The Effect of Public Expenditure Shocks on Macroeconomic Variables in a Real Business Cycle Model. Case Study: Iran

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Abstract

In this research we use a real business cycle model to analyses the impact of stochastic shocks of government spending on macroeconomic variables by application dynamic stochastic general equilibrium. Consumer preferences depend on private and public spending and households are habit forming. Product is transcendental function of government spending. The model estimates by the maximum-Likelilood method using Iran data from 1338 to 1387. Estimation results point out that a negative response of consumption and following a government spending shock. Another macroeconomics like private investment, capital, employment, wages and out-put are cause a positive response to government spending shock.

Key words: Real business cycle, macro variables, Complementary effects, substitution effect, stochastic dynamic general equilibrium

1. Introduction

Public sector in many countries has developed in the twentieth century. Table 1-1 shows share of government spending in GDP for 14 industrialized countries during the years 2002-1870. Government spending

in these countries was about 8 per cent of GDP in 1870.

IT rose to 15 per cent after worldwar I, and 30 per cent in 1960. Eventually reached up to 40 per cent of GDP in 2002.

Security, health, education and non-economic imbalances justify government intervention in economical activity. According to structure and duties, governments go under spending that affect macroeconomic variables. Increased government spending on infrastructure such as building roads, energy, telecommunications, training, increase productivity and reduce production costs of private sector. It Stimulate the private sector to increase investment and production and will increase consumption in long-term. On the other hand lack of productive resources such as labor, capital and raw materials, and increased government demand for these productive resources leads inadequate access of private sector to resources.

Table 1 share of government spending in 14 industrialized countries

	1870	1980	Before World War 1	After World War 1	Before World War 2	After World War 2	1990	2002
Australia	....	48.1	....	34.7	15.2	35.7	48.6	51.1
Bulgaria	....	58.6	....	....	21.8	30.3	54.8	50.2
Canada	....	38.8	....	13.3	18.6	38.6	46	40.4
France	12.6	46.1	17	27.6	29	34.6	49.8	54.2
Germany	10	47.9	14.8	25	42.4	32.4	45.1	48.1
Italy	11.9	41.9	11.1	22.5	24.5	30.1	53.2	47.7
Japan	8.8	32	8.3	14.8	25.4	17.5	31.7	38.3

	1870	1980	Before World War 1	After World War 1	Before World War 2	After World War 2	1990	2002
Netherlands	9.1	55.2	9	13.5	19	33.7	54	47.2
Norway	3.7	37.5	8.3	13.7	....	29.9	53.8	46.4
Spain	....	32.2	8.3	9.3	18.4	18.8	42	39.4
Swedish	5.7	60.1	6.3	8.1	10.4	31	59.1	58
Switzerland	....	32.8	2.7	4.6	6.1	17.3	33.5	37.8
England	9.4	43	12.7	26.2	30	32.2	39.9	40.1
America	3.9	31.8	1.8	7	8.3	27	33.3	35
Mean	8.3	43.3	9.1	15.4	18.3	28.5	46.1	45.1

Source: IMF Working Paper, 1995; updated with OECD

Theoretically the relationship between government spending and economic variables is complex. In the past, Thomas Hobbes (1950) claimed that it is not possible to live without government. He argued the law and orders issued by the government are the most crucical feature in the modern civil. Hobbes view of the government's main role is protecting the rights of individuals, social stability and security. These factors aid government to provide groundwork of economical growth. In addition, despite some public goods that markets and private are not willing to produce it, the need for government intervention in producing and distributing of goods, makes unavoidable. Because the nature of these goods is such the relationship between pay them through the market is difficult that is roads, national defense and security. Production and distribution of these goods by government can grow and speed up economical development. However, as the government is extend more and more, more allocates by policymakers instead of market forces. There are three reasons which decrease profitableness and usefulness of government role:

Financing, higher tax and loan to finance government spending, could affect negatively on economical variables. Higher taxes on labor, decline incentives for working and cut manufacturing activity. Similarly, loans slow down private investment. It also boot up the incoming taxes. As a result, even if the efficiency of government spending do not reduce, incentive effects of debt and tax will decline and transfer resources from the private to public led negative impact on economical growth. (Gwartney et al. 1998)

Size of Government: Public sector growth than the private, reduce public spending efficiency. Suppose government first focus to activities such as human rights the support, adoption and implementation of laws that will lead to expansion of community justice, create and develop a framework of monetary stability and national defense. Which are functions consider as essential duty of state. Performing these tasks inherent in the government for the efficient functioning market provides, and thus provides a context of economical growth. If the government provides other economic fields such as infrastructure and education to be imported, despite the ability of the private to carry out these activities, again, government spending will help economical growth. If government pays for production and distribution of private goods, public sector expansion and increased government spending will associate with reduced performance, and this will lessen economical growth.

Finally, policy process than the market are. Competition, as proper to act against the rewards there are also penalties for wrong decisions. Adjusted to changes in the public sector is much slower than market. Market compared with the time needed to compensate for an error, for example inadequate investment, or adjust to changing conditions, new information, and technical progress for government is very slow. Government limits, causing a great limits to economical growth.

This paper will try to answer the question whether the trend of changes in macro variables affect changes in public spending. In this study we use the extended real business cycle model, apply following consideration and research methods.

Government spending used as a variable in the representative household utility function and production of firms

Use of government spending in utility has been done by some researchers. For example, Barrow (1981), Karas (1994), Baxter and King (1993) and Rag - Murcia (2003) can noted. But government spending entering to production function in real business cycle studies not remarked. According to the function shows a technical relationship among the factors of production and out put. Government spending on consumption following to builds infrastructure and buy goods and services produced as a productive factor acts. Using government spending in the production, the marginal production affect as government spending rise. As a result the production, including the use of capital will be affected. Thus, change in government spending, leading to changes in these factors is the marginal production. Therefore, affect the rate of factor employment including capital spending. This way can help to analyze the effects

of government spending on investment and production. We also assume household behavior is habitual. This means the household current consumption affect by prior consumption placed. Therefore, pre consumption enters as an argument to utility function.

The idea is that choices consumer overtime also affect the consumption and past consumption are desirable due to the influence. Especially if the consumption in the past been a pleasure for the individual, he tries to keep his current choices based on that level. If households are habit behavior, smooth and uniform Consumption level and its rate of change. Because only changes the current income does not considered. Therefore, taking the shock reaction in the consumer behavior model that households affected by past consumption habits less than the model that consumer behavior is not habitual.

Organizing paper is as follows. In the second part will be paid to the theoretical foundations. Section III presents method. Estimate and solve the model is given in Section IV. Five sections devoted to solving the model, and finally in section six summary and conclusions are presented.

2. Theoretical Foundations

According to the theory of Lucas (1977), economic cycles oscillations in production and employment which have special characteristics. Most important characteristics is the variation around the long-term trend of variables and influence the long-term growth in similar direction (Karagedikli, et al. 2007)

In 1960 and 1970 decades monetary policy considered as the main item of all business cycle. Many analysts believed the main cause of business cycles and inflation is money supply growth rate. This view largely presented by Milton Fredman and shoarty (1960-1967). Edward Prescott (1986) in an article showed after Worldwar II, the business cycle created because of stochastic changes in the technology. The study by Prescott and Kydland (1982), John Long and Charles Plosser (1983) implies this theory as real business cycle theory stresses non-monetary factors i.e. population growth technological innovation and consumer preferences as determinants of the real growth. According to economic theory, when the market surpluses or shortages arise wages and prices will be adjusted and stand economy close to long-term rates of growth. If real shocks causes change in technology or economic wealth, make a mess into economic balance, there would appear a business cycle. Real shocks may appear in various forms such as cutting off oil supply in 1970 and a decrease in oil prices in 1986. Demand shifts from one section to another and changes in fiscal policy or a technological change in the machinery also are as real shocks. (Walsh : 1980)

Analysing periodic variation of macro variables such as GDP, investment and ... Gradually extended the research area to extract realities about different countries forever it explains theories on economical cycle. Theoretically, there is not a general agreement on reaction of key variables such as consumption, investment and production to changes in financial. Since such difference may come from the difference in specify the model, used policies and research method. Here we explain some different theoretical economic models.

Neoclassical model: The most important theoretical improvement in recent decade, becoming illumination of fiscal policy in neoclassical model resulting of research by Lyagaly et al (1992) and Baxter and King (1993) . In this model, fiscal policy mostly influences represented agents throw, the wealth effect of fiscal policy. When government spending increases, and also taxes. The representative household wealth reduced equivalent. As a result the reduction in household wealth, the purchase of goods and leisure reduce which both are normal goods. As a result, private consumption would be diminished. Labour supply increases and real wages are reduced. Since the long-term work/ investment is determined by time preferred rates, so it will not change. Therefore as the denominator of the fraction has increased, must also deduct numerator proportionally increases as well. Thus the investment would increase to yield a desirable capital stock. Boost up labour supply increases marginal production of capital and investment will increase. In long run less consumption, investment and employment. It forced real wages get back to its prior amount. Expanded neoclassical model by alia Galy et.al (1992) and Baxter and King (1993) based on real business cycle models standards become a general tool to analyse fiscal policy. In this model, periodic complementarity of work supply is a key parameter. The larger value of this substitution shows more growth in employment since shocks on government spending. The final outcome is increase in investment.

New Keynesian model: This model recently expanded by Lopez and colleagues (2005), and considered as the opposite of neoclassical view. In this model, empirical

evidence suggests positive effects of government spending on private consumption. Rigid prices, non-Ricardian households which follow the rule-of-thumb in their consumption behavior. And taking it as a function of their current income and non-competitive labour market. Wages set by unions and firms. Households tend to responds those firms that accept to the wages set by unions. In this theory, public spending and private consumption are complementary. Because under rigid prices, a rise in government spending increases aggregate demand, firms increase production. Then firms rise demand for workers. Because of the monopoly of a labour market, this increases real wages strongly and thus earnings of non-Ricardian households go up. This incentive them to increase their consumption. If the weight of such households in the community is large enough, the total consumption will increase.

Ricardian equivalence method: This method expanded by Barrow (1989). Based on these idea, a rise in the deficit from the increase in government spending, or should be refunded in present or future. As the present value receipts are equal the present value of spending, so a relative decline in taxes today should be offset by future increases in taxes. Since the interest rate does not change, the investment will not change. In other words, the expected increase in future taxes, consumers are saving more in the future to be able to pay additional taxes and reducing taxes equivalent to the increase in savings. Therefore, the total savings rate remains constant and will not change. As a result private investment does not change.

3. Mode

In this study, we are going to use the extended standard real business cycle (RBC) model which include three sectors. Household, firms and government.

3.1. Representative household:

Assuming that household drows its utility from Effective consumption $(\tilde{C}_t)$ and leisure where held from $L_t=(1-N_t)\ N_t$, is working hours and L_t is leisure. It is assumed that in each period, the representative household endowed one unit of time that divided between labour and leisure. Effective consumption provides as a function with constant elasticity substitution (CES) of private consumption (C) and government spending (G):

$$\tilde{C}_t = \left[\omega C_t^{\frac{(\tau-1)}{\tau}} + (1-\omega) G_t^{\frac{(\tau-1)}{\tau}}\right]^{\frac{\tau}{\tau-1}} \qquad 1$$

ω, shows that government spending how much will affect desirability. If ω = 1, the general view of the consumer government spending has no share in consumption. And if ω =. 5, the role of public and private goods in consumption is seen as identical. τ is elasticity substitution between private consumption and government spending. If τ=0, then private consumption and government spending are the perfect complement. And if $\tau \to \infty$ they will perfect substitution. Presented as a function (CES) is caused to achieve a certain level of effective consumption, diminishing marginal utility to government spending and private consumption is established. The household utility is separable function of effective consumption and leisure.

$$U(\tilde{C}_t, \tilde{C}_{t-1}^{\gamma}, N_t) = \frac{1}{1-\varepsilon}\left(\frac{\tilde{C}_t}{\tilde{C}_{t-1}^{\gamma}}\right)^{1-\varepsilon} + \varphi Ln(1-N_t) \qquad 2$$

ε is the risk aversion parameter. θ Parameter and $\gamma \in (0,1)$ represents the degree of household habitual behaviour. If γ = 0, then household current consumption behaviour does not in term of prior consumption. The above utility function should be placed on the following theoretical terms.

Function must be direct toward effective consumption and leisure.

$$\frac{\partial U}{\partial \tilde{C}_t} = \frac{1}{\tilde{C}_{t-1}^{\gamma}}\left(\frac{\tilde{C}_t}{\tilde{C}_{t-1}^{\gamma}}\right)^{-\varepsilon} > 0$$

$$\frac{\partial U}{\partial (1-N_t)} = \frac{\varphi}{1-N_t} > 0$$

If the second derivative to these two variables is negative, then utility has maximum value. And if one is fixed while another increase, total compliance with diminishing rates rise up and the graph will be hump. In other words, the diminishing marginal utility on leisure and effective consumption is established. First and second order derivative utility function to include leisure and effective consumption are as follows;

$$\frac{\partial^2 U}{\partial \tilde{C}^2{}_t} = \frac{-\varepsilon}{\tilde{C}_{t-1}^{2\gamma}}\left(\frac{\tilde{C}_t}{\tilde{C}_{t-1}^{\gamma}}\right)^{-\varepsilon} < 0$$

$$\frac{\partial^2 U}{\partial(1-N_t)^2} = \frac{-\varphi}{(1-N_t)^2} < 0$$

If $\varepsilon > 0$, then the first and second derivative to consumption is positive and has diminishing rate. If $\varphi > 0$ it set up to leisure too. Household disposable income to consumption and investment offers. Investment in each period increased capital stocks of households in the next period. So can write

$$K_{t+1} = (1-\delta)K_t + I_t \qquad 3$$

Is capital stocks of household in period t. Is the depreciation rate. Household budget constraint in period t is:

$$C_t + I_t = w_t N_t + r_t K_t - T_t \qquad 4$$

w_t Is real wages paid to labour, r_t real rental rate of capital and T_t Lump sum taxes. Representative household utility function related to the period of his life presented as follows.

$$U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} u(\widetilde{C}_t, \widetilde{C}_{t-1}, L_t)$$

Household maximizes its utility function subject to 1, 3 and 4.

E_t Is expectation operator formed in period t based on information at this period. The reason using present value of utility expectations is the uncertainty in the estimated Interest rate and wages for households in the future. Therefore, households will not choose a certain path for consumption, savings and labor supply. Its choose in each period depends on all economical shocks. These shocks may be caused by government spending, technology or other items. Therefore, the model presented on uncertainty. First order conditions obtained for optimal value

$$C_t, N_t, K_{t+1}$$

3.2. Firms

Firms hire labour and rent capital, combining them to produce goods and services. Government can stimulate firms to increase production through investment, education, research and buy goods produced by firms. Production is transcendental function as presented below.

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha} G_t^{\eta} \qquad 5$$

In Equation 5, A_t is technology coefficient. since in this study on the effects of technical shocks on macroeconomic variables is not consider, without suffered in generalization of model, the coefficient of technical progress assumes equal to one.

Each firm chooses workforce and capital to maximize its profit. Profit maximization yields the In-put demand equations as follows:

$$w_t = (1-\alpha)\, {}^{Y_t}/_{N_t} \qquad 6$$

$$r_t = \alpha\, {}^{Y_t}/_{K_t} \qquad 7$$

Which state that each factor must earn its marginal product.

3.3. Government

Government spending financed by taxation which equivalent to taxes.

$$G_t = T_t \qquad 8$$

Government spending is to be a stochastic variable and follows a first-order autoregressive given by:

$$\ln G_t = (1-\rho_G)\ln G + \rho_G \ln G_{t-1} + \mu_{Gt}$$

Where $-1 < \rho_G < 1$ and μ_{Gt} has normal distribution with mean zero and σ_{μ_G} standard deviation

General equilibrium and market clearing requires that:

$$\ln G_t = (1-\rho_G)\ln G + \rho_G \ln G_{t-1} + \mu_{Gt} \qquad 9$$

In this model, solving is simply is the proper values of nine time series $(G_t, \widetilde{C}_t, C_t, N_t, I_t, K_{t+1} Y_t, w_t . r_t)$ which satisfy equations (1) to (10) and the first order conditions.

3.4. Method of solving algebraic model

As mentioned above, representative households maximize lifetime utility function throw choose subject to the relations 1, 3 and 4. Maths can write as:

$$\max U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} u(\tilde{C}_t, \tilde{C}_{t-1}, L_t)$$

ST:

$$\tilde{C}_t = \left[\omega C_t^{\frac{(\tau-1)}{\tau}} + (1-\omega) G_t^{\frac{(\tau-1)}{\tau}}\right]^{\frac{\tau}{\tau-1}}$$

$$K_{t+1} = (1-\delta)K_t + I_t$$

$$C_t + I_t = w_t N_t + r_t K_t - T_t$$

Substituting $\tilde{C}_t$ from equation 1 into Objective function and I_t obtained from equation 3 into equation 4 we can write Lagrange equation as:

$$\mathcal{L} = \frac{1}{1-\varepsilon}\left(\frac{C_t}{C_{t-1}^{\gamma}}\right)^{1-\varepsilon} + \varphi Ln(1-N_t) + \lambda_t\{C_t + K_{t+1} - (1-\delta)K_t - W_t N_t - r_t K_t - T_t\}$$

λ is Lagrange coefficient. First order conditions for maximizing utility function will calculate for C_t, N_t and K_{t+1}.

With differentiating Lagrange equation toward above variables, Lagrange coefficient for the following three relationships are;

$$\lambda_t = \omega\left(\frac{\tilde{c}_t}{c_t}\right)^{\tau}\left[-\beta\gamma(\tilde{c}_{t+1})^{-2\varepsilon}(\tilde{c}_t)^{(2\gamma+1)\varepsilon} + (\tilde{c}_t)^{-\varepsilon}(\tilde{c}_{t-1})^{2\gamma\varepsilon}\right] \qquad 11$$

$$\lambda_t \frac{\varphi}{w_t(1-N_t)} \qquad 12$$

$$\lambda_t = \beta E_t[\lambda_{t+1}(1 + r_{t+1} - \delta)] \qquad 13$$

λ_t on equation 11 represents marginal utility of consumption . And in equation 12 the marginal substitution rate of consumption and leisure equal to real wages. In 13 it is the marginal value of capital. Equations 1 to 13 depict a set of simultaneous equations. Solving them, we obtain a general competitive equilibrium.

Almost all the real business cycle models could not solve analytically and algebraic. (Campbell: 1994). Mainly in papers presented to resolve this problem, used numerical solution. In this way, parameter values calculate on previous studies and the restrictions on them. So we can analyse the variance- covariance variables based on parameters set. And analysis the reciprocal effects of variables.. In This approach the source of influence is not clear (Campbell: 1994). He suggests that instead of numerical method, using first order Taylor series expansion, the equations can be extended. therefore, the equations in the model, expanded on relative logarithmic around Steady state value of variables. Then the approximation properties reviewed. In this way, equations are written on logarithmic deviation of the logarithm of each variable from its Steady state. In other words, the model is Log-Linearized. To convert the model equations to Log-Linearized, relationships (1) to (13) is written for the case the model is in Steady state. To obtain the seady state equations, we remove time index and expectations of variables, and equal all shocks to zero. Steady state equations are as follows.

$$C = \left[\omega C^{\frac{(\tau-1)}{\tau}} + (1-\omega) G^{\frac{(\tau-1)}{\tau}}\right]^{\frac{(\tau-1)}{\tau}} \qquad 14$$

$$K = (1-\delta)K + I \qquad 15$$

$$Y = K^{\alpha} N^{1-\alpha} G^{\eta} \qquad 16$$

$$\lambda = \omega\left(\frac{\tilde{C}}{C}\right)^{\tau}\left[-\beta\gamma C^{-2\varepsilon+(2\gamma+1)-\varepsilon} + C^{2\gamma\varepsilon}\right] \qquad 17$$

$$\lambda = \frac{\varphi}{w(1-N)} \qquad 18$$

$$\lambda = \beta[\lambda(1 + r - \delta)] \qquad 19$$

$$W = (1-\alpha)\,{}^{Y}/_{N} \qquad 21$$

$$Y = C + I + G \qquad 22$$

To Log-Linearized model, we apply equations 1 to 13 and Steady state equations 14 to 22 .

Log-Linearized equations presented as follows.

$$\hat{C}_t = \omega\left(C/\bar{C}\right)^{\frac{(\tau-1)}{\tau}}\hat{C}_t + (1-\omega)\left(G/\bar{C}\right)^{\frac{(\tau-1)}{\tau}}\hat{G}_t \quad 23$$

$$\hat{K}_{t+1} = (1-\delta)\hat{K}_t + \delta\hat{I}_t \quad 24$$

$$\hat{\lambda}_t = \frac{\beta\gamma(\varepsilon-1)}{1-\beta\gamma}E_t\hat{\varepsilon}_{t+1} - \frac{\beta\gamma(\gamma(\varepsilon-1)-1)+\varepsilon-1-\beta\gamma/\tau}{1-\beta\gamma}\hat{\varepsilon}_t + \frac{\gamma(\varepsilon-1)}{1-\beta\gamma}\hat{\varepsilon}_{t-1} - \frac{1}{\tau}\hat{c}_t \quad (25)$$

$$\hat{\lambda}_t = \frac{N}{1-N}\hat{N}_t - \hat{w}_t \quad 26$$

$$\hat{\lambda}_t = E_t\hat{\lambda}_{t+1} + \beta r E_t\hat{\lambda}_{t+1} \quad 27$$

$$\hat{Y}_t = \alpha\hat{K}_t + (1-\alpha)\hat{N}_t + \gamma\hat{G}_t \quad 28$$

$$\hat{W}_t = \hat{Y}_t - \hat{N}_t \quad 29$$

$$\hat{r}_t = \hat{Y}_t - \hat{K}_t \quad 30$$

$$\hat{Y}_t = \frac{\bar{C}}{\bar{Y}}\hat{C}_t + \frac{\bar{I}}{\bar{Y}}\hat{I}_t + \frac{\bar{G}}{\bar{Y}}\hat{G}_t \quad 31$$

The stochastic process of the shocks, (9) is:

$$\hat{G}_t = \rho_G\hat{G}_{t-1} + \mu_{Gt} \quad 32$$

The above simultaneous equations system can put to state - space form:

$$M_{t+1} = KM_t + \mu_{t+1} \quad 33$$

$$\Gamma_t = HM_t \quad 34$$

Where $M_t = (\hat{G}_{t-1}, \hat{K}_{t-1}, \hat{\tilde{C}}_{t-1})'$ state variables vector, Γ_t vector that contains the forward-looking

Variables, H, K are matrices, which elements are combinations of the model parameters. And finally $\mu_t = \mu_{Gt}$

Substitute Equation 33 in Equation 34, endogenous variables in the current period calculated in terms of state variables, which represent the policy functions. These functions are obtained by the solving model.

State variables are such variables that all its information in the current period (period t) is available (predetermined variables). With this data set, we can predict present and future behaviour of variables. Solving algorithm shows in Figure 2

Figure 2 Chart system solving methods

Step 1	$\hat{K}_0, \hat{G}_0, \hat{\tilde{C}}_0$ and μ_0 are determinate. Vector Γ_1 calculate.
Step 2	$\hat{K}_1, \hat{G}_1, \hat{\tilde{C}}_1$ and μ_{10} are determinate. Vector Γ_2 calculate.
Step 3	$\hat{K}_2, \hat{G}_2, \hat{\tilde{C}}_2$ and μ_2 are determinate. Vector Γ_2 calculate.

Variables $\hat{G}_{t-1}, \hat{K}_{t-1}, \hat{\tilde{C}}_{t-1}$ in period t are given. And shock on the system occurs in the period t. Therefore, all the endogenous variables including $\hat{G}_t, \hat{K}_t, \hat{\tilde{C}}_t$ identify in period t. Occurrence of shocks in the period t +1 and existence state variables in this period, the endogenous variables for period t +1 are calculated. And this goes on and determines the Future optimal path variables. Coefficients of model are estimated on maximum likelihood (ML). Then the effect of government spending shocks examined on investment, consumption and other variables. Number of observed variables should not exceed the number of structural shocks in the model. Otherwise the matrix variance - covariance will be singular. In this case, it is impossible to estimating parameters. Therefore, in this study to estimate the parameters, we use data of one variable. To solve and estimating the model, we use daynare software which works under lip Matt programming designed to solve real business cycle models, structured and expanded by Michel juillard and O.CameniK in Paris. This is a high power engine designed to simulation and estimation of Dynamic Stochastic General Equilibrium (DSGE) models. Model has 10 endogenous variables $(Y_t, C_t, I_t, K_t, W_t, r_t, \tilde{C}_t, G_t, \lambda_t, N_t)$ and an exogenous variable government spending shock (μ_G). First, using data from Iran and maximum-likelihood method to estimates the parameters of the model. Then apply the estimated parameters to solve system equations. Solve the system includes Steady state values, simulated values of endogenous variables, variance and covariance matrix of variables, policy functions and Impulse Response Function that come looking.

4. Results

Steady state results presented in Table 2.

Table 2: Steady state variables

Variables	Steady state
Domestic Gross Production(GDP)	.718869
Consumption(C)	.375739
Government Expenditure(G)	.199999
Effective Consumption($\tilde{C}_t$)	.323691
Wage(W)	1.83643
Employment(N)	.250527
Intrest(r)	.22601
Investment(I)	.143131
Capital(K)	11.45311
Lagrange (λ)	1.45311

Source: research findings

Terms Blanchard - Kahn set up. Which says for the existence of a unique stable equilibrium in the near of Steady state, require the number of eigenvalues greater than one equal to Forward-Looking variables. Model has three Forward-Looking variables and the same number of eigenvalues greater than one exists. Estimated parameters of the model Presented in Table 3. All parameters are significant in the 95% confidence level. As state in Chapter 3, τ is substitution elasticity between private consumption and public spending. Whenever value of this parameter is smaller, complementary between these two variables are greater. Considering the estimated value of this parameter is small, therefore, increased private consumption follow increase government spending. η, the production elasticity of government spending is positive, indicates increase in government spending could increase production. It would motivate to increase consumption and production, marginal production of labour and capital increase and causing increase wages and interest rate.

γ is the habitual degree of consumers. Which is significantly different from zero. Therefore can be concluded that households consider their previous consumption in their current consumption behaviour. Being small, it points out in utility function, the current consumption has greater importance than last period consumed. $(1-\omega)$ is the weight of government spending in the effective consumption index which estimated value equal to .2061. Therefore, households evaluate the share of government spending in effective consumption rather low. It would formed the households' expectations to increase government spending. As a result, it makes the government forced to rise the consumption spending share, especially increase subsidies.

Table 3: Estimated parameters

Parameters	Estimate	Standard deviation	t -statistic
α	0.4749	0.0002	3039.8864
φ	1.1853	0.0349	33.9348
ω	0.7935	0.0034	235.4961
β	0.9990	0.0006	1777.9702
δ	0.0438	0.0002	177.6209
τ	0.3942	0.0897	4.3964
ρ	0.9990	0.0002	4724.1639
η	0.2044	0.0043	47.3304
ε	4.9981	0.0054	919.7120
γ	0.3607	0.0010	353.6863

Source: research findings

Matrix coefficients of Policy functions shows in Table 4. In these functions, each endogenous variable in the model based on the current period state variables and shocks in the last period. . In this model, $\hat{K}_{t-1}, \hat{C}_{t-1}, \hat{G}_{t-1}$ are state variables and other variables in the current period can be written in terms of them. For example, optimal consumption path is defined as:

$$\hat{C}_t = 0.562646 - 1.117139\ \hat{G}_{t-1} + 1.369283\hat{C}_{t-1} + 0.009110\hat{K}_{t-1} - 0.223653\, e_{G_t}$$

Symbol '^' indicates the deviate of the logarithm variable from its Steady state logarithm. For example; $\hat{c}_t = \ln C_t - \ln C$ where C shows Steady state of C_t. Coefficients of variables in the log- linear form in equations represent the elasticity of them. So can write

$$\frac{\partial \hat{C}_t}{\partial \hat{G}_{t-1}} = -1.117139$$

$$\frac{\partial \hat{C}_t}{\partial \hat{e}_{Gt}} = -0.223653$$

Simpler words, matrix elements show interaction elasticity of the variables. Consumption elasticity toward government spending shocks in previous period is negative represents a negative reaction of consumption to government spending shocks. Policy function for investment is as follows.

$$\hat{I}_t = 0.660898 + 3.138052\,\hat{G}_{t-1} - 1.262791\,\hat{C}_{t-1} + 0.014576\;\hat{K}_{t-1} + 0.628242\,e_{G_t}$$

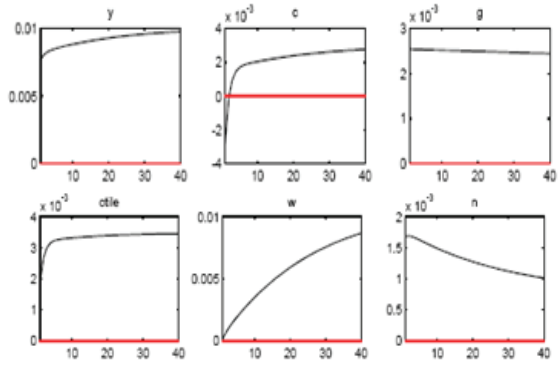
As we can see coefficients of variables e_{G_t} and $\hat{G}_{t-1}$ are positive. This shows government spending shocks impose positive effect on investment. And an increase in public spending in the current period would increase investment in the next period. It indicates that private investment and government spending are complementary. Similarly, the interaction variables can be examined. e_g shows unanticipated government spending Shocks. Matrix elements indicate the shock has a positive effect on other variables.

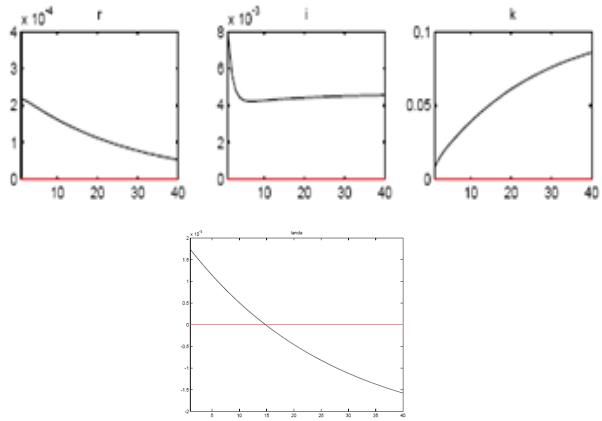
Table 4 policy matrix functions (transition)

variables	Costant	ctile(-1)	g (-1)	k (-1)	e_g
Domestic Gross Production(GDP)	1.423543	0.106492	3.019903	0.023686	0.604588
Consumption(C)	0.562646	1.369283	-1.117139	0.009110	-0.223653
Government Expenditure (G)	0.199999	0	0.998990	0	0.199999
Effective Consumption ($\tilde{C}$)	0.383009	0.409532	0.738453	0.002725	0.147839
Wage(W)	2.375241	-0.160687	0.060765	0.106512	0.012165
Employment(N)	0.314717	0.044834	0.659590	-0.008876	0.132051
Intrest(r)	0.044769	0.007093	0.085669	-0.002133	0.017151
Investment(I)	0.660898	-1.262791	3.138052	0.014576	0.628242
Capital(K)	15.100022	1.262791	3.138052	0.970808	0.628242
Lagrange (λ)	0.728177	0.096902	0.682247	-0.042085	0.136587

Source: research findings

Figure 1 shows the Impulse Response Functions. Impulse Response Functions (IRF) represents the future optimal expected path of variables to achieve next equilibrium point after occurring shock equal to one standard deviation of disturbance in current period. In this study, the effect studied for 40 periods after the shock. Impulse Response Functions shows that Shock effects on private consumption was initially negative and after a certain period convert to positive. In other words, the shock in short-term has negative impact but positive in long-term. In first step it increase with increasing rate over time, then by diminishing rate continues its increase. The shock imposes GDP in positive diminishing rate. In the early period, it increases fairly steep and then gently continues. Impulse Response Function shows that government spending Shock effect on investment is positive through the study period. It rapidly reduced in early period, then with a gentle slope will tend towards positive value. Path of capital stocks is positive and rising. As this could be due to which capital is as a storage and investments in each period is added to prior capital stocks. And when shock has a positive effect on investment, it will increase capital stocks. The effect of shock on government spending is positive and decreases with a gentle rate. This effect at the end of the period of study will tend to some positive constant. Shock effect on employment was positive and had a mild decline during the period. The increasing rate decreases overtime during the period studied and remain positive. So we can say government spending can lead to increased employment overtime. Wage path, is positive and increases with diminishing rate. This can be caused by the shock effect on increased demand labour exceeds supply. Effective consumption will get through positive direction over time. Shock impact on λ first is positive but scale down. After being zero at the beginning of the period, but decrease the negative direction will get through to reach its minimum point. The path is decline steep up to the end of the study and remains negative. Reverse direction when λ is as the marginal utility of so λ is decline as consumption increases and conversely. Reduction in λ during the period studied, indicates the path of consumption and investment is upside during the period.





5. Conclusion

Security, health, education and non-economic imbalances are justify government intervention in economical activity. According to structure and duties, governments go under spending that a effect macroeconomic. Increased government spending on building roads, energy, telecommunications, training, increase productivity and reduce production costs of private sector. It Stimulate the private sector to increase investment and production and will increase consumption in long-term. On the other hand lack of productive resources such as labour, capital and raw materials, and increased government demand for these productive resources leads Inadequate access of private sector to resources. Government spending can impact on production, consumption and welfare through efficiency. Buying final goods makes the firms to increase their production. This leads to employment growth which rises the consumption and welfare. Results show that consumption and government spending are substitution. The results confirm the research in real business cycle models and inconsistent with evidence and the results of studies in new classical model. More government spending stimulates other variables and increases them.

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