Does Public Debt and Investments Create Crowding-out Effect in Turkey? Evidence from ARDL Approach

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Kamu Borç ve Yatırımları Türkiye'de Dışlama Etkisi Yaratır mı? ARDL Yaklaşımından Kanıtlar

Abstract

The impact of public sector debt composition on the private sector is a matter of curiosity. This article explores the crowding-out effect of public debt and public investment on private investment in Turkey from 1975 to 2020, utilising the ARDL method. The findings reveal that public investment, public domestic debt stock, and external debt service create a crowding-out effect; on the other hand, the public external debt stock has a crowding-in effect on private sector investments. In this study, the crowding-out effect of public debt, which has not been directly related to private sector investments in the literature, is tried to be examined.

Keywords : Public Debt, Public Investment, Crowding-Out Effect, ARDL.

JEL Classification Codes : E62, H63, C32, O40.

Öz

Kamu kesimi borç kompozisyonunun, özel sektör üzerindeki etkisi bir merak konusudur. Bu makale, 1975-2020 dönemi için ARDL yöntemiyle kamu yatırımı ve kamu borcunun Türkiye'deki özel yatırımlar üzerindeki dışlama etkisini araştırmaktadır. Analizden elde edilen bulgular kamu yatırımı, kamu iç borç stoku ve kamu dış borç servisinin, özel sektör yatırımları üzerinde dışlama etkisi yarattığını göstermektedir. Kamu dış borç stoku ise özel sektör yatırımları üzerinde çekme etkisi yaratmaktadır. Bu çalışma, literatürde daha önce özel sektör yatırımları ile doğrudan ilişkisi araştırılmamış olan kamu borcunun dışlama etkisi incelenmeye çalışılmaktadır.

Anahtar Sözcükler : Kamu Borcu, Kamu Yatırımları, Dışlama Etkisi, ARDL.

1. Introduction

A lengthy discussion explores how the private sector is affected by the presence of the public sector, and its roots go back to the 18th century. It is not possible to say that a consensus has yet been reached on whether the existence of the public sector is a blessing or a disaster. In particular, countries' macroeconomic dynamics, development levels, and even social structures can differentiate the relationship between the private and public sectors. Financing the public sector is one of the critical structural problems of developing countries. On the one hand, a gradual increase and diversification of social demands and expectations put an extra burden on public expenditure. From another perspective, public expenditures were made with political preferences and priorities far from economic and financial rationality, creating considerable pressure on public spending.

On the side of public revenues, the quest for revenue increase, aside from solving the public finance problem, has revealed effects that cause the existing problems to deepen. For this reason, the impact of the public sector's expenditure, revenue, and even the use of debt instruments on the private sector is a matter of curiosity. In particular, the preference for expansionary fiscal policy in times of economic crisis caused deterioration in budget balances and severe increases in public debt in many countries (Yurdadog et al., 2021: 89). More importantly, the 2008 crisis that occurred in the housing market in the USA and affected the entire world, and the European Union debt crisis that followed this crisis, caused the share of the public sector in GDP to increase in most countries (Nautet & Meensel, 2011: 7). According to the IMF (2021), public debt stock/GDP in developed economies rose from 77% in 2008 to 120% in 2020. In developing countries, the public debt stock/GDP ratio, 34% in 2008, increased to 64% in 2020. The GDP share of Turkey's public domestic and external debt stock is also a sharp change, whose time path graph is presented in Figure 1. The effect of this sharp increase observed in the public debt stock on the private sector has become an issue that needs to be examined which is the primary motivation of this research.

Figure: 1
Public Domestic and External Debt Stock
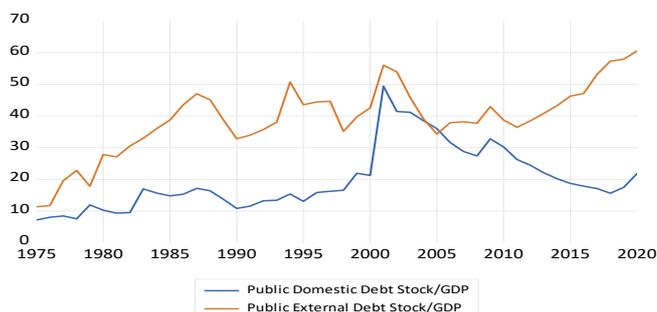
Source: TR Ministry of Treasury and Finance (2022).

Increasing tax revenues, resorting to central bank resources, and borrowing are the options that come to the fore as public revenues policy solves the public sector financing problem. In the part of expenditures, the priority is to reduce public spending. There are several constraints in using options for tax increases and central bank resources. As it is known, tax increases after a certain threshold create pressure on economic growth and development, while indirect tax increases create adverse effects on income distribution. Therefore, the issue that guides tax increases in the solution of the public financing problem is the negative effects of the tax increase on the social and economic structure rather than the financial resources required by the financing problem. Another option for the economic administrations facing some obstacles to the tax increase is the central bank resources. This resource's uncontrolled use undoubtedly causes deeper structural problems and exceptionally high inflation. In line with the fiscal rules applied in many countries, it is possible to say that the use of central bank resources is also subject to legal permissions. When it comes to reducing public expenditures to solve public financing problems, the type of expenditure primarily affected is investment expenditures.

Modern economic systems consist of not only the public sector but also the private sector. In this structuring, the state's ideological strategy is decisive regarding the share of the public and private sectors in the economy. Therefore, when analysed within the framework of macroeconomic theory, an increase in the use of resources by one of the sectors will cause the other to use fewer resources (Bilgili, 2003: 2). The goods and services offered by the public sector may include some social objectives instead of seeking profit. For this reason, private sector investments are vital for both developed and developing countries in terms of economic growth (Afonso & Aubyn, 2019: 48). With the Keynesian approach to sustainable economic growth, although the private sector's investments have a limited share in the total demand, it is an essential determinant of physical capital accumulation (Aschauer, 1989: 171). In this context, mixed economy models that accept the unity of the public and private sectors have been discussed for a long time in the literature of economic thought. The crowding-out effect, which has its roots in the classical economic view, has created comprehensive literature examining the impact of public expenditures on private investments by many authors (Sen & Kaya, 2014: 632).

It is observed that these studies, which investigate the effects of the public sector on the private sector, focus on three views: Keynesian, Neo-classical, and Ricardian approaches. Keynesian view-based studies argue that public expenditures have a complementary character to the private sector and therefore have a positive (crowding-in) effect on private sector investments (Khan & Gill, 2009: 6; Bahal et al., 2018: 323). However, studies centred on the Neo-classical approach also argue that public expenditures substitute for the private sector and create a negative (crowding-out) effect on the private sector's investments (Kustepeli, 2005: 186). Another approach within the scope of crowding-out effect studies is the Ricardian Equivalence approach, introduced to the literature by Barro (1974). Within the scope of Ricardian equivalence theory, it is argued that the public sector has neither a substitute nor a complementary effect on the private sector. This situation is because it is thought that tax increases in the future will finance the increase in public

deficits. Individuals who believe that tax rates will increase will not change their consumption/investment preferences by accepting that their income levels will not change. Therefore, it is argued that the deficits created by the public sector will neither have a deterrent nor an encouraging effect on the private sector (Taban & Kara, 2006: 16). If the public sector reduces the physical resources available to the private sector, there will be a direct crowding-out effect. However, suppose the expenditure structure of the public sector affects the private sector's cost structure because market conditions change. In that case, an indirect crowding-out effect comes to the fore.

The crowding-out effect is a concept that is theoretically based on public expenditures. Due to this structure, there are many studies examining the crowding-out effect empirically using various public expenditure compositions (Aschauer, 1989; Hyder & Qayyum, 2001; Kustepeli, 2005; Basar et al., 2011; Furceri & Sousa, 2011; Cural et al., 2012; Sen & Kaya, 2014; Yilanci & Aydın, 2016; Saidjada & Jahan, 2018; Funashima & Ohtsuka, 2019; Ebghaei, 2021). Unlike these studies, the number of studies examining the crowding-out effect of public investments on the private sector is substantial (Argimon et al., 1997; Cil-Yavuz, 2001; Uysal & Mucuk, 2004; Bilgili, 2003; Altunc & Senturk, 2010; Cural et al., 2012; Mahmoudzadeh et al., 2013; Yarasır-Tulumce & Buyrukoglu, 2013; Kesbic et al., 2016; Andrade & Duarte, 2016). However, studies examining the crowding-out effect of the public sector's debt structure on the private sector are relatively new and limited (Demir, 2017; Caskurlu, 2020; Ela & Pata, 2020; Kulu et al., 2021; Penzin & Oladipo, 2021; Vanlear et al., 2021). In short, various econometric methods, data sets, and samples are preferred in empirical studies. The following section provides a comprehensive review of the empirical literature examining the crowding-out effect.

In the studies conducted, there is no consensus on the impact of the public sector on private-sector investments. In addition, only a few studies in the literature directly deal with the crowding-out relationship between public debt components and the level of private sector investment, and current studies generally deal with public debt in one dimension as a domestic or external. With this study, the deficiency in the relationship between crowding-out and public debt in the literature has been tried to be eliminated. In this context, fixed capital investment in the private sector, fixed capital investment in the public sector, domestic debt stock, external debt stock, and external debt service variables are preferred for analysis.

The rest of the work is designed: Section two discusses the empirical literature. In the following section, the data set and econometric methodology are presented. In the fourth section, the study's empirical findings are given. The analysis results are associated with the literature and policy in this context in the last section. The study was concluded by making recommendations.

2. Literature

The roots of the theoretical literature examining the effects of the public sector on the private sector date back to the early periods of economic thought history. With the widespread use of econometric methods in light of scientific developments, many empirical studies have examined this theoretical literature from several aspects. It is observed that time series and panel data analysis is frequently preferred in terms of methods in studies conducted in this field. Although the literature examining the crowding-out effect has a common purpose in structure and model, the preferred model has a severe level of diversity in terms of sample and examination period. This diversity is valid in the findings obtained. This section discusses empirical studies examining the crowding-out effect of the public sector on the private sector and their conclusions.

Aschauer (1989) studied the crowding-out effect of public expenditures on private investment from the Neo-classical perspective for the United States from 1925 to 1985 using the FIML (full-information maximum-likelihood) method. As a result of research, increased public investment is expected to reduce one-to-one private investment. Argimon et al. (1997) used panel data methods to examine the crowding-out effect of government spending on private investment for 14 OECD member countries from 1979 to 1988. The study determined that public investment in infrastructure has a crowding-in effect on private investment. However, public expenditure on consumption has a crowding-out effect on private investment. Lächler and Aschauer (1998) examined the crowding-out effect in Mexico for the period 1970-to 1996 using the 2SLS (two-stage-least square) method. As a result of the study, it has been determined that public investment has a crowding-out effect on private investment.

Levaggi (1999) investigated the effect of the provision of pure and impure public goods crowding-out private consumption in Italy from 1960 to 1993 using the Maximum Likelihood method. The author argued that the provision of merit goods crowding-out effects occurs, but its impact is limited to private investment. In the case of pure public goods provision, the crowding-out effect have no significant impact on private consumption. Hyder and Qayyum (2001) studied the crowding-out effect of public investment on private investment and economic growth in Pakistan from 1964 to 2001 using Johansen co-integration and Granger causality methods. The authors concluded that public investment generates a crowding-in effect on private investment.

Hatano (2010) searched public investment's crowding-out effect on Japan's private investment from 1955 to 2004 using the Johansen co-integration and Granger causality method. In the research conclusion, the author points out a strong possibility of crowding-in relation to public investment on private investment. According to the Granger causality test result, there is a bidirectional Granger causality relationship between public investment and private investment. Furceri and Sousa (2011) performed an extensive study that focused on the crowding-out effect of government spending in 145 developed and developing countries from the period 1960 to 2007 by using the GMM (generalised method of moments)

estimation method. They found that government spending substantially crowds out private investment and consumption. Using the panel data method, Mahmoudzadeh et al. (2013) analysed the crowding-out effect of public expenditure on private investment for 38 (developed and developing) countries from 2000 to 2009. The authors found that public investment positively affects private investment in developing and developed countries. However, the crowding-in effect is more significant in developing countries than in developed countries. On the other hand, public consumption has a crowding-out effect in all samples. Additionally, the impact of the public deficit on private investment in developed and developing countries is crowding-out and crowding-in, respectively. Khan and Gill (2014) examined the crowding-out effect of public debt on the private sector in Pakistan from 1971 to 2006 using the Johansen co-integration method. The authors find a shred of evidence that the public debt crowd-in private investment.

Using the VAR method, Xu and Yan (2014) studied the crowding-out effect of public investment expenditures on private investment in China from 1980 to 2011. The authors investigate the public investment expenditure as two types: investment in public goods and investment in private goods. As a result of the research, the authors reported that when the government investment in public goods increases, it creates a crowding-in effect on private investment. However, government investment in private goods creates a crowding-out effect on private investment. Andrade and Duarte (2016) investigated the crowding-out effect of public investment on private investment in Portugal for the period 1960 to 2013 by using the VAR and ADL (augmented distributed lag) model. In conclusion, the author reported that public investment led to a crowding-in effect on private investment.

Atabaev et al. (2018) examined the public expenditure's crowding-out effect on private investment in Kyrgyzstan with monthly data from 2005 to 2013 using ARDL and VAR methods. The authors found that public spending affecting positively private investment in the transition economy of Kyrgyzstan. Bahal et al. (2018) analysed the public investment's crowding-out effect on private investment in India from 1950 to 2012 using the structural vector error correction (SVEC) method. The authors reported that public investment crowded out private investment from 1950 to 2012. In contrast to this finding, they are supported that there is a crowding-in effect in the more recent period 1980-2012. The authors explain the differences between results with the paradigm shift of India's economic growth model in the 1980s.

Saidjada and Jahan (2018) examined public investment's crowding-out effect on Bangladesh's private investment from 1981 to 2015 using the ARDL method. The authors found that public investment has a crowding-out effect on private investment. Using the VAR model, Afonso and Aubyn (2019) studied the macroeconomic impact of public and private investment in 17 OECD member countries from 1960 to 2014. They concluded that an increase in public investment led to a crowding-out effect for six countries (Belgium, Ireland, Finland, Canada, Sweden, and the UK). The crowding-in effect is valid for the rest of the sample.

Using spatial autoregressive panel data, Funashima and Ohtsuka (2019) performed innovative research about the crowding-out effect of government expenditure on the private sector in seven regions in Japan from 2001 to 2013. The authors found that the crowding-out effect differentiates from region to region, but the crowding-out effect of public investment might be negligible for the sample. As a result of the analysis of urban areas, public consumption has a partially crowding-in effect on private consumption. Nevertheless, in rural areas, there is a crowding-in effect. Using the panel data method, Kulu et al. (2021) examine the crowding-out effect of government domestic payment arrears on private investment for 33 Sub-Saharan African countries from 2007 to 2018. As a conclusion of the analysis, the authors point out that government domestic payment arrears have a crowding-out effect on private investment.

In the literature, some studies deal with the crowding-out effect outside of the dimensions of public expenditures and public investments. These studies investigate the crowding-out effect when the public sector prefers borrowing as a financing method.

Using panel data methods, Ahmet and Miller (2000) examined the crowding-out effect in the effect of debt-financed and tax-financed expenditures on private investment for 39 countries (developed and developing) from 1975 to 1984. The authors reported that debt-financed public spending has a crowding-out effect on private investment in developed countries; however, crowding-in for developing countries. However, tax-financed public expenditures crowd out private investment in all samples. Similarly, King'wara (2014) analysed the crowding-out effect of domestic public debt on private investment in Kenya from 1967 to 2007 using the Johansen co-integration method. The author reported a crowding-out effect of domestic public debt on private investment.

Akomolafe et al. (2015) analysed public debt's crowding-out effect on Nigeria's private investment from 1980 to 2010 using the Johansen co-integration method. In the research conclusion, the authors point out that domestic public debt has a crowding-out effect on private investment, though external public debt has a crowding-in effect in the long run but not in the short run. Mabula and Mutasa (2019) studied the impact of public debt on private investment in Tanzania for the period 1970 to 2016 by using the ARDL method. The authors found that external public debt has a crowding-in effect on private investment, but if the external debt/GDP exceeds the 40.89 thresholds, this relation turns into a crowding-out. Using panel data methods, Unsal (2020) studied the crowding-out effect of public expenditure on private investment in 17 OECD members from 1995 to 2017. The author reported that the public defence expenditure led to a crowding-in effect on private investment. On the other hand, the government's total public and social protection expenditures led to a crowding-out effect on private investment.

Using the GMM model, Vanlaer et al. (2021) examine the crowding-out effect of public and private debt on private investment for 28 EU member countries from 1995 to

2016. The authors found that public debt has a crowding-out effect on private investment. Finally, Penzin and Oladipo (2021) studied the crowding-out effect of domestic debt on private investment in Nigeria for 2000: Q1 - 2019: Q2 using the ARDL method. The authors reported that domestic debt negatively affects private investment.

The number of studies on the crowding-out effect on Turkey is also substantial. Studies on Turkey's public sector expenditures and investments report different results based on the preferred econometric method, the variables used, and the period examined. Cil Yavuz (2001) analysed the crowding-out effect of public investment and interest rates on private sector investment for Turkey in 1990: Q1-2000: Q4 using the Johansen co-integration method. The study determined that public investment has a crowding-out effect on private investment. Likewise, Simsek (2003) searched the crowding-out effect of public investment on private investment in Turkey from 1970 to 2001 using Johansen co-integration and Granger causality methods. The author reported that public investment has a crowding-out effect on private investment. Uysal and Mucuk (2004) investigated the crowding-out effect of public expenditure on private investment in Turkey from 1975 to 2000, employing the OLS method. As a result of the study, the authors reported that public spending has a crowding-out effect on private investment.

Kustepeli (2005) analysed the crowding-out effect of budget deficits on private investment in Turkey from 1963 to 2003 using the Johansen co-integration method. The author found that budget deficits create a crowd-out the private investment. Ismihan et al. (2005) studied the crowding-out effect of public expenditure on private investment in Turkey from 1963 to 1999 using the Johansen co-integration method. The authors point outs that public spending has a crowding-out effect on private investment. Comparably, Gunaydin (2006) searched public investment's crowding-out effect on private investment in Turkey for 1987: Q1-2004: Q3 by using the Johansen co-integration method. The author reported that public investment negatively affects private investment. In a similar period, Basar and Temurlenk (2007) investigated public expenditure's crowding-out effect on private investment in Turkey from 1980 to 2005 by using the SVAR (structural vector autoregression) method. The result of the study points out that the public expenditure crowd out private investment.

Using different indicators, Lebe and Basar (2008) studied the crowding-out effect of reel interest rates and foreign direct investment on private investment in Turkey from 1975 to 2006 using the OLS method. In the research conclusion, the authors found a crowding-in effect between foreign direct investment on private investment. However, the authors point out a crowding-out effect between reel interest rates on private investment parallel to the theoretical and empirical literature. Comparably, Bilgili (2003) examined the crowding-out effect of public expenditure on private investment for Turkey in 1988: Q1-2003: Q1 using VAR and VECM (vector error correction) models. The author reported a crowding-in relationship between total public expenditure on private investment. On the other hand, the author points out a crowding-out effect between public investment on private investment. Altunc and Senturk (2010) also studied the crowding-out effect of public investment on

private investment in Turkey from 1980 to 2009 using the ARDL method. According to the findings obtained, it has been suggested that there is a crowding-in relationship between public investment on private investment.

Basar et al. (2011) examined the crowding-out relationship between public expenditure and interest payment on private investment in Turkey for 1987: Q1- 2007: Q3 using the Johansen co-integration method. The authors found that public expenditure and interest payment generate a crowding-in effect on private investment. Cural et al. (2012) analysed the crowding-out effect of public investment on private investment in Turkey from 1970 to 2009 using the Carrion-I Silvestre and Sanso co-integration method. They reported the crowding-in effect of public investment on private investment. Sen and Kaya (2014) extensively analysed the crowding-out effect of public expenditure on private investment in Turkey for the period 1975 to 2011 by using the Johansen co-integration method. The authors concluded that public investment generates a crowding-in effect on private investment. However, the other type of public expenditure (government's current transfer, current spending, and interest payments) led to a crowding-out effect on private investment.

Kesbic et al. (2016) investigated public investment's crowding-out effect on private investment in Turkey from 1986 to 2014 using the Johansen co-integration method. The authors point out that public investment negatively affects private investment. Yilanci and Aydin (2016) searched the crowding-out effect of public investment on private investment in Turkey from 1980 to 2014 using the Maki co-integration analysis. As a result of the research, the author points out that public investment has a crowding-in effect on private investment. Similarly, Demir (2017) studied the crowding-out effect of public investment on private investment in Turkey from 1983 to 2013 using the ARDL method. The author reported that public investment generates a crowding-in effect on private investment.

Gultekin-Tarla and Temiz (2020) studied the crowding-out effect of public investment on private investment in Turkey for the period 1975 to 2016 by using the Johansen co-integration method. As a conclusion of the analysis, the authors reported that public investment led to a crowding-in effect on private investment. Ebghaei (2021) searched the crowding-out effect of public expenditure on private investment in Turkey from 1980 to 2018 using the Johansen co-integration method. The author points out that public investment has a crowding-in effect on private investment, but public expenditure has a crowding-out effect on private investment. Using different indicators, Kurul (2020) analysed the crowding-out effect of outward foreign direct investment on domestic investment in Turkey from 1970 to 2018 using the ARDL method. In the research conclusion, the author reported that foreign direct investment creates a crowding-out effect on domestic investment.

There is also relatively limited literature examining the effects of public-sector borrowing on the private sector. Taban and Kara (2006) searched the crowding-out effect of public domestic debt on private investment in Turkey for 1989: Q1-2004: Q4 using the OLS method. As a result of the study, the authors reported a crowding-out effect of public

domestic debt on private investment. Yarasir-Tulumce and Buyrukoglu (2013) searched the crowding-out effect of public debts on Turkey's private investment from 1980 to 2010 using the Johansen co-integration method. As a result of the research, the authors reported a crowding-out effect of rising interest rates because of public debt on private investment.

Caskurlu (2020) analysed the crowding-out effect of public debt on private investment in Turkey for the period 1975 to 2016 by using the ARDL method. As a result of the analysis, the author reported that public debt has a crowding-out effect on private investment. Also, Ela and Pata (2020) investigated the crowding-out effect of public debt on Turkey's private investment from 1987 to 2017 using the Bayer Hanck co-integration method. The authors found that the public external debt service has a crowding-out effect on private investment. The literature mentioned above examines public sector debts in a single dimension. The studies about the crowding-out effect of public debt in Turkey are somewhat limited. This study aims to address the public debt in Turkey with a multidimensional structure, trying to eliminate this gap in the literature and prepare a scientific basis for future works. In addition, the summary table regarding the empirical literature is presented in Appendix 2.

3. Data, Model and Methodology

3.1. Data and Model

This study will investigate the effect of public debt composition and public investment on private investment using annual data covering Turkey's period 1975-2020e model to be analysed in the study is presented in equation 1:

$$lnPI_t = \alpha_0 + \alpha_1 lnGI_t + \alpha_2 lnPddebt_t + \alpha_2 lnPedebt_t + \alpha_3 lnPedebtsrv_t + u_t \qquad (1)$$

Table: 1
Descriptive Statistics

Variables	Mean	Median	Max	Min	Std. Dev.	JB	JB (p-value)
lnPI	2.9031	2.8914	3.2241	2.4932	0.2415	3.0371	0.2190
lnGI	1.5698	1.5336	2.0281	1.1314	0.2624	2.8666	0.2385
lnPddebt	2.8707	2.8186	3.8999	1.9657	0.4794	0.7898	0.6737
lnPedebt	3.6129	3.6575	4.1033	2.4274	0.3595	40.483	0.0000
lnPedebtsrv	0.9026	1.0050	1.9100	-0.5300	0.6912	3.3984	0.1828

In Equation (1), the dependent variable as a proxy of Private investment PI represents the Private Fixed Capital Investment (% of GDP). As a proxy of public investment GI, the independent variable represents the Public Fixed Capital Investment (% of GDP). *Pddebt*, *Pedebt*, and *Pedebtsrv* are public domestic debt stock (% of GDP), public external debt stock (% of GDP), and public external debt service (% of GDP), respectively. The logarithm of all series expressed in Equation (1) has been taken. Descriptive statistics of the variables are presented in Table 1. The data was compiled using various sources such as the TR Ministry of Treasury and Finance, TR Presidency of Strategy and Budget, and The World Bank database, subject to their availability.

3.2. Methodology

The empirical analysis of the study consists of four stages. In the first step, the stationarity properties of the series will be tested by using the Fourier-ADF unit root test developed by Enders and Lee (2012) and the ADF unit root test developed by Dickey and Fuller (1979), then whether a cointegration relationship between the series will be investigated with the ARDL method developed by Pesaran et al. (2001). Diagnostic tests and long and short-run estimations will be presented if there is a cointegration relationship. Lastly, Phillips and Hansen (1990) Fully modified least squares (FMOLS) and Stock and Watson's (1993) dynamic least squares (DOLS) estimates will be performed to provide robust results.

3.2.1. Fourier-ADF and ADF Unit Root Test

The ADF unit root test, represented in equation 2, allows three regression specifications: no intercept and trend, only intercept and intercept with the trend.

$$\Delta y_t = \alpha(t) + \delta t + \vartheta y_{t-1} + \sum_{i=1}^{p} \beta_i y_{t-i} + u_t \tag{2}$$

In Eq. (2), the deterministic term as a function of time is (t) , optimal lag length determined by the Akaike or Schwarz information criteria denoted by p. u_t is a stationary error term with variance σ_u^2. Lasty, ϑ and β_i are coefficients. Furthermore, lagged values of Δy_t are included in a model to prevent autocorrelation problems. By adding nonlinear terms (*Fourier*) to equation (2) above, the Fourier ADF unit root test equation expressed by Enders and Lee (2012) is defined.

$$\Delta y_t = \alpha_1 + \delta t + \gamma_1 \sin\left(\frac{2\pi k t}{T}\right) + \gamma_2 \cos\left(\frac{2\pi k t}{T}\right) + \sum_{i=1}^{p} \beta_i y_{t-i} + \vartheta y_{t-1} + u_t \tag{3}$$

The Fourier ADF test's null hypothesis is that the series has a unit root. The table critical values in which the t-statistic is compared can only vary according to Fourier frequency (k), and the number of observations (T) (Pata & Aydın, 2020: 6). During the Fourier ADF testing process, bootstrap simulation or Monte Carlo calculates t statistics. If the t statistic value > the value of the t table, the variable is judged to have a stationary process. The F constraint test calculates the significance of the Fourier terms. As a first step, we tested the significance of the Fourier terms according to the F constraint test. Then, as a second step, the Fourier test statistic is calculated. If the F statistic calculated in the first step is lower than the F table value, the Fourier ADF equation turns into the ADF (1979) equation. In other words, the ADF test is used when the F statistic is not statistically significant.

3.2.2. The ARDL Method

Researchers in the empirical literature frequently prefer the ARDL model developed by Pesaran et al. (2001). The ARDL method provides flexibility to researchers as it allows independent variables to be I (0) or I (1) under the assumption that the dependent variable is

I (1). To determine whether there is a cointegration relationship between the ARDL method
and the series, Pesaran et al. (2001) F-bound test and t-bound test should be applied.

$$F_{test} \; H_0: \phi_1 = \phi_2 = \phi_3 = \phi_4 = \phi_5 = 0 \tag{4}$$

$$t_{test} \; H_0: \phi_1 = 0 \tag{5}$$

Pesaran et al. (2001) calculated an F-test statistic to determine the cointegration
relationship. Suppose that the test statistic calculated according to this approach, known as
the F-bounds test, is smaller than the critical value of the all-bound (0). In that case, the null
hypothesis cannot be rejected, and it will be concluded that there is no cointegration
relationship. Suppose that the obtained F test statistics are in the region of instability between
the lower bound critical value I (0) and I (1) upper bound critical value. In that case, deciding
on the cointegration relationship will not be possible. However, if the F-test and t-test value
of Pesaran et al. (2001) or if it is greater than the critical values in Narayan (2005) adjusted
for sample size, the null hypothesis will be rejected be decided that there is a cointegration
relationship.

In this context, the econometric model to be evaluated with the ARDL method is
presented in equation 6:

$$\Delta lnPI_t = \vartheta_0 + \omega_1 \sum_{i=1}^{h} \Delta lnPI_{t-i} + \omega_2 \sum_{i=0}^{s} \Delta lnGI_{t-i} + \omega_3 \sum_{i=0}^{c} \Delta lnPddebt_{t-i} +$$
$$\omega_4 \sum_{i=0}^{p} \Delta lnPedebt_{t-i} + \omega_5 \sum_{i=0}^{k} \Delta lnPedebtsrv_{t-i} \; + +\phi_1 lnPI_{t-1} + \phi_2 lnGI_{t-1} +$$
$$\phi_3 lnPddebt_{t-1} + \phi_4 lnPedebt_{t-1} + \phi_5 lnPedebtsrv_{t-1} + \mu_t \tag{6}$$

4. Empirical Results

First, the unit root properties of the variables are examined by Fourier ADF and ADF
unit root tests. Table 2 shows the unit root test results:

Table: 2
Unit Root Test Results

Variables	FADF (model A)				ADF		
	I (0)	I (1)	k(p)	f	I (0)	I (1)	p
lnPI	-0.904	-7.673***	5(0)	4.657	-1.366	-6.450***	0
LnGI	-2.834	-6.511***	3(1)	1.753	-1.336	-5.953***	1
lnPddebt	-2.873	-8.307***	2(0)	3.596	-2.074	-7.453***	0
lnPedebt	-4.948***	-	2(4)	6.684	-3.483**	-	0
LnPedebtsrv	-1.760	-6.556***	1(0)	5.998	-2.156	-5.157***	0

Note: ***, ** denote significance at 1% and 5% levels, respectively. (k) denotes the chosen frequency. Optimal lag lengths (p) were selected
automatically using the SC.

The results in Table 2 show that all variables except *lnPedebt* have a unit root at the
level. It is observed that the variables become stationary at the first difference. Maximum
integration of series is I (1). According to this finding, the integration degrees of the series
are suitable for the ARDL model to be preferred. The econometric model specified in
Equation (6) was tested within the framework of the constraints specified in equations (4)
and (5), and the results are presented in Table 3:

Table: 3
ARDL Bound Test Results

Model (2,1,4,1,3)	F_{test}		t_{test}			
lnPI=f(lnGı lnPddebt lnPedebt lnPedebtsrv)	7.0270***		-63671***			
	Pesaran et al. (2001)				Narayan (2005)	
	F_{test}		t_{test}		F_{test}	
Critical Values	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
1%	3.74	5.06	-3.43	-4.6	4.42	625
5%	2.86	4.01	-2.86	-3.99	3.20	4.54
10%	2.45	3.52	-2.57	-3.66	2.66	3.83

Note: *** denotes significance at the 1% level. Optimal lag lengths in the ARDL model selected by AIC.

In Table 3, the results of the ARDL bound test are calculated according to the constraints specified in equations (4) and (5), and the critical values for measuring their statistical significance are presented. The critical values for the general F-test and t-test were taken from Pesaran et al. (2001), and the general F-test was adjusted for sample size from Narayan (2005). When the bound test results were examined, it was decided that the critical values specified in the three tests were more significant at the 1% significance level. Therefore, the cointegration relationship between the series is valid. In other words, the series move together in the long run. In this context, the ARDL long-term estimations and diagnostic tests are presented in Table 4:

Table: 4
ARDL Long-run Coefficients

Variables	Coefficients	t-statistics	Standard Errors	Diagnostic Tests
lnGI	-0.3622***	-4.4682	0.0810	LM=2.1952 (0.1332) ***
lnPddebt	-0.1079**	-2.0179	0.0534	BPG=0.942(0.5343) ***
lnPeddebt	0.5255***	6.153	0.0854	Ramsey=0.2879(0.7757) ***
lnPedebtsrv	-0.175***	-5.0976	0.0344	JB=0.2024 (0.9037) ***
				Cusum (CusumQ) = S(S)

Note: ***, ** denote significance at the 1% and 5% levels, respectively. Probability values are in parentheses in diagnostic tests, and S denotes stable.

Table: 5
ARDL Short-run Coefficients

Variables	Coefficients	t-statistics	Standard Errors
ΔlnPI	0.3717***	3.0145	0.1233
ΔlnGI	-0.1587	-1.6187	0.0980
ΔlnPddebt	-0.2900***	-5.1948	0.0558
ΔlnPedebt	0.2563***	2.0700	0.1238
ΔlnPedebtsrv	-0.2054***	-2.7993	0.0733
C	1.9693***	6.4086	0.3073
ECT_{t-1}	-0.9566***	-6.3671	0.1502

Note: *** denotes significance at the 1% level.

The result of the diagnostic test is presented in table 4. The model has no serial correlation, heteroscedasticity, functional form, and non-normal distribution problems. Also, Cusum and CusumQ test results indicate stable coefficients (see Annex). According to the results of the diagnostic tests in Table 4, the model is stable and fit. When the long-run estimation results are examined, it is observed that the public investment expenditure has a negative and statistically significant effect on private investment. In other words, parallel to the theoretical expectation of the Neo-classical approach, public investments crowd out private investments in the long run. Public investment in Turkey is a substitute

for private investment. According to the findings, when public investment increases by 1%, private investment decreases by 0.36%. Similarly, public external debt services and public domestic debt have a statistically significant and negative effect on private investment. So that we support that public domestic debt and public external debt services also crowd out private investment. Numerically, an increase of 1% in public domestic debt led to a decrease of 0.10% in private investment. Also, when the public external debt services increase by 1% reduces private investment by 0,17%. The increase in the domestic debt of the public sector in Turkey makes the private sector's access to capital more costly. As of December 2020, the banking sector provides 67% of Turkey's public domestic debt stock. This shows that the state uses the capital needed for domestic investment and creates an indirect crowding-out effect by increasing costs. In addition, the increase in external debt service leads to a further decrease in foreign exchange resources in Turkey, which has an insufficient composition of foreign exchange resources.

Contrary to these effects, public external debt has a positive and statistically positive impact on private investment in the long run. For this reason, the public external debt is creating a crowding-in effect on private investment. When the public external debt increases by 1%, private investment rises by 0,5%. As a developing country, Turkey needs external resources to achieve economic growth. In this context, foreign resource inflow to the Turkish economy, which needs imported inputs purchased with foreign currency, especially energy, can increase domestic investments in production preference.

In Table 5, it can be seen that public domestic debt and external debt services crowd out private investments, similar to long-term relationships. Public investment has a negative sign but is statistically insignificant. Public external debt has generated a crowding-in effect in the short run. However, lagged value of the private investment creates a crowding-in effect since it generates capital accumulation. Finally, the error correction coefficient was negative and statistically significant. To check the robustness, a re-estimation was made using Stock-Watson's (1993) dynamic least squares (DOLS) and Phillips-Hansen's (1990) fully modified least squares (FMOLS) methods, and the results are presented in Table 6. FMOLS and DOLS results are in line with ARDL long-term estimates.

Table: 6
FMOLS and DOLS Estimate Results

Variables	FMOLS		DOLS	
	Coefficients	t-statistics	Coefficients	t-statistics
lnGI	-0.5983*** (0.0962)	-6.2150	-0.5435*** (0.1165)	-4.6645
lnPddebt	-0.1425*** (0.0519)	-2.7610	-0.1784*** (0.0552)	-3.2326
lnPeddebt	0.3443*** (0.0896)	3.8391	0.4539 *** (0.1060)	4.2796
lnPedebtsrv	-0.1649 *** (0.0347)	-4.7524	-0.1780*** (0.0429)	-4.1428
C	3.1701*** (0.4105)	7.7213	2.8033*** (0.4784)	5.8592

*Note: *** denotes significance at the 1% level. Values in parentheses indicate standard errors.*

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FMOLS and DOLS estimators' results presented in table 6 have fully supported the results of the ARDL method. Both public investment, public domestic debt and public external debt services have a crowding-out effect on private investments. On the other hand, the public external debt has a crowding-in effect on private investment.

5. Conclusion

The reduction in investment expenditures negatively affects economic growth and development and creates effects that deepen financing problems in the medium and long term. It can be said that the options for raising taxes, using central bank resources, or reducing public expenditures for the solution to the public finance problem do not have a wide range of action, and each option causes new problems with different symptoms. Another option for tackling the public finance problem is borrowing. From the point of view of efficiency, borrowing can sometimes lead to a crowding-out effect by reducing the number of available funds or increasing capital costs. It can potentially affect macroeconomic variables negatively. It is a fundamental reason for financing economic growth and development in some cases.

In this paper, the crowding-out effect for Turkey during the 1975-2020 period was analysed using the ARDL method, with private investment, public investment, public domestic debt, public external debt, and public external debt service. First, the series' integration degrees were tested using the Fourier ADF and ADF unit root tests. All series were stationary at the first difference except public external debt. The ARDL bound test was performed because the series that we used to have different integration degrees, and the ARDL bound test allows independent variables to be I (0) or I (1) under the assumption that the dependent variable is I (1). As a result of ARDL, the statistical values of the F-test and t-test were more significant than the critical values at the 1% significance level. For this reason, the cointegration relationship between the series is valid.

Firstly, it has been determined that public investment significantly negatively affects private investment in the long run. In other words, public investment in Turkey is a substitute for private investment. According to the findings, when public investment increases by 1%, private investment decreases by 0.36%. This finding is consistent with the empirical results (Aschauer, 1989; Lächler & Aschauer, 1998; Cil-Yavuz, 2001; Simsek, 2003; Uysal & Mucuk, 2004; Ismihan et al., 2005; Bilgili, 2003; Yarasır-Tumluce & Buyrukoglu, 2013; Kesbic et al., 2016; Bahal et al., 2018; Saidjada & Jahan, 2018; Afonso & Aubyn, 2019). On the other hand, a part of the empirical literature suggests that public investments have a crowding-in effect on private investment (Altunc & Senturk, 2010; Cural et al., 2012; Mahmoudzadeh et al., 2013; Sen & Kaya, 2014; Yılancı & Aydın; 2016; Demir, 2017). The reason behind reaching different findings is presumably related to the preferred variables and the preferred period to examine.

Secondly, it has been determined that public domestic debt significantly negatively affects long-term and short-term private investment. According to empirical findings, an

increase of 1% in public domestic debt led to a decrease of 0.10% in private investment. With another approach, public domestic debt decreased available loanable funds for the private sector and generated an indirect crowding-out effect and increased investment costs (Taban & Kara, 2006; King'wara, 2014; Akomolafe et al., 2015; Kurul, 2020). Parallel to these findings, the increase in the domestic debt level of the public sector causes the crowding-out effect. While the public sector domestic debt/GDP share was 7% in 1975, it increased to its maximum level of 49% in the 2001 economic crisis.

As public borrowing increases, the sustainability of debts becomes controversial, and after a while, debts become unsustainable. In a way, this means that public borrowing also excludes private-sector investments. Domestic debt stock, which started to decrease rapidly within the framework of the applied fiscal discipline, began to increase again after the 2008 crisis and reached 32%. The public domestic debt, which started to grow again after 2015, reached 20% in 2020. Another factor causing the crowding-out effect is public external debt service. The empirical results point out that an increase of 1% in public external debt services reduces private investment by 0,17%. Also, this finding is consistent with empirical literature (Were, 2001; Shabbir, 2013; Ela & Pata, 2020). High external debt service does not negatively affect local borrowing, making private sector borrowing more costly. Theoretically, it is seen that countries with high external debt services cause a decrease in their current foreign exchange reserves and therefore have a deterrent effect on investments (Ela & Pata, 2020). High external debt service also reduces domestic savings (Mabula & Mutasa, 2019). Moreover, when external debt servicing negatively impacts public investment, it exacerbates the crowding-out effect. Lastly, we concluded that public external debt has a statistically significant and positive effect on private investment. According to the findings, when the public external debt increases by 1%, private investment rises by 0.5%.

Based on the empirical findings, except for the public external debt, which creates a crowding-in, the other variables lead to a crowding-out effect. According to the neoclassical theory, private and public sectors receive the financing resources they need from national or international loanable fund markets. Therefore, the increase in the reserve of loanable fund markets in Turkey and the accessibility of the private sector to these markets causes the crowding in effect parallel to the theoretical expectations and vice versa. In this context, the government's preference for external debt resources instead of borrowing from internal loanable funds is necessary not to crowd out the private sector. In this context, the government not going into domestic borrowing will reduce the inflationary pressures following the unpleasant monetarist arithmetic put forward by Wallace and Sargent (1981), which will reduce the borrowing costs in the future. Furthermore, Suppose the additional resource created by public external debt is directed to infrastructure and social expenditures that complement the private sector. In that case, the crowding-in effect will be realised at a higher level with a spillover effect. The collaboration of the public and private sectors, which constitutes the economic ecosystem, can thus have a structure that encourages each other instead of preventing each other. Academically, although some studies address the exclusion effect of public debt, there is no study for Turkey that directly examines the effect of external debt on private investments. Future studies will likely make a meaningful contribution to the

literature by investigating and evaluating the crowding-out effect by considering these factors.

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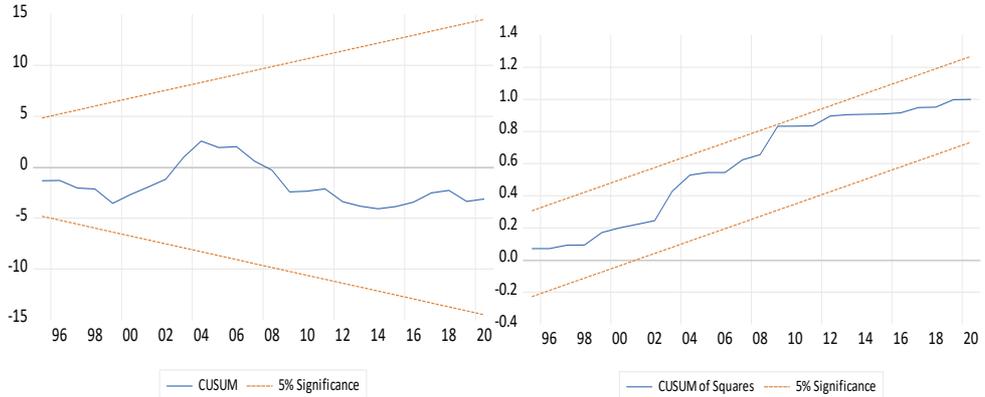
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Appendix: 1

Figure: 1
Plots of CUSUM and CUSUMSQ

Appendix: 2

Authors	Sample		Method	Empirical Results	
	Period	Country		Variable whose effect on private investment is investigated	The effects of the variable
Aschauer (1989)	1925-1985	United States	FIML	Public investment	Crowding-out
Argimon (1997)	1979-1988	14 OECD Countries	Panel Data	Public investment in infrastructure	Crowding-in
				Public expenditure on consumption	Crowding-out
Lächler & Aschauer (1998)	1970-1996	Mexico	2SLS	Public investment	Crowding-out
Levaggi (1999)	1960-1993	Italy	ML	Provision of merit goods	Crowding-out
				Provision of pure public goods	Statistically insignificant
Ahmed & Miller (2000)	1975-1984	39 Developed & Developing Countries	Panel Data	Debt-financed public expenditure	Crowding-out (Developed countries) Crowding-in (Developing countries)
				Tax-financed public expenditure	Crowding-out
Cil-Yavuz (2001)	1990:Q1 2000:Q4	Turkey	Johansen co-integration	Public investment	Crowing-out
Hyder & Qayyum (2001)	1964-2001	Pakistan	Johansen co-integration Granger causality	Public investment	Crowding-in
Simsek (2003)	1970-2001	Turkey	Johansen co-integration Granger causality	Public investment	Crowding out
Uysal & Mucuk (2004)	1975-2000	Turkey	OLS	Public expenditure	Crowding-out
Ismihan et al. (2005)	1963-1999	Turkey	Johansen co-integration	Public expenditure	Crowding-out
Kustepeli (2005)	1963-2003	Turkey	Johansen co-integration	Budget deficits	Crowding-out
Gunaydin (2006)	1987:Q1 2004:Q3	Turkey	Johansen co-integration	Public investment	Crowding-in
Taban & Kara (2006)	1989:Q1 2004:Q4	Turkey	OLS	Public domestic debt	Crowding-out
Basar & Temurlenk (2007)	1980-2005	Turkey	SVAR	Public expenditure	Crowding-out
Lebe & Basar (2008)	1975-2006	Turkey	OLS	Foreign direct investment	Crowding-in
				Real interest rates	Crowding-out
Bilgili (2003)	1988:Q1 2003:Q1	Turkey	VAR VECM	Public expenditure	Crowding-in
				Public investment	Crowding-out
Hatano (2010)	1955-2004	Japan	Johansen co-integration Granger Causality	Public investment	Crowding-in
Altunc & Sentruk (2010)	1980-2009	Turkey	ARDL	Public investment	Crowding-in
Furceri & Sousa (2011)	1960-2007	145 Developed & Developing Countries	GMM	Public expenditure	Crowding-out
Basar et al. (2011)	1987:Q1 2007:Q3	Turkey	Johansen co-integration	Public expenditure	Crowding-in
				Public interest payment	Crowding-in
Cural et al. (2012)	1970-2009	Turkey	Carrion-I Silvestre & Sanso co-integration	Public investment	Crowding-in
Mahmoudzadeh et al. (2013)	2000-2009	38 Developed & Developing Countries	Panel Data	Public investment	Crowding-in
				Public consumption	Crowding-out
				Public deficit	Crowding-out (Developed countries) Crowding-in (Developing countries)
Yarasir-Tumluce & Buyrukoglu (2013)	1980-2010	Turkey	Johansen co-integration	Public debt	Crowding-out

Khan & Gill (2014)	1971-2006	Pakistan	Johansen co-integration	Public debt	Crowding-debt
Sen & Kaya (2014)	1975-2011	Turkey	Johansen co-integration	Public investment	Crowding-in
				Government current transfers	Crowding-out
				Government current spending	
				Government interest spending	
Xu & Yan (2014)	1980-2011	China	VAR	Public expenditure on public good	Crowding-in
				Public expenditure on private good	Crowding-out
King'wara (2014)	1967-2007	Kenya	Johansen co-integration	Public domestic debt	Crowding-out
Akomolafe et al. (2015)	1980-2010	Nigeria	Johansen co-integration	Public domestic debt	Crowding-out
Andrade & Duarte (2016)	1960-2013	Portugal	VAR ADL	Public investment	Crowding-in
Kesbic et al. (2016)	1986-2014	Turkey	Johansen co-integration	Public investment	Crowding-out
Yilanci & Aydin (2016)	1980-2014	Turkey	Maki co-integration	Public investment	Crowding-out
Demir (2017)	1983-2013	Turkey	ARDL	Public investment	Crowding-in
Atabaev et al. (2018)	2005:M1 2013:M1	Kyrgyzstan	ARDL VAR	Public expenditure	Crowding-in
Bahal et al. (2018)	1950-2012	India	SVEC	Public expenditure (From 1950 to 2012)	Crowding-out
				Public expenditure (From 1980 to 2012)	Crowding-in
Saidjada & Jahan (2018)	1981-2015	Bangladesh	ARDL	Public investment	Crowding-out
Afonso & Aubyn (2019)	1960-2014	17 OECD Countries	VAR	Public investment	Crowding-in[1]
					Crowding-out
Funashima & Ohtsuka (2019)	2001-2013	Japan	Spatial Autoregressive Panel Data	Public expenditure	Crowding-in
Mabula & Mutasa (2019)	1970-2016	Tanzania	ARDL	Public debt	Crowding-in
Caskurlu (2020)	1975-2016	Turkey	ARDL	Public debt	Crowding out
Ela & Pata (2020)	1987-2017	Turkey	Bayer Hanck co-integration	Public external debt services	Crowding-out
Unsal (2020)	1995-2017	17 OECD Countries	Panel Data	Public defence expenditure	Crowding-in
				Total public expenditure	Crowding-out
				Social protection expenditure	Crowding-out
Gultekin-Tarla & Temiz (2020)	1975-2016	Turkey	Johansen co-integration	Public investment	Crowding-in
Ebghaei (2021)	1980-2018	Turkey	Johansen co-integration	Public investment	Crowding-in
				Public expenditure	Crowding-out
Kurul (2020)	1970-2018	Turkey	ARDL	Foreign direct investment	Crowding-out
Kulu et al. (2021)	2007-2018	33 Sub-Saharan African Countries	GMM	Public domestic payment arrears	Crowding-out
Vanlaer et al. (2021)	1995-2016	28 EU Countries	GMM	Public debt	Crowding-out
Penzin & Oladipo (2021)	2000:Q1 2019:Q2	Nigeria	ARDL	Public domestic	Crowding out

Not: ADL (augmented distributed lag), ARDL (Autoregressive Distributed Lag), FIML (Full-information maximum-likelihood), GMM (generalized method of moments), ML (The Maximum Likelihood), OLS (Ordinary least squares) VAR (Vector autoregression), SVAR (structural vector autoregression) SVEC (Structural Vector Error Correction) 2SLS (two-stage-least square).

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[1] *Crowding-in effect is observed in Belgium, Ireland, Finland, Canada, Sweden, and the UK. Crowding-out effect is valid for the rest of the sample.*