



Experimental test of government expenditures increase and crowding out of private consumption

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ABSTRACT

This study examined the question of whether the increase in public expenditures leads to crowding out of private consumption. In this regard, to estimate the research model and to test the related hypothesis, the Auto Regressive Distributed Lag Model (ARDL) and Error Correction Model (ECM) are used. Based on obtained long-term relationship, all the coefficients of estimated variables except the national income variable have a positive effect on private consumption. Moreover, household wealth and government expenditures variables impact on private consumption in long-term and government expenditures and private consumption are complementary which reflects an emphasis on Keynes theory. On the other hand, analysis of the obtained results in short-term is in contrast to long-term which means that all independent variables have a negative effect on private consumption. The negative coefficient of government expenditures on private consumption imply endorsement of the new Keynesian and neoclassical model and in fact, are considered as successor to each other and according to that increase of government expenditures reduces private consumption. Moreover, Error Correction Model results show that the coefficients of all estimated variables in short-term model are smaller than the ones for long-term relationship and the coefficient of Error Correction Model (ECM) in the estimated model equals to (-0.45) and this coefficient indicates the relatively slow speed of adjustment.

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1. Introduction

Consumption is one of the main variables and is associated with the levels of production and national income in economy. The original emphasis on this macro-economic variable was performed for the first time in 1936 by Keynes and continued with other economists (Rezaieepur and Aghaiee, 2011). When analysis is done on gross national product, it is reasonable to pay more attention to consumption as one of its essential components. In the discussions of intertemporal decision making, consumption is also considered as an important variable. Today less consumption and more savings can be considered as next period consumption or investment and capital resources. Therefore, by specifying consumption, it is possible to determine savings rate and capital accumulation with respect to economic growth patterns and grounds for economic conditions improvement is provided. Consequently, relationship between demand management policies and total supply policies is one of the results which is

available by more attention to consumption and recognition of its main components. In this study, the effect of government expenditures on private consumption expenditures in Iran economy is empirically analyzed. In this regard, we have an overview of the theoretical foundations and experimental studies, then research pattern is stipulated and based on that by using time series data during 1982- 2012 the estimation and empirical analyses are done.

2. Theoretical foundations

Today, economists emphasize that in implementation of financial policies government should observe limitations of its budget in a certain period of time. This means the implementation of an expansionary financial policy at the present time, whether in the form of increase of government expenditures or in the form of tax cuts, in future will be accompanied by a contractionary financial policy or an expansionary monetary policy. Otherwise the government debts will grow to finance interest of previous debts and its growth may exceed the growth of other macro variables. Ways to finance the

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budget deficit has different effects on levels of interest rates, investment and inflation. If deficits continue for a longer time, the volume of government debts increases too. In this case, the need to reduce financial expenditures of government and paying off all debts will increase. According to neoclassical and the new Keynesians theory where people are smoothing consumption over time, it is expected that the wealth effect caused by increased government expenditures reduces private consumption. But some researchers by the use of compensatory work schedule have discussed the possibility of reducing the degree of substitution for government Expenditures rather than private consumption as well as the possibility of a complementary relationship between these two variables. The first type of compensatory effect is the effect of income from government Expenditures as an input to private production that by improving production levels will increase household consumption. The second effect is related to the increase of household working hours following the negative wealth effect arising from the increase in government Expenditures which causes increase of production and increase of consumption in household (Samadi and Sayedi, 2012). Neoclassical patterns consider consumers with unlimited lifetime that maximize their utility over time. Based on these patterns, adoption of financial policy at the present time is required for a policy in future. So financing through taxation in future and its negative wealth effect will reduce private consumption. New Keynesians took dynamic general equilibrium view of the neoclassical and prices temporary adhesion view of Keynesian. In New Keynesians patterns –like neoclassical analyses- it is assumed that increase of government Expenditures is financed through fixed tax and causes reduction of private wealth. So in both conditions of prices adhesion and price flexibility, increase of government Expenditures reduces private consumption (Samadi and Sayedi, 2013). Many Keynesians believe that the budget deficit does not necessarily lead to the substitution. Since there is unemployment and lack of full employment of resources, budget deficit causes production growth and also stimulates the growth of other components of aggregate demand, and its resources is provided through the use of idle resources. According to this view, whenever government issues bonds to finance the budget deficit, private consumption will be affected via the wealth channel. Basically Keynesian models examine short-term and temporary effects. Thus, according to the Keynesian's second assumption that the consumption is very sensitive to changes in disposable income and nearsighted people have a final propensity to high consumption, any increase in government Expenditures or a decrease in taxes (budget deficit), increase disposable income through wealth channel and causes people consume more. In Ricardian view if government by reducing taxes finances the budget deficit through loan, consumption will not change. Household save their

surplus disposable income to pay future tax liabilities (which is caused by tax cuts). This increase in private saving is neutralized by reduction in public saving. National savings (i.e., sum of private and public savings) remains unchanged in the same situation. It should be noted that Ricardian view does not mean all changes in financial policy are ineffective. If financial policy affects the current and future government purchases, certainly it will impact on consumers' consumption. For example, assume that today government cuts taxes because it seeks to reduce its purchases in future. If consumer infers that tax cuts do not mean future tax increase, he feels that he has become richer and adds to his consumption. But it should be noted that the reduction in government purchases (rather than tax cuts) will increase consumption. If government announces that its purchases will decrease in future, it will cause today consumption go up even if today taxes don't change; because the announcement of the government's decision means that taxes will decrease at a future date. In the following an overview of internal and external studies is provided.

3. Literature review

Bailey (1971) first showed that perhaps there is a degree of substitution between government consumption Expenditures and private consumption or in other words there is effect of crowding. Barro (1980) enters the issue of substitution between government consumption and private consumption in the public model and test the direct effect of government purchases on consumption utility. Djajić (1987) investigated the effects of a predicted temporary change in public expenditures on private consumption and investment. According to the results of his research, if public and private goods are Edge worth substitutes, an unforeseen increase in public expenditures stimulates the accumulation of capital.

Aschauer (1985) and Kormendi (1983) used permanent income approach based on data from the United States and discovered the degree of substitution between private consumption and government Expenditures. Ahmed (1986) in the context of an intertemporal substitution model estimates the effects of government consumption on private consumption and found that government Expenditures will cause crowding out of private consumption. Aiyagari, Rao, Christiano, and Eichenbaum (1992) and Baxter and King (1993) in the form of a one-part neoclassical growth model and assuming constant returns to scale, examined the effect of government Expenditures shocks on a variety of the totality of economic. According to their findings increase of government Expenditures significantly leads to lower private consumption and in fact there is a negative relationship between government Expenditures and private consumption. Amano and Wirjanto (1997) with respect to a relative price approach estimated elasticity of

intertemporal substitution between government Expenditures and private consumption for the United States which equaled 0.9.

Some empirical studies have had different results. Devereux, Head, and Lapham (1996) in the context of a neoclassical model and assuming of increasing returns to scale and monopolistic competition, examined the effect of government Expenditures shocks on private consumption. The results indicate that an increase in government consumption, increases productivity and along with increase of productivity, real wages increase and cause a substitution from leisure to consumption. Thus, an increase in government Expenditures increases private consumption. The results of Karras (1994) study with respect to the cross-country data show that government consumption Expenditures and private consumption are complementary.

Hamori and Asako (1999) using data from Japan and in a non-linear model of rational expectations estimated final rate of substitution between private consumption and government expenditures. According to their study final rate of substitution between government expenditures and private consumption is between 0.57 and 0.75. In fact, these two types of Expenditures are successor to each other. Ho (2002) using panel data of OECD countries found that government Expenditures and private consumption are successor to each other. Nieh and Ho (2006) using annual data of 23 OECD countries approved the relationship between private consumption, government expenditures and their relative price. Elasticity of substitution between public and private expenditures shows that these two types of expenditures are complementary.

4. Model Presentation

To extract explicitly the mentioned relationship in this study the presented model of Ismail (2010) is used. It is assumed when consumers choose their consumption optimal path, enter the government budget constraint. The intertemporal consumption maximization will be as follow:

$$U_t = E_t(\sum_{i=0}^{\infty} \beta^i U(C_{t+i}^*)) \tag{1}$$

E is expectations operator, β is subjective discount factor and C^* is consumption. Bailey (1971) defines effective use as follow:

$$C_t^* = PC_t + \theta GC_t \tag{2}$$

Here PC is private consumption and GC is government consumption and θ measures substitution between PC and GC. Private consumption is a function of income, tax and wealth. So the consumer's intertemporal budget constraint is as follow:

$$\sum_{t=0}^{\infty} \frac{PC_{t+1}}{(1+r)^t} = \sum_{i=0}^{\infty} \left(\frac{Y_{t+i} - T_{t+i}}{(1+r)^t} \right) + WP_t \tag{3}$$

Wp is financial wealth of individual and Y is income. T is tax, PC is private consumption and r is interest rate. According to equations (3), (2) and (1), consumer utility function can be written as follow:

$$U = U(\beta^0 C_0^*, \dots, \beta^t C_t^*, \dots, \beta^{\infty} C_{\infty}^*) \tag{4}$$

Equation (4) shows that consumer's lifespan utility function is a function of his effective use at all periods. Consumer tries to maximize his utility according to this constraint that the present value of his total consumption in lifespan cannot be higher than the current value of his total wealth. That means:

$$\sum_{t=0}^{\infty} \frac{C_t^*}{(1+r)^t} = \sum_{t=0}^{\infty} \frac{A_t}{(1+r)^t} \tag{5}$$

A is total wealth (wealth plus income). According to Branson study (1989), it is assumed that the consumer utility function is logarithmic:

$$U(C^*) = \ln C^* \tag{6}$$

Feature of this utility function is that final utility is positive. $U'(C^*) = 1/C^*$ and $U''(C^*) = -1/C^{*2}$ are descending. It is assumed that the utility function over separation time is additive, which means that the final utility of each period is independent of all other periods' consumption. Another assumption is that future utilities discount in ρ subjective rate. These three assumptions provide clarification of utility function that is given below:

$$U = \ln C_0^* + \frac{\ln C_1^*}{(1+\rho)} + \dots + \frac{\ln C_t^*}{(1+\rho)^t} + \dots + \frac{\ln C_{\infty}^*}{(1+\rho)^{\infty}} \tag{7}$$

To solve this problem and to ensure the maximization of consumption, Lagrange multipliers method is used and is determined with the equation (8):

$$\max_{C_t^*, \lambda} L = \sum_0^{\infty} \frac{\ln C_t^*}{(1+\rho)^t} + \lambda \left(\sum_0^{\infty} \frac{A_t}{(1+r)^t} - \sum_0^{\infty} \frac{C_t^*}{(1+r)^t} \right) \tag{8}$$

Lagrange multiplier λ is a positive constant that measures final utility of additional wealth.

$$\frac{\partial L}{\partial C_0^*} = \frac{1}{C_0^*} - \lambda = 0 \tag{9}$$

$$\frac{\partial L}{\partial C_t^*} = \frac{1}{(1+\rho)^t} \times \frac{1}{C_{\infty}^*} - \frac{\lambda}{(1+r)^t} = 0 \tag{10}$$

$$\frac{\partial L}{\partial C_{\infty}^*} = \frac{1}{(1+\rho)^{\infty}} \times \frac{1}{C_{\infty}^*} - \frac{\lambda}{(1+r)^{\infty}} = 0 \tag{11}$$

$$\frac{\partial L}{\partial \lambda} = \sum_0^{\infty} \frac{A_t}{(1+r)^t} - \sum_0^{\infty} \frac{C_t^*}{(1+r)^t} = 0 \tag{12}$$

If λ is removed from the right side of (10) and then equation (10) is divided to (11), we will have:

$$\frac{C_t^*}{C_0^*} = \left(\frac{1+r}{1+\rho} \right)^t \tag{13}$$

In general, for two consecutive periods we will have:

$$\frac{C_t^*}{C_{t-1}^*} = \left(\frac{1+r}{1+\rho}\right) \text{ or } C_t^* = \left(\frac{1+r}{1+\rho}\right) C_{t-1}^* \quad (14)$$

General equation (14) can be rewritten as follow:

$$\frac{U'(C_t^*)}{U'(C_{t-1}^*)} = \frac{1+\rho}{1+r} \quad (15)$$

To investigate the empirical application of this model, the Ho (2002) study is followed and it is assumed that changes in final utility over time is negligible. So the optimal path of consumption, according to specified expectations of future income is as follow:

$$C_{t+1}^* = \left(\frac{1+\rho}{1+r}\right) C_t^* \quad (16)$$

Thus, the following econometric relationship is derived:

$$C_{t+1}^* = \beta C_t^* \quad (17)$$

Here $\beta = [(1+r)/(1+\rho)]$. Since it is assumed that consumers have full insights (information), time preference discount rate equals to the interest rate. Thus $\beta = 1$. Using the definition of $C_t^* = PC_t + \theta GC_t$ effective use, equation (17) can be written as follow:

$$PC_{t+1} + \theta GC_{t+1} = PC_t + \theta GC_t \quad (18)$$

$$\Delta PC_t = -\theta \Delta GC_t \quad (19)$$

In equation (19) it is observed that symbol θ determines how government consumption will impact on private consumption. If $\theta < 0$, the final effect of government consumption growth on private consumption is positive which means that private and government consumption are complementary. When $\theta > 0$, reasoning is inverse. In this case, private consumption and government consumption will move in the opposite direction. Thus private consumption will substitute for government consumption. For Ricardian equivalence test, households must enter the government budget constraint:

$$\sum_{t=0}^{\infty} \frac{GC_{t+i}}{(1+r)^i} = \sum_{i=0}^{\infty} \left(\frac{T_{t+i}}{(1+r)^i}\right) B_t \quad (20)$$

B_t is government bonds and shows that the current discounted total tax equals to current discounted government consumption plus current government debt. By solving the equation for consumption and according to the Hall's (1978) permanent income hypothesis, probably the following statement is obtained:

$$PC_t = \gamma + \beta \sum_{t=1}^{\infty} (1+r)^{-i} E_t(Y_{t+i}) - \beta \sum_{t=1}^{\infty} (1+r)^{-i} E_t(T_{t+i}) + WP_t \quad (21)$$

Here. $\gamma = \alpha\beta(1+r)^2/(r^2 + 2r - \delta - 1)$ and $\beta = (1+r)/(1+\delta)$ By replacing the government budget constraint, equation varies as follow:

$$PC_t = \gamma + \beta \sum_{t=1}^{\infty} (1+r)^{-i} E_t(Y_{t+i}) - \beta \sum_{t=1}^{\infty} (1+r)^{-i} E_t(GC_{t+i}) + \beta WP_t \quad (22)$$

Assuming government consumption and household income is a random walk with drift; this model can be simplified as follow:

$$PC_t = \beta_0 + \beta_1 Y_t + \beta_2 GC_t + \beta_3 H_t + \beta_4 W_{Pt} + \beta_5 T_t \quad (23)$$

In the above equation β_0 is a constant term. Because usually government deficits in Iran economy are financed by borrowing from the central bank and the publication of bills, variable monetary base will replace government bonds.

$$PC_t = \beta_0 + \beta_1 Y_t + \beta_2 GC_t + \beta_3 H_t + \beta_4 W_{Pt} + \beta_5 T_t \quad (24)$$

Variables: PC_t is private consumption, Y_t is national income, GC_t is government consumption expenditures, H_t is monetary base, W_{Pt} is household wealth and T_t is tax.

5. The statistical data used in the model

Private consumption as the most important component of aggregate demand can be affected by variables such as interest rates, tax, general level of prices and government expenditures that all are affected by the government's economic policies. In this study it is tried to examine a part of the factors affecting private consumption during two decades.

Used data are collected from the Central Bank and the Statistical Center of Iran site which are presented as follow:

Private Consumption (PC): It represents consumption expenditures of private sector based on the base year (2004) in terms of billion riyals.

National Income (Y): Gross National Product based on the base year (2004) in terms of billion riyals.

Government Consumption Expenditures (GC): Government consumption Expenditures in current price.

Monetary Base (H): Or power money in terms of billion riyals.

Household Wealth (WP): Capital accumulation of private sector based on the base year (2004) in terms of billion riyals.

Tax (T): Tax income in terms of billion riyals.

6. Estimates

The data used in this article is collected from the Central Bank site for the years 1982 to 2012. Before start of estimates, it is necessary first to examine data stationary to avoid spurious regression.

7. Data stationary

Applied data stationary is done using Augmented Dickey-Fuller Test and Eviews8 software which is shown in the Table 1.

According to the results of Dickey-Fuller test, as it can be seen in the above table, all variables are

stationary that in this regard there is not any problem to continue calculations.

Table 1: Dickey-fuller test: data stationary reviews

	PC	Y	H	GC	WP	T
1% Critical Value*	-2.65	-2.66	-2.66	-2.64	-2.65	-2.66
5% Critical Value	-1.95	-1.95	-1.95	-1.95	-1.95	-1.95
10% Critical Value	-1.61	-1.61	-1.61	-1.61	-1.61	-1.61
ADF Test Statistic	6.86	-2.64	6.34	10.00	8.99	1.98

Reference: research results

It is worth noting that one of the benefits of Autoregressive Distributed Lags model in comparison to other methods is lack of concern about the I(0) or I(1) of the variables. So regardless of the reliability of variables in first level or differences, we can obtain compatible estimates from the long-term coefficients.

As noted in this study experimental test of government expenditures increase and crowding out of private consumption in Iran economy in long-term and short-term are investigated. To do this two tests of Auto Regressive Distributed Lag Model (ARDL) and Error Correction Model (ECM) are used.

8. ARDL estimation

According to the done tests in the above discussions, in this part by the use of Microfit5 software, long-term relationship of government expenditures increase and private consumption in Iran economy is estimated.

$$\begin{aligned}
 PC = & 5254.2 + 1.45 PC(-1) + 0.21 Y - \\
 & 0.16 Y(-1) - 1.58 GC - 0.08 H - 0.32 WP - \\
 & 0.71 WP(-1) - 0.61 T \\
 & (1.42) \quad (11.59) \quad (7.16) \quad (2.51) \quad (-7.37) \\
 & (-1.85) \quad (-5.50) \quad (1.42) \\
 R^2 = & 0.99 \quad D - W = 2.90
 \end{aligned}$$

As can be seen from the above results, all their independent and lagged variables (except national income) have a negative effect on private consumption variable. Moreover, just monetary base variable is not significant (numbers in parentheses are t-statistics). On the other hand the high value of R² indicates relatively good explanatory power of the model.

9. Test of long-term relationship existence between variables and relationship determination

In estimating the long-term relationship if the total of coefficients of lagged variables related to the dependent variable in the above model is smaller than one, dynamic model will tend to long-term equilibrium model. Before extracting long-term relationship, it is necessary to examine the presence or absence of long-term relationship. One of the tests that are commonly used for this purpose is Banerjee, Dolado and Mestre test. To perform this test whole

lagged coefficients of dependent variable must be subtracted from one and then divided into standard deviation.

Its T-statistic is as follow:

$$t = \frac{1.45 - 1}{.126} = 3.57$$

Due to the critical quantity provided by Banerjee, Dolado and Moastre at 95% confidence level which is equal to 3.57, it is considered that the calculated absolute value is greater than the absolute value of the provided critical quantity. Therefore, long-term relationship is confirmed.

Long-term relationship is estimated as follow:

$$\begin{aligned}
 PC = & -11558.5 - 0.77 Y + 3.48 GC + 0.19 H + \\
 & 2.27 WP + 1.35 T \\
 & (-1.17) \quad (-2.14) \quad (3.51) \quad (0.45)
 \end{aligned}$$

Based on obtained long-term relationship, all the coefficients of the estimated variables at 95% confidence level (except monetary base variable) are significant and just national income variable has a negative effect on private consumption. This could be due to the fact that in long-term people decide to increase the level of their private savings and therefore reduce their consumption. Furthermore, by increasing the monetary base and liquidity, purchasing power of people will increase and consumption of society will go up too.

On the other hand, the effect of household wealth variable (in order to encourage greater savings in long-term) and government expenditures on private consumption in long-term is complementary which reflects an emphasis on Keynesian theory. Moreover, shows the compensation effect of the income effect of government expenditures on the rise of household consumption level.

Furthermore, about positive effect of tax incomes on private consumption can be said that probably in long-term by the increase of tax income level, the government budget deficit is funded and thus government transfer payments to the private sector will increase that would encourage the private sector to increase the level of consumption, although these results may not be obtained in short-term.

10. ECM estimation

Engle and Granger (1987) have shown that each long-term relationship has a short-term ECM model that achieving it guarantees balance and vice versa.

For the formation of ECM model estimates of long-term coefficients based on ARDL model are used and the following result is obtained:

$$dPC = 0.21 dY - 1.58 dGC - 0.61 T - 0.08 dH - 0.32 dWP - 0.45 ecm(-1)$$

(7.16) (-7.37) (-1.84) (-0.44) (-1.85) (3.62)

Analysis of obtained results in short-term suggests that all independent variables have a negative effect on private consumption and except monetary base variable, other variables are significant. The negative coefficients of government expenditures on private consumption imply endorsement of the new Keynesian and neoclassical pattern and based on that increase in government expenditures reduce private consumption. Accordingly, it can be said that government expenditures and private consumption are successor to each other. Moreover, because any growth in government expenditures or any decrease in taxes (budget deficit) increases disposable income through wealth channel and makes people to use more of it and also with the growth of tax, purchasing power of people in short-term reduces, it has a negative effect on private consumption. Then negative coefficient of tax income and household wealth is approved. On the other hand, the Error Correction Model results show that the short-term coefficients of all estimated variables in short-term model are smaller than the ones for long-term relationship. Furthermore, coefficient of Error Correction Model (ECM) in the above estimated pattern equals -0.45 and this coefficient indicates the relatively slow rate of adjustment. This means that each year about 45% of imbalance in a period is adjusted in respect of private consumption in the next period.

11. Conclusion

The aim of this study is to evaluate the effect of changes in government expenditures and crowding out of private consumption in Iran economy for the years 1982 to 2012. Estimates were done using Microfit5 and Eviews8 econometric software. Furthermore, estimates are obtained using ARDL and ECM models during both short-term and long-term periods.

Based on obtained long-term relationship, all the coefficients of estimated variables except the variable of national income have a positive effect on private consumption. The effect of household wealth and government expenditures on private consumption in long-term is also positive. On the other hand, analysis of the obtained results in short-term is in contrast to the long-term. This means that all independent variables have a negative effect on private consumption and government expenditures coefficient on private consumption is negative, so based on that increase in government expenditures reduces private consumption. Moreover, Error Correction Model results show that the coefficients

of all estimated variables in short-term model are smaller than the ones for long-term relationship and coefficient of Error Correction Model (ECM) in the estimated pattern equals -0.45. This means that each year about 45% of imbalance in a period is adjusted in respect of private consumption in the next period.

In general it can be concluded that in long-term two variables of government expenditures and private consumption are complementary that emphasize Keynesian hypothesis. But in short-term these two variables are successor to each other and they confirm new Keynesian and neoclassical model. On the other hand, the short-term to long-term adjustment process usually takes place very slowly.

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