PANOECONOMICUS, 2014, 6, pp. 631-651
Recevied: 23 September 2012; Accepted: 11 December 2013.

UDC 336.12:330.322.12 (560)
DOI: 10.2298/PAN1406631S
Original scientific paper

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Acknowledgements: We would like to special thanks to the editor of Panoeconomicus and anonymous two referees for their support and constructive comments on earlier versions of this paper. We are also grateful to Metehan Cömert from Yıldırım Beyazıt University, and Bianka Martinez Karaca from Çankırı Karatekin University for their valuable proofreadings during the revising process of the paper. Any remaining errors in the paper are our own.

Crowding-Out or Crowding-In? Analyzing the Effects of Government Spending on Private Investment in Turkey

Summary: The main objective of this paper is to analyze empirically the effects of government spending on private investment, evaluating the existence of crowding-out/-in effects, in Turkey for the 1975-2011 period. In contrast to previous studies, we employed in the paper the modified version of David A. Aschauer's (1989) model, which allows us to see the effects of each component of government spending taking place in the Turkish budget system. The empirical findings of the paper showed that government current transfer spending, government current spending, and government interest spending crowd-out private investment, whereas government capital spending crowds-in private investment in Turkey.

Key words: Government spending, Crowding-out, Crowding-in, Private investment, Fiscal policy, Turkey.

JEL: E62, H54, H72, R42.

Many economists have argued the effects of government spending on private investment since the time of Adam Smith. In this regard, there are two different arguments as crowding-out effect and crowding-in effect in the literature. The former suggests that government spending reduces private investment; whereas, the latter asserts that government spending stimulates private investment.

Crowding-out effect of government spending on private investment shows itself either directly or indirectly. Indirect crowding-out takes place through an increase in interest rates and prices, but direct crowding-out occurs with the reduction of the physical resources available to the private sector. This paper considers and analyzes only the direct (real) crowding-out effect.

In the literature, there are three different views regarding crowding-out/-in effects of government spending. These are the Neo-classical, Keynesian and Ricardian views. According to the Neo-classical view, crowding-out of private investment by government spending occurs when the government decides to increase its spending. Neo-classicals advocate that the government budget deficits increase the level of consumption in the economy. This is because today's individuals think that the existing deficits would be financed through taxes which would be collected from future generations. The Neo-classicals further assert that since government spending is less productive than private investment, the increased output as a result of the debt financed government spending does not fully offset the negative effect of the crowd-

ing-out of private investment on output, thus reducing GDP (Alauddin M. Majumder 2007). Since the Neo-classical view assumes that the economy is generally at full employment level, they maintain that increasing consumption would result in a decrease in savings. Due to saving-investment identity in the economy, it is expected that interest rate should increase to balance the decrease in savings. An increase in interest rates would make private investment less profitable. Hence, private investment would tend to decrease. Consequently, government spending would crowd-out of private investment.

In contrast to the Neo-classical view, the Keynesian view argues that an increase in government spending stimulates the domestic economic activity and thus crowds-in private investment rather than crowds-out. According to the Keynesian view, it is a rare case for an economy to always be at the full employment level. In general, economies are at an under employment level. In such a case, the sensitivity of investment to interest rates would be low. Accordingly, an increase in interest rates as a result of expansionary, i.e. an increase in government spending, would be minimal, and therefore, the output level of the economy would expand. Again, according to the Keynesian view, the principle of fiscal multiplier would work, and thus, a change in the government spending would generate a greater change in the output level of the economy. Moreover, in open economies, as initially argued by John Maynard Keynes and then Paul Davidson, persistent current account surpluses create a demand constraint which reduces global performance, and thus, reducing it through conventions to expand demand leads to crowd-in global private investment (Phillip A. O'Hara 2011).

The final argument on crowding-out/-in effects belongs to the Ricardian view which is based on Ricardian equivalence theorem. It suggests that private investment results in neither crowding-in, nor crowding-out effect, and as such, private investment and government spending are considered to behave independently from each other. The premise for this view is that an increase in government spending is anticipated to be accompanied by a rise in taxes in the future, if not today (Philip Arestis 2011). So government spending financed by the issue of public bonds is expected to be repaid by revenue generated through taxes levied in the future. Interest rates and private investment, therefore, remain unchanged as economic agents realize that their income would be taxed in the future, and hence, they do not alter their current savings and consumption level.

The remainder of the paper proceeds as follows: Section 1 presents a detailed empirical literature review focusing on empirical studies while Section 2 outlines the econometric specification and data description. Section 3 reports and discusses the empirical findings of the paper. And finally, Section 4 provides concluding remarks.

1. A Comprehensive Empirical Literature Review

The issue of crowding-out/-in effects has been at the forefront of many academic discussions and has been explored in a number of studies so far. Theoretical debates and studies on the relationship between government spending and private investment were begun by Adam Smith (1776), continued by John M. Keynes (1929), Martin J. Bailey (1971), Willem H. Buiter (1977), and Arestis (1979). These pioneering stu-

dies mainly were concerned with the crowding-out effect of government spending and the degree of substitutability or complementarily relationship between them (Mehdi S. Monadjemi 1996; Yasemin Özerkek and Sadullah Çelik 2010; Muhammad Z. Bello, Aminu B. Nagwari, and Mubarak A. Saulawa 2012). The empirical literature on crowding-out/-in effect have focused mainly on measuring the relationship between government spending and private investment (see, among the others: Aschauer 1989; Habib Ahmed and Stephen M. Miller 1999; Yeşim Kuştepeli 2005; Selim Başar and Mehmet S. Temurlenk 2007; Rana E. A. Khan and Abid R. Gill 2009; Davide Furceri and Ricardo M. Sousa 2011; Bello, Nagwari, and Saulawa 2012; Njimanted G. Forgha and Mukete E. Mbella 2013; Nwosa P. Ifeakachukwu, Oyeyemi O. Adebiyi, and Adedayo O. Adedeji 2013; Roghayeh T. Samaei, Leila Ahmadi, and Simin Alali 2013) as well as the relationship between government investment and private investment (Miguel D. Ramirez 1994; Sharon J. Erenburg and Mark E. Wohar 1995; Bruno de Oliveira Cruz and Joanílio R. Teixeira 1999; Graham M. Voss 2002; Erdal Atukeren 2005; Bazoumana Quattara 2005; Pritha Mitra 2006; António Afonso and Miguel S. Aubyn 2010; Toshiya Hatano 2010; Umakrishnan Kollamparambil and Michael Nicolaou 2011). In the literature there are also some other studies, such as Kanhaya L. Gupta (1992), Mohsen Bahmani-Oskooee (1999), Fredrick O. Asogwa and Izuchukwu C. Okeke (2013), Rumbidzai A. Biza, Forget M. Kapingura, and Asrat Tsegaye (2013), Mahmoud Mahmoudzadeh, Somaye Sadeghi, and Soraya Sadeghi (2013) which examined the effects of government budget deficit on private investment.

As it seems, the literature is quite rich in terms of empirical studies about crowding-out/-in effect. However, the debate with regard to the effects of government spending is still ongoing. In accordance with the purpose of our study, we made a place for the studies on the effects of government spending on private investment. In reviewing the studies, we considered them in terms of their models, empirical findings, periods when they were used, etc. We then classified them according to their similarities and/or differences.

A more recent study done by Mahmoudzadeh, Sadeghi, and Sadeghi (2013) used a panel data of 23 developed and 15 developing countries during the 2000-2009 period, and concluded that the budget deficits create crowding-out effect on private investment in developed countries whereas they induce crowd-in effect in developing countries. However, both effects were extremely small in both country groups. On the other hand, another more recent study Asogwa and Okeke (2013) indicated that budget deficits crowd-out private investment in the case of Nigeria. They applied the ordinary least square (OLS) and Granger causality tests to annual data set of Nigeria and reached such a result. One more recent study by Biza, Kapingura, and Tsegaye (2013) implemented a cointegration and VAR model with impulse response and variance decomposition analysis to a quarterly data set of South Africa for the period of 1994:Q1-2009:Q4. They reached the same result as Asogwa and Okeke (2013), indicating that budget deficits significantly crowd-out private investment. Two more studies, one recent and the other one older, done by Abdullah H. Albatel (2004), Gaotlhobogwe R. Motlaleng, Pinehas Nangula, and Boitumelo Moffat (2011) also confirmed that budget deficits crowd-out private investment. The study of Motlaleng, Nangula, and Moffat (2011) used an error-correction model with a quarterly data of

Namibia covering the 1990:Q1-2005:Q2 period whereas the latter implemented single and multiple equation systems to annual data of two industrialized countries, the USA and Canada, for the 1949-1976 period.

A study by Furceri and Sousa (2011) searched out the effects of government spending on private investment by using a panel data of 145 developed and developing countries for the 1960-2007 period. Their findings revealed that government spending creates an important crowding-out effect by negatively affecting both private investment and private consumption. In particular, they tested whether the effect of government spending varies among regions and whether it depends on the phase of the economic cycle. They observed that the effect of government spending varies substantially among countries, but it does not seem to depend on the phase of the economic cycle. Based on their empirical findings, they further added that all results are economically and statistically significant, and robust to several econometric techniques.

Afonso and Sousa (2011) used a SVAR analysis with a quarterly data of Portugal covering the period of 1979:Q1-2007:Q4, and reached the result that government spending crowds-out private investment. Başar and Temurlenk (2007) reached the same result by using the same model for Turkey for the 1980-2005 period. Another study belongs to Afonso and Sousa (2009) obtained exactly the same result with two studies above by using a VAR model with a quarterly data set for four developed countries including the USA, the UK, Germany, and Italy. For different countries and/or country groups but with same or varied models as well as time period chosen, the studies such as Alberto Alesina et al. (2002), Andrew Mountford and Harald Uhlig (2005), Kirsten H. Heppke-Falk, Jörn Tenhofen, and Guntram B. Wolff (2006), Afonso and Sousa (2009), Furceri and Sousa (2011), Samaei, Ahmadi, and Alali (2013) also observed that government spending crowds-out private investment.

Taking into consideration the term as short- and long-term, a study on China by Dingyu Wu and Zhijue Zhang (2009) with cointegration and an error correction model showed that government investment crowds-out private investment in the short-term whereas crowds-in in the long-term. Another study on Pakistan done by Adnan Hussain et al. (2009) examined the long-term correlation between government expenditure and private investment by using time series annual data during the period from 1975 to 2008 with Johansen cointegration technique. Their study confirmed that current expenditure, such as defence and debts serving, causes crowding-out effect on private investment while development expenditure like infrastructure, health, and education cause crowding-in effect on private investment.

However, some studies analyzing the effects of government spending on private investment, such as Kuştepeli (2005), Raffaela Giordano et al. (2007), Khan and Gill (2009), Afonso and João T. Jalles (2011) yielded opposite results (crowding-in effect) to the studies above whereas some others, such as the studies of Ahmed and Miller (1999), Tsung-wu Ho (2001), Nikiforos T. Laopodis (2001), Faik Bilgili (2003), Motlaleng, Nangula, and Moffat (2011), Ifeakachukwu, Adebiyi, and Adedeji (2013) depicted mixed results in regard to crowding-out/-in effects of government spending on private investment. Third part studies, such as Monadjemi (1996), Isabel

Argimón, Jose M. González-Páramo, and Jose M. Roldán (1997), Antonio Fatás and Ilian Mihov (2001), Zhuxian Shi, Junsheng Liu, and Chengxiao Jin (2005), Baotai Wang (2005), Kollamparambil and Nicolaou (2011), Forgha and Mbella (2013), Mahmoudzadeh, Sadeghi, and Sadeghi (2013) found no evidence or weak evidence.

In the literature on crowding-out/-in effect, there are also quite voluminous studies focusing on the effects of government investment on private investment. We do believe that it would also be useful to mention here some of these studies.

Mitra (2006) explored crowding-out effect in India for the period of 1969-2005 by using a SVAR model and reached the result that government investment crowds-out private investment. Başar and Temurlenk (2007) used the same model for Turkey for the 1980-2005 period and found a similar result, indicating that the government spending has a negative effect on private investment. Another study on Turkey done by Kuştepeli (2005) with a Johansen cointegration test for the two different periods, 1963-2003 and 1967-2003, discovered that increases in government spending crowd-in private investment while government deficits have a crowding-out effect on private investment. Like Mitra (2006), a study done by Voss (2002) investigated crowding-out effect of government investment on private investment in Canada. In his study, he used a VAR model along with a quarterly data set of 1947:Q1-1988:Q1, and concluded that government investment tends to crowds-out private investment.

At the same time, in the literature there are a number of studies belonging to William Easterly and Sergio Rebelo (1993), Ramirez (1994), Erenburg and Wohar (1995), Stefan Mittnik and Thorsten Neumann (2001), Kuştepeli (2005), Quattara (2005), Lekha S. Chakraborty (2007), Giordano et al. (2007), Khan and Gill (2009), Hatano (2010), Afonso and Jalles (2011) among others, which found that government investment crowds-in private investment. Some others, such as Shi, Liu, and Jin (2005), Kollamparambil and Nicolaou (2011) discovered that government investment neither crowds-out, nor crowds-in private investment whereas the studies of Gupta (1992), Nemat Shafik (1992), Karen Parker (1995), Luis Servén (1996), Cruz and Teixeira (1999), Laopodis (2001), Wu and Zhang (2009), Afonso and Aubyn (2010), Motlaleng, Nangula, and Moffat (2011), Bello, Nagwari, and Saulawa (2012), Ifeakachukwu, Adebiyi, and Adedeji (2013), found that both are possible, depending on a number of factors such as the empirical model implemented, the length of term, country specification, components of government spending considered, etc.

After all, it could be necessary to elaborate some of these studies. At least, we found them interesting. A study by Cruz and Teixeira (1999) examined the effects of government investment on private investment in Brazil for the 1947-1990 period. It brought to light that private investment is crowded-out by government investment in the short-term, but in the long-term these two variables complement each other.

An interesting study belongs to Atukeren (2005). He examined the relationship between public investment and private investment in 25 developing countries for the 1970-2000 period. For this purpose, he employed different econometrical tests, such as Granger causality, cointegration tests and probit analysis. As a result, he discovered that the higher the share of government involvement in the economy, the lower the trade openness; the more restrictions on the use of foreign currencies,

and the more stable and developed the fiscal and monetary environment is, the higher the likelihood that public investment may crowd-out private investment. However, his empirical findings presented mixed results. Crowding-out/-in effect varies from country to country. He reached the result of 10 out of 11 cases of crowding-out effects and 13 out of 14 cases of no crowding-out.

Using the same data sources and definitions, and adding 10 new cases to his study above, Atukeren (2010) reinvestigated the political and economic determinants of the crowding-in effects of public investment in a cross-section of 35 developing countries by using probit analysis. His findings indicated that productive public investments, i.e. public fixed capital investments, may crowd-in private investments. Based on these findings, he asserted that this effect depends on the developments in the governance-related factors and the overall environment of private business in individual countries.

Mittnik and Neumann (2001) carried out a study analyzing the dynamic relationship between public investment and output in 6 developed countries included Canada, France, the UK, Japan, Netherlands, and Germany. They applied a VAR model in 6 industrial countries for the 1955-1994 period. Based on their findings, they concluded, among the others, that in none of these countries, crowding-out effect dominates. On the contrary, government investment triggered an increase in private investment in 3 out of 6 of these countries.

Quattara (2005) explored the long-term determinants of private saving in Senegal for the period of 1970-2000. He explored that private investment is positively affected by government investment while credit to private sector and terms of trade affect negatively it. Based on his findings, he argued that the positive impact of public investment on private investment, triggering public sector resources to the end of capital accumulation, is a useful channel to boost private sector development in Senegal.

Erenburg and Wohar (1995) examined the causal linkage between private investment and government provision of public capital and government investment spending through Granger causality test by using an annual data of the USA for the 1954-1989 period. In their study, they focused specifically on the influence of the provision of public infrastructure on private investment activity by including public sector investment spending and public capital stock along with the variables specified in the major theoretical private investment models. They found that government investment and private investment share a symbiotic relationship. In addition to this, their findings demonstrated the existence of feedback effects between public and private investment.

Khan and Gill (2009) performed a study by using exactly the same models as Monadjemi (1996), and Majumder (2007). They estimated the relationship between public borrowing, GDP, and lending in Pakistan with time series data of 34 years covering fiscal year of 1971-1972 to 2005-2006. Their empirical findings did not corroborate the crowding-out hypothesis in Pakistan due to the market imperfections and substantial amount of excess liquidity. On the contrary, their findings provided evidence of crowding-in effect, which could be explained by the direction of government expenditures towards private sector through contractors, politicians and bu-

reaucrats, instead of public projects. The provision of subsidy, transfer payments, and the substantial amount of micro-credit also explain the phenomenon of crowding-in effect in this country.

One of these studies belongs to Kollamparambil and Nicolaou (2011). They employed unit root test and VAR analysis to South Africa for three different periods, 1946-2005, 1960:Q1-2006:Q1, and 1965-2005. They found that government investment does neither crowd-in nor crowd-out private investment, but it creates an indirect effect on private investment through accelerator.

Argimón, González-Páramo, and Roldán (1997) searched for the relationship between government spending and private investment by using a panel data of 14 OECD countries. Their findings indicated that government investment leads to a significant crowding-in effect on private investment by creating the positive impact of infrastructure on private investment productivity. According to them, these findings become more important, in particular, when the fiscal consolidation comes into the agenda. The policies of deficit reduction carried out through cuts in government investment, for this purpose, could trigger a negative effect on capital accumulation as well as growth prospects.

Voss (2002) explored the short- and long-term interactions between government investment and private investment with reference to Canada and the USA in 1947:Q1-1988:Q1 period by using VAR analysis based on Jorgensen's Neo-classical model of investment. He demonstrated that there is no evidence of crowding-in due to complementarities between government and private investment in both the USA and Canada. His findings, on the contrary, suggested that innovations to government investment tended to crowd-out private investment.

Another study done by Afonso and Aubyn (2010) also used a VAR model but for 14 EU countries, Canada, Japan, and the USA for the sub-period of 1960-2005. Their empirical findings indicated that both government and private investments have a positive effect on output; whereas, government investment crowds-out private investment in a significant number of countries. On their findings, they argued that government investment can either crowd-in or crowd-out private investment. In strong crowding-out cases, it is possible that an increased government investment could lead to a decrease in GDP. Besides, government investment had a contractionary effect on output in the cases of Belgium, Ireland, Canada, the UK and the Netherlands with positive government investment impulses, creating a crowding-out effect. On the other hand, expansionary effects and crowding-in prevailed in the cases of Austria, Germany, Denmark, Finland, Greece, Portugal, Spain and Sweden.

Ahmed and Miller (1999) implemented three different econometrical methods including Lagrange-multiplier test, Random-effect model, and OLS for 39 developed and developing countries for the 1975-1984 period. Based on their empirical findings, they showed that government spending related to transport and communication crowds-in private investment in developing countries. Openness has a significantly positive effect on investment only in developing countries while it does not have any significant effect on investment in developed countries. As just noted above, however, spending on transport and communication crowds-in private investment in developing countries only. Contrary to spending on transport and communication, gov-

ernment spending on social security and welfare, regardless of either tax financed or debt financed, crowd-out investment in both developed and developing countries.

As reviewed above, we see that numerous studies have been done on the crowding-out/-in effect up to now. We scanned throughout the literature, and we reported all the studies which we were able to find on the basis of covering period, country specification, method used, and their empirical results in Appendix (Table 5). At a glance, what one sees from the Appendix at a glance is that the empirical findings of the studies are highly controversial. Some empirical studies reveal that the effects of government spending on private investment is negative while the others bring into light positive and/or negative, or insignificant results depending mainly on a number of factors such as models implemented, study period, country specification, term length, components of government spending considered, etc.

2. Econometric Specification and Data Description

2.1 Econometric Specification

Aschauer (1989) emphasized that it is essential to separate different components of spending in order to be able to examine the relationship between government spending and private investment. In this paper we tried to analysis the effects of government spending on private investment in Turkey by applying a modified version Aschauer's (1989) model which allow us to see the effects of each sub item consisting of central government spending in Turkish budget system. In other words, the model was modified by adding various components of government spending to the Aschauer's (1989) model in order to be able to examine their separate effects on private investment.

After modifying, the specified model which we used in our study to analysis the effects of various components of government spending on private investment is expressed as follows:

$$PI_t = \beta_0 + \beta_1 GCS_t + \beta_2 GCTS_t + \beta_3 GCAS_t + \beta_4 GIS_t + \beta_5 GDP_t + u_t, \quad (1)$$

where PI_t, GCS_t, $GCTS_t$, $GCAS_t$, GIS_t, GDP_t and u_t are private investment, government current spending, government current transfer spending (excluding interest spending), government capital spending, government interest spending, gross domestic product and an error term, respectively.

As an econometrical test, we first employed Søren Johansen (1988) cointegration test in the paper. As known before employing Johansen test, the first step for cointegration analysis is to test whether the variables in question are stationary, i.e. I(0), or they are integrated, i.e. I(1) or higher. And then we employed first Augmented Dickey-Fuller - ADF (David A. Dickey and Wayne A. Fuller 1979), and Phillips-Perron - PP (Peter C. B. Phillips and Pierre Perron 1988) tests. The reason for using ADF unit root test is to examine the stationarity properties of the level and first difference of variables. As also known, PP unit root test, an alternative test for ADF test, has less strict assumptions about the behavior of the test equation's error term.

In the PP test, serial correlation and heteroscedasticity are also taken into account, which could be relevant. If both of the variables are found to be I(1) processes, then it is possible that they are also cointegrated. After implementing ADF and PP tests, since all of the variables are I(1), one needs to investigate whether there exist a possible long-term relationship among them by performing Johansen (1988) cointegration test. And finally the Vector error correction model (VECM) was set up for investigating short- and long-term causality.

2.2 Data Description

In this paper, we tested the crowding-out/-in effects of government spending on private investment in the sample of Turkey, covering the 1975-2011 period. We employed annual data. The data were collected from different sources such as T. R. Ministry of Development, T. R. Ministry of Finance and T. R. Prime Ministry Undersecretariat of Treasury subject to their availability. All the variables were transformed into real values by using the consumer price index and written in the form of *ln(log)* in year *t*.

A visual representation of the series can be seen in Appendix (Figure 1). The figure presents the series of *PI*, *GCS*, *GCTS*, *GCAS*, *GIS* and *GDP* for the period of 1975-2011. As shown from the figure, the time series for all variables are not stationary. In other words, there is a clear trend for all variables except private investment. They fluctuate around a trend through the end of the sample period.

3. Empirical Findings

We first performed the unit root test in levels and first differences in order to determine time series properties of the variables used in the paper. The results of the unit root test were represented in Table 1. The estimation results of ADF and PP tests for the unit root show that first differences variables are stationary. With a technical expression, the first differences of *PI*, *GCS*, *GCTS*, *GCAS*, *GIS*, *GDP* are stationary, indicating that all these variables are integrated of order one I(1). This means that it is not possible to reject the null hypothesis of unit roots for both variables in level forms. The alternative hypothesis; however, was rejected when the ADF and PP tests were applied to the first differences of each variable.

Table 1 Unit Root Tests and Stationary Results, 1975-2011

	ADF unit root test					
Series	Level constant	Critical value		First difference constant and trend	Critical value	
		%5	%1		%5	%1
PI	-2.6599	-2.9458	-3.6267	-5.4669(1)**	-3.5442	-4.2436
GCS	-1.2382	-2.9484	-3.6329	-7.3797(1)**	-3.5442	-4.2436
GCTS	-1.4233	-2.9677	-3.6793	-6.1599 (1)**	-2.9540	-3.6463
GCAS	-1.6394	-2.9458	-3.6267	-4.2070 (1)*	-2.9484	-3.6329
GIS	-2.2078	-2.9484	-3.6329	-6.5266(1)**	-2.9484	-3.6329
GDP	-2.0161	-2.9540	-3.6463	-3.8673 (1)*	-2.9862	-3.7240

Series	PP unit root test					
	Level constant	Critical value		First difference constant and trend	Critical value	
		%5	%1		%5	%1
PI	-2.6723	-2.9458	-3.6267	-5.4636(1)**	-3.5442	-4.2436
GCS	-1.0633	-2.9458	-3.6267	-9.2570(1)**	-3.5442	-4.2436
GCTS	-1.7684	-2.9458	-3.6267	-7.4721(1)**	-3.5442	-4.2436
GCAS	-1.4098	-2.9458	-3.6267	-4.4378(1)*	-3.5442	-4.2436
GIS	-2.0031	-2.9458	-3.6267	-7.3911(1)**	-3.5442	-4.2436
GDP	0.6976	-2.9458	-3.6267	-7.1052(1)**	-3.5442	-4.2436

Note: The number in parentheses indicate the selected lag order of the ADF models. Lags are chosen based on AIC. The critical values are obtained from James G. MacKinnon (1991) for the ADF test. The ADF tests examine the null hypothesis of a unit root against the stationary alternative. Asterisks (*), (**) denote statistical significance at 1% and 5%, respectively. E-Views 6.1 was used for computations.

Source: Computed by the authors.

We implemented an AR Roots test to analyze whether the model is stable or not. The AR Roots graph was shown in Appendix (Figure 2). Based on the figures, we argued that all the roots lied within the unit circle, indicating that the model is stable. This means that we can move to the next step of the analysis. Consequently, it is appear that the model does not suffer from autocorrelation.

Since all of the variables are stationary in first differences, Johansen (1988) cointegration test can be implemented safely. However, it is important to keep in mind here that before applying to Johansen cointegration test, the lag length for the VAR analysis should be determined. For this purpose, we determined the optimum lag length. It suggested 1 lag for the unconstrained VAR estimation. The results of cointegration tests were reported in Table 2.

Table 2 Selection of Lag Length

Number of lags	Log likelihood function	Final prediction error (FPE)	Akaike information criteria (AIC)	Schwarz information criteria (SC)	Hannan-Quinn information criteria (HQ)
0	-153.1682	0.000359	9.095325	9.361956	9.187366
1	38.30904	5.14e-08*	0.210912*	2.077330*	0.855199*
2	68.61213	8.62e-08	0.536450	4.002654	1.732983

Note: Asterisk (*) donates lag order selected by the criterion. E-Views 6.1 was used for computation.

Source: Computed by the authors.

As for Table 3, it presents eigen values and trace statistics for determining the number of cointegration vectors (r) by using Johansen maximum-likelihood approach. We tested null hypothesis of no cointegration ($r = 0$) against the alternative of $r \leq 1$ and $r \leq 2$. As it was evident from Table 3, the null hypothesis of $r \leq 1$ cannot be rejected at a 90% level of significance.

The maximum eigenvalue statistic is 40.07757, which is above the 5% critical value of 38.13060. Thus, the null hypothesis of ($r = 0$) was rejected at the 5% level of significance. Turning to the trace test as shown in Table 3, the null hypothesis of no cointegration was also rejected at the 5% level of significance. However under $r \leq 2$, the trace and maximum eigenvalue statistics were equal to 26.93455 and 17.13162, which are below the 5% critical values of 29.79707 and 21.41162, respectively. These results implied that our series have one cointegration equations. In other

words, it should be confirmed that *PI*, *GCS*, *GCTS*, *GCAS*, *RGIS*, *GDP* were cointegrated for the 1975-2011 period.

Table 3 Johansen Cointegration Test Results, 1975-2011

Rank test (trace)					Rank test (maximum eigenvalue)				
Number of cointegration	Eigenvalue	Trace statistic	5% critical value	Probability**	Number of cointegration	Eigenvalue	Max-eigen statistic	5% critical value	Probability**
None*	0.663597	120.1482	95.7536	0.0004	None*	0.663597	40.07757	38.13060	0.0006
At most 1	0.391936	26.93455	29.79707	0.1033	At most 1	0.391936	17.13162	21.41162	0.1027

Note: Trace and max-eigenvalue tests indicate 1 cointegrating equation(s) at the 5% level. Asterisk (*) donates rejection of the hypothesis at the 0.05 level whereas asterisk (**) donates MacKinnon, Alfred A. Haug, and Leo Michelis (1999) *p*-values. E-Views 6.1 was used for computation.

Source: Computed by the authors.

Since the series were cointegrated, a VECM was set up for investigate short and long-term causality. In the VECM, the first difference of each endogenous variable was regressed on a one period lag of the cointegrating equation. The VECM was estimated through the maximum likelihood method. The lag of the system was decided by Akaike information criterion (AIC) to be 1. Table 4 presented the results of the causality test based on the VECM. We performed causality test the joint significance of the coefficients of lagged terms of each explanatory variables by Wald χ^2 tests. The results presented in Table 4 showed that the error correction term (ECT) coefficients of equations are significant and have negative signs, implying that the series cannot drift too far apart and convergence is achieved in the long-term. Specifically, each ECT coefficient indicates that a deviation from the long-term equilibrium value in one period was corrected in the next period by the size of that coefficient.

Table 4 Granger Causality Tests Results Based on VECM, 1975-2011

Dependent variables	Independent variables						
	Short-term						Long-term
	ΔPI	*ΔGCS*	*ΔGCTS*	*ΔGCAS*	*ΔGIS*	*ΔGDP*	Lagged ECT
ΔPI	-	(0.5483)**	(0.3199)	(0.1603)*	(0.5422)**	(0.8057)***	-0.296 [0.1246]
ΔGCS	(0.8307)	-	(0.2253)	(0.4198)	(0.7253)	(0.0072)	0.150 [0.2166]
ΔGCTS	(0.2523)*	(0.9379)	-	(0.1395)	(0.2419)	(0.5834)	-0.177 [1.1788]
ΔGCAS	(0.4844)**	(0.5959)	(0.6202)	-	(0.9840)	(0.0021)	-0.847 [-3.7124]*
ΔGIS	(0.5546)	(0.6520)	(0.8922)	(0.7127)	-	(0.0758)	-0.221 [0.6010]
ΔGDP	(0.8238)	(0.0422)	(0.8487)	(0.2515)	(0.5590)	-	-0.134 [0.2256]

Note: Figure in parentheses ( ) and brackets [ ] are *p*-value and *t*-statistic, respectively. Asterisks (*), (**), (***) denote statistical significance at 1%, 5% and 10%, respectively. E-Views 6.1 was used for computation.

Source: Computed by the authors.

Since we proposed to examine the causality between all variables, the emphasis was placed only on the relationships between these variables. The results which we found suggested that there is a short-term causality from *PI* to *GSTS* and *GCAS*. On the other hand, the same result is to be current from *GCS*, *GCTS*, *GCAS*, and *GIS* to *PI*.

With regard to the long-term causality test, it can be referred to as the ECT test. The estimates of the coefficient of the ECT showed that at least one of the ECT is significant in the private investment equation for Turkey. This result implied that when there is a deviation from the equilibrium cointegrating relationship as measured by the ECT, it is government capital spending, not the other variables, that adjusts to restore the long-term equilibrium within the system. This finding provides a better understanding of government spending - private investment nexus to formulate a fiscal policy in Turkey.

4. Concluding Remarks

It can be said that the relationship between government spending and private investment is a controversial issue from both theoretical and empirical perspectives. Over the past few decades crowding-out/-in effects across countries have been focused on and have attracted several theoretical and empirical studies due to its importance in the literature. Although most of these studies are voluminous, they have exposed mixed results; changing country to country, from period to period, and using method in the studies such as unit root test, VAR analysis, panel data analysis, SVAR analysis, and VECM. What seems further from previous studies is that even if the methods used in the studies are equal, their effects are different.

Although the issue of crowding-out/-in has been studied extensively, there is still no consensus for the effects of government spending on private investment. It seems that the issue is highly controversial. Therefore, it is difficult to make a policy suggestion from either a theoretical or an empirical perspective.

Unlike most of previous studies, in this paper, we considered the component of government spending, and accordingly, we examined the effects of each component of government spending on private investment instead of taking them cumulatively. For this purpose, we processed the analysis to find out what the most effective government spending on private investment are by employing the unit root test, cointegration tests and VECM taking into consideration the Turkish data covering the 1975-2011 period.

This paper aimed to make a contribution to empirical literature by analyzing the effects of government spending on public investment. Contrary to a majority of other studies, in this paper we examined the effects of public spending by considering its components. The empirical findings of the paper demonstrated that all government spending, but except capital spending, crowds-out private investment in the case of Turkey.

All in all, based on these findings we can assert that Turkish governments should give more priority to capital spending which crowds-in private investment, rather than spending, such as government current spending, government current transfer spending and government interest spending - which crowd-out private investment.

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Appendix

Table 5 Some Selected Empirical Studies about the Effects of Government Spending on Private Investment, 1990-2013*

Study	Period and country		Method	Empirical results	The Effects of government spending on private investment
	Period	Country			
Asogwa and Okeke (2013)	Not specified	Nigeria	OLS and Granger causality test	Budget deficits crowd-out private investments.	Negative
Biza, Kapingura, and Tsegaye (2013)	1994:Q1-2009:Q4	South Africa	Cointegration and VAR analysis with impulse response and variance decomposition analysis	Budget deficits significantly crowd-out private investment.	Negative
Forgha and Mbella (2013)	1980-2012	Cameroon	VAR analysis	Public expenditure insignificantly crowds-in private investment.	Positive but insignificant
Ifeakachukwu, Adebiyi, and Adedeji (2013)	1981-2010	Nigeria	An error correction model	Components of public spending have different effects on private investment both in the long- and the short-run. Specifically, recurrent and government final consumption expenditure had positive (crowd-in) effect on private investment while capital expenditure had negative (crowd-out) effect on private investment.	Positive and negative
Mahmoudzadeh, Sadeghi, and Sadeghi (2013)	2000-2009	23 developed countries and 15 developing countries[1]	Panel data technique	The effect of a budget deficit on private investment in developed countries is negative (crowding-out effect), while for developing countries it is positive (crowding-in effect). However, these effects are very small in both groups.	Positive and negative but insignificant
Samaei, Ahmadi, and Alali (2013)	1971-2008	Iran	Cointegration and VECM	Government spending has significant negative effect on private investment in the long-run.	Negative
Bello, Nagwari, and Saulawa (2012)	1975-2009	Nigeria	Multiple regression analysis	Certain categories of government spending crowds-in private investment, while others crowd-out private investment.	Positive and negative
Afonso and Jalles (2011)	1970-2008	95 developed and developing countries	Panel data analysis	A positive effect is attributed to total government expenditures and to public investment in fostering private investment.	Positive
Afonso and Sousa (2011)	1979:Q1-2007:Q4	Portugal	SVAR analysis	Government spending crowds-out private investment.	Negative
Furceri and Sousa (2011)	1960-2007	145 countries	Panel data analysis	Government spending crowds-out private investment.	Negative
Kollamparambil and Nicolaou (2011)	1946-2005, 1960:Q1-2006:Q1, 1965-2005	South Africa	Unit root test, VAR analysis	Government investment is neither crowding-in, nor crowding-out private investment.	No effect
Motlaleng, Nangula, and Moffat (2011)	1990:Q1-2005:Q2	Namibia	Error correction model	While increases in government spending crowds-in private investment, government budget deficits crowd it out.	Positive and negative
Afonso and Aubyn (2010)	1960-2005 and its sub-periods	14 EU countries, Canada, Japan, and USA	VAR analysis	Public investment can either crowd-in or crowd-out private investment. But in strong crowding-out cases, it is possible that increased public investment could lead to a decrease in GDP.	Positive and negative
Hatano (2010)	1955-2004	Japan	Unit root test, cointegration test, Granger causality test	Government investment crowds-in private investment.	Positive

[1] Developed countries consist of Canada, USA, Australia, Austria, France, Germany, Greece, Italy, Switzerland, UK, Spain, Portugal, Netherlands, Iceland, Ireland, Norway, Finland, Belgium, Luxembourg, Sweden, New Zealand, and Denmark while developing countries make up of Egypt, Indonesia, Algeria, Venezuela, Iran, Kuwait, Tunisia, Colombia, Malaysia, Kazakhstan, Brazil, Argentina, Trinidad and Tobago, Bolivia, and Russia.

Afonso and Sousa (2009)	USA 1970:Q3-2007:Q4; UK 1971:Q2-2007:Q4; Germany 1979:Q2-2006:Q4; Italy 1986:Q2-2004:Q4	USA, UK, Germany, and Italy	VAR analysis	Government spending crowds-out private investment.	Negative
Hussain et al. (2009)	1975-2008	Pakistan	Johansen cointegration technique	Current expenditure like defence and debts serving causes crowding-out effect on private investment while development expenditure like infrastructure, health and education causes crowding-in effect on private investment.	Positive and negative
Khan and Gill (2009)	1971-1972, 2005-2006	Pakistan	Unit root test, cointegration test, VECM	Public spending crowds-in private spending.	Positive
Wu and Zhang (2009)	1978-2004	China	Cointegration and error correction model	Government investment expenditure crowds-out private investment in the short-run whereas crowds-in private investment in the long-run.	Positive and negative
Başar and Temurlenk (2007)	1980-2005	Turkey	SVAR analysis	Government spending crowds-out private investment.	Negative
Chakraborty (2007)	1970-1997, 2002-2003	India	VAR analysis	There is no real crowding-out between public and private investment; rather, there is a complementarity between the two.	Positive
Giordano et al. (2007)	1982:Q1-2004:Q4	Italy	VAR analysis	The effect of fiscal policy on private investment is positive.	Positive
Majumder (2007)	1976-2006	Bangladesh	Unit root test, cointegration test, VECM	Public spending crowds-in private expenditure.	Positive
Heppke-Falk, Tenhofen, and Wolff (2006)	1974:Q1-2004:Q4	Germany	SVAR analysis	Government spending shocks decrease private investment.	Negative
Mitra (2006)	1969-2005	India	SVAR analysis	Government investment crowds-out private investment.	Negative
Atukeren (2005)	1970-2000	25 developing countries[2]	Cointegration test, Granger causality test, probit analysis	Public investment may crowd-out private investments. 10 out of 11 cases of crowding-out and 13 out of 14 cases of no crowding-out were observed.	Positive and negative
Kuştepeli (2005)	1963-2003, 1967-2003	Turkey	Cointegration test	Government spending crowds-in private investment.	Positive
Mountford and Uhlig (2005)	1955-2000	USA	VAR analysis	Public spending shocks crowd-out private investment.	Negative
Perotti (2005)	Australia 1980-2001, 1960-1979; Canada, 1980-2001, 1960-1979; Germany 1975-1989, 1960-1974	Australia, Canada, Germany, and UK	Standard open economy DSGE Model	The effects of fiscal shocks on GDP and its components have declined in the last twenty years.	Insignificant
Shi, Liu, and Jin (2005)	1978-2002	China	OLS, cointegration tests, and error correction mechanism	When government expenditures are divided into two as consumption expenditure and investment expenditure, it seems that government consumption has no effect on private investment.	No effect
Wang (2005)	1961-2000	Canada	Cointegration test and error correction model	Public expenditures on health and education have positive impact, while expenditure on infrastructure has negative effects on private investment. Other public expenditures like debt charge, social security have negative and insignificant effects on private investment.	Positive and negative but insignificant

[2] Argentina, Brazil, Chile, Colombia, Costa-Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Mexico, Paraguay, Uruguay, Bangladesh, India, South Korea, Malaysia, Pakistan, Philippines, Thailand, Turkey, Kenya, Malawi, Morocco, South Africa and Tunisia.

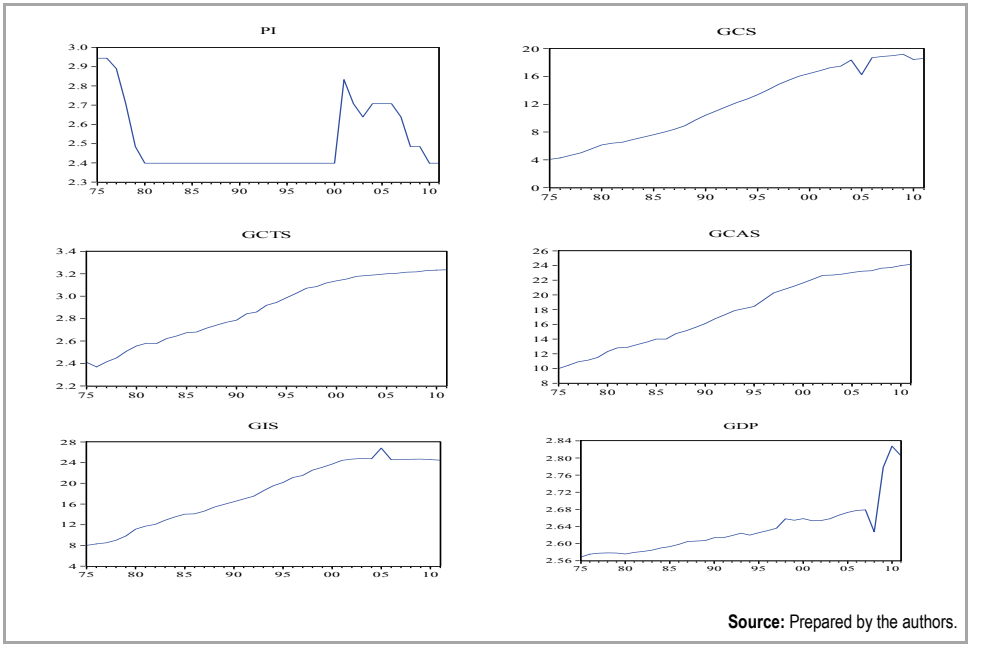
Albatel (2004)	1970-2000	Saudi Arabia	Cointegration test, VECM, variance decomposition test, and impulse response function test	Government budget deficits have a crowding-out effects on private sector investment.	Negative
Bilgili (2003)	1988:Q1-2003:Q1	Turkey	VECM and impulse response analysis	Government investment crowds-out, whereas its current spending crowds-in the private investment.	Positive and negative
Alesina et al. (2002)	1960-1996	18 OECD countries[3]	Unit root test, VAR analysis, Tobin's Q model	Fiscal spending, in particular, has a negative effect on the wage component of private investment.	Negative
Voss (2002)	1947:Q1-1988:Q1	Canada and USA	VAR analysis	Public investment tends to crowd-out private investment.	Negative
Fatás and Mihov (2001)	1963-2000	USA	VAR analysis	Government investment shocks have insignificant multiplier effect.	Insignificant
Ho (2001)	1968-1980, 1980-1999	Taiwan	Chow test	Government expenditure causes crowding-in on private investment in 1968-1980 while causes crowding-out on private investment in 1980-1999.	Positive and negative
Laopodis (2001)	Greece, Portugal, and Spain 1960-1997; Ireland 1970-1996	Emerging European countries (Greece, Ireland, Portugal and Spain)	Cointegration test and error correction model	For Spain, the analysis tentatively points to the validity of the crowding- out hypothesis where it is found that, while most government consumption and expenditures appear to reduce private investment significantly, higher public capital spending marginally surfaced as promoting investment. For the others, the results suggest that public expenditures have positively contributed to private investment.	Positive and negative
Mittnik and Neumann (2001)	Canada 1955:Q1-1994:Q1; France 1970:Q1-1994:Q1; UK 1962:Q1-1993:Q2; Japan 1955:Q1-1994:Q1; Netherlands 1977:Q1-1994:Q1; Germany 1960:Q1-1989:Q4	Canada, France, UK, Japan, Netherlands, and Germany	VAR analysis	Public investment leads to an increase in private investment.	Positive
Ahmed and Miller (1999)	1975-1984	39 developed and developing countries	Lagrange-multiplier test, random-effect model, and OLS model	Spending on transport and communication crowds-in private investment in developing countries, whereas spending on social security and welfare crowds-out investment in both developed and developing countries.	Positive and negative
Bahmani-Oskooee (1999)	1947-1992	USA	Cointegration test	In the long-run, real federal deficits of the USA crowd-in real investment.	Positive
Cruz and Teixeira (1999)	1947-1990	Brazil	Cointegration test	Private investment is crowded-out by government investment in the short-run, but in the long-run these two variables complement each other.	Positive and negative
Monadjemi and Hyeonseung Huh (1998)	Not specified	Three OECD countries (Australia, UK, and USA)	Error correction model	The empirical results provide limited support for crowding-out effects of government investment on private investment.	Negative but insignificant
Argimón, González-Páramo, and Roldán (1997)	14 OECD countries	Australia, Austria, Belgium, Canada, Denmark, Germany, Finland, France, Ireland, Norway, Spain, Sweden, UK, and USA	Panel data analysis	Public investment leads to a significant crowding-in effect on private investment by creating the positive impact of infrastructure on private investment productivity.	Positive and negative

[3] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, Norway, Spain, Sweden, UK, and USA.

Monadjemi (1996)	1960-1991, 1963-1991	UK and USA	Variance decompositions derived from the error correction model	There is a little support for the importance of fiscal measures in explaining variations of private investment.	Insignificant
Servén (1996)	1960-1995	India	Cointegration test, VAR analysis, error correction model	In the long-run capital for public infrastructure projects crowds-in private capital – other types of public capital have the opposite effect. But in the short-run, both kinds of public investment may crowd-out private investment.	Positive and negative
Erenburg and Wohar (1995)	1954-1989	USA	Granger causality test	Government investment crowds-in private investment.	Positive
Parker (1995)	1974-1994	India	Accelerator model	Public investment crowds-out private investment whereas public infrastructure crowds-in private investment.	Positive and negative
Ramirez (1994)	1950-1988	Mexico	Granger causality test	Public investment crowds-in private investment.	Positive
Easterly and Rebelo (1993)	1970-1988	Developed and developing countries	Cross section analysis	Public investment crowds-in private investment.	Positive
Monadjemi (1993)	1976-1990	USA and Australia	Granger causality test	The private expenditure in the USA and Australia is crowded-out by government consumption.	Negative
Gupta (1992)	1960-1985	10 Asian countries plus Sri Lanka, India Indonesia, and Philippines	Ricardian equivalence theorem	Evidence of crowding-out in all Asian countries except India.	Positive and negative
Shafik (1992)	1970-1988	Egypt	Error correction method and cointegration test	The effects of government policy on private investment are mixed with some evidence of crowding-out in credit markets and of crowding-in as a result of government investment in infrastructure.	Positive and negative
Basanta K. Pradhan, Dilip K. Ratha, and Atul Sarma (1990)	1960-1990	India	Computable general equilibrium (CGE) model	Public investment crowds-out private investment. However, the extent of crowding-out varies with the different modes of financing the public investment.	Positive and negative

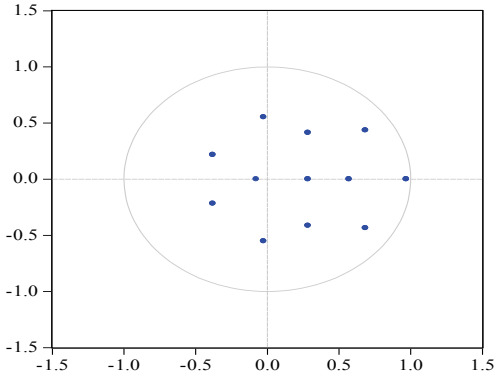
Note: * Selected studies are reported according to inversely chronological order.

Source: Prepared by the authors.



Source: Prepared by the authors.

Figure 1 A Visual Representation of the Series, 1975-2011



Source: Prepared by the authors.

Figure 2 Inverse Roots of AR Characteristic Polynomial

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