Dynamic implications of fiscal policy: Crowding-out or crowding-in?

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Abstract

The purpose of this paper is to analyze the short run and long run effects of fiscal policy. The classical-Harrodian model developed in Moudud (2000, 1999), which is an extension of Shaikh (1995, 1992, 1991), provides a demonstration of dynamic fiscal policy context. It asserts that the there is a crowding in of output growth in the short run. In the long run, however, the impact of government spending is subject to change under some circumstances of capital utilization, normal profit rate and social savings rate.

Blinder and Solow (1973), using IS-LM model, reveal that bond-financed fiscal expansion does not engender a complete crowding out. Friedman (1978, 1985) notices the possibility of crowding-in. Crowding-out or crowding-in debate can be extended to other economists. Blanchard and Perotti (1999) and Easterly and Rebelo (1993) reach crowding-in results. Bairam and Ward (1993) find crowding-out of private investment. Barro (1989, 1999) and Kormendi and Meguire (1985) obtain either a negative or no effect of government spending on the growth, whereas the works of Argimon *et al.* (1997), Devarajan *et al.* (1996) and Ahmed and Miller (2000) have mixed results.

This study runs VECM models and impulse response analysis to juxtapose the crowding in/out effects of fiscal policy. Investigating the short run and long-run implications of fiscal policy for the Turkish economy, this paper concludes that government investments crowd out, whereas its current expenditures crowd in the private investment.

Keywords: Fiscal policy, crowding-in, crowding-out, cointegration, VECM
JEL: E62, O40

I. Introduction: Theoretical perspectives

The neoclassical model claims that an increase in government spending, with constant revenue, results in a decline in output and employment. This result is due to the neoclassical assumptions of full employment and full utilization of capacity. The model of neoclassic argues that increase in government spending, given that government revenue is fixed, brings about higher interest rates, thereby crowding out private investments. To be more specific, the result of increase in interest rate comes from the neoclassical loanable funds theory. In the theory, bond-financed government spending creates an insufficient fund for private investment. Since it is assumed that the supply of fund is fixed in the theory, the competition between government and private sector for the available fund gives rise to higher interest rates. As a result, (at least some of) private investors leave the loan market.

However, in the short run, the IS-LM side of the neoclassical model suggests that there might be unemployment. By following standard IS-LM model, in the short run, deficit-financed (bond-financed) government expenditure lets IS curve shift to right. Then output will go up together with the increase the demand for money. Both rightward shift in IS and increase in demand for money would imply a rise in interest rate and thus a fall in investment. This will cause output to fall. One should note that the new output level is still grater than the initial output before fiscal expansion, as long as LM has positive slope. Another way of saying is that the output is greater than the initial level but smaller than it would be otherwise. Of course, this is not end of the story. The portfolio effect of excessive supply of bonds would also imply a leftward shift in LM curve and therefore further increase in interest rates. In other words, since, in portfolio, the ratio of money to bond has decreased, LM curve has shifted to left. In order for households to keep this relatively lower money/bond ratio (M/B), interest rates need to be higher. One can put this way: When there is excessive supply of bonds (lower ratio of M/B), there occurs an excessive demand for money and then resulting outcome is a higher rate of interest rate. Then, what is the magnitude of crowding out? Obviously it depends on the income and interest sensitiveness' of investment and demand for money.

One can continue for IS-LM analysis to capture the stochastic results of bond financed-deficit in the long run. After a short run implication of fiscal policy given above paragraph, what happens in the next period? As long as government needs to issue new bonds because of repayment of earlier bonds supplied, there will be higher rate of interest at each period because of leftward shift of LM each period. This implies a fall in output every period. Combining all these each short-run fiscal expansions, at the end, one might reach complete crowding-out. Further, as an extreme case, the final consequence of initial impact of fiscal policy in the long run might be a collapsed output together with a complete crowding-out (CEPA, 2003).

Following Blinder and Solow (1973), because of the wealth effects of bonds and money, initial (short run) and final (in the long run) consequences of fiscal policy do not yield a complete crowding-out. A fall in output causes unemployment and, therefore, a fall in wages and prices. Within this Pigou effect, even if government repeats the issue of bonds at each period, an increase in power of purchasing of households due to increase in bond and money in their portfolios, the consumption will be higher. This implies a shift in IS to the right. If rightward shift in IS (wealth effect) compensates leftward shift in LM (portfolio effect) at each period, then, a complete crowding-out would not occur. Blinder and Solow (1973) claim that in case of unemployment, the wealth effect is greater than the portfolio effect. Therefore the net output is going to be higher than initial level. This less than complete crowding-out (partial crowding-out) might also imply a partial crowding-in.

Friedman (1978) also notices the possibility of crowding-in result. An extension of IS-LM analysis with three assets of money, government bonds and real capital (equity), emphasizes the importance of relative substitutabilities of these assets. If the substitution degree between government bonds and money were greater than that of bonds and capital, crowding-in would occur. A good substitution of bonds for money results in a rightward shift in LM through portfolio effect. After bond financed-fiscal expansion, the ratio of bond plus money to capital [(M+B)/K] increases in households' portfolio. This will cause the LM to sift to right. In this case the resulting income with portfolio effect (Y_{1p}) is greater than both initial income (Y_o) and the income produced by traditional IS-LM equation with money demand effect (Y_{1md}). To be more specific; assume that government issues bonds to finance it's spending. First outcome is an increase in income (income effect of fiscal policy). The second outcome is an increase in demand for money, which is a function of income (money demand effect of income).

The money demand effect offsets a part of income effect (partial crowding-out). The third or concurrent outcome is an amended portfolio by households (portfolio effect). Under the assumption of a good substitutability of bond for money, the consequence of expansionary fiscal policy is $Y_{1p} > Y_{1md} > Y_{o.}$

Friedman (1978), on the other hand, indicates that, if bond is a good substitute for capital, then, a bond financed-deficit engenders a relative decline in portfolio of [(M/(K+B)]. In this case, LM curve shifts to leftward. This portfolio crowding-out effect together with money demand crowding-out effect may result in as $(Y_{1p} + Y_{1md}) < Y_{o.}$

In Friedman' analysis (1978), however, the empirical evidence reaches the conclusion that the money and bonds are not perfect substitutes; hence crowding-in can occur.

One may focus the relative returns of these assets in analyzing the potential different portfolio effects. In a portfolio crowding-out case, a bond financed-spending implies an increase the rates of return on bonds and capital (bonds and capital are substitutes). The portfolio crowding-in case, on the other hand, a bond financed-spending implies a fall in the rate of return on capital and a rise in return on bonds (bonds and capital are not substitutes). To be more specific, following Friedman (1985), one should underline two points. First, a supply of any asset raises that asset's expected return. Second, a supply of any asset may raise the expected return on other assets (they are substitute since they move together) or lower the expected return on other assets (they are not substitute since they do not move together).

Friedman (1985) finds that a $100 billion additional supply of short-term debt lowers expected return on equity (capital) by 0.33 %, relative to the return on short-term debt. His study (1985) also concludes that a $100 billion additional supply of long-term debt lowers expected return on equity (capital) by 0.24 %, again relative to the return on short-term debt. Hence, the result in general is that bonds and equity are relatively poor substitutes. Together with these results, Friedman (1978, 1985) suggests that, although neither bonds and money nor bonds and capital (and nor short-term bonds and long-term bonds) are perfect substitutes, a good debt management policy should be followed by considering the relative substitutability among assets. To this end, one can draw a conclusion from Friedman' works that long-term financing may bring about crowding-out, whereas the short-term financing may cause crowding-in.

The literature of substitutability of the assets is, of course, ambiguous. For instance, Aivazian *et al.* (1990) investigate whether non-money assets (i.e., bonds and equities) are substitutes or complements. Their empirical finding is that bonds and equities are substitutes. In this circumstance, bond-financed deficit make households switch from illiquid (bond and equity) to liquid (money). The potential consequence is a crowding-out.

In short so far, due to existence of unemployment in the short run of IS-LM model, an increase in government expenditure may have positive effect on output and employment. The Keynesian model, since the problems of unemployment and unutilized capacity are recurrent, predicts also that fiscal policy has positive/desired effects to adjust the cyclical growth. For both models, however, once economy reaches to full employment, fiscal policy is not effective.

What about if economy is at full productive capacity? Then, one may derive the conclusion of ineffective fiscal policy no matter which model is considered. Moudud (1999), on the other hand, suggests that, even the existence of normal capacity utilization, which is defined as economically feasible capacity, the fiscal policy may yield a higher output. Any productive fiscal policy, i.e., government productive investments rather than its consumption, that lowers business costs or increase business-retained earnings yields higher long-run growth. The model's results about efficiency of fiscal policy are basically based on social savings rate (i.e., share of business retained earnings when households' savings are ignored) and the composition of government spending (consumption and infrastructure investments). A higher growth of output can be reached through higher social saving rate and a higher share of government infrastructure investment to government consumption.

II. More tangible results of fiscal policy

In searching the literature to analyze the link between output and fiscal policy, I would like to underline several papers, which deserve consideration, among many others cited intensively in the literature. This section presents the results of some calibrated and regression models. The outcomes of some of these works either support crowding-in, or are in favor of the crowding-out result, whereas some others have mixed results.

Barry and Devereux (2003) search, for instance, the possible outcome of a contractionary fiscal policy in a dynamic general equilibrium model. In their overlapping generations model, when it is calibrated, the government spending multiplier is negative and can be quantitatively significant. Therefore, the model predicts that a fiscal contraction is expansionary in terms of aggregate national income. When the government-spending ratio is 20%, long run government spending multiplier is approximately –0.45. In a dynamic framework, a unit cut in government spending increases the current consumption by less than unit cut in spending. This causes a fall in interest rate and an immediate rise in labor supply, hence an increase in investment and capital stock. As capital accumulation occurs from short term to the long term, output rises immediately in the very short run and gradually in the long run. The initial increase of output is, however, very small. Thus, the view that large spending cut creates an immediate boom in the real economy does not hold. The higher is the initial government-spending ratio, the higher the response of output by a fiscal contraction both in the short and in the long run.

Moudud (2000), in his classical-Harrodian model, which is an extension of Shaikh (1992, 1995), and which dates back to Quesnay, Marx, Ricardo and Harrod, posits that growth and cycles are endogenous, underutilized capacity is recurrent and unemployment is persistent. The model reveals that long-run growth of output depends on long run or normal rate of profit. This rate is determined by income distribution and technology as in Ricardo, Marx and Sraffa. An increase in profit margin (i.e., lower business costs due to investment tax credits, lower rates of corporate taxation and accelerated deductions for capital depreciation) will raise the growth. In the model, given the normal rate of profit, the key determinant is social savings rate (s*). It is defined as the private savings rate (business retained earnings plus households savings) less the budget deficit of government. The simulation exercises of the model indicate that a rise in government spending level (G) relative to Y, (g), leads crowding-in the short-run. If private savings rate is fixed, then, an increase in g leads crowding-out in the long run at normal capacity with structural unemployment. If s* increases with the increase in private savings rate, then, an increase in g result in crowding-in in the long run. On the other hand, model also estimates the result of an increase in G rather than g. One-time increase in G yields crowding-in in the short run. In the long run, one-time increase in G does not engender crowding-out since g remains fixed.

Barro (1990) employs also an endogenous growth model to investigate the effects of government expenditures on growth as in Moudud (2000). His model, of course, differs from Moudud's model with many perspectives but has the same emphasis on positive effect of productive government expenditures on growth as Moudud (1999, 2000). His growth analysis includes tax-financed government expenditures. According to the predictions of the model, the marginal (average) income tax, *t*, with a given the ratio of public services per person to the output per person (g/y), has a negative effect on growth and savings rates since *t* is associated with a negative effect on private investment after-tax return. The share of productive government expenditures or the share of public services, g/y, effects growth and savings rates positively. These public services, such as police, fire protection and national defense that individuals receive, are proportional to the amount of individuals' property. Improvement in property rights resembles reductions in marginal tax rates from the point of investors. An increase in g, which improves property rights, lowers the negative effect of *t* in effective value. Therefore, enhancement in property rights brings about higher growth and savings. Productive government expenditures therefore cause an increase in growth and savings in the short run, but a decline in the long run (i.e., due to increase in taxes through increase in output). An increase in share of nonproductive government expenditures or share of government consumption, h/y, for g/y given, leads to lower growth and savings rates. The reason is that an increase in h/y creates both productivity in private sector and higher income tax rate.

Barro (1989, 1990) employs the data for the period over 1960 to 1985, which is modified version of Summers-Heston data (1988), to reveal the effects of government consumption as a share of output (gc/y), public investment as a share of total investment (gi/i) and public investment as a share of output (gi/y) on growth of per capita income. Using the data for 98 developed and developing countries, the parameter estimate of gc/y is –0.12 (s.e = 0.03). Thus non-productive government consumption yields lower growth. Employing the data for 76 countries, gi/i is estimated as 0.014 (s.e. = 0.022). Positive but insignificant coefficient indicates no relation between public investment and growth, which in turn implies that government optimizes according to the theory. Finally, using the data for 76 countries, the coefficient of gi/y is again positive but insignificant with the values of 0.13 (s.e. = 0.10).

Easterly and Rebelo (1993) follow a large data set of Government Financial Statistics (GFS), International Financial Statistics (IFS), Summer and Heston (1991), Barro and Wolf (1989), Easterly, Rodriguez and Schmidt-Hebbel (1993) and some other sources for the period 1970-1988 for 100 countries. Their cross sectional analysis reveals the significant evidence that the share of transport and communication has positive effect on growth, which ranges between 0.59 and 0.66 and that general government investment is also consistently positively correlated with both growth with the coefficient of 0.4 and private investment with the coefficient of close to 1.

Argimon, Gonzales and Roldan (1997) reach the same result as Easterly and Rebelo (1993). They predict the effects of public investment and government consumption on private investment. Using a panel data for 14 developed OECD countries from Summers and Heston (1991), they present an existence of a crowding-in effect of private investment induced by public investment due to existence of positive impact of infrastructure on private investment productivity. In their findings, there also appears some evidence of crowding out of investment by government consumption. From this fact, they oppose the deficit reductions through cuts in public investment since those cuts may bring about severe negative impact on private capital accumulation and growth.

Despite the existence of crowding-in effect by public investment for developed countries in Argimon, Gonzales and Roldan (1997) and in another work, Devarajan, Swaroop and Zou (1996) find reverse existence for developing countries. They develop a model to examine the link between components of government expenditure and economic growth. Using the Government Financial Statistics (GFS) and International Financial Statistics (IFS) annual data on 43 developing countries for the period of 1970 to 1990, they test if different productive and nonproductive shares of government expenditure are associated with higher growth. The some components of productive expenditures; capital, transport and communication, health and education are found either insignificant or negative in their relation to growth. The current expenditure has, however, positive and significant relation with growth. One way of interpreting this result, as they do, is that seemingly productive expenditures may be unproductive, for instance, due to their excessive shares in total government expenditure. From this evidence, they suggest, as opposed to Argimon, Gonzales and Roldan (1997), that governments may need to reconsider the shares of expenditures since several components of current expenditure, such as operations and maintenance, may have higher returns than public investment.

Bairam and Ward (1993) use an aggregate investment function for 25 OECD countries over the period of 1950-1988. The annual data, which comes from Summers and Heston (1991), following Box-Cox specification, measures the elasticities of private investment with respect to government expenditure (e_g), income (e_y) and prices (e_p) for each country. Among 20 developed and developing countries, 19 e_g values are statistically significant and ranges from –0.54 to –1.66. The result implies that an increase in government expenditure lowers the investment in 19 of 20 countries significantly.

Whereas Bairam and Ward (1993) indicate a significant crowding-out of private investment by aggregate government spending, Ahmed and Miller (2000) reveal some opposite results with disaggregated data. They search the effects of tax-financed and debt financed government expenditures on private investment for developed and developing countries.

Their data covers the period of 1975 to1984 for 39 countries. Using the data from Miller and Russek (1997) with OLS, fixed and random-effect models, they report only fixed-effect model results since it gives the best F test results among others. In their work, all variables are as shares of GDP. Ahmed and Miller find that debt-financed aggregate government expenditure (*gd*) has no significant effect on investment (*inv*) for the full sample; it has positive effect on *inv* in developing countries and negative effect in developed countries. As for the tax-financed aggregate government expenditure (*gt*), it has negative effects for full and sub-samples. Findings, in other words, imply that *gd* yields crowding-in for developing countries, crowding-out for developed countries whereas *gt* results in crowding-out for all three cases. Ahmed and Miller (2000) search also the effects of components of government expenditures (i.e. defense, education, health, social security and welfare, transportation and communication) and finally conclude that tax-financed government expenditure crowds out more investment than debt-financed expenditure.

Kormendi and Meguire (1985) present the empirical evidence of some macroeconomic variables that may affect economic growth. In cross-sectional analysis, using the IFS data of 1950-1977 for 47 countries, the share of government spending, which excludes transfer payments and government fixed capital formation, has a coefficient of 0.024 (s.e. = 0.14). It depicts that mean growth of the ratio of government spending to output has positive but insignificant effect on the output growth. Therefore this study does not confirm the pure neoclassical hypothesis, as some other papers do not either, that increase in government spending, or reduction efficient resource allocation, bears a lower level of output.

Finally, yet it is not end of the literature of course, in comparison with the Kormendi and Meguire (1985), Blanchard and Perotti (1999) show a reverse result in a dynamic context. They analyze the dynamic effects of shocks in government spending and taxes on output by a structural VAR system for the USA data, which comes from Quarterly National Income and Product Accounts and Quarterly Treasury Bulletin, for the period of 1960:1 – 1997:4. Where the variables are shares of GDP, the increase in tax has a negative effect on output, whereas the spending shocks have positive effects on output and are longer lasting than tax shocks.

III. Empirical analysis

In this part of study, I analyze the short-run and long-run dynamics of fiscal policy for the Turkish Economy. The purpose is to process several time series analysis to disclose if government actions by its expenditure components pressure private sector movements in the markets.

The variables chosen to be employed in analysis are private gross fixed capital formation, from now on private investment (PINV), government gross fixed capital formation, from now on government investment (GINV), private final consumption (PC), government current expenditures, which include wages, salaries and other current expenditures (GC) and total taxes (TAX), respectively. All variables are real with 1987 prices. The quarterly data covers the period of 1988:1 – 2003:1. The data is obtained from The Central Bank of Turkey. By using the data, I aim at obtaining the long run and short run parameters of private investment and other variables if there exists a long run relationship among them. Given the foregoing framework, cointegration, vector error correction tests and impulse-response analysis are applied to variables. By investigating the test results and innovation accounts, it would be possible to reveal whether government expenditures crowd out private investment or not.

In econometrical analysis, it is a basic necessity that either series are stationary or they are cointegrated. In the case of nonstationarity, one would get spurious results from the regression equations. Therefore, either researcher ought to use stationary variables in levels or differences or he/she uses cointegrated non-stationary variables in their levels. Although the variables of interest might be individually nonstationary, $I(1)$, as many macro variables do, one or more linear combinations of those might be stationary, $I(0)$. In presence of such linear combination(s), the variables are said to be cointegrated and therefore there exists a long-run relationship (equilibrium) among them (Granger, 1991). In literature, it is underlined that prerequisite for cointegration is to obtain $I(1)$ variables. Then, either naturally or due to this prerequisite, almost all cointegration applications refer to the $I(1)$ series, hence a cointegration relation is denoted as $CI(1,1)$. Before proceeding the analysis, it should be noted that the set of $I(2)$ variables, on the other hand, might be candidates of cointegration relationship of order $CI(2,1)$, so that there exist a linear combination that is $I(1)$ (Enders, 1995:359-361; Jørgansen *et al.,* 1996).

Dickey Fuller/Augmented Dickey Fuller unit root test results of the natural log of variables are given in Table 1. All variables are found $I(1)$ in their levels and $I(0)$ in their differences, hence they are difference stationary. The next step is to search if any linear combination(s) of them is stationary. I established two standard VAR systems. The first system, VAR(I), includes the endogenous variables of LPINV, LGINV, LTAX and LGC. The second system, VAR(II), consists of LPINV, LGINV, LGC and LPC. In both systems, to capture the seasonal effects in data, a centered seasonal dummy (DS) is employed. Besides, to catch up the possible effects of financial crises; 5 April of 1994 and 22 February of 2001 in the data, two pulse dummies, D94 and D01, are used. In determining the lag numbers of the VAR systems, considering over-parameterization, the maximum lag number is chosen as 6. In lag order selection, Schwarz information criteria (SC), likelihood ratio (LR), final prediction error (FPE), Akaike information criteria (AIC) and Hannan-Quinn criteria (HQ) are used, together with the main concern of choosing the relatively smaller lag. In testing the Johansen's deterministic trend assumptions, the SC and AIC are observed.

III.1 Private investment behavior in VAR(I)

In VAR (I), the lag length is chosen as 2 by SC. It is found as 5 by LR, FPE, AIC and HQ. I preferred SC to avoid over-parameterization problem. Some evidence from Monte Carlo studies also shows that SC dominates all other criteria named above in VAR process (Köse and Uçar, 1994). In the system, dummies of DS, D4 and D01 are found significant by LR test at 1%, 5% and 5%, critical values, respectively. After determining the optimal lag length, one needs to test the deterministic trend assumptions. By SC criteria, it is found that the series in VAR have linear trends but the cointegrating equations (CE) have only intercepts. Table 2A gives the result of one rank by both trace and max-eigenvalue statistics at both 5% and 1% levels.

Table 1. Unit Root Test in Levels and Differences

	DF/ADF	**Lag**	**Q Stat** (a)	***p*(Q)**
LPINV				
1	0.305	5	17.802 (13)	0.165
2	-2.264	4	22.045 (14)	0.078
3	-1.990	4	20.381 (14)	0.119
LGINV				
1	-0.474	4	11.822 (14)	0.621
2	-2.063	4	12.131 (14)	0.596
3	-2.063	4	12.518 (14)	0.565
LTAX				
1	5.928	7	18.851 (13)	0.128
2	-0.019	7	18.343 (13)	0.145
3	-1.660	7	20.543 (13)	0.082
LGC				
1	2.192	4	21.166 (14)	0.097
2	-0.965	4	21.428 (14)	0.091
3	-2.428	4	21.431 (14)	0.091
LPC				
1	1.508	4	21.619 (14)	0.087
2	-2.287	4	22.265 (14)	0.073
3	-2.865	4	17.734 (14)	0.219

Table 1. Unit Root Test in Levels and Differences (continued)

	DF/ADF	Lag	Q Stat (a)	*p*(Q)
DLPINV				
1	-3.517	4	20.278 (14)	0.122
2	-3.501[b]	4	20.255 (14)	0.122
3	-5.292	5	12.863 (14)	0.537
DLGINV				
1	-4.259	3	11.859 (14)	0.618
2	-4.197	3	11.827 (14)	0.620
3	-4.158	3	11.984 (14)	0.608
DLTAX				
1	-1.292[c]	8	18.674 (13)	0.134
2	-8.478	6	18.378 (13)	0.144
3	-8.385	6	18.679 (13)	0.133
DLGC				
1	-3.669	3	23.372 (14)	0.054
2	-4.405	3	21.251 (14)	0.095
3	-4.400	3	21.750 (14)	0.084
DLPC				
1	-2.840	3	22.088 (14)	0.077
2	-3.245	3	21.670 (14)	0.086
3	-5.886	6	13.055 (13)	0.444

1: no constant, no trend
2: constant, no trend
3: constant and trend
a: Number of lags in correlogram for residuals
b: DLPINV 2 is significant at %5.
c: DLTAX 1 is not significant %1 and %5.
All others are found significant at both %5 and %1 critical values.

Table 2.a Trend Assumption: Linear Deterministic Trend

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.873383	135.2913	47.21	54.46
At most 1	0.151700	13.36240	29.68	35.65
At most 2	0.060047	3.655671	15.41	20.04
At most 3	3.48E-05	0.002055	3.76	6.65

Trace test indicates 1 CE at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.873383	121.9289	27.07	32.24
At most 1	0.151700	9.706725	20.97	25.52
At most 2	0.060047	3.653616	14.07	18.63
At most 3	3.48E-05	0.002055	3.76	6.65

Max-eigenvalue test indicates 1 CE at both 5% and 1% levels

Normalized cointegrating coefficient (std.err. in parentheses)

LPINV	LGINV	LGC	LTAX
1.000000	1.324391	-14.56826	6.620327
	(0.36342)	(1.03260)	(0.45244)

Adjustment coefficients (std.err. in parentheses)

D(LPINV)	D(LGINV)	D(LGC)	D(LTAX)
-0.072297	-0.009015	0.058047	-0.093553
(0.00969)	(0.02103)	(0.00483)	(0.00657)

Table 2.b Significance Tests of the Adjustment and Cointegrating Coefficients

D(LPINV)	$\chi^2(1)$=43.572 (0.000)	LPINV	$\chi^2(1)$=8.730 (0.000)
D(LGINV)	$\chi^2(1)$=0.2114 (0.645)	LGINV	$\chi^2(1)$=11.500 (0.000)
D(LGC)	$\chi^2(1)$=77.592 (0.000)	LGC	$\chi^2(1)$=84.718 (0.000)
D(LTAX)	$\chi^2(1)$=94.742 (0.000)	LTAX	$\chi^2(1)$=90.421 (0.000)

The standard errors from Table 2.a indicate that all estimated coefficients, except the adjustment coefficient of D(LGINV), are statistically significant. One can check the significance of the coefficients by LR test also. LR test results shown in Table 2.b confirm the result of Table 2.a. The single cointegrating equilibrium, or long-run equilibrium of LGINV, LGC and LTAX with respect to LPINV, is given by Eq.(1) .

$$LPINV = -1.324\ LGINV + 14.568\ LGC - 6.620\ LTAX \quad (1)$$

The private investment in Turkey is positively affected by government current expenditures but negatively affected by both government investment and taxes imposed by government in the long run. The adjustment coefficients imply the short-run dynamics. They show the speed of adjustments of the variables in response to a standard deviation from long-run equilibrium. LPINV changes, for instance, in response to the one unit deviation from long-run equilibrium by -0.072297 units. In order for the system to return to the long-run equilibrium, the movements of at least some of the variables must respond to the magnitude of the disequilibrium. If all adjustment coefficients were equal to zero, there would be no long-run relation and no error correction. Therefore, at least one of them should be statistically different from zero (Enders, 1995:365-366).

By exclusion the adjustment parameter of D(LGINV) with the normalized cointegrating coefficients (LPINV =1), one obtains a new vector error correction model (VECM) together with the new cointegrating vector and adjustment parameters. Eq(2) gives the normalized cointegrating vector, which represents long-run equilibrium of LPINV with government's fiscal components. Eq. (3) represents the short-run dynamics of LPINV, which is the first equation of VECM.

$$LPINV = -1,299\ LGINV + 14.584\ LGC - 6.626\ LTAX \qquad (2)$$

$$\begin{aligned} D(LPINV) = & -0.0723[LPINV(-1) + 1.2995\ LGINV(-1) - 14.5841\ LGC(-1) \\ & \quad + 6.6261\ LTAX(-1) + 27.4472] \\ & + 0.0273\ D(LPINV(-1)) + 0.0478\ D(LGINV(-1)) - 0.3860\ D(LGC(-1)) \\ & + 0.1553\ D(LTAX(-1)) + 0.0071 \\ & + 0.1446\ DS - 0.2001\ D94 - 0.2021\ D01 \qquad (3) \end{aligned}$$

As the adjustment coefficient of D(LGINV) is restricted to zero, LPINV, LGINV, LGC and LTAX are again individually found statistically significant in Eq.(2) at 5%, 1%, 1% and 1% critical values respectively . The adjustment coefficients of D(LPINV), D(LGC) and D(LTAX) are again significant at 5%, 1% and 1% respectively. Lag exclusion test also indicates that the first differenced lags of all endogenous variables are jointly significant in the model with the p value of 0.000. The signs of all cointegration and adjustment coefficients are the same as those found before at Table 2.a. With slight differences in coefficient values, the short-run and long-run implications did not change under the exclusion. Finally diagnostic tests are carried out for VECM. Table 3 indicates that the model does not suffer from autocorrelation and heteroskedasticity and normality assumption is not rejected.

Table 3. Diagnostic Tests of Residuals

Ho: No serial correlation	$\chi^2(15)=16.252$	(0.435)
Ho: Residuals are multivariate normal	$\chi^2(55)=72.39$	(0.057)
Ho: No ARCH without c.t. (levels and squares)	$\chi^2(130)=116.5$	(0.794)
Ho: No ARCH with c.t.	$\chi^2(280)=288.1$	(0.356)

In short, all coefficients of VECM are found significant and the model performs well. At this point, one can make inferences about Eqs. (2) and (3). The statement of Eq. (2) is that government fixed investment and taxes crowd out private fixed investment, as government current consumption crowd in private investment in the long run. Eq. (3) gives the short-run adjustment of LPINV to deviation from lung run. On the right-hand side of Eq. (3), the first and second line in brackets gives the estimate of deviation from long-run equilibrium in period (t-1). With respect to investment relation, this discrepancy disappears by -0.0723 units each quarter.

Before analyzing VAR(II), despite their lag selection disadvantage relatively to SC, one might wonder the case of LR, FPE, AIC and HQ's selection in VAR(I). By these criteria, the lag length is chosen as 5. In testing the deterministic trend assumptions, AIC determined that both series and CE have linear trends. By conducting these application, dummies are found significant and rank is determined as 1 by both trace and max statistics. Following the model, in the long run equation, all cointegration and adjustment parameters are found statistically significant except LGINV. The LPINV is affected positively by LGC and negatively by LTAX, as it is not affected significantly by LGINV in the long run (not reported).

III.2 Private investment behavior in VAR (II)

In VAR (II), I substituted LPC for LTAX. In this system, one would expect that private final consumption have positive relation with private investment. By employing LPINV, LGINV, LPC and LGC in VAR(II), all lag selection criteria used here; SC, LR, FPE, AIC and HQ select the lag order of 4. The both SC and AIC are in favor the model of linear trends in both series and CE. In the system, dummies of DS and D4 are found significant by LR test at 1% critical values, but the null of D01 could not be rejected with the $\chi^2(4) = 0.909$ and the corresponding p value of 0.923. Exclusion D01 did not change the lag number and the hypothesis test result about trend. Table 4A gives the result of single cointegration equation at 5% level by both trace and max statistics.

Table 4.a Trend Assumption: Linear Deterministic Trend

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.426573	64.37805	62.99	70.05
At most 1	0.279575	32.67890	42.44	48.45
At most 2	0.169526	13.98781	25.32	30.45
At most 3	0.057898	3.399572	12.25	16.26

Trace test indicates 1 cointegrating equation(s) at the 5% level
Trace test indicates no cointegration at the 1% level

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None *	0.426573	31.69915	31.46	36.65
At most 1	0.279575	18.69109	25.54	30.34
At most 2	0.169526	10.58824	18.96	23.65
At most 3	0.057898	3.399572	12.25	16.26

Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level
Max-eigenvalue test indicates no cointegration at the 1% level

Normalized cointegrating coefficients (std.err. in parentheses)

LPINV	LGINV	LGC	LPC	@TREND(88:2)
1.000000	0.678059	-1.806425	-3.485462	0.038441
	(0.06672)	(0.41621)	(0.20676)	(0.00376)

Adjustment coefficients (std.err. in parentheses)

D(LPINV)	D(LGINV)	D(LGC)	D(LPC)
-0.492940	-1.402534	0.029141	0.092391
(0.28314)	(0.40518)	(0.12616)	(0.11354)

Table 4.b Significance Tests of the Adjustment and Cointegrating Coefficients

D(LPINV)	$\chi^2(1)=2.034$ (0.153)	LPINV	$\chi^2(1)=12.958$ (0.000)
D(LGINV)	$\chi^2(1)=11.800$ (0.000)	LGINV	$\chi^2(1)=12.905$ (0.000)
D(LGC)	$\chi^2(1)=0.052$ (0.818)	LGC	$\chi^2(1)=8.852$ (0.002)
D(LPC)	$\chi^2(1)=0.493$ (0.482)	LPC	$\chi^2(1)=12.986$ (0.000)

Upon significance results from Table 4.a and Table 4.b, I first excluded the adjustment parameters of D(LGC) and D(LPC). Then D(LPINV) becomes significant with the *t* value of –3.13. LR tests also validates this result as is seen at Table 4.c

Table 4.c Significance Tests of the Coefficients with the Restriction D(LGC)=0, D(LPC)=0

D(LPINV)	$\chi^2(3)=10.543$ (0.014)	LPINV	$\chi^2(3)=24.989$ (0.000)
D(LGINV)	$\chi^2(3)=12.842$ (0.004)	LGINV	$\chi^2(3)=24.127$ (0.000)
D(LGC) =0		LGC	$\chi^2(3)=13.218$ (0.004)
D(LPC) =0		LPC	$\chi^2(3)=21.226$ (0.000)

With the restriction D(LGC)=0, D(LPC)=0 and the normalized cointegrating coefficients (LPINV =1), all coefficients are significant and exclusion test indicate that first, second and third differenced lags of endogenous variables are jointly significant. The long-run equilibrium and short-run adjustment equilibrium of LPINV are given below by Eqs. (4) and (5) respectively. Eq. (5) is D(LPINV) part of the VECM. Diagnostic check of the VECM is reported at Table 5.

$$LPINV = -0.683\ LGINV + 1.651\ LGC + 3.476\ LPC \quad (4)$$

$$\begin{aligned} D(LPINV) = & -0.6736\ [LPINV(-1) + 0.6833\ LGINV(-1) - 1.6514\ LGC(-1) - 3.4768\ LPC(-1) \\ & + 0.0368\ TREND + 31.636] \\ & + 0.3721\ D(LPINV(-1)) - 0.0001\ D(LPINV(-2)) + 0.1593\ D(LPINV(-3)) \\ & + 0.2113\ D(LGINV(-1)) + 0.2375\ D(LGINV(-2)) + 0.0019\ D(LGINV(-3)) \\ & - 0.5628\ D(LGC(-1)) - 0.2217\ D(LGC(-2)) + 0.6023\ D(LGC(-3)) \\ & - 1.2823\ D(LPC(-1)) - 0.6436\ D(LPC(-2)) - 0.5776\ D(LPC(-3)) \\ & + 0.0261 - 0.2742\ DS - 0.1411\ D94 \quad (5) \end{aligned}$$

Table 5. Diagnostic Tests of Residuals

Ho: No serial correlation	$\chi^2(14)=18.502$	(0.295)
Ho: Residuals are multivariate normal	$\chi^2(55)=59.357$	(0.319)
Ho: No ARCH without c.t. (levels and dquares)	$\chi^2(280)=296.30$	(0.240)
Ho: No ARCH with c.t.	na	na

Table 5 indicates that the residuals obtained from VECM are not serially correlated, normally distributed with no heteroskedasticity. With the conclusion that all coefficients are significant and model is adequate, one can interpret the Eqs. (4) and (5) in confident. In the long run, private investment decreases due to increase in government investment. Government consumption and private consumption, on the other hand, are positively associated with private investment. This finding confirms the long-run relation of private investment given by Eq. 2 in VAR (I). In the short run, private investment changes in response to the one unit deviation from long run equilibrium by –0.6736 units. In other words, the deviation value between actual LPINV (short run) and long-run LPINV is corrected by -0.6736 units each period.

III.3 Impulse-response analysis

Impulse response functions expose the dynamic response of each endogenous variable to a shock in the other variables. This dynamic tracing enables us to observe the effect of a unit shock in one variable on current and future values of itself and another variable(s). Hence all variables in VAR system are all affected through one standard deviation shock occurred in innovations of any variable in the system. In impulse-response analysis, ordering the variables in VAR system is important and analysis is subject to change under different ordering, if one works with Choleski factorization.

Then one should make decision on which variable behaves more exogenously, then that variable can come first (Doan, 1992: 8.14). I, however, use the generalized impulse responses that appear recently in the literature since this method does not impose a priori restrictions to the ordering of the variables (Pesaran and Shin, 1998; Ewing, 2003).

Figure 1 exhibits the responses of LPINV to the impulses of all individual variables in the VAR(I) system. From up to down, first line shows the response of LGINV to its own shock. Second line reveals the impact of LGC on LPINV. With the impulse, LPINV increases sharply for two quarters, increases steadily till the third quarter, declines at the fourth quarter then keep its relatively higher level for the following quarters. The third line exhibits almost negligible effect of LGINV. This exhibition brings about some doubts about the negative long-run effect of government investment on private investment. Finally the fourth line shows negative effect of LTAX on LPINV. Upon a unit shock of LTAX, LPINV moves down for three quarters. Although LPINV increases for one period, this negative impact on LPINV does not die out in the long run.

Figure 2 shows the impulse responses in VAR(II) system. From up to down, first line exhibits the response of LPINV to the LPINV equation. Second and third lines give the positive impacts of LPC and LGC, respectively. LPC has relatively stronger positive effect on LPINV compared to LGC. Due to these shocks in LPC and LGC equations, LPINV goes up quickly in the short term and keeps its relatively higher level for the long term. As for the fourth line, it depicts the effect of LGINV on LPINV. Looking at the responses, we observe that a positive LGINV innovation at initial time has a lasting effect on LPINV. Upon a shock, in the short-term, LPINV decreases sharply for two quarters, then slightly increases till the third quarter, then again starts declining for four quarters. This negative effect of LGINV on LPINV stands for longer periods. This effect does not disappear till the 20th quarter, hence might be called permanent negative effect.

Figure1. Response of LPINV to Generalized One S.D. Innovations in VAR(I)

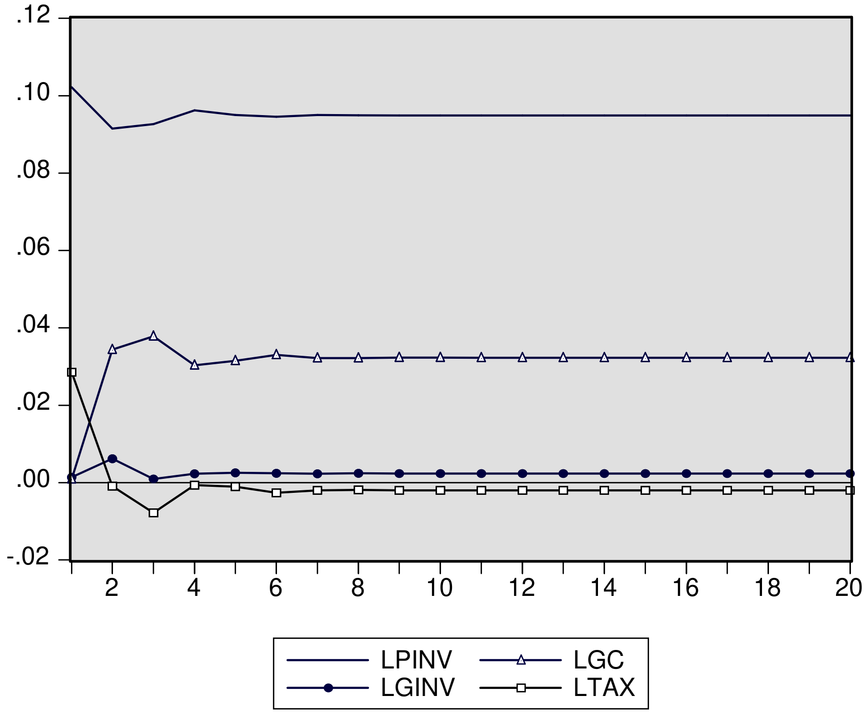
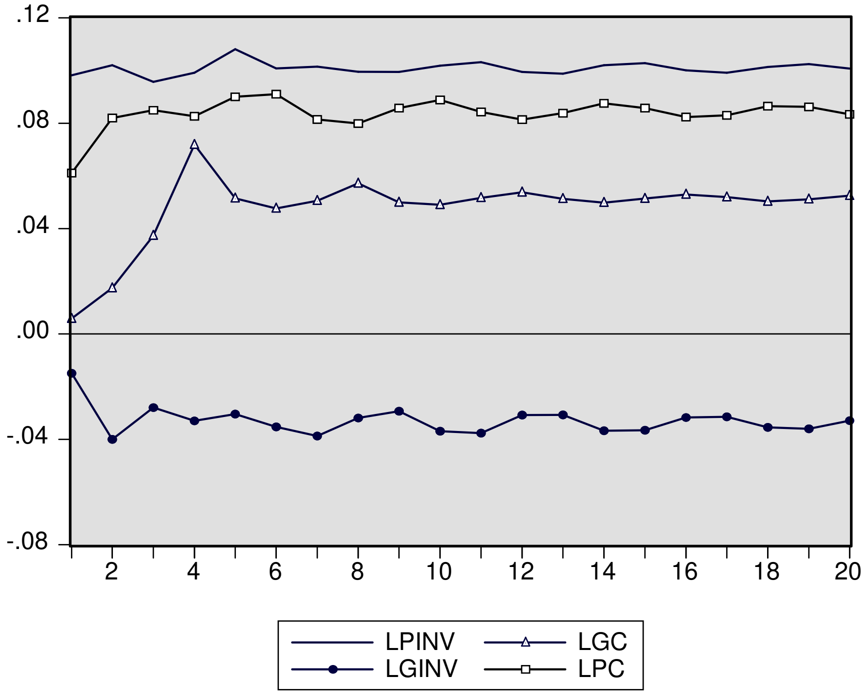


Figure 2. Response of LPINV to Generalized One S.D. Innovations in VAR(II)



IV. Conclusion

The preceding sections shortly exposed the basic literature of crowding-out/in debate and conducted time series analysis on this issue. Depending upon their core assumptions, pure neoclassical model, the Keynesian model and neoclassical synthesis created a huge controversy for many decades in this area of debate. Empirical analysis, however, are still far from ending in these disputes of macroeconomics. Furthermore, combining also the classical and or Marxists theories, in their more sophisticated structural perspectives, into these juxtaposing analyses of macro dynamics, one would see macroeconomics' going far below the consensus. The consensus is required? This is another question. The study adds one more statistical search into available ones, in which recent time series analyses, that are mostly absent from the studies presented, are carried out.

Working on two different VAR systems and related cointegration and VECM models reveal a crowding out effect of government investment and crowding in effect of government current consumption in the long run. This result is confirmed by impulse response analysis, except the seemingly insignificant effect of government investment on private investment in VAR(I). This might be due to the investment relation equation set up in VAR(I). The second VAR system establishes a more identified investment equation in which investment is a function of aggregate expenditures rather than just government fiscal components. With this regard, one may keep the result that government investments crowd out whereas its current expenditures crowd in. This may suggest that government may reconsider its current consumption in its guidance toward macro goals. The concluding result may also propose government to eliminate the size of the potential unproductive investments.

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