

Impact of Public Investment Through Public Debt on Economic Growth: Empirical Analysis in European Countries in Transition

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Abstract The main aim of this study is to investigate the link between public investment and public debt in transition countries. This analysis includes European countries in transition, and the source of data will be the World Bank, the International Monetary Fund, and Eurostat. This study has particular scientific importance; firstly, this study will reflect the relationship between public investment and public debt. Secondly, this study will give empirical data that shows the impact of public debt through public investment on economic growth in European countries in transition. To conduct this research, we have used various econometric models, such as OLS, Fixed and Random Effects, Hausman-Taylor, and GMM. The results obtained through this study are in full accordance with the theoretical hypotheses presented at the beginning of this research which emphasize that public debt is likely to affect economic growth through public investment positively. Empirical results show that public debt positively affects economic growth through public investment in transition countries in Europe, and it can be argued that these countries can increase the level of debt to finance public capital investment which then affects economic growth. The findings of this study are beneficial for the governments of European countries in transition, as it provides them with helpful information on the link between investment and public debt.

Keywords: Economic Growth, Public Investment, Public Debt, Panel Data, European Transition Country.

JEL classification: E20,E6, C10,C30.

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1. Introduction

The main purpose of this scientific research is to reflect the link between public investment and public debt. The paper will empirically analyze European countries in transition. This scientific study will try to present the impact of public debt through public investment on economic growth in European countries in transition. Some scientific papers deal with the threshold of the utilization of public debt, where it is observed that European countries in transition have different levels of utilization of public debt; if we refer to the current period, we see that most countries have exceeded the optimal threshold of the utilization of public debt, and this can then affect economic stability (Mencinger et al., 2015; Reinhart and Rogoff, 2010; Bexheti et al., 2020; Fetaj et al., 2020; Blanchard et al., 2018). However, through this analysis, we will explore how the growth of public debt can be affected if it is used for public investment, which can then affect economic growth. We will see how the eventual increase of public debt affects public investment in the context of economic growth in European countries in transition.

From the theoretical literature, we notice some approaches which do not support the high growth of public debt to finance public investments, which are not reasonable because unbalanced growth of public debt can negatively affect economic growth. On the other hand, some scientific studies pay special attention to the use of public debt if it is gathered to finance productive public investments, which later stimulate economic activity in European countries in transition (Checherita and Rother, 2010). To examine the relationship between public investment and public debt, we have addressed some research hypotheses which can help us solve this problem, such as:

H1: There is a positive link between public investment and public debt.

H2: Public debt is likely to positively impact economic growth through public investment in European countries in transition.

To confirm the reliability of the hypotheses, we will use various econometric methods in order for the results to have a high scientific significance, such as the following: OSL, Fixed Effects, Random Effects, Taylor-Hausman, GMM.

To summarize, the main findings of this study show that there is a possible link between public debt and public investment, where more specifically, the results show that public debt positively affects public investment by 0.011%. While public debt placed in the square negatively affects public investment by 0.403%, this result has statistical reliability.

The structure of this paper is as follows: the first part begins with the introduction and motivation of the thesis, then continues with the literature review, methodology, and in the last part will be set the results and conclusions of the study.

2. Literature Review

When reviewing the empirical literature on the relationship between public investment and public debt in the context of economic growth in European countries in transition, we note that few scientific studies address this relationship between these variables and their impact on economic growth (Checherita and Rother, 2010; Valila and Mehrotra, 2005; Heinemann, 2006; Picarelli et al., 2019). However, we see that many scientific studies have addressed the impact of public debt on economic growth in countries in transition. We should emphasize that some of these studies have determined the optimal threshold of the utilization of public debt to what extent public debt can be used and still positively affect economic growth, and conversely exceeding the use of public debt above the optimal threshold will negatively affect economic growth (Mencinger et al., 2015; Fetai et al., 2020; Reinhart and Rogoff, 2010; Checherita and Rother, 2010; Andres et al., 2016; Fetai and Avdimetaj, 2020). Some studies point out that an increase in public debt, in the long run, can drive out capital as well as reduce output, but in the short run, it can boost aggregate demand and aggregate output Barro, 1979; Elmendorf and Mankiw, 1999; Salotti and Trecroci, 2016). On the other hand, Rubin and Sinai (2004) have pointed out the negative consequences of persistent budget deficits resulting from increased public debt. This can be argued because the persistent deficit is a burden for many generations, and government spending becomes unmanageable, and as a result, economic and social problems are caused, which can hardly be repaired. While Elmeskov and Sutherland (2012) claim that high long-term rates increase the cost of capital, focusing more on public investment, and most importantly, reducing private investment, which in the long run can negatively affect growth economically.

Checherita and Rother (2010) analyze the relationship between public debt and public investment, in their empirical research they analyzed the impact of public debt on economic growth in a sample of twelve Eurozone countries through several channels such as private investment, public investment, the overall level of productivity, as well as real and nominal interest rates. According to the analyzed results, we see that the return point of public debt in the 12 euro area countries is from 90% to 100%, and the reliability of this threshold is about 70% of GDP. The authors have argued these empirical findings on how public debt can be affected through public investment, which means that increasing budget deficits from earlier periods could positively affect the economic growth of these countries if used to finance productive public investment.

Almada and Juarez (2016) analyzed the impact of public debt and public investment on Mexico's economic growth through simple OLS regression. The findings of this study showed that public debt is positively related to public investment, which positively affects economic growth in Mexico. The study recommended that the legal framework for public debt needs to be reformed to improve economic growth. The scientific study conducted by Bacchiocchi et al. (2011) has analyzed the relationship between public investment and public debt. The empirical results of this

study show that the high level of public debt affects the reduction of public investment in all OECD countries, without specific differences between countries. Also, Valila and Mehrotra (2005), using the data of the joint panel, have analyzed the evolution of public investments and shares of public capital during the period 1972-2003 for 14 EU countries. Their findings show that public investments are mainly defined by national income and fiscal sustainability. Heinemann (2006) tries to explain the decrease in public investment for the 16 OECD countries, most of which are European, and the results of this study show that the increase in public debt since 1970 has severely limited the ability to finance new public investment.

Picarelli et al. (2019) have analyzed 26 EU countries through panels data from 1995-2017. Their findings show that if public debt increases by 1% will affect the reduction of public investment by 0.03%.

These findings refer to countries with a high level of public debt, while the negative impact of public debt on public investment is smaller in EU countries compared to other European countries. To summarize, it is clear that a considerable number of studies have analyzed the relationship between public debt and public investment in developed and developing countries.

However, a few empirical studies address the impact of public debt through public investment on economic growth in transition countries, especially in European transition countries. This paper will try to contribute to this issue by investigating how increasing public debt for public investment will positively impact economic growth in European countries in transition.

3. Research methodology

Empirical data which have been used to test variables in European transition countries cover the period from 1995 to 2017 (approximately 22 years) testing the impact of public debt through public investment has been done in transition countries in Europe, while the source of data for the realization of this scientific research has been the World Bank and the International Monetary Fund. To confirm the reliability of the hypotheses, we will use econometric methods in order for the results to have a high scientific significance, such as the following: OLS, Fixed Effects, Random Effects, Hausman-Taylor, and GMM. The dynamic panel model (GMM) is used to test the relationship between public debt and public investment and other independent variables in transition countries in Europe. We will use the GMM estimator from Arellano and Bond (1991), Blundell and Bond (1998), Blundell, Bond and Windmeijer (2000) as it is the proper estimator. To address the problem of endogeneity, we use the instrumental variable (IV) or the two steps of the GMM instrumental estimator (IV). This instrument has the advantage of not having a direct causal effect on the growth rate if it is assumed that there are no effects between debt levels in transition countries of Europe. The problem of endogeneity is also avoided through our specifications because the independent

variables have all remained 1 or 2 years compared to the dependent variable. For the purpose of comparison, we also apply OLS, Fixed Effects, and Random Effects.

The essential difference between Fixed Effects and Random Effects lies in whether the unobserved individual effect counts elements related (correlated) to other regressors in the model and whether these effects are not stochastic. The “Fixed Effects” model is not correlated with the “Random Effects” model. It follows that in the “Fixed Effects” model, it is assumed that there are “ n ” unknown parameters to be treated in econometric estimates, while in the case of the “Random Effects” model, it is treated as a diagram with an average distribution of “ μ ,” as well as a variance independent of the explanatory variables in the model. To see which of those two methods will provide the most appropriate and argumentative results, we will also use the Hausman-Taylor test and evaluator, which offers an alternative to these approaches as mentioned above. The reliability of the GMM assessor depends on the validity of its groups. To address this issue, we consider two tests suggested by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1997). The first is the Sargan test that tests the invalid hypothesis of limitations on identifying the set of exogenous instruments that apply.

The dynamic panel model (GMM) specification is as follows:

$$\begin{aligned} FINAL_GOVERNMENT_{it} = & \mu + FINAL_GOVERNMENT_{(t-1)} + B_1 DEBT_{it} + \\ & B_2 DEBT_SQUARE_{it} + B_3 FINAL_CONSUM_{it} + B_4 EXPORT_{it} + B_5 GDP_{it} + \\ & B_6 BRUTO_SAV_{it} + B_7 CURRENT_{it} + \delta_i + \gamma_i + \varepsilon \end{aligned}$$

The dependent variable is the growth rate of the public investment expressed through government spending for each country i and t represents the years, μ is the term of the constant, while the explanatory variables include $FINAL_GOVERNMENT_{(t-1)}$ is the first group of the dependent variable, $DEBT_t$ is debt and $DEBT_SQUARE_{it}$ represents debt assuming a non-linear relationship between government debt and economic growth. Based on the theoretical assumptions that the relationship between public debt and public investment is non-linear, we expect public debt to impact economic growth through public investment positively. We also include control variables in order to improve model performance and ensure robust results. Control variables are selected based on key determinants of economic growth (see Sala-i-Martin, 2004; Kumar and Woo, 2010; Checherita and Rother, 2010). The control variables are final consumption, exports, gross savings, current account, and gross domestic product.

The term δ_i is the fixed effect of the country that enables us to control unacceptable time factors that may affect economic growth, which might otherwise lead to bias coefficients. The term γ_i is the usual time effect covering the business cycle’s effect, which might otherwise lead to inducible regression between the dependent and explanatory variables. While the term ε_{it} represents the standard error.

4. Results

This part of the section will present the empirical results gained through several econometric approaches such as OLS, Fixed Effects, Random Effects, Hausman-Taylor, and GMM. The variety of use of these econometric models is because the results obtained should reflect high statistical reliability. The results presented below through Tables 4.1 and 4.2 show that all the methods calculated in the dynamic panels are well modeled, as their coefficients are statistically reliable. Furthermore, the Sargan-Test identifies the constraints in the presence of heteroskedasticity with the associated t-value, which examines the validity of the instrumental variables accepted as sound instruments for all evaluated equations. Therefore, the results from the GMM estimator confirm the finding that the instrumental variables are not related to the waste group. As a result, the Arellano-Bond tests AR (1) and AR (2) with associated t-values are rejected in the first order, while they are accepted in the second-order, which confirms that there is no auto-correlation in the second-order between the term of errors.

4.1. The data from empirical research

Table 4.1. Statistical description of exogenous and endogenous variables in European countries in transition

Variables	OBS	Std.Dev	Min	Max
Final_Goverment_Expenditure	146	1.547	15.76	25.88
Debt	146	19.560	3.7	85.7
Debt_Square	146	1637.4	13.69	7344.49
Final_Consum	146	5.552	65.48	89.31
Exsport	146	16.557	22.09	86.54
Gdp	146	4.371	-14.56	12.92
Bruto_Saving	146	4.204	10.46	30.46
Current_Account	161	5.001	-21.07	7.9

Source: Calculated by Author

Empirical data used to investigate the link between public debt and public investment in transition countries in Europe cover the period from 1995 to 2017. Meanwhile, the data source will be the World Bank and the International Monetary Fund. To test the impact of public debt on economic growth through public investment, we have

built econometric models that include several econometric approaches, ranging from OLS, Fixed Effects, Random Effects, Hausman-Taylor, and the GMM (General Methodology) Moments), which are in line with other empirical studies that try to explain the impact of public debt on economic growth through certain channels, including public investment (Checherita and Rother (2010).

According to the data presented in Table 4.2, we can see the results from all the econometric approaches used in this empirical research, representing the relationship between public debt and public investment. Where the dependent variable is set final_government_expenditure (which otherwise represents public investment expenditure), debt (public debt), debt square (debt placed in square), export (export), final_consum (consumption expenditure), gross_saving (gross savings), current account, and GDP are set as independent variables. All variables in this empirical research are expressed as a percentage of GDP.

The empirical results in this study will be interpreted through the GMM estimator, or instead according to the latest model in Table 4.2. This is because the data obtained from this estimator are seen to be more reliable.

4.2. Empirical results

Table 4.2. Results from regression analysis in transition countries of Europe

Variable	OLS Model (1)	Fixed Effects Model (2)	Random Effects Model (3)	Hausman- Taylor Model (4)	GMM Model (5)
Final_gov_ex_ Lag1				0.6650*** (13.19)	0.3865*** (4.47)
T-Statistics					
Gdp	-0.095*** (-3.11)	-0.0098 (-0.43)	-0.0951*** (-3.11)	-0.099*** (-6.01)	-0.0733*** (-4.14)
T-Statistics					
Debt	-0.031*** (-2.05)	-0.0213** (-1.51)	0.0318 (-2.05)	-0.0050 (0.52)	0.0116 (0.61)
T-Statistics					
Debt_Square	0.046 (0.22)	0.3102* (-1.04)	0.0465 (0.22)	-0.0911 (-0.47)	-0.4039*** (-1.26)
T-Statistics					
Export	-0.035*** (3.22)	-0.055*** (-3.68)	-0.035*** (-3.22)	-0.0147* (1.37)	-0.0118 (-0.76)
T-Statistics					
Final_Consum	-0.108** (-2.00)	0.0516 (0.63)	-0.1080** (-2.00)	-0.0087 (0.17)	0.0992** (1.54)
T-Statistics					
Bruto_Saving	-0.212*** (3.08)	-0.345*** (4.87)	-0.212*** (-3.08)	0.111*** (2.16)	-0.135*** (-2.17)
T-Statistics					

Variable	OLS Model (1)	Fixed Effects Model (2)	Random Effects Model (3)	Hausman- Taylor Model (4)	GMM Model (5)
Current_Account T-Statistics	0.1097*** (2.63)	0.1460*** (4.13)	0.1097*** (2.63)	0.0205 (0.78)	0.0518** (1.70)
Constant T-Statistics	35.43*** (5.78)	24.88*** (2.97)	35.43 (5.78)	11.38** (1.99)	-- --
Observation	146	146	146	145	139
Arellano - Bond test for AR (1)	--	(-1.55)	--		(-1.55)
Arellano - Bond test for AR (2)	--	(-0.98)	--		(-0.98)
Sargan Test	--	-	-		(142.90)

$X^{2(56)prob.}$

Note: Final government expenditure means government expenditure and presents (public investment) wherein this table it is placed as a dependent variable. Interpretation of results will be made through the GMM approach.

Source: Calculated by Author

Reliability and significance will be based on the t-statistics coefficient, where parameters 1 to 1.5 results are significant on *, parameters 1.5 to 2 are **, and over 2 on ***. Whereas if we are based on the results given by the regression analysis in table 4.2 for the transition countries of Europe, as well as by their interpretation through the GMM estimator, we notice the possible connection between public debt and public investment. Where specifically, in Table 4.2, we notice that public debt positively affects public investment. More specifically, if public debt increases by 1% in European countries in transition will affect by 0.011% public investment. While referring to the results according to econometric methods show that the public debt placed in the square negatively affects public investment, which means that the increase in debt in the square by 1% negatively affects public investment by 0.403%, and this result has high statistical reliability. Square debt otherwise refers to doubling the level of debt, and this means that if its level increases indefinitely, its effect will be negative on economic growth, even if used to finance public investment.

This result is in line with the study conducted by Mencinger et al. (2015), who have determined the public debt threshold in developing and developed countries based

on public debt in relation to GDP and debt located in the square. From the results, we see that the increase in exports negatively affects public investment by -0.011%, while final consumption expenditures positively affect public investment by 0.099%, a result that has statistical reliability. An increase in gross savings by 1% negatively affects public investment expenditures by -0.135%. While increasing the current account ratio positively impacts public investment by 0.051%, this ratio is also statistically reliable. According to these results and empirical findings, we see that public debt can positively affect economic growth through public investment in European transition countries. This can be reflected through the effect of public investment, where countries in transition can increase the level of public debt to finance public investment increasing production boosting economic growth. Increasing public debt to finance public investment can positively impact economic growth if investments are made in certain areas, such as education, infrastructure, or tourism. At the same time, the opposite of this approach is whether the increase in public debt is used to finance social schemes or wage increases in the public sector (e.g., the case of Greece), which will negatively affect economic growth. Therefore, based on the results given by the assessor "GMM" in Table 4.2, we fully support hypotheses 1 and 2 raised at the beginning of this study. The results mentioned above can also be compared with the study done by (Checherita and Rother, 2010), where in their empirical research, they have analyzed the impact of public debt on economic growth in a sample of twelve Eurozone countries through the following channels such as public investment, private investment, the overall level of productivity, as well as real rates and nominal ones of interest. This scientific study shows that the turning point of public debt through these channels in euro area countries is from 90% to 100%, results with a very high statistical reliability. The authors have given a reasonably clear explanation of how public debt can be affected through public investment, meaning that the increase in accumulated deficits from the past can positively affect economic growth if those deficits are used to finance productive public investment. However, if the increase in public debt exceeds the threshold of 45% - 68% in relation to GDP, then it can negatively affect public investment.

5. Conclusion

We have investigated public debt impact through public investment on economic growth in some European transition countries (Estonia, Lithuania, Latvia, Slovenia, Czech Republic, Poland, Croatia) using advanced econometric methods. What is very important to emphasize is that we have tried to investigate the relationship between public debt and public investment in relation to economic growth through this study. For testing the empirical data, we have used some of the econometric models such as: OLS, Fixed Effects, Random Effects, Hausman-Taylor, and GMM. The reason for the variety of uses of these econometric models is because the results obtained should reflect high statistical reliability and have scientific significance in practice.

For the construction of econometric models, we have used data from the World Bank, the International Monetary Fund, and the European Statistics Agency, including the period from 1995 to 2017. The main findings of this study show that there is a link between public debt and public investment in European countries in transition, and this can be seen in the results in Table 4.2, where we see if public debt eventually increases by 1% for public investment in European countries in transition will positively affect economic growth by 0.011%. These empirical results can also be argued in practical terms because European countries in transition can increase the level of public debt to finance public investment aimed at economic growth. While the debt placed in the square negatively affects public investment, which means that the increase in debt in the square by 1% negatively affects public investment by 0.403% and does not affect economic growth, this result has high statistical reliability. In addition, from the empirical findings, we see that there is no possible link between exports and public investment; more specifically, the results show that export growth negatively affects public investment by -0.011% in European countries in transition. Also, according to the results, we see that gross savings negatively affect public investment by -0.135% and do not show any relationship with each other.

While the increase in expenditures for final consumption positively affects public investment by 0.099%, reflecting high statistical reliability. Also, the current account has a positive impact on public investment by 0.051%. Furthermore, this ratio is statistically very reliable. The results show that some control variables used for testing this study show a positive relationship with public investment while others show a negative relationship with public investment. Most result coefficients possess statistical reliability.

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Appendix

Table A1. List of the Transition European countries

Nr	Countries of the Central Europe
1	Estonia
2	Lithuania
3	Letonia
4	Slovenia
5	Czech Republic
6	Poland
7	Croatia

Table A2: Description of variables in Transition European countries

Nr	Variables	Code
1	Government Expenditure (% of GDP)	final_goverment_ex_lag1
2	GDP (Gdp Per Capita -Annual %)	gdp
3	Public Debt (% of GDP)	debt
4	Debt Square (% of GDP)	debt_square
5	Export (% of GDP)	eksport
6	Final Consum (% of GDP)	final_consus
7	Bruto Saving (% of GDP)	bruto_saving
8	Current_Account (% of GDP)	current_account