Foreign and Public Investment and Economic Growth: The Case of Romania

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Abstract

In the last decades, there were many empirical studies regarding the role of private and public investment in the growth process.

The aim of this paper is to examine, in the Romanian economy, the relationship among 5 macroeconomic variables: Gross Domestic Product, Foreign Direct Investment, Foreign Portfolio Investment, Foreign Other Investment and State Public Investment, using quarterly data over the period 2006Q1-2016Q2. A multiple regression model is used to investigate the effects of the selected independent variables (FDI, FPOI, FOI and SPI) on the endogenous variable (GDP).

The results obtain from the multiple regression model show a positive relationship between Gross Domestic Product and Foreign Direct Investment, State Public Investment and Foreign Portfolio Investment (in this order) and a negative relationship between Gross Domestic Product and Foreign Other Investment.

We hope that this paper can be a useful tool for government and policy makers in formulating the right investment policies in order to enhance economic development.

1) Introduction

The continuous changes in the composition and direction of investment flows (private and public) and liberalization of governments policies towards foreign investment in developed and developing economies called for a debate regarding the effects of private and public investment on the economic growth.

From the theoretical point of view, the academics and policy makers argue that private and public investment can create a better economic environment, new job opportunities, stimulates technology and know-how transfer, and through all this, it boosts the growth process. These theories have a powerful empirical support: a large number of macroeconomic studies demonstrated a positive correlation between private and public investment and economic growth (private investment having a much larger impact than public investment).

However, a number of studies suggested that the effect of investment toward growth depended on some economic or social factors from the targeted economy (the development level of economy, human capital, local financial markets or institutions).

On the other hand, there is no universal agreement about the positive correlation between investment and economic growth, a number of academic studies suggesting that there is no empirical evidence supporting the claim that some form of investment (FDI or portfolio investment) accelerates economic growth.

We aim to contribute to the existing literature by examining the influence (in Romania) of 4 macroeconomic variables (Foreign Direct Investment, Foreign Portfolio

Investment Foreign Other Investment and State Public Investment) towards Gross Domestic Product.

The organization of paper is as follows: section 2 provides a brief literature review of the correlation between public and private investment and economic growth; section 3 discusses the methodology and the model used; section 4 data description; section 5 outlines our empirical results; section 6 concludes.

2) Literature review

In the last decades, there were many empirical studies regarding the role of private and public investment in the growth process.

Some of the macroeconomic studies suggested a positive causal relationship between investment (private and public) and economic growth, but, sometimes, economic or social conjunctures are needed for the recipient countries.

Aschauer (1989) examined the effects of public investment on the economic growth in the G-7 industrial countries over the period 1966 to 1985. He concluded that there exists a strong, positive correlation between productivity and public capital expenditures.

Barro (1991) studied the relation between growth, fertility, and investment for 98 countries over the period 1960 to 1985. The results showed that the growth rate of real per capita GDP was positively related to initial human capital and that countries with higher human capital had higher ratios of physical investment to GDP. Also, growth was insignificantly related to the share of public investment.

Cullison (1993) implied in the results of his study that government spending on education and labor training had positive effects on future economic growth

Blomström, Lipsey, and Zejan (1994) examined the effects of interchanges with foreign countries (in two forms: the inflow of direct investment capital from abroad and imports of machinery and transport equipment) on growth for 101 countries for the period 1960-1985. They concluded that inflows of direct investment were an important influence on growth rates for higher income developing countries, but not for lower income ones.

Khan and Kumar (1997) surveyed the impact of public and private investment on economic growth using a sample of 95 developing countries for the period 1970-1990. The authors founded that both kinds of investment had a positive impact on growth, but private investment had a much larger impact than public investment.

De Mello (1997) examined the impact of inward FDI on growth in developing countries over the period 1980-1994. The author argued that the impact of FDI on output growth in the recipient economy depended on the scope for efficiency spillovers to domestic firms, by which FDI leaded to increasing returns in domestic production, and increases in the value-added content of FDI-related production.

Borensztein , De Gregorio and Lee (1998) estimated the effect of FDI flows from industrial countries to 69 developing countries for the period 1970-1989. The results showed that FDI contributed to growth process when the host country had a minimum threshold stock of human capital.

De Mello (1999) studied the relation between FDI and factor productivity growth. He concluded that the extent to which FDI was growth-enhancing depended on the degree of complementarity and subsitutions between FDI and domestic investment.

Nair-Reichert and Weinhold (2001) used a panel of 24 developing countries from 1971 to 1995 to analyze the dynamic relationship between FDI and economic growth. The authors concluded that the efficacy of FDI was higher in more open economies.

Chowdhury and Mavrotas (2003) examined the causal relationship between FDI and economic growth, using data covering the period 1969–2000 for three developing countries (Chile, Malaysia and Thailand). They suggested that for some recipient countries it was GDP that caused FDI, and in other cases bi-directional causality between GDP and FDI was present.

Alfaro, Chanda, Kalemli-Ozcan and Sayek (2004) surveyed the links among FDI, financial markets and growth, using a sample of 39 countries over the period of 1981-1997. The results showed that FDI impact on economic growth is depending on the level development of local financial markets.

Durham (2004) studied the effect of FDI and equity foreign portfolio investment on economic growth using data on 80 countries from 1979 through 1998. He argued that the effect was depending on the financial or institutional development of the host countries.

Hansen and Rand (2005) estimated the Granger causal relationships between FDI and GDP in a sample of 31 developing countries covering 31 years (1970-2000). They found that FDI had a lasting impact on GDP, while GDP had no long- run impact on the FDI-to-GDP ratio. The authors interpreted that FDI had an impact on GDP (via knowledge transfers and adoption of new technology).

Bose, Haque and Osborn (2007) argued in their study (based on a panel of 30 developing countries over the period 1970-1990) that the share of government capital expenditure in GDP is positively and significantly correlated with economic growth.

Cavallo and Daude (2008) examined the impact of public investment on private investment in a panel of 116 developing countries between 1980 and 2006. The authors found a strong and robust crowding-out effect, both across regions and over time. They also found that this effect is dampened (or even reversed) in countries with better institutions and more open to international trade and financial flows.

Not all the empirical studies found a positive correlation between investments and GDP. Carkovic, and Levine (2002) used data 72 countries from 1960 to 1995 to argue that there was no reliable cross-country empirical evidence supporting the claim that FDI per se accelerates economic growth. Alfaro (2003) used a cross-section regressions with 47 countries for the time period 1980-1999 to demonstrate that FDI exerts an ambiguous effect on growth.

3) Methodology and specification of the model

In this paper a multiple regression model is used to investigate the effects of four selected independent variables on the endogenous variable.

We start with the equation:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k \qquad (1)$$

where:

y - endogenous (response) variable

$x_1, x_2, \ldots\ldots, x_k$ - independent (explanatory) variables

β_0 – intercept

$\beta_1, \beta_2, \ldots\ldots, \beta_k$ – regression coefficients

We select the following multiple regression model:

$$GDP = \beta_0 + \beta_1 FDI + \beta_2 FPoI + \beta_3 FOI + \beta_4 SPI + \varepsilon \qquad (2)$$

where:

GDP – Gross Domestic Product (million euro)

FDI – Foreign Direct Investment (million euro)

FPoI – Foreign Portfolio Investment (million euro)

FOI – Foreign Other Investment (million euro)

SPI – State Public Investment (million euro)

β_0 – intercept of the model

$\beta_1, \beta_2, \beta_3, \beta_4$ – regression coefficients

ε – error term

The method of model estimation is the Ordinary Least Square (OLS). This is a method for estimating the coefficients in a linear regression model, with the goal of minimizing the sum of the squares of the differences between the observed responses in the given dataset and those predicted by a linear function of a set of explanatory variables.

To understand the tendency of the variables used in the model, a basic analysis of the data is done.

In order to apply the model, the variables must be stationery. So, the next step is to tests the data series properties, using a unit root test (Augment Dickey Fuller).

The standard DF test is carried out by estimating the following equations:

$$y_t = \rho y_{t-1} + v_t \quad (3)$$

$$y_t - y_{t-1} = \rho y_{t-1} - y_{t-1} + v_t \quad (4)$$

$$\Delta y_t = (\rho - 1) y_{t-1} + v_t = \gamma y_{t-1} + v_t \quad \text{(5a - no constant and no trend)}$$

$$\Delta y_t = \alpha + \gamma y_{t-1} + v_t \quad \text{(5b - with constant, but no trend)}$$

$$\Delta y_t = \alpha + \gamma y_{t-1} + \lambda t + v_t \quad \text{(5c - with constant and with trend)}$$

The null and alternative hypotheses may be written as:

$$\begin{aligned} H_0 &: \rho = 1 \Leftrightarrow H_0 : \gamma = 0 \\ H_1 &: \rho < 1 \Leftrightarrow H_1 : \gamma < 0 \end{aligned} \quad (6)$$

If $\gamma = 0$, the variable has a unit root.

The Augmented Dickey Fuller test is an extension of the standard DF test and constructs a parametric correction for higher-order correlation, allowing the possibility that the error term is autocorrelated.

$$\Delta y_t = \alpha + \gamma y_{t-1} + \sum_{s=1}^{m} a_s \Delta y_{t-s} + v_t \quad (7)$$

After testing the data series properties, necessary adjustments are made to the data series (logarithmic values of all series are used to test the unit root) and to the model:

$$LOG(GDP) = \beta_0 + \beta_1 LOG(FDI) + \beta_2 LOG(FPoI) + \beta 3\ LOG(FOI) + \beta 4\ LOG(SPI) + \varepsilon \quad (8)$$

After the OLS regression is employed to determine the relationship of the variables from equation (8), we verify the results by estimating and analyzing the coefficients of 4 simple linear regression models. The models investigate the relation between GDP (endogenous variable) and each of the independent variables.

4) Data description

In this paper we use quarterly data, covering the period January 2006 – June 2016. All the data are collected from 4 sources:

a) Eurostat, for the Gross Domestic Product (GDP), over the period January 2006 – March 2016; GDP measures the monetary value of final goods and services produced in a country in a given period of time; we use GDP at market prices, unadjusted data, current prices (million euro); for the second quarter of 2016, we extracted the data from National Institute of Statistics from Romania (flash estimates from August 12, 2016: the GDP in Q2 2016 increased by 6%, compared to the same quarter in 2015);

b) National Bank of Romania (monthly bulletins), for the Foreign Direct Investment (FDI), Foreign Portfolio Investment (FPoI) and Foreign Other Investment (FOI); data regarding FDI (equity; debt instruments), FPoI (equity and investment fund shares; debt securities) and FOI (other equity; currency and deposits; loans; trade credit and advances; other accounts payable; SDR allocation) are taken from international investment position, liabilities (million euro, end of period);

c) Ministry of Public Finance of Romania (monthly bulletins), for the State Public Investment (SPI); SPI data reflects the quarterly public capital expenses from the consolidated budget execution account (million lei); for euro conversion, we use a quarterly average exchange rate (calculated based on the daily official exchange rate).

5) Results

Descriptive statistics

The following tables (Table 1 and Table 2) shows the descriptive statistics of all variables in original and logarithmic form.

Table 1. Descriptive statistics of the variables in original form

	FDI	FOI	FPOI	GDP	SPI
Mean	51833.68	55602.42	10405.57	33470.26	1138.245
Median	53866.50	56765.00	7188.500	33539.55	902.9505
Maximum	66883.00	77310.00	21254.00	47575.60	2958.360
Minimum	21697.60	23351.70	4393.100	18323.70	285.8220
Std. Dev.	11830.67	14562.30	6351.521	6777.658	659.6981
Skewness	-0.965016	-0.611028	0.629040	-0.054671	0.906220
Kurtosis	3.337103	2.567187	1.679387	2.394698	3.021553
Jarque-Bera	6.717658	2.941311	5.821872	0.662107	5.749454
Probability	0.034776	0.229775	0.054425	0.718167	0.056432

We calculate, for the original form of all data series, mean (the average value of the series), median (the middle value of the series), maximum and minimum values of the series and standard deviation (the measure of dispersion in the series). Positive skewness (the right tail is longer; the mass of the distribution is concentrated on the left) is observed on SPI and FPOI data series, negative skewness (the left tail is longer; the mass of the distribution is concentrated on the right) is observed on FDI, FOI and GDP data series. Analyzing kurtosis we can conclude that the distribution of FDI and SPI is leptokurtic and the distribution of FOI, GDP and FPOI is platykurtic.

Table 2. Descriptive statistics of the variables in logarithmic form

	LOGFDI	LOGFOI	LOGFPOI	LOGGDP	LOGSPI
Mean	10.82312	10.88452	9.071782	10.39716	6.872736
Median	10.89426	10.94664	8.879167	10.42047	6.805659
Maximum	11.11070	11.25558	9.964300	10.77008	7.992390
Minimum	9.984957	10.05843	8.387790	9.815951	5.655369
Std. Dev.	0.277292	0.309445	0.597755	0.212596	0.592738
Skewness	-1.551136	-1.169327	0.367468	-0.521703	-0.120794
Kurtosis	4.878859	3.617575	1.461246	2.877011	2.351486
Jarque-Bera	23.01985	10.23873	5.088817	1.931688	0.838137
Probability	0.000010	0.005980	0.078519	0.380662	0.657659

We calculate, for the logarithmic form of all data series, mean, median, maximum and minimum values of the series and standard deviation. Positive skewness is observed on LOGFPOI data series, negative skewness is observed on LOGFDI, LOGFOI, LOGGDP and

LOGSPI data series. Analyzing kurtosis we can conclude that the distribution of LOGFDI and LOGFOI is leptokurtic and the distribution of LOGGDP, LOGSPI and LOGFPOI is platykurtic.

Unit root test

To test the data series properties, the unit root test is done. The null hypothesis is that there is a unit root in the series which means that the time series data is non-stationary. The following Table 3 shows the results of unit root test by using Augmented Dickey-Fuller (ADF), at level, with constant and trend.

Table 3. ADF test for all the variables (at level)

Null Hypothesis: GDP has a unit root
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-3.509651	0.0530
Test critical values:	1% level	-4.226815	
	5% level	-3.536601	
	10% level	-3.200320	

Null Hypothesis: FDI has a unit root
Lag Length: 7 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-3.453773	0.0610
Test critical values:	1% level	-4.252879	
	5% level	-3.548490	
	10% level	-3.207094	

Null Hypothesis: FPOI has a unit root
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-2.162881	0.4964
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

Null Hypothesis: FOI has a unit root
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-2.358955	0.3938

Test critical values:	1% level	-4.226815	
	5% level	-3.536601	
	10% level	-3.200320	

Null Hypothesis: SPI has a unit root
Lag Length: 6 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-3.261540	0.0895
Test critical values:	1% level	-4.243644	
	5% level	-3.544284	
	10% level	-3.204699	

In the case of all variables tested at level, we are unable to reject a null hypothesis (the macroeconomic variables are non-stationary at level).

For this reason, logarithmic values of all data series are used to test the unit root, with constant and trend (Table 4).

Table 4. ADF test for all the variables (logarithmic values)

Null Hypothesis: D(LOGGDP) has a unit root
Lag Length: 9 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.556008	0.0004
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

Null Hypothesis: D(LOGFDI) has a unit root
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.914698	0.0016
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

Null Hypothesis: D(LOGFPOI) has a unit root
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.660182	0.0002
Test critical values:	1% level	-4.205004	

	5% level	-3.526609	
	10% level	-3.194611	

Null Hypothesis: D(LOGFOI,2) has a unit root
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-10.30675	0.0000
Test critical values:	1% level	-4.226815	
	5% level	-3.536601	
	10% level	-3.200320	

Null Hypothesis: D(LOGSPI) has a unit root
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-15.71692	0.0000
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

We can observe from the table 4 that when logarithmic values of all data series are used then its become stationary at first difference (except FOI, where second difference is needed).

Multiple regression results

The results obtained from the multiple regression model (equation 9) are presented in Table 5.

LOG(GDP) = C(1) + C(2)*LOG(FDI) + C(3)*LOG(FPOI) + C(4)*LOG(FOI) + C(5)*LOG(SPI) (9)

Table 5. Multiple regression results

Dependent Variable: LOG(GDP)
Method: Least Squares
Sample: 2006Q1 2016Q2
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.791788	0.724774	7.991169	0.0000
LOG(FDI)	0.289172	0.161966	1.785384	0.0824
LOG(FPOI)	0.157141	0.050884	3.088240	0.0038
LOG(FOI)	-0.153951	0.105715	-1.456285	0.1537
LOG(SPI)	0.251104	0.032173	7.804779	0.0000

R-squared	0.774261	Mean dependent var	10.39716
Adjusted R-squared	0.749857	S.D. dependent var	0.212596
S.E. of regression	0.106328	Akaike info criterion	-1.533226
Sum squared resid	0.418312	Schwarz criterion	-1.326360
Log likelihood	37.19774	Hannan-Quinn criter.	-1.457401
F-statistic	31.72650	Durbin-Watson stat	2.140718
Prob (F-statistic)	0.000000		

LOG(GDP) = 5.791788 + 0.289172*LOG(FDI) + 0.157141*LOG(FPOI) - 0.153951*LOG(FOI) + 0.251104*LOG(SPI) (10)

The results can be interpreted as follows:

- the high levels of R-squared and Adjusted R-squared and the small value of Prob (F-statistic) confirm the validity of the regression model;
- the regression's coefficients show a positive relationship between Gross Domestic Product and Foreign Direct Investment, State Public Investment and Foreign Portfolio Investment (in this order) and a negative relationship between Gross Domestic Product and Foreign Other Investment (in our opinion, a possible explanation is the strong negative trend of FOI in the last 4 years);
- the value of standard error of the regression's coefficients, which are lower than the values of the coefficients, together with the small levels of probabilities lead to the conclusion that they are well estimated;
- the Durbin Watson statistic close to 2 means that there is no autocorrelation in the data sample.

Simple linear regression results

We verify the results of the multiple regression model by estimating and analyzing the regression's coefficients of 4 simple linear regression models (GDP-FDI; GDP-FPOI; GDP-FOI and GDP-SPI). The models investigate the relation between GDP (endogenous variable) and each of the independent variables.

Table 5. Simple linear regression results

Dependent Variable: LOG(GDP)
Method: Least Squares
Sample: 2006Q1 2016Q2
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.181228	1.020741	5.075947	0.0000
LOG(FDI)	0.481925	0.094281	5.111586	0.0000

R-squared	0.395115	Mean dependent var	10.39716
Adjusted R-squared	0.379993	S.D. dependent var	0.212596
S.E. of regression	0.167399	Akaike info criterion	-0.690425
Sum squared resid	1.120897	Schwarz criterion	-0.607679
Log likelihood	16.49893	Hannan-Quinn criter.	-0.660096
F-statistic	26.12831	Durbin-Watson stat	2.006738

Prob(F-statistic)	0.000008

Dependent Variable: LOG(GDP)
Method: Least Squares
Sample: 2006Q1 2016Q2
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.814049	0.445454	19.78666	0.0000
LOG(FPOI)	0.174510	0.049000	3.561459	0.0010

R-squared	0.240756	Mean dependent var	10.39716
Adjusted R-squared	0.221775	S.D. dependent var	0.212596
S.E. of regression	0.187546	Akaike info criterion	-0.463140
Sum squared resid	1.406936	Schwarz criterion	-0.380394
Log likelihood	11.72594	Hannan-Quinn criter.	-0.432810
F-statistic	12.68399	Durbin-Watson stat	1.732049
Prob(F-statistic)	0.000970		

Dependent Variable: LOG(GDP)
Method: Least Squares
Sample: 2006Q1 2016Q2
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.008985	1.054448	6.647067	0.0000
LOG(FOI)	0.311284	0.096838	3.214494	0.0026

R-squared	0.205292	Mean dependent var	10.39716
Adjusted R-squared	0.185425	S.D. dependent var	0.212596
S.E. of regression	0.191876	Akaike info criterion	-0.417489
Sum squared resid	1.472653	Schwarz criterion	-0.334742
Log likelihood	10.76726	Hannan-Quinn criter.	-0.387159
F-statistic	10.33297	Durbin-Watson stat	1.445276
Prob(F-statistic)	0.002585		

Dependent Variable: LOG(GDP)
Method: Least Squares
Sample: 2006Q1 2016Q2
Included observations: 42

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.911619	0.312154	28.54876	0.0000
LOG(SPI)	0.216150	0.045255	4.776255	0.0000

R-squared	0.363185	Mean dependent var	10.39716

Adjusted R-squared	0.347265	S.D. dependent var	0.212596
S.E. of regression	0.171760	Akaike info criterion	-0.638984
Sum squared resid	1.180066	Schwarz criterion	-0.556238
Log likelihood	15.41867	Hannan-Quinn criter.	-0.608654
F-statistic	22.81261	Durbin-Watson stat	0.657713
Prob(F-statistic)	0.000024		

It is clear that almost all the independent variables maintain, in the simple linear regression model, the same trend of the regression's coefficients from the multiple regression model. The exception is Foreign Other Investment (with a positive regression's coefficient in the simple linear regression and a negative one in the multiple regression). In our opinion, in a one to one analysis (GDP-FOI), the macroeconomic variable Foreign Other Investment have a positive effect on Gross Domestic Product, but in a multiple regression with 4 independent variables (and a strong negative trend in the last 4 years), statistically, the effect turn to be negative.

6) Conclusion

The aim of this paper is to examine, in the Romanian economy, the relationship among 5 macroeconomic variables: Gross Domestic Product, Foreign Direct Investment, Foreign Portfolio Investment, Foreign Other Investment and State Public Investment, using quarterly data over the period 2006Q1-2016Q2. A multiple regression model is used to investigate the effects of the selected independent variables (FDI, FPOI, FOI and SPI) on the endogenous variable (GDP).

The Augment Dickey Fuller test suggests that the macroeconomic variables are non-stationary at level; for this reason, logarithmic values of all data series are used.

The results obtain from the multiple regression model show a positive relationship between Gross Domestic Product and Foreign Direct Investment, State Public Investment and Foreign Portfolio Investment (in this order) and a negative relationship between Gross Domestic Product and Foreign Other Investment.

We hope that this paper can be a useful tool for government and policy makers in formulating the right investment policies in order to enhance economic development.

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