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Research Paper

Budget Deficit, Economic Growth and FDI in the Baltics: A Cross-Section Dependence Panel Approach.

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ABSTRACT: *This study investigates the importance of budget deficit and foreign direct investments on economic growth of the Baltic countries. In our analysis, we use a panel data set for all three countries over the period 1995-2012. This paper, therefore, applies panel unit root tests (first and second generation), panel cointegration methods and panel causality test through the Vector Error Correction Model. The empirical findings reveal a positive and significant long-run relationship between foreign direct investment and economic growth in Baltic countries. In contrast, the relationship between budget deficit and economic growth is found to be negative. Also, the causality results show, both in short and long-run, unidirectional causal relationship from foreign direct investments to economic growth as well as from budget deficit to economic growth. Results on this paper indicate that the transition countries, which implement the privatization programs successfully, attract foreign direct investment faster which in turn promotes economic growth.*
Keywords: *Baltic Countries, Budget Deficit, Economic Growth, FDI, Panel Data*

I. INTRODUCTION

The global financial crisis of 2008 is considered by many economists as the worst financial crisis since the Great Depression of the 1930s. The recent crisis started in the US (United States) mortgage market and went global when mortgage-backed securities traded by financial institutions. Although not all subprime mortgages were bad loans, the crisis was spread quickly because investors lost their faith in this category of investments.

The interdependence of the financial markets had as a result the transmission of crisis in Europe. Today, the financial conditions have been improved in most European countries. These improvements are due to the massive support measures taken by the governments and the European Central Bank. On the other, even today many years after outbreak of the crisis, there are still countries in Europe that are facing serious structural and financial problems.

The Baltic States were arguably some of the European countries which affected significant by the global financial crisis. The collapse in demand and the shocks in the financial markets led to output reduction in these economies. In 2009, the decline of GDP in Estonia, Latvia and Lithuania was 14.1%, 17.9% and 14.7% respectively. Moreover, the reduction in domestic demand and exports had as a result a significant increase on unemployment. In all three countries, the unemployment rate was almost three times higher at the end of 2009 than it was in 2007 (WDI, 2016).

In response to crisis, the Baltics chose the "internal" devaluation of their domestic currency, which means downward adjustment in nominal wages. The governments of these countries were strongly opposed to the "external" devaluation, believing that this strategy would be an obstacle on their quick accession to the Eurozone.

As far as the fiscal policy, the response to the crisis was different across the Baltics. Until 2007 the budget in Estonia was balanced, while in the other two countries was in deficit. After the outbreak of the crisis, Latvia's and Lithuania's budget deficits reached almost 10% of their GDP. On the other, Estonia managed to keep its deficit almost at 2% of GDP, in 2009. This direct fiscal adjustment, compared with the gradual approaches of Latvia's and Lithuania's, was due to Estonia's effort to join Eurozone as soon as possible. In

early 2010, the Baltic countries seem to have left behind the difficulties of the crisis. Their economies have returned to growth, with reduced unemployment rates and increased quantity of exports.

The relationship between budget deficit and economic growth has been the focus of a considerable number of academic studies. In the literature there are three perspectives as far as the relationship between these variables: Ricardian theory supports that there is neutral relation between budget deficit and economic growth. Keynesian, which says that there is positive relation between budget deficit and economic growth. Finally, Neoclassical theory supports that exists an inverse relationship between the two variables.

Foreign direct investments (FDI) had a vital role in the world economy the last twenty years. Foreign direct investments are an important source of private capital since they are directed towards productive activities, and therefore contribute significantly to economic development (Gorbunova *et al.*, 2012). As far as the Baltic countries, FDI have played a key factor in their transition process, from planned to market economies. During this period, these countries have received a lot of FDI. In Latvia and Lithuania the average level has been over than 3% of GDP. However, in Estonia this number has been much larger (8% of GDP) (UNCTAD, 2016). The political determination of Estonia to implement fast economic liberation was the main reason for this large share of FDI.

The aim of this paper is to examine the relationship between budget deficit, FDI inflows and economic growth in the three Baltic countries, viewed as group, using annual data for the period 1995-2012. Although there is a large number of academic studies that examine the link between these variables, little academic research has been done on the Baltics. Perhaps due to the small size of Baltic economies, which also may reflects the weakness of the domestic economic research (Sutela, 2001). Moreover, the Baltic economies were closed and integrated parts of Soviet system until 1990, so no FDI flows were before.

The structure of the paper is as follows: Section 2 briefly reviews the theoretical framework. Section 3 presents the empirical literature. Section 4 describes data and methodology. Empirical results are discussed in section 5. Concluding remarks are given in the final section.

II. THEORETICAL FRAMEWORK

The recent economic crisis had undoubtedly a negative impact on the economies of all EU countries. However, the magnitude of the impact was not the same for all members. This depended on the infrastructure and the level of the domestic economy of each country. For this reason, the governments of these countries have implemented different types of fiscal measures in order to maintain economic stability. These measures had a significant effect in macroeconomic variables such as GDP, government debt, budget deficit and FDI.

Budget deficit is the amount by which government expenditures exceed its revenues over a particular period of time, usually a year. According to European System of integrated economic Accounts (ESA) there is a distinction between the central government deficit and the general government deficit, depending on the government's sectors that are included. In addition, there is a distinction between primary deficit and total deficit. The primary deficit does not include the interests on debt service.

All countries can have deficits in their budgets. However, it is necessary to keep their deficits below certain quantitative limits. Theoretically, these limits are defined from the long term debt sustainability. In practice, the limits are defined from the possibility of the deficit financing by the banking system. The government deficit is funded by loans provided by the banks and other institutional investors and also by the bonds issued by the national governments.

In general, there are three schools of economic though regarding the impact of budget deficits:

Neoclassical: According to this theory, the fiscal deficits increase the overall consumption and shift the taxes to future generations. In full employment of the economy's resources, an increase in consumption will reduce savings. Subsequently, the interest rates should be increased in order to bring balance in the capital markets. In this way, fiscal deficits crowd out the private capital accumulation. Buiter (1997) supported that, when the economy is at full capacity and employment of resources, any increase in public expenditures should necessarily lead to a reduction of the same amount of private spending (crowding-out) and create negative effects on economic growth.

Keynesian: According to Keynesian theory, fiscal deficit is used as a means for improving the economic situation and maximizing the social welfare. This approach supports that there is a negative relation between budget deficit and unemployment as well as a positive relation between budget deficit and real growth. In 1989, Berheim argued that appropriately timed deficits are beneficial for the economy.

Ricardian Equivalence: Ricardo supports that the budget deficit increases due to an increase in government spendings. This deficit can be paid now or at a later stage. Therefore tax cuts, arising from the budget deficit policy, have no effect on consumption and savings. So, employment does not change as well as other macroeconomic variables including economic growth. Saleh (2003), supported that budget deficits have no significant impact on investments, savings and overall on economic performance.

A foreign direct investment is an investment made by a company or entity based in one country, into a company or entity based in another country. The effect of FDI on a domestic economy has been extensively studied during the last years. Most of the studies show positive effects of FDI in transitional and long term economic growth through capital accumulation and transfer of knowledge (Basu *et al.*, 2003). Denisia (2010) believed that FDI promotes economic growth both directly and indirectly through exports. However, the positive effect of FDI on a host country appears to be greater in developed economies, since they can absorb more easily new technologies (Blomstrom *et al.*, 1992).

On the other, some studies have shown that these positive results may be insignificant or even negative due to the concentration of domestic capital (Carkovic and Levine, 2005). Reuber *et al.* (1973) disputed the positive effects of FDI because of the short-term unemployment it often causes and the high adjustment cost of domestic companies in order cope the new competitive conditions.

III. REVIEW OF EMPIRICAL LITERATURE

In previous years, studies on the relationship between budget deficit, FDI and economic growth, using either time series or panel data, revealed different results which seem to depend on the countries (developed or developing), the econometrics methods and the period the analysis was carried out.

Ball and Mankiw (1995) proved that there is an inverse relationship between budget deficit and economic growth for the case of the US, using data over the period 1960-1994. It was found that economies with budget deficits have lower growth rates than economies with budget surplus. The continuous increase in budget deficits can lead to a bankruptcy problem.

Asogwa and Okeke (2013) supported that crowding out effect of budget deficit on private investment in the Nigeria's economy has a significant impact on the economy's output, the level of employment and the standard of living. The Nigerian government should reduce recurrent expenditure and increase its capital expenditure in order to encourage private investments and promote economic growth.

Hussain and Ahmad (2015) investigated causal link between FDI, budget deficit and economic growth for Pakistan using data over the period of 1971-2007. The analysis indicated that there are bidirectional causality relations between FDI and economic growth and between economic growth and budget deficit, as well as a unidirectional causality running from FDI to budget deficit. Findings support that FDI is an important factor for economic growth in Pakistan. Also, findings indicate that there is a long run association between economic growth and budget deficit. This means that government is investing more for the welfare of the nation. However, this spending must be at the right track.

As far as the studies which conducted under the panel framework, Bose *et al.* (2007) found that budget deficit can help economy to grow faster. For their analysis they used a panel data set of 30 developing countries from 1970 to 1990. They supported that the deficits were due to expenditures in fields such as education and health.

Afonso and Jalles (2011) investigated the impact of budget deficit on productivity and economic growth using a large panel of 155 countries over the period 1970-2008. Their results revealed that the deficits have significant negative effects on economic growth, while the overall efficiency of the production factors has a positive and significant impact.

Miteza (2012) examined the impact of budget deficits and investment spending on current account deficits using panel data for 20 OECD countries over the period of 1974-2008. Both budget deficits and domestic investment are found to Granger-cause the current account. Larger budget deficits lead to higher current account deficits especially in the short term. Increases in investment spending have a similar effect over time. Miteza, concluded that the results of this study do not support the Ricardian Equivalence hypothesis.

Yucel (2014) investigated the relationship between FDI and economic growth for the Baltic countries using panel data for the period 1996-2008. The results showed that FDI has a positive effect on economic growth for the group of the countries. The attraction of foreign capital inflows will increase FDI, will boost economic development and will help in reducing unemployment.

Bökemeier (2015) found that there is a significant negative relationship between budget deficit and economic growth for the group of eight EU countries, that joined the union in 2004. The sample of the study consists of annual panel data during the period 1996-2012. The debt or deficit financing involves future payments on interest and redemptions, which in turn reduce the scope of budget or the fiscal policy decisions. The link between these variables seems to be stronger after 2004.

Akbaş and Lebe (2016) investigated the validity of the triplet deficit hypothesis in the G7 countries, using panel data over period 1994-2011. Their results revealed that budget deficit and savings gap have important role on current account deficit. In addition, bi-directional causality between the current account deficit and the savings gap and between the budget deficit and the savings gap were determined. They conclude that triplet deficit hypothesis is valid in G7.

IV. DATA AND METHODOLOGY

1. Data

The variables that are used in this study are gross domestic product (GDP), foreign direct investments inflows (FDI) and budget deficit (BD) expressed in million US dollars. The data are annual covering the period 1995-2012. All Data collected from World Development Indicator (WDI, 2016), published by the World Bank and from United Nations Conference on Trade and Development (UNCTAD, 2016). The current prices of GDP, FDI inflows and BD were deflated by the GDP deflator of each country (2005=1) in order to be converted in constant prices.

2. Methodology

The purpose of the paper is to examine the causal relationship between foreign direct investments, budget deficit and economic growth in the Baltic countries, viewed as group, over the period 1995-2012. Following Hussain and Ahmad (2015) we specify the functional form as follows:

$$GDP_{it} = a_i + \beta_1 FDI_{it} + \beta_2 BD_{it} + u_{it} \quad (1)$$

where: $GDP_{i,t}$ = Gross Domestic Product, $FDI_{i,t}$ = Foreign Direct Investments Inflows, $BD_{i,t}$ = Budget Deficit, a_i = Intercept, β_1 = Estimated coefficient of FDI, β_2 = Estimated coefficient of BD, $u_{i,t}$ = Error term, i = the number of individual members and t = the number of observation over time.

After the specification of the model, our paper involves four objectives:

i. The first is to examine the stationarity of the variables. Panel unit root tests are divided into first and second generation. The first generation tests assume that the units of the panel are independent each other. On the other, the second generation take under consideration the cross sectional dependency. According to Breusch and Pagan (1980) and Pesaran (2004) the existence of cross sectional dependence between the series can affect the whole panel significantly. In this study, we begin applying the first generation unit root tests. Considering that panel data models are likely to exhibit substantial cross sectional dependence in the errors, it necessary to test for cross sectional dependence in order to avoid biased estimates and spurious results. Since cross sectional dependence exists, we continue applying the second generation tests.

ii. Having defined the order of integration, we continue applying panel cointegration methodology. The classical method of Pedroni (1999) under the assumption of cross-sectional independence and the Westerlund (2007) test robust to cross sectional dependence are computed.

iii. The third is to estimate the long run relationship with the panel Dynamic Ordinary Least Square (DOLS) method.

iv. The fourth aim is to estimate a dynamic panel vector error correction model (VECM) in order to provide us with the Granger causal relationships.

2.1 First Generation Unit Root Tests

The first step in panel causality analysis is to define the order of integration of the variables included in the study. The literature proposes several approaches for testing unit root in panels. Taking under consideration that these methods may give different results we select tests suggested by Breitung (2000), Levin *et al.* (2002) (LLC), Im *et al.* (2003) W-test (IPS), ADF-Fisher Chi-square test, PP Fisher Chi-Square test, Maddala and Wu (1999), and Hadri (2000). In all cases except Hadri, the null hypothesis is that the variable contains a unit root. All these tests assume that panel data do not exhibit a cross-sectional dependence in the errors. The first generation unit root tests can be divided into homogeneous and heterogeneous models.

Levin *et al.* (2002) and Breitung (2000) tests, assume homogeneity in the dynamics of the autoregressive coefficients for all individuals of the panel. Phillips and Sul (2003) proved that this hypothesis in many cases can lead to the rejection of the null hypothesis incorrectly. Also, Hadri (2010) suggested a residual based Lagrange multiplier test for the null that the time series are stationary, for each *i*, around a deterministic trend against the alternative of a unit root in panel data. However, the rest tests are not so restrictive.

Im *et al.* (2003) proposed an alternative since it allows for heterogeneous coefficients in the panel. Moreover, Maddala and Wu (1999) proposed two different tests, based on the Augmented Dickey-Fuller and the Phillips-Perron tests, in order to check the stationarity in panel data. In these tests, the null and alternative hypotheses are the same as in the IPS test.

2.2 Cross Sectional Dependence Tests

As we mention before, the first generation unit root tests have the drawback to suppose that the cross sections in the panel are independent. However, this assumption is not valid in the empirical investigation. Panel data models are more likely to exhibit a cross-sectional dependence in the errors, which may arise due to

unobserved common factor, the presence of common shocks, regional and macroeconomic linkages and general residual interdependence (De Hoyos and Sarafidis, 2006)

Prominent cross-sectional dependence tests are these proposed by Breusch-Pagan (1980) and Pesaran (2004). Following Pesaran (2004), consider the panel data model:

$$y_{it} = a_i + \beta' x_{it} + u_{it} \quad \text{with } i = 1,\ldots, N \text{ and t} = 1,\ldots T \tag{2}$$

where a_i represents the intercept, $x_{i,t}$ is a k dimensional column vector of regressors, β' is a k x 1 vector of parameters to be estimated, $u_{i,t}$ is assumed to be independent and identically distributed over time periods and across cross-sectional units.

Pesaran's cross dependence (CD) test is based on the correlations between the disturbances in different cross section units:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} \hat{\rho}_{ij}\right) \tag{3}$$

whrere $\hat{\rho}_{ij} = \hat{\rho}_{ji} = \dfrac{\sum_{\tau=1}^{T} \hat{u}_{it}\hat{u}_{jt}}{\left(\sum_{\tau=1}^{T} \hat{u}^2_{it}\right)^{1/2}\left(\sum_{\tau=1}^{T} \hat{u}^2_{jt}\right)^{1/2}}$

The most well-known cross section dependence diagnostic is the Breusch-Pagan (1980) test. Breusch and Pagan (1980) proposed a Lagrange Multiplier (LM) statistic given by:

$$LM = T\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} \hat{\rho}_{ij}^{\,2}\right) \tag{4}$$

where $\hat{\rho}_{ij}$ are the correlation coefficients obtained from the residuals of the model as described above. For both tests, the null hypothesis is that there isn't cross-sectional dependence in the panel. Under the null hypothesis, the statistic has a chi-square asymptotic distribution with N(N-1)/2 degrees of freedom.

In the case that time dimension is larger than cross section dimension Breusch-Pagan (1980) test is proposed. On the other hand, if time dimension is smaller than cross section dimension Pesaran (2004) test is preferred.

2.3 Second Generation Unit Root Test

Since cross-sectional dependence among countries has been determined, we continue applying the second generation unit root tests. The most common of these tests is the Cross Sectionally Augmented IPS (CIPS) proposed by Pesaran (2007). The procedure of CIPS test begins with the OLS estimation for the i^{th} cross section in the panel considering the following Cross-Sectional Augmented Dickey Fuller (CADF) regression:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \delta_i \bar{y}_{i,t-1} + \sum_{j=0}^{k} \delta_{ij} \Delta \bar{y}_{i,t-j} + \sum_{j=0}^{k} \Delta y_{i,t-j} + \varepsilon_{it} \tag{5}$$

where: $\bar{y}_{i,t-1} = \left(\frac{1}{N}\right)\sum_{i=1}^{N} y_{i,t-1}$, $\Delta \bar{y}_t = \left(\frac{1}{N}\right)\sum_{i=1}^{N} y_{i,t}$ and $t_i(N,T)$ is the t-statistic of ρ_i that is used for the computation of the individual ADF statistic. CIPS statistic is based on individual CADF average statistics. Equation of CIPS is as follows:

$$CIPS = \left(\frac{\sum_{i=1}^{N} CADF_i}{N}\right) \tag{6}$$

Pesaran (2007) has tabulated the critical values for CIPS for various deterministic terms. If calculated CIPS value is smaller than the table the critical value, the null hypothesis of non stationarity is rejected.

2.4 Panel Cointegration Tests

Since the order of stationarity has been defined, our next step is to use panel cointegration methodology in order to examine the long run relationship between the variables. The classical method of Pedroni (1999) under the assumption of cross-sectional independence and the Westerlund (2007) test robust to cross-sectional dependence are applied.

Pedroni (1999) introduces seven cointegration statistics that allow for heterogeneous slopes coefficients across cross sections. Of these seven statistics, four are based on the within-dimension of the panel and three on the between-dimension (see Appendix). The null hypothesis of no cointegration is the same for each statistic $H_0 = p_i = 1$ for all i. For the between-dimension statistics the alternative is $H_1 = p_i < 1$ for at least one i, while for the within-dimension the alternative is $H_1 = p = p_i < 1$ for all i.

The second test proposed by Westerlund (2007). This test examines the presence of cointegration by determining if the error correction term in a conditional error correction model exists or not. Consider the following error correction model:

$$\Delta Y_{i,t} = a_i + \lambda_i (Y_{i,t-1} - \varphi_i X_{i,t-1}) + \sum_{k=1}^{p} \beta_{i,k} \Delta Y_{i,t-k} + \sum_{k=1}^{p} \gamma_{i,k} \Delta X_{i,t-k} + u_{i,t} \quad (7)$$

where $Y_{i,t}$ stands for the GDP, $X_{i,t}$ gives a set of the exogenous variables, λ_i is the speed of adjustment term and $u_{j,i,t}$ is the disturbance term assumed to be uncorrelated with zero means. The null hypothesis of no error correction term is accepted in the case that $\lambda_i = 0$. If $\lambda_i < 0$, the model is error correcting which means that the variables are cointegrated.

Westerlund (2007) proposed two types of tests. The first includes the whole panel statistics, namely P_t and P_a, while the second includes the group mean statistics namely G_t and G_a. The null hypothesis is the same for all statistics $H_0 : \lambda_i = 0$ for all i. On the other, for the whole panel statistics the alternative is $H_1 : \lambda = \lambda_i < 0$ for all i and for the group mean test statistics the alternative is $H_1 : \lambda_i < 0$, for at least one i. One property of Westerlund (2007) is that it provides p-values quite robust to cross-sectional dependence through to the bootstrap approach used by Chang (2004).

2.5 Panel DOLS Estimates

Since our variables are cointegrated the next step is the estimation of the long-run equilibrium relationship. According to Kao and Chiang (2000) the ordinary least square (OLS) estimator is biased and inconsistent when applied to cointegrated panels. Pedroni (2000) argued that only in the case that the regressors are strictly exogenous the OLS estimators are unbiased and could be generally used for valid inferences. So, we use the dynamic OLS (DOLS) estimator proposed by Kao and Chiang (2000) in order to estimate the long-run cointegration vector. The DOLS estimator allow for greater flexibility in the existence of heterogeneity of the cointegrating vectors (Pedroni 1999; 2000).

Consider the following fixed effects panel regression:

$$y_{it} = \alpha_i + \beta x_{it} + u_{it} \quad \text{for i = 1…N members and t = 1…T} \quad (8)$$

where y_{it} is a matrix (1,1), β is a vector of slopes $(k,1)$ dimension, α_i is the individual fixed effect, u_{it} are the stationary disturbance terms. x_{it} $(k,1)$ vector assumed to be an integrated process of order one for all i, where $x_{it} = x_{it-1} + e_{it}$.

The DOLS is an extension of Stock and Watson (1993) estimator and is constructed making corrections for endogeneity and serial correlation to the OLS estimator (Phillips, 1995).

Following equation is used to obtain the DOLS estimator:

$$y_{it} = \alpha_i + \beta x_{it} + \sum_{j=-q}^{j=q} c_{ij} \Delta x_{i,t-j} + v_{it} \quad (9)$$

Where c_{ij} represents the lead or lag coefficient of explanatory variables at first differences. The DOLS estimator is obtained as following:

$$\hat{\beta}_{DOLS} = \left[\sum_{i=1}^{N} \sum_{t=1}^{T} z_{it} z_{it}' \right]^{-1} \left[\sum_{i=1}^{N} \sum_{t=1}^{T} z_{it} \hat{y}_{it}^{*} \right] \quad (10)$$

where $z_{it} = [x_{it} - \bar{x}_i, \Delta x_{i,t-q}, ..., \Delta x_{i,t+q}]$ is $2(q+1)\times 1$ vector of regressors. Kao and Chiang (2000) supported that the DOLS estimator is less biased and has superior small sample properties compared with FMOLS estimator.

2.6 Panel Causality Analysis

The existence of cointegration between the examined variables implies that there is causality relation among them in at least one direction (Engle and Granger, 1987). We continue with the estimation of the VECM in order to find the short and long run dynamics between budget deficit, FDI and economic growth. The equations that are used to test Granger causality are the following:

$$\Delta GDP_{i,t} = a_{1,i} + \sum_{k=1}^{p} \beta_{1,1,i,k} \Delta GDP_{i,t-k} + \sum_{k=1}^{p} \beta_{1,2,i,k} \Delta BD_{i,t-k} + \sum_{k=1}^{p} \beta_{1,3,i,k} \Delta FDI_{i,t-k} + \lambda_{1,i} ECT_{i,t-1} + u_{1,i,t} \quad (11)$$

$$\Delta BD_{i,t} = a_{2,i} + \sum_{k=1}^{p} \beta_{2,1,i,k} \Delta GDP_{i,t-k} + \sum_{k=1}^{p} \beta_{2,2,i,k} \Delta BD_{i,t-k} + \sum_{k=1}^{p} \beta_{2,3,i,k} \Delta FDI_{i,t-k} + \lambda_{2,i} ECT_{i,t-1} + u_{2,i,t} \quad (12)$$

$$\Delta FDI_{i,t} = a_{3,i} + \sum_{k=1}^{p} \beta_{3,1,i,k} \Delta GDP_{i,t-k} + \sum_{k=1}^{p} \beta_{3,2,i,k} \Delta BD_{i,t-k} + \sum_{k=1}^{p} \beta_{3,3,i,k} \Delta FDI_{i,t-k} + \lambda_{3,i} ECT_{i,t-1} + u_{3,i,t} \quad (13)$$

Where Δ is the first difference operator, $k = 1,\ldots,p$ is the optimal lag selected by the Schwarz, $ECT_{i,t-1}$ stands for the lagged error correction term from the long-run cointegration equation, $\lambda_{j,i}$ is the adjustment coefficient ($j = 1, 2, 3, 4$) and $u_{j,i,t}$ is the disturbance term assumed to be uncorrelated with zero means.

V. EMPIRICAL RESULTS

1. First Generation Unit Root Results

We begin applying the unit root tests of LLC, Breitung, IPS, ADF-Fisher, PP-Fisher and Hadri. The results of level and first difference unit root tests for the three variables are provided in Table 1.

Table 1: Panel Unit Root Results

Level				
		GDP	**FDI**	**BD**
LLC	Intercept	-1.015 (0.154)	-1.428 (0.076)	-2.806 (0.002)***
	Intercept and Trend	6.894 (1.000)	-3.072 (0.001)***	-1.814 (0.034)**
Breitung	Intercept			
	Intercept and Trend	-0.230 (0.408)	-1.897 (0.028)**	-0.554 (0.289)
IPS	Intercept	0.566 (0.714)	-0.466 (0.320)	-2.547 (0.005)***
	Intercept and Trend	-0.928 (0.176)	-1.636 (0.058)	-2.458 (0.007)***
ADF	Intercept	2.296 (0.890)	6.448 (0.374)	16.708 (0.010)**
	Intercept and Trend	7.703 (0.260)	11.887 (0.064)	16.008 (0.013)**
PP	Intercept	2.138 (0.906)	8.996 (0.173)	10.8722 (0.092)
	Intercept and Trend	1.698 (0.945)	6.815 (0.338)	7.216 (0.301)
Hadri	Intercept	4.105 (0.000)***	2.268 (0.011)**	2.369 (0.008)***
	Intercept and Trend	1.617 (0.052)	1.209 (0.113)	0.398 (0.345)
First Differences				
		GDP	**FDI**	**BD**
LLC	Intercept	-5.050 (0.000)***	-8.694 (0.000)***	-5.124 (0.000)***
	Intercept and Trend	-4.446 (0.000)***	-7.574 (0.000)***	-0.908 (0.181)
Breitung	Intercept			
	Intercept and Trend	-4.156 (0.000)***	-3.496 (0.000)***	0.387 (0.650)
IPS	Intercept	-3.109 (0.000)***	-7.315 (0.000)***	-5.306 (0.000)***
	Intercept and Trend	-2.074 (0.019)**	-6.200 (0.000)***	-2.457 (0.007)***
	Intercept	20.218	46.286	34.471

ADF		(0.002)***	(0.000)***	(0.000)***
	Intercept and Trend	13.900 (0.030)**	36.093 (0.000)***	15.914 (0.014)**
PP	Intercept	14.218 (0.027)**	47.732 (0.000)***	40.742 (0.000)***
	Intercept and Trend	6.200 (0.401)	41.344 (0.000)***	29.188 (0.000)***
Hadri	Intercept	-0.4729 (0.681)	-0.005 (0.502)	-0.594 (0.724)
	Intercept and Trend	0.7135 (0.237)	3.074 (0.001)***	1.209 (0.113)

Notes: Panel data include all countries. The numbers in parentheses denote p-values. ***, ** denotes rejection of null hypothesis at the 1% and 5% level of significance, respectively. The null hypothesis is that the panel series has a unit root except with the Hadri test which has no unit root in panel series. Lag length selection automatic based on Schwarz criterion.

As can be seen from Table 1, the results showed that GDP contain a unit root (non-stationary) in levels, while the results for the other two variables are inconclusive. In the cases of FDI and BD two out of six tests and three out of six tests respectively fail to reject the stationarity hypothesis, either with intercept or including intercept and trend, in 5% level o significance Evidently, the results indicated that all variables are stationary in their first differences (i.e. *I*(1)).

2. Results of Cross-Sectional Dependence Test

All the above unit root tests have the drawback to suppose that the cross sections are independent each other. The fact that the unit root tests results for the variables of FDI and BD are inconclusive could be attributed to the cross-sectional independence hypothesis (Breusch and Pagan 1980; Pesaran 2004). In this study, the cross-sectional dependence tests proposed by Breusch and Pagan (1980) is applied, since there are 3 countries (N=3) and 18 years (T=18).

Table 2: Cross-Sectional Dependence Results

Test	Statistic	Probability	d.f
Breusch-Pagan (LM)	9.139**	0.027	3

Note: ** indicates rejection of null hypothesis at 5% level of significance.

As can be seen from Table 2, the Breusch-Pagan test strongly rejects the null hypothesis of no cross-sectional dependence at 5% level of significance. This means that a shock which has come from one of the countries, affects the others.

3. Second Generation Unit Root Results

Since cross-sectional dependence has been determined among countries, we proceed applying the CIPS test proposed by Pesaran (2007). We run the test for each variable up to 4 lags with and without trend.

Table 3: CIPS Results

Level				
		GDP	**FDI**	**BD**
CIPS Statistic	Intercept	-1.628	-2.199	-2.183
	Intercept and trend	-1.958	-2.945	-2.870
First Differences				
		GDP	**FDI**	**BD**
CIPS Statistic	Intercept	-2.813***	-5.760***	-5.209***
	Intercept and trend	-3.230**	-5.947***	-5.310***

Notes: *** and ** denotes rejection of null hypothesis at at 1% and %5 levels of significance. The null hypothesis of non stationarity is rejected in the case that CIPS statistics is smaller than critical value. The critical values in the case of intercept are -2.64 and -2.33 at 1% and 5% levels of significance respectively. In the case of intercept and trend are -3.46 and -3.02 at 1% and 5% level respectively.

The results of Table 3 support that all variables are not stationary in levels but in their first differences. Considering the first generation unit root tests results, the cross-sectional dependence results and the results of second generation unit root test we conclude that GDP, FDI and BD are integrated of order one (i.e. *I*(1)).

4. Panel Cointegration Results

Since the order of integration has been confirmed, we proceed applying panel cointegration methodologies to test whether there is long-run relationship between the examined variables. The results of

Pedroni (1999) and Westerlund (2007) tests are reported in Table 4.

Table 4: Panel Cointegration Results

Pedroni (GDP as dependent variable)			
	Test statistic	**Probability**	
Within-Dimension			
Panel-v	2.085	0.018**	
Panel-rho	-1.498	0.067*	
Panel-PP	-1.824	0.034**	
Panel-ADF	-1.379	0.083*	
Between-Dimension			
Group-rho	0.282	0.611	
Group-PP	-0.814	0.207	
Group-ADF	-1.838	0.033**	
Westerlund (GDP as dependent variable)			
Statistic	**Value**	**Z-value**	**P-Value**
Gt	-3.972	-2.974	0.002***
Ga	-14.618	-0.233	0.408
Pt	-14.013	-11.142	0.000***
Pa	-32.965	-5.760	0.000***

Notes: Under the null tests, all variables are distributed normal, N(0, 1). ***, **, * significant at 1% , 5% and 10% levels. In Westerlund test Akaike Information Criterion is used for optimal lag/lead length selection.

The results of Table 4 show that there is a cointegrating vector between the examined variables, for the group of the Baltic countries. The null hypothesis of no cointegration is rejected at panel level with both methods. In other words, the results show that GDP, FDI and BD are moving together in the long run.

5. Panel Cointegration Estimation Results

We proceed by estimating the parameters of the long-run equilibrium relationship. The results of Dynamic OLS estimations are provided in Table 5.

Table 5: DOLS Estimations Results (GDP as dependent variable)

	DOLS	
	Independent Variables	
	FDI	BD
Coefficient	1.388 (4.016***)	-0.928 (-4.057***)
R^2	0.953	
Adj. R^2	0.907	

Notes: The numbers in parentheses denotes t-statistic. Asymptotic distribution of t-statistic is standard normal as T and N go to infinity. *** significant at 1% level. Lag and lead method selected by Akaike.

The estimation results show that there is a positive relationship between FDI and economic growth in 1% level of significance. On the other, budget deficit has a negative impact on economic growth in 1% level of significance.

6. Panel Cointegration Estimation Results

The panel data results on the short and long-run dynamics between economic growth, foreign direct investments inflows and budget deficit for the group of the Baltic countries are provided in the next table.

Table 6: Panel Causality Results

Dependent Variable	**Source of Causation (independent variables)**			**t-test**
	F-statistic			
	Short-run			**Long-run**
	ΔGDP	**ΔFDI**	**ΔBD**	**ECT**
ΔGDP		7.6975***	4.9308**	-2.034**
ΔFDI	0.0300		0.3422	0.7723
ΔBD	0.0805	0.0450		0.4255

Notes: Δ denotes first difference operator. *** and ** significant at 1% and 5% levels. Short-run causality is determined by the statistical significance of the partial F-statistics associated with the right hand side variables. Long-run causality is revealed by the statistical significance of the respective error correction terms using a t-test.

From the results of Table 6 we see that there is a short-run unidirectional causal relationship between budget deficit and economic growth with direction from budget deficit to economic growth, as well as a short-run causality running from foreign direct investments to economic growth.

The estimated coefficient $\lambda_{1,i}$ of $ECT_{i,t-1}$ in equation (11) is statistically significant at 5% level of significant implying that GDP could play an important adjustment role in the long-run equilibrium. Consequently findings suggest that, in the long run, there is a unidirectional causality running from FDI to economic growth and a unidirectional causality relation running from budget deficit to economic growth. The knowledge about the direction of causality will help policy makers to trace out policies for faster economic growth in the Baltic countries.

VI. CONCLUSION AND POLICY IMPLICATIONS

On this paper we examine the relationship among budget deficit, foreign direct investment and economic growth in three transition economies such as Baltic countries. Data of this econometric study showed that there is a significant relationship between foreign direct investment and economic growth as well as between budget deficit and economic growth. The error correction model, which was used in order to capture the short and long run dynamic relationships between series, revealed both in short and long run unidirectional causalities running from foreign direct investment to economic growth and from budget deficit to economic growth. However, the results of causality didn't show a relationship between budget deficit and foreign direct investment.

The findings of the study can be explained as follows:

The financial sector flourished in the Baltic countries because of the financial integration. The result was the rapid growth of credit expansion, which according to the World Bank, was almost 47% of GDP during the period of 2000-2008, while the period 2009-2010 was 85%. However, the result is not the same for all three countries. During the period of 1997-2007, the credit expansion has been raised by three, six and nine times in Estonia, Lithuania and Latvia, reaching in 2008 to 130%, 85% and 120% of their GDP respectively.

The savings rates were low in the early years. However this trend was reserved after 2009, as the propensity to saving increased significantly. During the period of 2009-2012, savings rates of the Baltic countries were between 12% and 14% of their GDP (AMECO, 2016).

The Baltic economies are often presented as an example of successful austerity program, implementing the "internal" devaluation as a strategy for economic recovery. According to professor Kattel (2012), in the mid 2000s the Baltic countries were the countries with the highest GDP growth rates in Europe (Estonia 7.6%, Lithuania 5.9%, Latvia 5.5%). This happened not because the imposed austerity program was successful, but because the Baltics "outsourced" their recovery. There are two reasons for the Baltic recovery. The first is the massive use of the EU budgetary funds. The second refers to the extreme integration of the export sector with Scandinavian producers. But these sources of growth cannot be sustainable in the long-run. The funding from the EU is running out and the exports mainly to the Scandinavian countries are uncertain.

Since regaining their independence, the Baltic countries are distinguished from all other Central and Eastern European countries, which also were in transition. Their enthusiasm as far as the implementation of neoliberal reforms is concerned. In the early 90s, these countries adopted a mixture of policies to ensure stabilization, fiscal discipline, price and trade liberalization and large-scale privatization. Indeed, the Baltic countries developed as standards of neoliberal transition, with very open economies. After their accession to the EU, all three economies had an unprecedented period of economic boom. These economies recorded very high annual growth rates. However, this remarkable growth was accompanied by double digit inflation, rise in real estate, increase in real exchange rates, wage growth acceleration beyond the increase of productivity, rapid accumulation of net foreign liabilities and increasing deficits on current account balances which, as has been proved in our study, have negative impact on economic growth.

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Appendix: Pedroni Test Statistics

1. **Panel *v*-Statistic**

$$Z_v = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{2} \right)^{-1}$$

2. **Panel *ρ*-Statistic**

$$Z_\rho = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{2} \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

3. **Panel *t*-Statistic (non-parametric)**

$$Z_{pp} = \left(\sigma^2 \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{2} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{it} - \hat{\lambda}_i \right)$$

4. **Panel *t*-Statistic (parametric)**

$$Z_t^* = \left(\hat{S}^{*2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*} \Delta \hat{e}_{i,t}^{*}$$

5. **Group *ρ*-Statistic**

$$\tilde{Z}_\rho = \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{e}_{i,t-1}^{2} \right)^{-1} \sum_{t=1}^{T} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

6. **Group *t*-Statistic (non-parametric)**

$$\tilde{Z}_{pp} = \sum_{i=1}^{N} \left(\hat{\sigma}^2 \sum_{t=1}^{T} \hat{e}_{i,t-1}^{2} \right)^{-1/2} \sum_{t=1}^{T} \left(\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i \right)$$

7. **Group *t*-Statistic (parametric)**

$$\tilde{Z}_t = \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{S}_i^{*2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \sum_{t=1}^{T} \hat{e}_{i,t-1}^{*} \Delta \hat{e}_{i,t}^{*}$$