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# Testing of the crowding out effect for Turkey

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**Abstract**

In this study, we test the effect of public investment on private sector investment for Turkey for the period 1980-2014. There can be three different types of relationship between them. Public investment can have crowding in effect on private sector investment. That is, an increase in public investments creates same way change in private sector investments. Public investment can have crowding out effect on private sector investment. In other words, an increase in public investments decreases private sector investments Public investment can have no effect on private sector investment. We first test the existence of the relationship between them by using recently introduced unit root and cointegration tests. We test the stationarity of the variables by using Kapetanios (2005) unit root test and test the long run relationship by employing Maki (2009) cointegration test. Both of the tests allow multiple structural breaks which determined endogenously. Since we find the long run relationship between public and private sector investments we examine the type of the effect using FMOLS cointegrating model which supports evidence for the crowding-in effect.

Keywords: Crowding Out Effect, Cointegration, Structural Breaks

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## 1. Introduction

One of the most important issues in economics literature has been analyzing the effect of public sector investment expenditures on private sector investment expenditures.

Private investment expenditures has an important role in the economic growth policy of developing countries. These expenditures contribute on the forming physical capital. Thus, in the long run private investments has an effect on both economic growth and increase of production capacity (Altunç & Şentürk, 2010). On the other hand, public investments can be defined as the tools which used for increasing in the growth and employment level.

The stimulating public investments also create a rise in interest rates which creates a decreasing effect on private investments (Çil Yavuz, 2001). This effect known as the crowding out effect.

There are some explanations that used for clarifying the crowing out effect. First of them is that; if the public and private sectors are rivals and public invests in the areas where they competes with private sectors, this directly crowd outs private sector. Second; if the public subsidizes the expenditures by increasing taxes; this decreases the desire of making investments of private sector.

Certainly, there can be also crowing-in effect of public investments. Crowding-in effect show that government spending rises the demand for goods which also increases private sector investments for new output sources.

The relationship between public sector investments and private sector investments has been heavily investigated in the literature. Cil Yavuz (2001) investigated the existence of crowding out effect for Turkey over the period from 1990 to 2000 by using cointegration and causality tests. The results of the analysis show public investments has negative effect on private spendings. Pereira (2001) tested the crowding-in effect for USA from 1956 to 1997 by using the VAR analysis. The results of the study show that especially in the industrial and transport sectors there exists crowding in effect, but the results show an evidence for crowing-out effect in the information sector.

Basar and Temurlenk (2007) analyzed the crowding-in and crowding-out effects for Turkey in the 1980-2005 period using SVAR method. They conclude that after the 1980-period, public investments crowding-outs private investments. Narayan (2004) examined the relationship between public investments and private investments. After using Zivot-Andrews unit root test, he divide the analysis period in the two sub-periods. He conclude that in the 1950-1975 period there exists crowding-in effect long run, and in the second sub-period there exists no cointegration relationship.

In this study we test the long run relationship between the private sector investments and public sector investments by using unit root tests and cointegration tests which allows to determine not only the location of structural breaks but also the number of breaks endogenously. In the following section, we described the econometric methodology which used in the analysis, Section 3 present the test results and we conclude the study in the Section 4.

## 2. Econometric Methodology

Since ignoring structural breaks in unit root testing and cointegration testing can give biased results, in this study we employ unit root and cointegrationt tests which allow structural breaks. The study of Perron (1989) is the first study which consider possible structural breaks in the unit root testing. However, since the unit root test which he introduced to the literature determine the structural breaks exougenously the study has been criticized. Zivot Andrews(1992), Lumsdaine-Papell (1997) and Lee –Strazizch (2002, 2003) have introduced new unit root tests to the literature which determine structural breaks endogenously. But these studies have also a drawback; they allow to determine the number of structural breaks a priori. We employ Kapetanios (2005) unit root test which also allow to determine the number of structural breaks endogenously.

We use the following model to test the null of unit root:

$$y_t = \mu_0 + \mu_1 t + \alpha y_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{k} \theta_i DU_{i,t} + \sum_{i=1}^{k} \varphi_i DT_{i,t} + \varepsilon_t \quad (1)$$

Where t stands for the trend term, m shows the optimal lag length and k shows the number of the maximum structural breaks. Dummy variables in this model are the proxies of the structural breaks and can be described as follows:

$$DU_{i,t} \begin{cases} 1 & while \ \ t > T_{b,i}, \\ 0 & other \end{cases} \qquad DT_{i,t} \begin{cases} t - T_{b,i} & while \ \ t > T_{b,i}, \\ 0 & other \end{cases} \quad \textbf{(2)}$$

We employ model C which allow the structural breaks in the intercept and trend. Kapetanios (2005) use the technique that suggested by Perron (1989) to determine the number and date of structural breaks.

To investigate the existence of cointegration relationship between the public investments and private investments we use Maki cointegration test which is similar to the Kapetanios unit root test in the way that in this test the number and the location of the structural breaks are determined endogenously. In this test we can employ the following models:

$$\begin{aligned} y_t &= \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta' x_t + u_t && (I) \\ y_t &= \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta' x_t + \sum_{i=1}^{k} \beta' x_t D_{i,t} + u_t && (II) \\ y_t &= \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \gamma t + \beta' x_t + \sum_{i=1}^{k} \beta' x_t D_{i,t} + u_t && (III) \\ y_t &= \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \gamma t + \sum_{i=1}^{k} \gamma_i t D_{i,t} + \beta' x_t + \sum_{i=1}^{k} \beta' x_t D_{i,t} + u_t && (IV) \end{aligned} \quad (3)$$

Where x and y show the I(1) variables. Here Model I shows the level shift model, while Model II is the level shift model with trend, model III allows for regime shifts and model IV allows for Trend and Regime shifts. In this model we test the null of no cointegration relationship between the variables by examining the unit root characteristics of the residuals. The case of stationary residuals implies the existence of cointegration relationship. To determine the number and location of the structural breaks, we again follow the Perron (1989) method. At the first step, we estimate the selected model for all the possible structural breaks. Then select the first structural break which give the minimum sum of squared residuals. We re-estimate the selected model after including the first dummy variable and select the next structural break which gives the minimum sum of squared residuals. We proceed to this technique until including the all the dummy variables which are the proxies of the structural breaks. To determine the number of the breaks, we select the model which gives the minimum unit root test statistics for the residuals.

## 3. Data and Empirical Results

In this study we employ the yearly data of public investments and private investments from 1980 to 2014 which obtained from Undersecretariat of Treasury of Republic of Turkey Prime Ministry. At the first step of the analysis to test the stationary characteristics of the data we employ Kapetanios (2005) unit root test and present the results of the test as follows:

Table 1. Kapetanios Test Results

| | t-stat | TB |
|---|---|---|
| Public Inv. | -4.1555 | 2002 |
| Private Inv. | -4.3839 | 1997 |

The optimal numbers are breaks are found to be as 1 for the both series. The test results show that a break occurred in 2002 in the public investments series while 1997 in the private investments. We found both series as nonstationary which allows us to continue to the analysis using Maki cointegration test. The results of Maki cointegration test are as follows:

Table 2. Maki Test Results

| | t-stat | TB |
|---|---|---|
| Prv. - Public Inv. | -5.8140459 | 1982, 1989, 2000, 2008 |

The test results reveal the long run relationship between the variable. So we estimate the long run parameters using FMOLS:

Table 3. FMOLS Test Results

| | Constant | Lpublic | DU1 | DU2 | DU3 | DU4 |
|---|---|---|---|---|---|---|
| Coefficients | 1.470379 | 0.78778 | 0.093444 | 0.280675 | -0.00374 | 0.130301 |
| p-values | 0.5995 | 0.077 | 0.4913 | 0.001 | 0.9592 | 0.242 |

The coefficient of the Lpublic seems to be positive and significant which implies that %1 increase in public investment creates %0.78 increase in private investments which can be accepted as an evidence of crowding-in for Turkey.

## 4. Conclusion

In this study we test the existence of crowding-out effect for Turkey for the period of 1980-2014 by using econometric methods that allow for structural breaks whose number and location not determined a priori. Since the results show that the series, under investigate have unit root, we test the existence of long run relationship between the variables and conclude that there exists cointegration relationship, the estimation results of FMOLS indicate the crowding-in effect for Turkey in the analysis period.

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