The effect of inflation on government revenue and expenditure: the case of the Islamic Republic of Iran

Abbas Alavirad

Abstract

This paper provides an empirical analysis of the government budget deficit, money supply growth and inflation in the Islamic Republic of Iran. We use a simultaneous equation system to examine the effect of inflation on government revenue and expenditure, using quarterly data. Our major finding has been that the government budget deficit will increase in the inflationary condition. In addition, the deficit will increase money supply and this tends to increase inflation in Iran.

The author is from the Department of Economics, Islamic Azad University of Yazd, Safayieh, Yazd, Islamic Republic of Iran.

MANY ECONOMISTS argue that inflation is strictly a monetary phenomenon and that it occurs when the rate of growth of money supply is higher than the rate of growth of the economy. Furthermore, it also needs to be noted that the money/inflation relationship is a highly dynamic one, for the following reasons.

i) Inflation will cause the velocity of circulation to rise and even an intact level of money supply will generate more inflation.

ii) A rise in inflation will reduce the available inflation tax base for the government, and an attempt by the government to collect a given level of inflation tax revenue will bring forth an increase in the tax (inflation) rate.

iii) Inflation might cause budget deficits to rise (revenue to fall) due to the tax effect, and the pursuing monetisation could lead to even higher rates of inflation.

The observation that inflation reduces real revenue when there are lags in tax collection has a long background in the literature (Mourmouras and Tijerina, 1994). Our attempt will be to develop a theoretical model to indicate that monetary expansion will cause a deterioration in real government revenue and will seriously restrict the government in its ability to use a budget deficit policy. In other words, a deterioration in government revenue may lead crucially to a fall in the financial resources of the budget. In addition, any attempt at providing financial resources through increasing the budget deficit will cause inflation to grow substantially.

The present paper is concerned with the following three assumptions.

a) An increase in prices will lead to an increase in the budget deficit, through its effect on expenditure and government revenue.

b) The government budget deficit should increase money supply.

c) The growth of money supply should increase the price level.

This study aims at gaining an insight into the channels through which these occur. We attempt to focus on modelling relationships among our major macroeconomic variables, which deal with the above assumptions — prices, government revenue, government payments and money supply.

Section II of the study provides a brief review of the literature. A model is developed to study the relationship among the budget deficit, money supply and inflation. Section III contains a description of the empirical results. And section IV provides the conclusion.

1. Theoretical background of the conceptual model

There are two quite different extreme approaches — the view based on monetary economics and the cost-push approach — to tackling the subject of inflationary pressure and the government budget deficit. However, various approaches can be found between these two extremes. First, there is the monetarist claim that inflation is a purely monetary phenomenon and that, in the long run, the rate of inflation equals the rate of monetary expansion in excess of the growth of capacity output. This claim is expected to hold for market economics, including both developed and less developed countries (LDCs). And secondly, proponents of the cost-push approach believe that the sources of inflationary pressure are basically non-economic. According to them, social and political, as well as worker, units can temporarily impact upon the price level.

Most countries, particularly developing countries, have experienced big economic problems, such as an increasing rate of inflation and an ample budget deficit in recent decades. This had led, of course, to a broad range of research into the causes and effects of these problems. Studies on this issue have been carried out by De Silva (1977), Aghevli (1977), Aghevli and Khan (1978), Haan and Zelhorst (1990), Chaudhury and Parai (1991) for the LDCs, and Chaudhury and Ahmad (1995).

Aghevli and Khan (1978) have investigated the existence of bilateral relationships between inflation and the government deficit in developing countries. They have used an equation system to examine the relationships among the general level of prices, government expenditure, government revenue and money supply. Their model is as follows:

$$\log P_t = -\lambda\alpha_0 - \lambda\alpha_1 \log GDP_t + \lambda\alpha_2\pi_t^* - (1-\lambda)\log\left(M/P\right)_{t-1} + \log M_t \quad (1)$$

$$\log GE_t = \gamma B_0 + \gamma B_1 \log GDP_t + (1-\gamma)\log\left(GE/P\right)_{t-1} + \log P_t \quad (2)$$

$$\log GR = \delta\theta_0 + \delta\theta_1 (\log GDP_t + \log P_t) + (1-\delta)\log GR_{t-1} \quad (3)$$

$$\log M_t = K_0 + K_1 \log GE_t - K_2 \log GR_t + K_3 \log E_t + \log m_t \quad (4)$$

where endogenous variables in the model are defined as:

P = domestic prices
GE = nominal government expenditure
GR = nominal government revenue
M = nominal money supply
π^* = the 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 the 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 the central bank's claims and government foreign exchanges, and the government budget deficit.

Aghevli and Khan (1978) estimate the model and examine the stability of the equation system for relevant countries. However, because of the different structure of the economic and social conditions, this model may not be applied to oil-exporting countries, including the Islamic Republic of Iran. According to the theoretical and empirical studies conducted before, a bilateral relationship between inflation and the budget deficit has been modelled 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 in proportion to the difference between the actual rate of inflation and the expected rate, formed in the previous period:

$$\Delta\pi_t = \phi\left[\Delta \log P_{t-1} - \pi_{t-1}\right] \tag{5}$$

where $0 \leq \phi \leq 1$. Now we solve equation (5) to determine the actual inflation rate in the current period (π_t) and get:

$$\pi_t = \phi\Delta \log P_{t-1} + (1-\phi)\pi_{t-1} \tag{6}$$

The demand for real money balances equation is defined as:

$$\left(M/P\right)^D = f\left(GDP, \pi\right) \tag{7}$$

The demand for real money balances equation $\left(M/P\right)^D$ is given as in log forms, which include real income (GDP) and the actual inflation rate (π).

$$\log\left(M/P\right)_t^D = \alpha_0 + \alpha_1 \log GDP_t - \alpha_2 \pi_t \qquad \alpha_1, \alpha_2 > 0 \tag{8}$$

Following Aghevli and Khan (1978), we postulate that the actual stock of real money balances adjusts in proportion to the difference between the demand for real money balances and the actual stock in the previous stock, as follows:

$$\Delta \log\left(M/P\right)_t = \lambda\left[\log\left(M/P\right)_t^D - \log\left(M/P\right)_{t-1}\right] \qquad 0 < \lambda < 1 \tag{9}$$

Substituting (8) into (9) and solving for the level of real money balances and simplifying, we can write:

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

The variable of liquidity, log M_t, in the price equation is limited to unity, indicating that liquidity growth follows a proportional increase in price levels. The aforementioned issues, concerning the impact of money on prices and economic activity, can be fruitfully examined within a monetarist framework of the inflationary process.

According to Choudhoury (1991), lags in the collection of taxes can be represented by delays between the accrual and payment of taxes. As discussed in Kiguel (1989), the real value of government revenue falls during inflationary periods, while nominal government expenditure tends to move equivalently with inflation. Since 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. Based on both the aforementioned issues, real government expenditure $\left(GE/P\right)$ and real government revenue $\left(GR/P\right)$ can be in terms of actual inflation (π):

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

and:

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

where GE(0) and GR(0) stand for real government expenditure and real government revenue at the price level (P(0) = 1.0) at time t = 0, respectively. The

coefficient g is the average lag in government payments, and the coefficient γ is the average lag in earning government receipts.

As discussed in Aghveli and Khan (1978), a rise in the fiscal deficit (GE–GR) is assumed to lead to a change in the stock of money supply (M). This would be true, because the government deficit is often financed by borrowing from the central bank or from abroad. There is, thus, a positive relationship between money supply and the fiscal deficit. Money supply can be also affected by changes in foreign reserves, changes in the central bank's claims on the private sector and, finally, changes in the central bank's claims on the government. According to Aghveli and Khan (1978), the coefficient variable of liquidity ($\log m_t$) in the money supply equation is limited to unity. Hence, an equation is specified by considering a linear relationship between money supply and these variables.

So the complete model, simultaneous equation system, used in the present research has been specified in logarithmic and outlined as follows:

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

$$\log GE_t = g_0 + g_1 \log GDP_t + g_2\pi_t + \log P_t \quad (14)$$

$$\log GR_t = \gamma_0 + \gamma_1 \log YNO_t - \gamma_2\pi_t + \log P_t \quad (15)$$

$$\log M_t = K_0 + K_1 \log GE_t - K_2 \log GR_t + K_3 \log E_t + \log m_t \quad (16)$$

where the γ parameter is the adjustment coefficient in the price equation.

Endogenous variables in the model are then defined as:

P = the general level of prices (GDP implicit index)
GE = nominal government expenditure
GR = nominal domestic government revenue
M = nominal money supply

The model also includes the following exogenous variables:

GDP = real gross domestic product
π = actual inflation rate (growth of implicit index)
$\left(M/P\right)_{t-1}$ = lagged real money supply
YNO = non-oil income in the factor price
m = money multiplier
E = residual items, including changes in foreign reserves, changes in the central bank's claims on the private sector, and changes in the central bank's claims on the government

3. Empirical estimation and results

We estimated equations 13–16 by three-stage least squares (3sls), using quarterly data from 1981:1 to 1997:1. We have used the 3sls method, because the basic model given by the simultaneous equation system is linear. In addition, a dummy variable (D) was needed to account for some important interventions during the period considered. The dummy variable is introduced for the structural changes over the first social economic and cultural developing plan in Iran.[1] The estimation results are as follows:

$$\log P_t = \underset{(-0.60)}{-0.33} \underset{(-3.71)}{-0.29\log GDP_t} + \underset{(5.08)}{0.36\pi_t} \underset{(-3.53)}{-0.36\log\left(M/P\right)_{t-1}} - \underset{(-4.38)}{0.12D_t} + \log M_t \quad (17)$$

$R^2 = 0.99$ S.E. = 0.04

$$\log GE_t = \underset{(-5.01)}{-10.79} + \underset{(7.12)}{1.63\log GDP_t} + \underset{(1.83)}{0.45\pi_t} \underset{(-4.97)}{-0.44D_t} + \log P_t \quad (18)$$

$R^2 = 0.90$ S.E. = 0.26

$$\log GR_t = \underset{(-7.61)}{-11.04} + \underset{(10.14)}{1.61\log YNO_t} \underset{(-3.63)}{-0.67\pi_t} \underset{(-5.96)}{-0.28D_t} + \log P_t \quad (19)$$

$R^2 = 0.96$ S.E. = 0.14

$$\log M_t = \underset{(5.60)}{2.77} + \underset{(2.44)}{0.56\log GE_t} \underset{(-1.98)}{-0.39\log GR_t} + \underset{(9.80)}{0.47\log E_t} + \underset{(2.73)}{0.29D_t} + \log m_t \quad (20)$$

$R^2 = 0.90$ S.E. = 0.25

where the numbers in parentheses are the absolute values of the t-statistic, S.E. is the standard error of the estimated equation, respectively, and R^2 is the coefficient of determination.

Obviously, all the estimated coefficients have the expected signs and are significant at the one per cent level of significance.[2] In addition, the significant coefficients of the dummy variable indicate that structural changes over the first social, economic and cultural developing planning period have had an influence on the equations.

The estimated values for 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, $\log\left(M/P\right)_{t-1}$, shows the deviation of the adjustment coefficient λ from unity $(1 - \lambda)$. Therefore, obtaining the value for λ ($\lambda = 0.64$) through $(1 - \lambda) = 0.36$, 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 equation 8. They are equal to 0.51, 0.45 and 0.56, respectively.

From the estimated price equation, presented in equation 17, we find that the estimated income elasticity of the demand for real money balances equals about 0.45. Hence, a one per cent rise in real GDP will lead to a 0.45 per cent rise on average in the demand for real money balances. The expected inflation rate is also about –0.56, implying that a one per cent increase in the expected inflation rate will cause the demand for real money balances to decrease by 0.45 per cent on average. The weighted mean lag of the real money balances is equal to 0.56 of a quarter.[3] It means the period required is about 0.56 of a quarter on average to adjust completely any disequilibrium between the demand for real money and its real stock.

Equation 18 is the government expenditure. The income elasticity of government expenditure is about 1.63. However, in equation 19, the (non-oil) income elasticity of government revenue is about 1.61. In general, as expected, the significant income elasticities of government expenditure and revenue imply that both government expenditure and revenue would move proportionally with inflation.

According to the results obtained from the estimated equations of government expenditure and revenue (equations 18 and 19), the average lags in earning government receipts is about 0.67 of a quarter, while the average lags in government payments is about 0.45 of a quarter. According to the assumptions previously described, it is expected that the average delay in government domestic receipts is more than that in government payments. 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.

Finally, in the estimated money supply, equation 20, the elasticity of government expenditure is about 0.56, while the elasticity of government revenue is about –0.39. Hence, the financing of the fiscal deficit would then raise money supply and produce more inflation.

4. Conclusion

In this paper, we have used the quarterly macro data of Iran to recognise factors that cause economic problems, such as the government budget deficit, monetary supply growth and inflation. We have used a simultaneous equation system to find out the effect of inflation on government revenue and expenditure. The general conclusion emerging from all the evidence discussed in this paper is that the rate of inflation tends to increase nominal government expenditure faster than government revenue. In the country's inflationary condition, this will be increase the government's budget deficit. As illustrated by the empirical results, the financing of the fiscal deficit will increase money supply and this tends to increase inflation.

Our empirical results have generally confirmed the theoretical assumptions made in this study, and have also supported the previous findings of Aghevli and Khan (1978).

There are two policy implications that emerge from this study. First, in order to control inflationary pressure, Iran needs to cut the size of the government's budget deficit. And secondly, the policy of cutting Iran's budget deficit can be done by denationalizing its numerous public sector activities and also by cutting down drastically the size of its bureaucracy. In addition, Iran needs to reform the tax revenue system.

Footnotes

1. *It is defined as:* $D_t = 1$ *t = 1989:1 – 1997:1* $D_t = 0$, *otherwise. This plan was for the period 1989–93.*

2. *However, the estimated coefficient of the inflation rate variable (in equation 18) and government revenue variable (in equation 20) are significant at the five per cent level of significance.*

3. *Which is derived directly from* $\left(1 - \lambda/\lambda\right)$.

References

Aghevli, B., and S.M. Khan (1978), "Government deficits and the inflationary process in developing countries", IMF staff papers, Vol. 25, pp. 383–416.

Aghevli, B., and S.M. Khan (1977), "Inflationary finance and the dynamics of inflation: Indonesia 1951–72", American Economic Review, Vol. 67, pp. 390–403.

Cagan, P. (1956), "The monetary dynamics of the hyperinflation", in M. Friedman, Studies in the Quantity Theory of Money, University of Chicago Press, Chicago, pp. 25–117.

Chaudhury, M.A., and A.K. Parai (1991), "Budget deficits and inflation: the Peruvian experience", Applied Economics 23.

Choudhury, M.A., and N. Ahmad (1995), "Money supply, deficit, and inflation in Pakistan", The Pakistan Development Review, 34:4, pp. 945–956.

Choudhury, N.N. (1991), "Collection lags, fiscal revenue and inflationary financing: empirical evidence and analysis", IMF working papers, No. 41, pp. 1–17.

De Silva, K.E. (1977), "Money supply, inflation and balance of payments in Sri Lanka 1959–74", The Journal of Development Studies 13:2.

Haan, J.D., and Zelhorst (1990), "The impact of government deficits on money growth in developing countries", Journal of International Money and Finance 9:4.

Institute for Research on Planning and Development in Iran (IRPD), Planning Data System (PDS), Quarterly Data for Iran's Economy, Tehran.

Kiguel, M.A. (1989), "Budget deficit, stability and the monetary dynamics of hyperinflation", Journal of Money, Credit and Banking, Vol. 21, No. 2, pp. 148–157.

Mourmouras, A., and J.A. Tijerina (1994), Collection lags and the optimal inflation tax, IMF staff papers, Vol. 41, pp. 30–54.

