



The Relationship between Public Expenditure and Private Investment in Developed and Developing Economies: Policy Implications Based on the Difference*

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Abstract

Public spending is one effective instrument of fiscal policy in both developed and developing countries. Governments use it to overcome the cyclical nature of the economy and to run the economy. However, it can crowd in or crowd out private investment. Is there a difference in the public expenditure – private investment relationship between developed and developing countries? This study looks for an answer by empirically investigating the effect of public expenditure on private investment for a group of 36 developed countries and a group of 98 developing countries from 2002 to 2019. The results by the two-step difference GMM Arellano-Bond estimator seem to be counter-intuitive. Public expenditure crowds out private investment in developed countries but crowds in it in developing countries. The study uses the FE-IV estimator and the PGM estimator to check the robustness of these estimates. The study suggests some arguments to explain the validity of the counter-intuitive results and policy implications for governments in both developed and developing countries.

Keywords: Public expenditure, Private investment, Developed countries, Developing countries.

JEL Classification: E62, H32.

1. Introduction

Public spending plays a crucial role in running the economy in developed and developing countries. Compared with the tax policy, public spending represents an active role of fiscal policy in helping the government overcome the cyclical nature of the economy. The government actively increases public spending for a recession economy with a high unemployment rate (an expansionary fiscal policy with increased public spending) but cuts it for a hot economy

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with a high inflation rate (a contractionary fiscal policy with decreased public spending). Meanwhile, private investment is an input of the growth model. In most economies, the private sector provides more jobs and contributes mainly to economic development and growth. Despite the crucial role of both public spending and private investment in the economy, the impact of public expenditure on private investment remains a hotly debated topic among economists and policymakers. Recently, some related studies note the crowding-in effect of public expenditure on private investment, while some show the crowding-out effect. Does the difference in the public expenditure-private investment relationship stem from the difference in institutional settings between different samples of countries? This study will answer this research question to fulfill the research gap in the literature.

Given the relevance of the topic, Wang (2005) notes that the Keynesian lines and the neoclassical schools suggest the crowding-in/crowding-out hypothesis or the complementarity/substitutability hypothesis for the relationship between public expenditure and private investment. So, does public expenditure affect private investment differently between developed and developing countries? We believe that it can stem from the difference in institutional settings between these two groups. Countries with good institutional settings formulate and implement regulations and policies transparently and publicly. The policies linking with public spending financed by borrowing often compete for available funds with the private sector. To easily borrow, governments in these countries often raise the interest rates of government bonds, which increases the interest rate in the economy. The consequence of increasing the interest rate reduces private investment. By contrast, countries with poor institutional settings formulate and implement regulations and policies non-transparently and arbitrarily. The policies relating to public spending often control and regulate the interest rates on deposits and loans of banks. Therefore, public spending financed by borrowing does not compete for available funds with the private sector, which on the contrary allows the private sector to increase investment through interest rates on loans controlled at a low level. As a result, public expenditure crowds in private investment.

Another mechanism for explanation comes from the role of central banks. In countries with good institutional settings, central banks are independent of governments' policies. These central banks often control inflation, exchange rate, and interest rate through money supply despite short-term government pressure. An increase in public spending does not put pressure on central banks to increase the money supply; therefore, there is competition for available funds between the government and the private sector, which increases interest rates. The consequence of increasing the interest rate decreases private investment. In countries with poor institutional settings, in contrast, the money supply of central banks strongly depends on governments' policies. Central banks in these countries have to increase the money supply and lower interest rates to respond to increased government spending. An increase in money supply coupled with low-interest rates sets up conditions for the private sector to increase investment.

Regarding the practical context, Ortiz-Ospina and Roser (2016) say that there is heterogeneity in public spending between world regions. Governments in high-income economies, especially governments in Europe, control and manage a much larger share of GDP than those in low-income economies. For example, government expenditure in France captures

almost 50% of GDP while that in Nigeria accounts for near 6%. Furthermore, governments in high-income economies spend more resources than those in low-income economies, both as a share of GDP and per capita. High-income economies have higher levels of social spending component of government expenses than low-income economies, especially in the form of transfers. Notably, developed economies use a much larger share of GDP specifically for social transfers. By contrast, developing economies in sub-Saharan Africa dedicate a much lower share to GDP to social transfers that keep a less crucial role. Furthermore, governments worldwide often recognize that the private sector plays a key role in producing and managing goods and services. Public procurement is a process through which governments buy goods, services, and works from enterprises. In high-income economies, government purchases from the private sector are significant. In the Netherlands, for instance, public procurement accounts for almost 45% of total public spending, corresponding to 20% of GDP. In Greece, public procurement captures about 20% of government expenditure, but its size seems significant for the economy with 10% of GDP.

Driven from the fact that public expenditure differently affects private investment between developed and developing countries, this study investigates the effect of public expenditure on private investment for a group of 36 developed countries and a group of 98 developing countries between 2002 and 2019. It applies the two-step difference GMM Arellano-Bond estimator for estimation and the PMG estimator for robustness check.

The study has the structure as follows. Section 1 presents the theoretical framework, while Section 2 describes the relationship between public expenditure and private investment. Section 3 shows the methodology and research data, while Section 4 notes the result and discussion. The final section (Section 5) is the conclusion and policy implications.

2. Literature review

Unlike other research strands, the strand on the effect of public expenditure on private investment is small. Some studies find that this effect is positive, while some report that this effect is negative. Furthermore, other studies provide a mixed result.

Regarding the negative effect, Argimon *et al.* (1997), Furceri and Sousa (2011), Şen and Kaya (2014), and Kim and Nguyen (2020) note that public expenditure crowds out private investment. Argimon *et al.* (1997) use some estimators as fixed effects, random effects, instrumental variable estimation for an unbalanced panel dataset of 14 OECD countries from 1979 through 1988. Meanwhile, Furceri and Sousa (2011) apply some estimators as pooled OLS, fixed effects, random effects, one-step GMM Arellano-Bond for a group of 145 countries between 1960 and 2007. Similarly, Şen and Kaya (2014) employ the Vector Error Correction Model (VECM) for Turkey from 1975 to 2011. Recently, Kim and Nguyen (2020) use the aggregated first-stage regression for the United States from 1980 through 2008. They all conclude that public expenditure makes domestic companies enjoy fewer investment opportunities and emphasize that the efficient allocation of public expenditure contributes to maximizing the potential benefits of such expenditure.

Regarding the positive effect, both Omitogun (2018) and Idowu *et al.* (2020) show that public expenditure crowds in private investment in Nigeria for the same period from 1981 to 2015/2016 with the same estimator (Autoregressive Distributed Lag technique). Omitogun (2018) suggests that policymakers pay more attention to private investment in public spending plans while Idowu *et al.* (2020) recommend stimulating public capital spending.

Regarding the mixed result, Wang (2005) uses the VECM model for Canada from 1961 to 2000 and finds that government expenditure on education and health crowds in private investment but government expenditures on capital and infrastructure crowds out it. Meanwhile, Ahmed and Qayyum (2007) apply the VECM model for Pakistan between 1980 and 2002 and note that public development expenditure increases private investment while public consumption expenditure decreases. Notably, Akinlo and Oyeleke (2018) do not discover the effect of public expenditure on private investment using the VECM model for Nigeria between 1980 and 2016.

From the literature perspective, in short, the study highlights two aspects that can be different from the mentioned studies. Firstly, it empirically examines the difference in the public expenditure-private investment relationship between developed and developing countries. Secondly, it applies the two-step difference GMM Arellano-Bond estimator for estimation and the PMG estimator for robustness check. Notably, endogenous phenomena and serial autocorrelation often exist in empirical models in which macro-variables are used. The two-step difference GMM Arellano-Bond estimator can handle these problems. Furthermore, the PMG estimator treats the short-term parameters between countries heterogeneous but the long-term coefficients between countries homogeneous. Details for applying the two-step difference GMM Arellano-Bond estimator and the PMG estimator are explained below (Subsection 3.1 Methodology).

3. Methodology and research data

3.1. Methodology

Following Şen and Kaya (2014), the empirical equation is re-modified as follows:

$$PIN_{it} = \beta_0 + \beta_1 PIN_{it-1} + \beta_2 EXP_{it} + Z_{it} \beta' + \eta_i + \psi_{it} \quad (1)$$

where subscript i and t are the country and time index, respectively. PIN_{it} is gross fixed capital formation (% GDP), a proxy for private investment, PIN_{it-1} is the initial level of private investment, and EXP_{it} is public expenditure. Z_{it} is a set of control variables such as economic growth, trade openness, and inflation; η_i is an unobserved time-invariant, country-specific effect and ψ_{it} is an observation-specific error term; β_0 , β_1 , β_2 , and β' are estimated coefficients. Following the related studies such as Ahmed and Qayyum (2007), Furceri and Sousa (2011), Şen and Kaya (2014), Akinlo and Oyeleke (2018), and Idowu *et al.* (2020), we introduce some control variables (economic growth, inflation) into the empirical model. Furthermore,

we use trade openness as a control variable because it can stimulate private investment by helping the private sector access investment capital from other countries.

The study uses Equation (1) to investigate the effect of public expenditure on private investment for a group of 36 developed countries and a group of 98 developing countries. Four serious problems in econometrics arise from estimating Equation (1). Firstly, economic growth, trade openness, and inflation can be endogenous. These variables can correlate with η_i , which leads to the endogenous phenomenon. Secondly, some unobserved characteristics such as customs, geography, culture, and anthropology (fixed effects) can correlate with the regressors. These characteristics exist in η_i . Thirdly, a high autocorrelation stems from the presence of the lagged dependent variable PIN_{it-1} . Fourthly, the panel dataset has a large unit of countries ($N=98$) but a relatively short observation length ($T=18$). These problems can make the OLS estimator inconsistent and biased. The random-effects model (REM) and the fixed-effects model (FEM) can not deal with endogenous phenomena and serial autocorrelation while the IV-2SLS estimator requires some suitable instrumental variables out of regressors in the empirical model. Following the suggestion by Judson and Owen (1999), therefore, the study applies the two-step difference GMM Arellano-Bond estimator for estimation and the PMG estimator for robustness test.

Holtz-Eakin *et al.* (1988) are the first to propose the general method of moments (GMM) Arellano and Bond (1991) estimator. For estimation, the GMM Arellano-Bond estimator takes the first difference in Equation (1) to remove country-fixed effects. Next, it uses the regressors in the first difference as instrumented by their lags under the assumption that there are no serial correlations in time-varying error terms in the original models (Judson and Owen, 1999). This strategy is known as the difference GMM Arellano-Bond estimator (D-GMM) that may deal with simultaneity biases in regressions.

In practice, the two-step D-GMM is more asymptotically efficient than the one-step D-GMM. However, applying the two-step D-GMM in small samples like our study has a problem (Roodman, 2009). It is the proliferation of instruments that quadratically rise as the time dimension increases. In this case, the number of instruments is very large relative to the number of panel units. To handle it, Roodman (2009) recommends using the rule of thumb to keep the number of instruments less than or equal to the number of countries (the number of panel units).

The two-step D-GMM uses the Arellano-Bond, Sargan, and Hansen statistics to test the validity of instruments in the empirical model. The Sargan and Hansen tests detect endogenous phenomena, while the Arellano-Bond test checks the autocorrelation of errors in the first difference. Therefore, the study ignores the first autocorrelation test of errors AR(1) and keeps the second autocorrelation test of errors AR(2).

For the robustness of the two-step D-GMM estimates, the study applies the Pooled Mean Group (PMG) estimator by Pesaran *et al.* (1999). In this estimation, the short-term parameters between countries are heterogeneous, but the long-term coefficients between countries are homogeneous. Furthermore, the PMG estimator highlights the correction dynamic be-

tween the long-run and short-run by the error-correction coefficient (the speed of adjustment). The PMG-based Error Correction Model is shown as follows:

$$\Delta H_{it} = \Phi Z_{it-1} + \sum_{j=1}^p \delta_{ij} \Delta N_{it-j} + \eta_{it} + \psi_{it} \quad \text{where} \quad Z_{it-1} = H_{it-1} - \theta N_{it-1} \quad (2)$$

where H is private investment; Z_{it-1} is the deviation from long-run equilibrium at any period for country i , and Φ is the speed of adjustment or the error-correction coefficient. The vector θ captures the long-run coefficients. These coefficients express the long-run elasticity of private investment in corresponding with each variable in N_{it-1} . Meanwhile, the vector δ captures the short-run responses of the N variables. η_i is a fixed effect and ψ_{it} is an error term. The study uses the value and significance level of the error-correction coefficient Φ (negative, smaller than 1) to test the validity of the PMG estimates.

For further check, the study uses the FE-IV estimator. The FE-IV estimator is the instrumental variable regression for panel data with fixed effects in which the variables can be endogenous (Baum *et al.*, 2003). The validity of instruments in the FE-IV estimator is also assessed through the Sargan statistic.

3.2. Research data

The variables are gross fixed capital formation (private investment), public expenditure, governance indicators, real GDP per capita (economic growth), trade openness, and inflation. Data are extracted from the International Monetary Fund and World Bank database. The research sample contains 36 developed countries¹ and 98 developing countries² from 2002 to 2019. The Appendix (Table A, Table B, and Table C) presents the definition and descriptive statistics for the dataset. The statistical data in Table B and Table C show that developed countries have good governance while developing countries have poor governance. It is consistent with the approach from Li and Filer (2007) that developed economies are those with rule-based governance (good institutional quality) while developed economies are those with relation-based governance (poor institutional quality).

4. Estimated results and discussion

4.1 The two-step D-GMM estimates

The study presents the two-step D-GMM estimates for developed and developing countries in Table 1. The relationship between private investment and economic growth is bi-direction because private investment is an endogenous input of economic growth in growth models, and economic growth promotes capital accumulation in private investment. In the estimation procedure, therefore, the study detects that economic growth is endogenous, thus the study uses economic growth as instrumented in the GMM-style while private investment, public expenditure, trade openness, and inflation as instruments in the IV-style.

The results in Table 1 indicate that the difference in the public expenditure-private investment relationship between developed and developing countries is counter-intuitive. Public expenditure crowds out private investment in developed countries but crowds in it in developing countries. The counter-intuitive results can stem from the difference in institutional quality between these two groups of countries. According to Li and Filer (2007), developed countries are those with rule-based governance (good institutional quality) while developing countries are those with relation-based governance (poor institutional quality). Governments in developed countries often formulate and implement regulations and policies transparently and publicly. An increase in government spending financed by borrowing, therefore, competes with the private sector. To easily get the loans, governments often raise the interest rates of government bonds, which leads to a decrease in private investment due to high-interest rates in the economy. By contrast, governments in developing countries often formulate and implement regulations and policies non-transparently and arbitrarily, which control and regulate the interest rates on deposits and loans of banks. Therefore, an increase in public spending financed by debt not only does not compete with the private sector for available funds but also sets up favorable conditions for the private sector to increase investment by keeping the lending interest rate at low levels, especially in large state-dominated banks. As a result, public expenditure crowds in private investment.

The difference in the independence of central banks is another explanation. Central banks in developed countries are independent of governments' policies in running the economy. They use the money supply independently to control inflation, exchange rate, and interest rate despite short-term government pressure. The increase in government spending does not put pressure on them to increase the money supply. Therefore, there is competition for available funds between the public and private sectors, which leads to an increase in interest rates. An increase in the interest rate contradicts the private sector's investment. In contrast, central banks in developing countries are strongly dependent on governments' policies in running the economy. They have to increase the money supply and lower interest rates to meet the demand for increased government spending. An increase in money supply accompanied by low-interest rates enhances the private sector's investment.

Is the counter-intuitive difference in the public expenditure-private investment relationship between developed and developing countries unusual? We say no as the development form begins at a low level (in developing countries as in this study) with a cooperative mechanism for development coexistence between the public and private sectors. However, over time, along with the change in the institutional settings (in a better manner from relation-based governance to rule-based governance), competition for available resources (in particular loans) begins to appear between the public and private sectors. In short, the development process with a better change in the institutional settings will transform developing countries with a complementarity relationship between public expenditure and private investment into developed countries with a substitutability relationship between them. Competition in a market economy will lead to more efficient use of resources as indicated in the development form in developed countries that developing countries are trying to become.

So, institutional quality is a crucial cause to lead to the difference in the public expenditure-private investment relationship between developed and developing countries. Due

to the significant role of institutional quality in this relationship, we introduce institutional quality into the model to see how it affects the sign and significance level of the coefficients of interest. The paper uses the six dimensions of governance by the World Bank (control of corruption, government effectiveness, political stability and absence of violence, regulatory quality, rule of law, voice & accountability) as a proxy for institutional quality from 2002 to 2019 as control variables. Table 2 and Table 3 report the two-step D-GMM estimates for developed and developing countries, respectively. Every column in each table is the empirical model corresponding with each dimension. The results across all models in Table 2 and Table 3 indicate that institutional quality decreases private investment in developed countries but increases in developing countries. This finding is consistent with our arguments that good institutional quality (transparency and accountability) in developed countries reduces private investment, and poor institutional quality (non-transparency and unaccountability) in developing countries promotes it. Notably, the sign and significance level of the coefficients of interest in the model remain.

Furthermore, Table 1, Table 2, and Table 3 note that inflation enhances private investment in developed countries while trade openness stimulates it in developing countries. An increase in inflation will raise the saving-investment, which provides available funds for the private sector's development. Meanwhile, trade openness will facilitate the investment of the private sector through activities such as exports, access to capital in the international stock market, and access to foreign inflows to the host countries.

Table 1
PUBLIC EXPENDITURE AND PRIVATE INVESTMENT: TWO-STEP D-GMM
(without the presence of institutional quality)

Dependent variable: Private investment (% GDP)		
Variables	Developed countries	Developing countries
Private investment (-1)	0.475*** (0.067)	0.081 (0.101)
Public expenditure	-0.476*** (0.057)	0.51*** (0.161)
Economic growth	-0.040 (0.029)	0.024 (0.036)
Trade openness	0.003 (0.022)	0.135*** (0.047)
Inflation	0.160*** (0.031)	-0.002 (0.039)
Instrument	18	25
Country/Observation	36/504	98/1470
AR(2) test	0.294	0.112
Sargan test	0.477	0.668
Hansen test	0.582	0.563

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Table 2
PUBLIC EXPENDITURE AND PRIVATE INVESTMENT: TWO-STEP D-GMM
(36 developed countries with the presence of institutional quality)

Dependent variable: Private investment (% GDP)						
Variables	INS1	INS2	INS3	INS4	INS5	INS6
Private investment (-1)	0.539*** (0.059)	0.510*** (0.056)	0.425*** (0.041)	0.522*** (0.055)	0.539*** (0.039)	0.563*** (0.046)
Public expenditure	-0.547*** (0.045)	-0.528*** (0.045)	-0.563*** (0.052)	-0.539*** (0.047)	-0.484*** (0.051)	-0.553*** (0.044)
Economic growth	-0.079 (0.055)	-0.061 (0.065)	-0.064 (0.053)	-0.049* (0.029)	-0.049 (0.035)	-0.078 (0.064)
Trade openness	0.027 (0.019)	0.016 (0.019)	0.014 (0.017)	0.020 (0.021)	0.024*** (0.007)	0.024*** (0.007)
Inflation	0.129*** (0.026)	0.138*** (0.024)	0.165*** (0.026)	0.133*** (0.026)	0.119*** (0.025)	0.109*** (0.027)
Institutional quality	-2.972** (1.390)	-0.972*** (0.339)	-2.462*** (1.041)	-2.608** (1.250)	-1.685** (0.761)	-2.896*** (0.950)
Instrument	21	21	22	22	23	21
Country/Observation	36/504	36/504	36/504	36/504	36/504	36/504
AR(2) test	0.350	0.322	0.340	0.355	0.328	0.309
Sargan test	0.489	0.521	0.201	0.627	0.120	0.345
Hansen test	0.391	0.513	0.282	0.561	0.556	0.808

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Table 3
PUBLIC EXPENDITURE AND PRIVATE INVESTMENT: TWO-STEP D-GMM
(98 developing countries with the presence of institutional quality)

Dependent variable: Private investment (% GDP)						
Variables	INS1	INS2	INS3	INS4	INS5	INS6
Private investment (-1)	0.338*** (0.100)	0.433*** (0.086)	0.470*** (0.087)	0.457*** (0.103)	0.472*** (0.090)	0.446*** (0.088)
Public expenditure	0.624*** (0.236)	0.360*** (0.126)	0.364*** (0.100)	0.454*** (0.122)	0.277** (0.137)	0.294** (0.139)
Economic growth	0.023 (0.046)	0.006 (0.033)	0.015 (0.028)	0.034 (0.030)	0.000 (0.028)	0.006 (0.026)
Trade openness	0.154*** (0.050)	0.092** (0.043)	0.117*** (0.036)	0.137*** (0.036)	0.146*** (0.038)	0.137*** (0.039)
Inflation	-0.034 (0.041)	-0.026 (0.031)	-0.032 (0.030)	-0.048 (0.031)	-0.053* (0.029)	-0.029 (0.030)
Institutional quality	1.682** (0.814)	5.049** (2.374)	0.753** (0.341)	5.880*** (0.814)	1.531** (0.741)	5.122*** (2.025)
Instrument	24	28	28	27	27	27
Country/Observation	98/1372	98/1372	98/1372	98/1372	98/1372	98/1372
AR(2) test	0.366	0.670	0.660	0.583	0.675	0.646
Sargan test	0.578	0.101	0.122	0.120	0.107	0.119
Hansen test	0.647	0.503	0.296	0.146	0.259	0.315

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

4.2. Robustness check

For the robustness check, the study uses the FE-IV in Equation (1) and the PMG Equation (2). In line with the two-step D-GMM, the results by the FE-IV in Table 4 and Table 5 present that public expenditure decreases private investment in developed countries but increases it in developing countries. Similarly, institutional quality reduces private investment in developed countries but promotes in developing countries. Besides, trade openness enhances private investment in both groups while inflation fosters it in developed countries.

Table 4
PUBLIC EXPENDITURE AND PRIVATE INVESTMENT: FE-IV ESTIMATES
(36 developed countries)

Dependent variable: Private investment (% GDP)						
Variables	INS1	INS2	INS3	INS4	INS5	INS6
Private investment (-1)	0.733*** (0.030)	0.739*** (0.030)	0.744*** (0.030)	0.729*** (0.031)	0.740*** (0.030)	0.737*** (0.031)
Public expenditure	-0.333*** (0.028)	-0.331*** (0.028)	-0.320*** (0.028)	-0.334*** (0.028)	-0.333*** (0.029)	-0.330*** (0.028)
Economic growth	-0.007 (0.008)	-0.006 (0.008)	-0.007 (0.008)	-0.015 (0.008)	-0.008 (0.009)	-0.007 (0.008)
Trade openness	0.010** (0.005)	0.010** (0.005)	0.012** (0.005)	0.013** (0.005)	0.011 (0.005)	0.011 (0.005)
Inflation	0.148*** (0.054)	0.148*** (0.054)	0.152*** (0.054)	0.154*** (0.054)	0.147*** (0.054)	0.149*** (0.054)
Institutional quality	-1.129** (0.565)	-0.649 (0.600)	-1.117** (0.477)	-1.275** (0.647)	0.191 (0.759)	0.608 (0.892)
Country/Observation	36/576	36/576	36/576	36/576	36/576	36/576
Sargan test	0.469	0.560	0.390	0.460	0.533	0.525

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Table 5
PUBLIC EXPENDITURE AND PRIVATE INVESTMENT: FE-IV ESTIMATES
(98 developing countries)

Dependent variable: Private investment (% GDP)						
Variables	INS1	INS2	INS3	INS4	INS5	INS6
Private investment (-1)	0.651*** (0.017)	0.654*** (0.017)	0.650*** (0.017)	0.653*** (0.017)	0.653*** (0.017)	0.653*** (0.017)
Public expenditure	0.178*** (0.023)	0.175*** (0.023)	0.176*** (0.023)	0.177*** (0.023)	0.177*** (0.023)	0.175*** (0.023)
Economic growth	0.003 (0.005)	0.007 (0.005)	0.003 (0.005)	0.005 (0.005)	0.005 (0.005)	0.006 (0.005)
Trade openness	0.043*** (0.006)	0.043*** (0.006)	0.045*** (0.006)	0.043*** (0.006)	0.043*** (0.006)	0.043*** (0.006)
Inflation	0.008 (0.016)	0.007 (0.016)	0.011 (0.016)	0.008 (0.016)	0.007 (0.016)	0.007 (0.016)
Institutional quality	1.179** (0.519)	0.161 (0.519)	0.915*** (0.269)	0.355 (0.476)	0.422** (0.129)	0.355 (0.433)
Country/Observation	98/1666	98/1666	98/1666	98/1666	98/1666	98/1666
Sargan test	0.472	0.517	0.448	0.479	0.479	0.503

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Meanwhile, the PMG estimator is a kind of panel Error Correction Model (ECM) that requires the existence of co-integration between regressors and the dependent variable. So, the study first tests the stationary of all variables in the empirical model to ensure that they all have the same order of co-integration. Next, the study applies the panel co-integration tests by Westerlund (2007). The stationary tests in Table 6 (developed countries) and Table 7 (developing countries) indicate that private investment, public expenditure, economic growth, trade openness, inflation, and institutional quality are significantly stationary at levels less than 5%, which confirms all variables in the empirical model have integration of zero-order $I(0)$. Meanwhile, the results by the Westerlund panel co-integration tests in Table 8 (developed countries) and Table 9 (developing countries) show that at least three in four tests reject the null of no co-integration –a covariate is considered co-integrated with the dependent variable. Therefore, public expenditure, economic growth, trade openness, inflation, and institutional quality are co-integrated with private investment.

The paper shows the main results in Table 10 (developed countries) and Table 11 (developing countries). Similar to the two-step D-GMM estimates, public expenditure crowds out private investment in developed countries but crowds in it in developing countries. Institutional quality also decreases private investment in developed countries but increases in developing countries. Furthermore, trade openness also stimulates private investment in both groups while inflation boosts it in developed countries. The value and significance level of the error-correction coefficients at the bottom of Table 7 note that PMG estimates are highly reliable.

Table 6
FISHER TYPE UNIT ROOT TESTS (36 developed countries)

Variables	Augmented Dickey-Fuller test		Phillips-Perron test	
	Prob > chi2		Prob > chi2	
	Without trend	With trend	Without trend	With trend
Private investment	106.664***	97.433**	63.571	43.011
Public expenditure	72.131	39.290	116.571***	69.174
Economic growth	83.768	122.872***	57.926	41.625
Trade openness	78.075	104.687***	73.124	98.132**
Inflation	80.711	83.062	231.331***	201.187***
Regulatory quality	65.548	42.543	106.354***	93.766**
Rule of law	130.404***	135.154***	176.804***	165.978***
Voice and accountability	131.909***	103.445***	270.702***	218.309***
Control of corruption	68.000	85.879	103.351***	115.124***
Government effectiveness	129.937***	104.585***	137.331***	122.308***
Political stability	185.487***	224.117***	137.443***	107.842***

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Table 7
FISHER TYPE UNIT ROOT TESTS (98 developing countries)

Variables	Augmented Dickey-Fuller test		Phillips-Perron test	
	Prob > chi2		Prob > chi2	
	Without trend	With trend	Without trend	With trend
Private investment	312.404***	234.939**	251.168***	185.354
Public expenditure	203.276***	198.161***	294.770***	298.323***
Economic growth	287.369***	240.302**	435.613***	201.006
Trade openness	213.449	212.568	228.995**	222.106*
Inflation	623.180***	647.293***	827.331***	719.233***
Regulatory quality	281.393	248.881	355.666	305.207
Rule of law	419.003***	368.077***	372.595***	337.238***
Voice and accountability	371.661***	321.876***	436.266***	399.543***
Control of corruption	322.685***	293.292***	314.034***	292.022***
Government effectiveness	259.634***	288.242***	245.994***	291.917***
Political stability	254.939***	304.872***	306.354***	292.392***

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Table 8
WESTERLUND PANEL CO-INTEGRATION TESTS (36 developed countries)

Normalized variable: Private investment (% GDP)				
Covariates	G_t	G_α	P_t	P_α
Public expenditure	-2.188***	-9.101**	-12.631***	-7.836***
Economic growth	-2.699***	-7.71	-20.722***	-6.828***
Trade openness	-3.152***	-10.971***	-19.170***	-11.984***
Inflation	-2.390***	-8.494*	-18.127***	-13.518***
Regulatory quality	-2.940***	-10.089***	-18.610***	-10.785***
Rule of law	-2.997***	-9.019**	-14.060***	-8.415***
Voice and accountability	-3.041***	-10.243***	-13.225***	-8.461***
Control of corruption	-2.741***	-11.127***	-18.534***	-13.721***
Government effectiveness	-2.416***	-9.975***	-19.251***	-11.242***
Political stability	-3.083***	-7.726	-17.949***	-11.218***

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Table 9
WESTERLUND PANEL CO-INTEGRATION TESTS (98 developing countries)

Normalized variable: Private investment (% GDP)				
Covariates	G_t	G_α	P_t	P_α
Public expenditure	-2.484***	-8.647***	-24.188***	-8.361***
Economic growth	-2.843***	-7.446	-29.001***	-12.381***
Trade openness	-2.615***	-8.572***	-23.320***	-9.234***
Inflation	-2.417***	-8.365**	-20.331***	-8.771***
Regulatory quality	-2.353***	-9.158***	-20.461***	-11.145***
Rule of law	-2.564***	-8.265***	-32.879***	-12.186***
Voice and accountability	-2.479***	-9.210**	-27.361***	-9.670***
Control of corruption	-2.550***	-8.228***	-25.238***	-8.761***
Government effectiveness	-2.751***	-8.881***	-30.970***	-11.628***
Political stability	-2.689***	-7.365	-20.570***	-8.984***

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Table 10
PUBLIC EXPENDITURE AND PRIVATE INVESTMENT: PMG ESTIMATES
(36 developed countries)

Long run co-integrating vectors						
Dependent variable: Private investment (% GDP)						
Variables	INS1	INS2	INS3	INS4	INS5	INS6
Public expenditure	-0.166*** (0.022)	-0.323*** (0.061)	-0.307*** (0.063)	-0.323*** (0.063)	-0.189*** (0.058)	-0.287*** (0.063)
Economic growth	-0.214*** (0.017)	-0.028*** (0.011)	-0.029** (0.013)	-0.017 (0.014)	-0.019* (0.011)	-0.018 (0.013)
Trade openness	0.019 (0.013)	0.046*** (0.013)	0.046*** (0.013)	0.044*** (0.013)	0.038*** (0.011)	0.044 (0.012)
Inflation	0.030 (0.057)	0.345*** (0.058)	0.366*** (0.062)	0.330*** (0.062)	0.266*** (0.056)	0.323 (0.062)
Institutional quality	-0.845** (0.278)	-1.781*** (0.478)	-1.005*** (0.478)	-0.755 (0.676)	-2.222*** (0.741)	-0.496 (0.889)
Error correction	-0.275***	-0.347***	-0.339***	-0.346***	-0.384***	-0.356***
Country/Observation	36/612	36/612	36/612	36/612	36/612	36/612
Log likelihood	-571.765	-547.268	-549.498	-550.365	-548.794	-550.499

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

Table 11
PUBLIC EXPENDITURE AND PRIVATE INVESTMENT: PMG ESTIMATES
(98 developing countries)

Long run co-integrating vectors						
Dependent variable: Private investment (% GDP)						
Variables	INS1	INS2	INS3	INS4	INS5	INS6
Public expenditure	0.251*** (0.064)	0.961*** (0.080)	0.702*** (0.066)	0.931*** (0.080)	0.594*** (0.047)	0.591*** (0.057)
Economic growth	1.266*** (0.080)	0.766*** (0.055)	0.584*** (0.048)	0.767*** (0.058)	0.110*** (0.010)	0.505*** (0.044)
Trade openness	0.075*** (0.017)	0.208*** (0.017)	0.191*** (0.016)	0.190*** (0.018)	0.238*** (0.022)	0.152*** (0.014)
Inflation	0.093*** (0.039)	0.059 (0.034)	0.037 (0.029)	0.050 (0.034)	0.115*** (0.032)	0.029 (0.026)
Institutional quality	4.148*** (0.278)	2.306*** (0.747)	0.877** (0.419)	3.176*** (0.903)	1.576*** (0.574)	1.472*** (0.598)
Error correction	-0.263***	-0.326***	-0.377***	-0.329***	-0.326***	-0.405***
Country/Observation	98/1666	98/1666	98/1666	98/1666	98/1666	98/1666
Log likelihood	-2947.3	-2959.3	-2960.5	-2958.1	-2944.4	-2960

Note: ***, ** and * denote significance at 1 percent, 5 percent and 10 percent levels respectively.

5. Conclusion and policy implications

Driven from the fact that the effect of expenditure on private investment in developed countries can be different from that in developing countries, the study empirically investigates the effect of public expenditure on private investment for a group of 36 developed countries and a group of 98 developing countries from 2002 to 2019. The study applies the two-step D-GMM, FE-IV, and PMG for estimation and robustness check. The results are counter-intuitive that public expenditure crowds out private investment in developed countries but crowds in it in developing countries. Similarly, institutional quality decreases private investment in developed countries but increases in developing countries. Furthermore, trade openness increases private investment in developing countries while inflation enhances it in developed countries.

The counter-intuitive difference in the public expenditure-private investment relationship between developed and developing countries found in this study is not unusual. It shows that the development form begins at a low level (developing countries with relation-based governance) with a complementarity relationship between public expenditure and private investment and shifts to a high level (developed countries with rule-based governance) with a substitutability relationship between them. Therefore, the findings in this study imply that governments in developing countries should continuously improve and reform institution-

al settings. Over time, developing countries will become developed countries, and the corresponding relationship between public expenditure and private investment will shift from crowding-in into crowding-out. This shift is appropriate as competition in a market economy will lead to more efficient use of resources as indicated in the development form in developed countries that developing countries are trying to become. However, governments in developed countries should reduce unnecessary public spending and leave it to the private sector. Future research should focus on: (i) the role of political setting (governance/institutional environment) in the public expenditure-private investment relationship, (ii) the difference in the effect of government investment/current public expenditure between developed and developing countries, (iii) the panel VAR/VECM estimators for estimation. The idea is to include in the analysis not only the effect of current period public expenditure but also that of the previous ones.

Appendix

Table A
DATA DESCRIPTION

Variable	Definition	Type	Source
Private investment (PIN)	Gross fixed capital formation (% GDP).	%	IMF
Public expenditure (EXP)	Total expenditure consists of total expense and the net acquisition of nonfinancial assets.	%	IMF
Economic growth (GDP)	GDP per capita (constant 2010 US\$).	Level	World Bank
Trade openness (OPE)	Trade is the sum of exports and imports of goods and services (% GDP).	%	World Bank
Inflation (INF)	Inflation, consumer prices (annual %).	%	World Bank
Regulatory Quality (INS1)	Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Value	World Bank
Rule of Law (INS2)	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	Value	World Bank
Voice and Accountability (INS3)	Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	Value	World Bank
Control of Corruption (INS4)	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	Value	World Bank
Government Effectiveness (INS5)	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	Value	World Bank
Political Stability (INS6)	Political Stability and Absence of Violence/Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.	Value	World Bank

Table B
DESCRIPTIVE STATISTICS FOR 36 DEVELOPED COUNTRIES

Variable	Obs	Mean	Std. Dev.	Min	Max
Private investment	648	22.437	4.356	9.4851	53.697
Public expenditure	648	40.305	10.587	9.015	65.032
Economic growth	648	41201.4	20336.28	8013	111968.4
Trade openness	648	119.983	88.252	20.685	442.62
Inflation	648	2.024	1.859	-3.047	15.253
Regulatory quality	648	1.370	0.710	-0.189	2.469
Rule of law	648	1.430	0.468	0.197	2.436
Voice and accountability	648	0.831	0.527	-1.626	1.755
Control of corruption	648	1.391	0.383	0.148	2.260
Government effectiveness	648	1.389	0.478	0.083	2.100
Political stability	648	1.147	0.412	-0.387	1.800

Table C
DESCRIPTIVE STATISTICS FOR 98 DEVELOPING COUNTRIES

Variable	Obs	Mean	Std. Dev.	Min	Max
Private investment	1,764	23.196	8.361	4.445	80.817
Public expenditure	1,764	26.905	9.918	4.173	64.641
Economic growth	1,764	5138.67	6453.273	194.873	49578.36
Trade openness	1,764	79.099	34.517	0.167	210.400
Inflation	1,764	6.263	7.180	-7.44	108.893
Regulatory quality	1,764	-429	0.636	-1.826	1.724
Rule of law	1,764	-378	0.641	-2.270	1.572
Voice and accountability	1,764	-387	0.815	-2.810	1.384
Control of corruption	1,764	-332	0.646	-2.625	1.538
Government effectiveness	1,764	-431	0.631	-1.816	1.555
Political stability	1,764	-396	0.767	-2.233	1.292

Notes

1. Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong SAR, Iceland, Ireland, Israel, Italy, Japan, Korea Republic, Latvia, Lithuania, Luxembourg, Macao SAR, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, and the United States.
2. Algeria, Angola, Argentina, Armenia, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Brazil, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Central African Rep., Chad, Chile, China, Colombia, Comoros, Dem. Rep. of the Congo, Rep. of Congo, Costa Rica, Côte d'Ivoire, Croatia, Dominican Rep., Ecuador, Egypt, Equatorial Guinea, Eswatini, Ethiopia, Fiji, Gambia, Georgia, Ghana, Guinea, Honduras, Hungary, India, Iran, Jamaica, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyz Rep., Lesotho, Madagascar, Malaysia, Mali, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, North Macedonia, Oman, Pakistan, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Sierra Leone, Solomon Islands, Sri Lanka, Tajikistan, Thailand, Togo, Tunisia, Turkey, Uganda, Ukraine, Uzbekistan, Vanuatu, Vietnam, and Zambia.

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Resumen

El gasto público constituye un instrumento eficaz de la política fiscal tanto en los países desarrollados como en los países en vías de desarrollo para corregir el carácter cíclico de la economía. Sin embargo, el gasto público puede producir un desplazamiento de la inversión privada. En este trabajo nos preguntamos si existe alguna diferencia en la relación entre el gasto público y la inversión privada en los países en función de su grado de desarrollo. Investigamos la relación entre ambas variables para un grupo de 36 países desarrollados y 98 países en desarrollo, durante el periodo 2002-2019. Las estimaciones obtenidas con el estimador GMM en dos etapas de Arellano-Bond indican que el gasto público no causa un efecto expulsión en la inversión privada en los países en vías de desarrollo, pero sí en los países desarrollados. A continuación, realizamos un análisis de robustez de las estimaciones, mediante el estimador FE-IV y el estimador PGM. Por último, sugerimos algunos argumentos que pueden explicar estos resultados, así como sus implicaciones políticas para los gobiernos de los países desarrollados y en desarrollo.

Palabras clave: gasto público, inversión privada, países desarrollados, países en desarrollo.

Clasificación JEL: E62, H32.