observation that inflation reduces real revenues when there are lags in tax collection had a long background in the literature (Mourmouras and Tijerina, 1994). Our attempt will be to develop a theoretical model to indicate that a deterioration in government revenues may lead crucially to a fall in financial resources of the budget deficit. In other words, the monetary expansion will deteriorate real government revenues, and while we consider real government payments, the budget deficit will expand so that the financing budget by the monetary expansion becomes more restricted. In addition, any attempt for providing financial resources of the budget deficit will cause inflation to grow up substantially.

Actually, the present paper is concerned with the two following assumptions:

a) A delay in earning government receipts should expand the budget deficit and inflation and thus decrease the real values of government receipts, whereas government payments ought to happen without any postponement.

b) The government budget deficit should increase money supply, which is one of the most important factors of increasing the price level.

As a result, our attempt is to focus on modelling relationships among our major macroeconomic variables, prices, government revenues, government payments, and money supply, which deal with above assumptions. In section II we draw a framework of the conceptual model that incorporates these relationships. Results obtained by estimating coefficients of the model will be analised in section III. Finally, section IV represents concluding remarks.

2. The Framework of the Conceptual Model

There are two quite different approaches, views based on monetary economics and the cost- pushed approach, which often verify reasons of inflationary pressures and government budget deficit. However, various approaches can be found between these two extremes. Monetary economies, on the one hand, realize inflation as a monetary phenomenon being only affected by money supply. On the other hand, economists based on the cost- pushed approach believe that sources of inflationary pressures are basically non- economics. According to them, social and political forces as well as worker units can be the major determinants of inflation.

Most countries, particularly developing countries, have experienced widely economic problems such as the increasing rate of inflation and ample budget deficit in recent decades. This has led, of course, to a broad range of researches finding out causes and effects of these problems. Aghveli and

Khan (1978) have investigated the existence of bilateral relationships between inflation and government deficits in developing countries. An equation system presented by these authors indicate relationships among the general level of prices, government expenditures, government revenues and money supply. Their model is as follows:

$$\text{Log}\,P_t = -\lambda\alpha_0 - \lambda\alpha_1\,\text{Log}\,GDP_t + \lambda\alpha_2\pi_t^* - (1-\lambda)\,\text{Log}\,(M/P)_{t-1} + \text{Log}\,M_t \qquad (1)$$

$$\text{Log}\,GE_t = \gamma\beta_0 + \gamma\beta_1\,\text{Log}\,GDP_t + (1-\lambda)\,\text{Log}\,(GE/P)_t + \text{Log}\,P_t \qquad (2)$$

$$\text{Log}\,GR_t = \delta\theta_0 + \delta 1\theta_1\,(\text{Log}\,GDP_t + \text{Log}\,P_t) + (1-\delta)\,\text{Log}\,GR_{t-1} \qquad (3)$$

$$\text{Log}\,M_t = k_0 + k_1\,\text{Log}\,GE_t - k_2\,\text{Log}\,GR_t + k_3\,\text{Log}\,E_t + \text{Log}\,m_t \qquad (4)$$

where endogenous variables in the model are defined as:
P = domestic prices,
GE = nominal government expenditures,
GR = nominal government revenues,
M = nominal money supply,
π^* = expected inflation rate.
The model also includes the following exogenous variables:
GDP = real gross domestic product,
m = money multiplier,
E = residual items including changes in foreign reserves, changes in central bank's claims on the private sector, the stock of high-powered money in the previous period, errors as a result of the difference between changes in central bank's claims and government foreign exchanges, and finally government budget deficit.

Having used a simultaneous equation system, Aghveli and Khan (1978) estimate the model and examine the stability of the equation system for relevant countries. However, because of the different structure of economic and social conditions, this model may not be applied for oil- exporting countries including Iran. According to the theoretical and empirical studies conducted before, a bilateral relationship between inflation and budget deficit has been modeled simultaneously.

In addition, in most developing countries, where many financial assets are not available as an alternative to money, the substitution between money and physical assets becomes more important. Thus the relevant option is the rate of return on physical assets or goods, namely the expected inflation rate, and the rate of return on financial assets can be ignored. Since the expected inflation rate in the aforementioned model is not observable, the

actual rate of inflation is thus considered as an appropriate alternative derived by using the adaptive expectations method.

Expectations of inflation are assumed to be generated by Cagan's (1956) adaptive expectations model. Inflationary expectations are revised proportionally to the difference between the actual rate of inflation and its expected rate formed in the previous period:

$$\pi_t^o = \psi \left[\left(P^o / P_t \right)_{t-1} - \pi_{t-1} \right] \tag{5}$$

or

$$\Delta \pi_t = \psi \left[\Delta \operatorname{Log} P_{t-1} - \pi_{t-1} \right] \tag{6}$$

where $0 \leq \psi \leq 1$ (Tayyebi 1996). Rearranging Eq. (6), the determination of the actual inflation rate in the current period, π_t will be as follows:

$$\pi_t = \psi \Delta \operatorname{Log} P_{t-1} + \left(1 - \psi \right) \pi_{t-1} \tag{7}$$

In order to specify an equation for prices, we first formulate the demand for real money balances $(M/P)^D$ as a function of real income (real GDP) and the actual inflation rate (π). Therefore the demand for real money balances is specified in a log- linear equation as:

$$\operatorname{Log} (M/P)_t^D = \alpha_0 + \alpha_1 \operatorname{Log} GDP_t - \alpha_2 \pi_t \tag{8}$$

where $\alpha_1, \alpha_2 > 0$.[1] Following Aghevli and Khan (1978), we postulate the actual stock of real money balances adjusts proportionally to the difference between the demand for real money balances and the actual stock in the previous stock as follows:

$$\Delta \operatorname{Log} (M/P)_t = \lambda \left[\operatorname{Log} (M/P)_t^D - \operatorname{Log} (M/P)_{t-1} \right] \tag{9}$$

where λ shows the adjustment coefficient, $0 < \lambda < 1$. Substituting Eq. (8) into Eq. (9) and solving for the level of real money balances, we are able to obtain the price equation as:

$$\operatorname{Log} P_t = -\lambda \alpha_0 - \lambda \alpha_1 \operatorname{Log} GDP_t + \lambda \alpha_2 \pi_t - \left(1 - \lambda \right) \operatorname{Log} (M/P)_{t-1} + \operatorname{Log} M_t \tag{10}$$

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1. This is because for reasons of convenience, that is, elasticities can be obtained directly from the logarithmic specification. See also Frenkel (1977) and Aghevli and Khan (1978).

Based on monetary wiews about the inflationary process, the coefficient variable of liquidity, Log M_t, in the price equation is limited to unity, indicating that the liquidity growth follows a proportional increase in price levels. More specifically, a 1 percent increase (decrease) in liquidity will lead just a 1 percent increase (decrease) in the price level.

Changes in Iranian government revenues are dependent of movements in production and the world price of oil. This is because a large amount of such incomes come from exporting oil by the country, denominated in foreign exchange. Since the oil prices are determined officially outside Iran, government oil revenues should be exogenous (Motamed 1979 and Vaez-Zadeh 1989), whereas government domestic revenues (GR) will be related to non- oil revenues. Hence total domestic government revenues, comprising both direct and indirect taxes, can be only a positive function of non- oil income.

The coefficient variable fo prices, log P_t, in both government expenditure and revenue equations is also restricted to unity because the government is always trying to keep the balance between its nominal domestic payments and receipts in the favour of an increase in prices. Some studies of Iran and other oil- exporting countries (such as Aghveli and Sassanpour 1982 and Vaez- Zadeh 1989) have shown that the level of government expenditures in each period is established in such a way as to move toward a balanced budget policy over time.

As discussed in Choudhry (1991), lags in the collection of taxes can be represented by delays between the accrual and payment of taxes. Kiguel (1989) also argues that the real value of government revenues falls during inflationary periods while nominal government expenditures tend to move equivaleritly with inflation. Since the the shares of the various categories of tax revenue can increase, decrease, or remain unchanged with an increase in inflation, the average lag in tax collection may change with inflation. According to Choudhry (1991), therefore, real government expenditures (GE/P) and real government revenues (GR/P) can be expressed in terms of actual inflation (π):

$$(GE/P)_t = GE(0)\, e^{g\pi_t} \tag{11}$$

and

$$(GR/P)_t = GR(0)\, e^{-\gamma\pi_t} \tag{12}$$

where GE(0) and DR(0) stand for real government expenditures and real government revenues at the price level (P(0)=1.0) at time t=0,

respectively. The coefficients g and γ are the average lags in collection of taxes.

An increase in the fiscal deficit (GE - GR) is assumed to lead a change in the stock of money supply (M). This would be true because government deficit is often financed by borrowing from central bank or by borrowing abroad. There is thus a positive relationship between money supply and fiscal deficit. Money supply can be aslo affected by changes in international reserves (changes in values of imports and exports), changes in the central bank's claims on the government, and changes in the central bank's claims on the private sector and commercial banks (Aghveli and Khan 1977). Hence an equation is specified by considering a log- linear relationship between money supply and these variables, presented below in Eq. (16).

Overall, a simultaneous equation system used in the present research has been specified in logarithmic form and outlined as follows:

$$\text{Log}\,P_t = -\lambda\alpha_0 - \lambda\alpha_1\,\text{Log}\,GDP_t + \lambda\alpha_2\pi_t - (1-\lambda)\,\text{Log}\,(M/P)_{t-1} + \text{Log}\,M_t \quad (13)$$

$$\text{Log}\,GE_t = g_0 + g_1\,\text{Log}\,GDP_t + g_2\pi_t + \text{Log}\,P_t \quad (14)$$

$$\text{Log}\,GR_t = \gamma_0 + \gamma_1\,\text{Log}\,YNO_t - \gamma_2\pi_t + \text{Log}\,P_t \quad (15)$$

$$\text{Log}\,M_t = k_0 + k_1\,\text{Log}\,GE_t - k_2\,\text{Log}\,GR_t + k_3\,\text{Log}\,IM_t + k_4\,\text{Log}\,E_t \quad (16)$$

where the λ parameter is the adjustment coefficient in the price equation. As discussed previously, g_2 and λ_2 are the delay time coefficients in the both government expenditure equation (Eq. 14) and government revenue equation (Eq. 15), respectively.

Endogenous variables in the model are then defined as:

P = general level of prices (GDP implicit index),

GE = nominal government expenditures,

GR = nominal domestic government revenues,

M = nominal money supply (liquidity volume of the private sector),

The model also include the following exogenous variables:

GDP = real gross domestic product,

π = actual inflation rate (growth rate of GDP implicit index),

$(M/P)_{t-1}$ = lagged real money supply,

YNO = non- oil income in the factor price,

IM = total imports,

E = residual terms containing the private sector exports, credit flows devoted to the private sector, changes in international reserves (changes in values of imports), changes in the central bank's claims on the government,

and changes in the central bank's claims on the private sector and commercial banks. etc.

3. estimation Results

Since the basic model given by Equations (13) - (16) is linear, we estimate it by the 3SLS (three stage least squares) method using time series data over the period 1963 - 1992.[1] This method allows us to take into account all a priori restrictions inherent in the specification. The estimation results are summarized as follows:

$$\underset{}{\text{Log}\,P_t} = \underset{(3.51)}{0.94} - \underset{(-5.61)}{0.26}\,\text{Log}\,GDP_t + \underset{(5.16)}{0.38}\,\pi_t - \underset{(-37.1)}{0.84}\,\text{Log}\,(M/P)_{t-1} + \text{Log}\,M_t \quad (17)$$

$$R^2 = 0.998 \qquad S.E. = 0.044$$

$$\text{Log}\,GE_t = \underset{(-0.86)}{-1.21} + \underset{(6.11)}{0.97}\,\text{Log}\,GDP_t + \underset{(1.19)}{0.64}\,\pi_t + \text{Log}\,P_t \quad (18)$$

$$R^2 = 0.959 \qquad S.E. = 0.322$$

$$\text{Log}\,GR_t = \underset{(-0.03)}{-0.03} + \underset{(7.60)}{0.78}\,\text{Log}\,YNO_t - \underset{(-1.50)}{0.69}\,\pi_t + \text{Log}\,P_t \quad (19)$$

$$R^2 = 0.970 \qquad S.E. = 0.270$$

$$\text{Log}\,M_t = \underset{(-8.1)}{-0.64} + \underset{(12.02)}{0.57}\,\text{Log}\,GE_t - \underset{(-3.60)}{0.63}\,\text{Log}\,GR_t - \underset{(-1.80)}{0.11}\,\text{Log}\,IM_t + \underset{(10.80)}{1.16}\,\text{Log}\,E_t \quad (20)$$

$$R^2 = 0.997 \qquad S.E. = 0.090$$

where in the estimated equations t- values are reported in parentheses. R^2 and S.E. are the coefficient of determination and the standard error of the estimated equation respectively.

Based upon the statistical tests the estimation results are mostly acceptable, and the model captures the required features of the Iranian economy. The empirical results indicate that the equations of the model perform well. All of the coefficients have the correct and expected signs, and are similar to the aforementioned theoretical assumptions. The values of

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1. The Iranian Calendar year starts on March 21 each year and ends March 20 the following year. By adding 621 to the Iranian year, we convert it to Gregorian Calendar. Thus, the Iranian year 1342, for instance, is equated with 1963.

t-statistic indicate that most variable coefficients are statistically significant at the 5 percent level.[1]

Considering the price equation, we find that an increase in real GDP would decrease the price level while an increase in inflation would lead to a rise in it. Also, the higher the previous period's stock of real money balances, the lower would be the current price level.

Estimated values for the coefficients of the intercept, log GDP_t and π_t in the price equation indicate respectively the multiplication of the adjustment coefficient λ by individual coefficients α_0, α_1, and α_2. The estimated value for the lagged real money balances, log $(M/P)_{t-1}$, shows the deviation of the adjustment coefficient λ from unity, $(1-\lambda)$. Therefore, obtaining the value for λ ($\lambda = 0.16$) through $(1-\lambda) = 0.84$, we can calculate easily the estimated values for the individual coefficients α_0, α_1, and α_2, the original coefficients of real money balances shown in Eq. (8). They are equal to -5.9, 1.6 and 2.4, respectively. The weighted mean lag of the real money balances is equal to 5.25 year, which is derived directly from $(1-\lambda/\lambda)$.

According to the results obtained from the estimated equations of government expenditures and revenues [Eqs. (18) and (19)], the effect of income on government expenditures and revenues is positive and highly significant. As estimation results represent, although insignificant, the average lags in earning government receipts is about 0.7 of year (8.4 months), while the average lags in government payments is about 0.64 of year (7.7 months). According to the assumptions previously described, it is expected that the average delays in government domestic receipts is more than that in government payments.

In addition, the insignificant coefficient of the inflation rate variable in the government revenue equation reveals the fact that a number of political and economic episodes occurred during the period under consideration. The economy experienced a sharp rise in the oil price and then a huge growth in its foreign exchange reserves since 1971, Islamic revolution in 1979, and the commencement of the eight- year Iran- Iraq war in 1980. As a result, the model is re- specified with the inclusion of an appropriate dummy variable (DUM) in the following section, persusing the impacts of such events on the structure of the Iranian economy.

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1. However, with an exception, the coefficient of the inflation rate variable is not significant in both government expenditure and revenue equations.

In the estimated money supply equation, Eq. (20), all coefficients are significant at the 5 percent significance level except the coefficient of imports[1]. Nevertheless, all these estimated coefficients have the expected signs and are by no means negligible. The higher value of the government expenditure elasticity reflects the swift monetization that is taking place in the country. As a whole the specification of money supply seems to be quite acceptable.

A dummy variable (DUM) is concerned with the unity value for the period 1979-1992 and the zero value for the remaining years of the period under consideration (i.e. 1963-1978). Estimation results obtained for the re-specified model are represented as below:

$$\underset{}{\text{Log}\,P_t} = \underset{(5.30)}{1.20} - \underset{(-3.60)}{0.32}\,\text{Log}\,GDP_t + \underset{(5.20)}{0.40}\,\pi_t - \underset{(-13.1)}{0.80}\,\text{Log}\,(M/P)_{t-1} \qquad (21)$$

$$- \underset{(-0.55)}{0.03}\,DUM_t + \text{Log}\,M_t$$

$$R^2 = 0.998 \qquad \text{S.E.} = 0.047$$

$$\text{Log}\,GE_t = \underset{(-5.0)}{-5.10} + \underset{(12.30)}{1.43}\,\text{Log}\,GDP_t + \underset{(1.09)}{0.40}\,\pi_t - \underset{(-4.55)}{0.40}\,DUM_t + \text{Log}\,P_t \qquad (22)$$

$$R^2 = 0.960 \qquad \text{S.E.} = 0.21$$

$$\text{Log}\,GR_t = \underset{(-3.3)}{-2.60} + \underset{(11.40)}{1.11}\,\text{Log}\,YNO_t - \underset{(-2.50)}{0.73}\,\pi_t - \underset{(-5.98)}{0.57}\,DUM_t + \text{Log}\,P_t \qquad (23)$$

$$R^2 = 0.980 \qquad \text{S.E.} = 0.18$$

$$\text{Log}\,M_t = \underset{(-3.9)}{-0.84} + \underset{(5.80)}{0.78}\,\text{Log}\,GE_t - \underset{(-2.90)}{1.04}\,\text{Log}\,GR_t - \underset{(-2.50)}{0.20}\,\text{Log}\,IM_t \qquad (24)$$

$$+ \underset{(5.46)}{1.4}\,\text{Log}\,E_t - \underset{(-1.07)}{0.17}\,DUM_t$$

$$R^2 = 0.990 \qquad \text{S.E.} = 0.13$$

Obviously, all estimated coefficients have correctly expected signs.

1. However, the estimated coefficient of imports is statistically significant at the 10 percent of significance level.

Furthermore, with the exceptions of dummy variable in the both price and money supply equations and the coefficient of the inflation rate in the government expenditure equation, other coeficients are statistically significant at the 5 percent level. The insignificant coefficients of the dummy variable implies that the direct effects of the structural changes in the post-revolutionary period on the price level and money supply have been negligible. The insignificant inflation rate coefficient in the government expenditure equation supports the hypothesis in which there has been no delay in the government payments over the period. Again, the new values for the adjustment as well as individual coefficients, λ, α_0, α_1, and α_2 are about 0.2, -6, 1.6 and 2, respectively.

From the estimated price equation presented in Eq. (21), we find that the long- run estimated income elasticity of the demand for real money balances equals about 1.6. Hence a 1 percent rise (fall) in real GDP will lead to a 1.6 percent rise (fall) on average in the demand for real money balances. The long- run expected inflation rate is also about -2, implying that a 1 percent increase (decrease) in the expected inflation rate will cause the demand for real money balances to decrease (increase) by 2 percent on average. Furthermore, an average delay for the real money balances is about 4 years. It means the period required is about 4 year on average to adjust completely any disequilibrium between the demand for real money and its real stock.

The income elasticity of government expenditures is about 1.43. Thus, due to the growth in real GDP over the period in accordance with the inclusion of the dummy variable, government expenditures have inceased relatively in comparison with the previously estimated results. There is the same interpretation for the (non- oil) income elasticity of government revenues. Its estimated value obtained is about 1.11, much higher than that of the former results. In general, as expected, the significant income elasticities of government expenditures and revenues imply that both government expenditures and revenues would move proportionally with inflation.

The value of average lags in the adjustment of government expenditures is about 0.40 of year (4.8 months), given in Eq.(22). However, this coefficient is statistically insignificant, confirming the hypothesis that nominal government expenditures are adjusted automatically to keep pace with inflation. On the other hand, the adjustment coefficient is statistically significant with a value of about 0.73 in the government revenue equation (Eq. 23). An average delay in obtaining domestic revenues is about 8.8 months, which is more substantially than that in government expenditures. It means the lags in the adjustment of nominal revenues are generally longer.

In the country's inflationary condition, this has led to a sharp decline in the real value of such incomes causing the government budget deficit to widen. This result is a confirmation of one of our assumptions, namely, that the longer the lag in government domestic revenues, the higher will be be the inflation.

Finally, the significant coefficient of the dummy variable is obtained at about -0.57, indicating that structural changes over the post- revolutionary period has influenced substantially government domestic revenues to decrease relatively. The elasticities of both government revenues and expenditures in the money supply equation are respectively about 0.78 and -1.04, while the import elasticity in this equation is around -0.2. These values have increased roughly two times more than those of the former results [Eq.(20)].

4. Conclusions

In this paper a simple dynamic model was developed based on the idea that the rate of inflation tends to increase nominal government expenditures faster than government revenues. The basic assumption is that, while government expenditures rise simultaneously with inflation, government revenues tend to fall behind in real terms as a result of collection lags. Hence, the financing of the fiscal deficit would then raise money supply and produce more inflation.

The Iranian economy experienced considerable economic and social episodes (such as sharp fluctuations in the oil price, revolutionary movements, and war) during the period under consideration. The model was therefore re- specified regarding the inclusion of a dummy variable to explore how such events could affect the economy. It was demonstrated that it had sensible properties and more effectively estimation results compared to the previous estimation results. In particular, we found that mean lags in the adjustment of government expenditures were negligible in the both cases, while the corresponding revenue lags were importantly longer, resulting in higher deficits in the inflationary process. In general, the results confirmed our theoretical assumptions conducted in this study, and also supported the previous findings of Aghevli and Khan (1978) and Choudhry (1991).

The conclusion of the paper is that the country with longer revenue lags is the one that has higher inflation rates. Hence, conducting a passive fiscal policy on the basis of inflation should be dangerous. To control inflation, it is up to the authorities to reduce or eliminate budgetary deficit. In addition, the tax administration of the country should also give priority to reforming the tax revenue system.

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