ISSN 1392-3730/eISSN 1822-3605
2015 Volume 21(6): 813–826
10.3846/13923730.2015.1046478

FOREIGN DIRECT INVESTMENT AND GROWTH: ANALYSIS OF THE CONSTRUCTION SECTOR IN THE BALTIC STATES

Nerija BANAITIENĖ[a], Audrius BANAITIS[a], Mindaugas LAUČYS[b]

[a]*Department of Construction Economics and Property Management, Faculty of Civil Engineering, Vilnius Gediminas Technical University, Saulėtekio al. 11, LT-10223 Vilnius, Lithuania*
[b]*Department of Construction, Faculty of Technologies, Klaipėda State College, Bijūnų g. 10, LT-91223 Klaipėda, Lithuania*

Received 07 Aug 2014; accepted 09 Apr 2015

Abstract. In the construction industry of the Baltic States, the aftermath of the economic crisis poses new questions as to what occasioned the crisis. The paper analyses a causal relationship between foreign direct investment in construction (CFDI) and the contribution of the construction industry to gross domestic product (GDP) using data obtained in the Baltic States (Lithuania, Latvia and Estonia) for the period from 2000 to 2011. The conducted research includes the initial econometric analysis of variables, which involves the verification of seasonality and stationarity with the help of time series plots, a unit root test and *Granger* causality test. The study has found that, in the case of Lithuania and Estonia, CFDI is not the Granger cause of the construction industry's contribution to GDP growth; conversely, value added by the construction sector is not the Granger cause of FDI into the sector, and there is one-way causality from value added by the construction sector to CFDI, and the construction industry's contribution to GDP does not influence CFDI in Latvia.

Keywords: construction sector, *Dickey-Fuller* test, *Granger* causality.

Introduction

Over the last two decades, the Baltic States – Estonia, Latvia and Lithuania – have survived a few complicated economic periods. The first slump in Lithuania's real estate and construction industry came in the wake of 1998 Russian crisis with dire consequences on the country's economy. By mid-2001, the number of transactions plummeted while real estate prices dropped by 20% on average, compared to those of 1998. In 2002–2003, the real estate sector started recovering: prices increased by about 30% on average in the period, compared to the one before (Misiūnas 2011). The three Baltic States – Lithuania, Latvia and Estonia – had the fastest growing economies in the EU from 2004 to 2006 (Grigas *et al.* 2013). In 2004–2008, the real estate and construction sector stood out among other industries by its activity and the abundance of investors. Its growing attractiveness stemmed from property inflation, consumer optimism, expectations and favourable loan terms. Nevertheless, the first signs of the events that later shook the global financial system had been already apparent in 2008, and, by September, had reached the crucial point. In 2009, the sharpest economic contractions in the EU were reported in three Baltic States: Lithuania (–20.4%), Latvia (–17.3%) and Estonia (–16.1%). All three countries experienced punishing economic downturn with collapsing output, a severe 'correction' in property prices and rapidly declining average income and consumer consumption levels as well as widespread unemployment (Sommers, Wolfson 2014). Many economies plunged into recession. But heading into the crisis, some Baltic states were better off than others. Latvia suffered the blow first while Estonia recovered pretty soon and even managed to meet the Maastricht convergence criteria and join the Euro. Lithuania has been hard hit by the economic downturn: Lithuania's GDP experienced the sharpest fall in the EU in the second quarter of 2009 (–20.4% compared to the same quarter in 2008). A rapid decline in production was followed by increasing unemployment. A decline in output particularly affected labour-intensive sectors such as construction, manufacturing and retail services (Staehr 2013). By the fourth quarter of 2009, the unemployment rate among 15–74 year-olds had risen to 18.2% in Estonia, 21.3% in Latvia and 17.4% in Lithuania. The construction industry was hardest hit. All three Baltic States experienced a decline in the construction industry. Growth rates had already begun to move downwards in Estonia and Latvia before 2009. In 2009, the construction sector in Lithuania had an extreme reduction in 54.4%, and that in Latvia and

Corresponding author: Nerija Banaitienė
E-mail: *nerija.banaitiene@vgtu.lt*

Estonia dropped in 49.5% and 34.7%, respectively. As decisions in each Baltic State were different, they swayed foreign investors in their choices to bet on real estate and the construction industry.

The construction industry experiences significant cyclical variations in output, employment and sales (Abdel-Wahab, Vogl 2011; Bennett 2005; Wilkinson *et al.* 2012). These may be linked to consumer confidence, the availability of credit, political events, or general economic cycles (Stawińska 2010). Nistorescu and Ploscaru (2010) highlighted the impact of the economic and financial crisis in the construction industry at the European and national level. The authors emphasized that no European country had been exempt from the economic crisis, including the construction sector. Several European countries experienced that the impact of the financial crisis was greatest for the construction sector (European Investment Bank 2013; Nistorescu, Ploscaru 2010; Öcal *et al.* 2006).

The life cycle model has been developed and analysed by Kaklauskas *et al.* (2010) who illustrates the relationship between different issues and crisis management in the sectors of construction and real estate. The authors emphasize that an understanding of a broader social, cultural, ethical and psychological context of the crisis provides the management of the real estate crisis in an integrated manner.

Recently, the role of foreign direct investment (FDI) in economic growth and the development of host countries have been widely investigated (Choe 2003; Égert, Martin 2008; Hansen, Rand 2006; Liu *et al.* 2002; Popescu 2014; Simelyte, Antanaviciene 2014). Special attention has been paid to FDI flows to transition economies owing their economic and social transformation to a large extent to foreign firms that introduce knowledge, technology and new opportunities into the emerging markets (Bevan, Estrin 2004; Estrin, Uvalic 2014; Gorodnichenko *et al.* 2014; Jensen 2006). Transition from socialism to capitalism and the integration of Central and Eastern European countries into the world economy proceeded through international trade and capital flows, which encouraged growth and innovation and facilitated the restructuring of firms and sectors (Bevan, Estrin 2004).

The Baltic economies emerged from communism as the examples of quick and efficient transition countries even though the transition period was marked by numerous challenges. Thanks to strong political will and public support, the reforms in the fields of institution building, privatisation and trade liberalisation were largely successful as evidenced by astonishing economic performance. In the mid-2000s, the three Baltic States had a golden age. The economies were growing at the spectacular pace of 8–9% per year on average in real terms, and the levels of national real wealth more than doubled in the period of 2000–2008. Pegged exchange rates and EU membership in 2004 provided the required credibility. As a result, large capital inflows followed: FDI peaked at 20% of GDP in Estonia, 8.5% in Latvia and 6% in Lithuania in the pre-crisis years (Grigas *et al.* 2013). Unemployment rates dropped from 14–16% in 2000 to approximately 4% in Estonia and Lithuania and 6% in Latvia in 2007. One of the drivers of the growth was the rapid expansion of the construction sector in the Baltic States. This rapid expansion was mainly stoked by a strong growth in real estate prices, the inflow of FDI in the sectors of real estate and construction and a relatively large share of public (infrastructure) investment (Égert, Martin 2008). FDI played an important role in the economic growth of the Baltic States. On average, FDI inflows during the period of 1994–2008 equalled 8.6% of GDP in Estonia, 5.4% in Latvia and 3.6% in Lithuania. However, the financial crisis in 2009 caused a backlash.

Construction is the major industry throughout the world accounting for a sizeable proportion of GDP in most countries (Crosthwaite 2000). Wigren and Wilhelmsson (2007) examined a statistical relationship between GDP and a broad group of construction and, furthermore, the presence of crowding-out within the construction industry in Europe. The authors applied to co-integrating and error correction approaches and the Granger causality test. Empirical analysis supported the findings of no crowding-out effect within the construction industry. On the contrary, infrastructure investments have a filling-in effect by an increase in both types of construction residential and other buildings. Giang and Sui Pheng (2011) reviewed the studies completed for the past 40 years, which examined the role of the construction industry in economic development. The findings from these studies have demonstrated a significant relationship between the construction industry and economic growth in developing countries. The relationship between economic growth and the construction sector in Turkey was studied by Ozkan *et al.* (2012). According to these authors, the construction sector is a significant argument catalysing an economic policy of the Government. In times of demand shortages in economy, governments yield GDP by increasing construction investments and vitalizing the sector. Puapan (2014) examined the overall and sectorial economic impact of FDI on Thailand economy using economic data from 2005–2013. In assessing the overall economic impact, the authors found that FDI had contributed positively to an economic growth in Thailand. However, the analysis of sectorial details demonstrates empirical results indicating that FDI has a varying impact on productive sectors in Thailand. Out of 9 sub-sectors covered by this study, manufacturing, financial, wholesale, retail trade, agriculture and construction show strong statistically-significant positive effects of FDI on the relevant value-added output of the sector.

Gross domestic product (GDP) is the most commonly used measure for national economic activity. A number of studies have recently focused on investigating the causal relationship between foreign direct investment and economic growth. However, there has been little detailed empirical study of causal links between foreign direct investment in construction (CFDI) and the construction industry's contribution to gross domestic product (GDP) in the Baltic States, especially in a multivariate framework. Understanding causal connections between these phenomena is important for development strategies in Lithuania and other Baltic countries. Causal relationships between construction and national economies received considerable attention in the past. However, the results of research on this topic provide contrasting views on relationship. Ozkan *et al.* (2012) used different types of the methodology (Engle–Granger cointegration (Engle, Granger 1987), error correction model (ECM) and Granger causality) to test a causal relationship between data on construction growth (infrastructure, building and residential (public), building and residential (private) investment) and gross domestic product (GDP) in Turkey for the period from 1987 to 2008. They found bidirectional relations between infrastructure investments – GDP and building and residential (public) investments – GDP variables; these relations seem to be stronger from infrastructure and building and residential (public) investments to GDP. In their study covering all Europe, Wigren and Wilhelmsson (2007) indicated that public infrastructure policies had an effect on short-run economic growth but only a weak one on the long run and that there existed a filling-in effect from other types of construction, and, moreover, residential construction did have a long-run effect on economic development.

On the other hand, empirical results provided by Yiu *et al.* (2004), Ramachandra *et al.* (2013), Ruddock and Lopes (2006), Lopes *et al.* (2011) reveal that GDP causes growth in construction output. Yiu *et al.* (2004) examined the Granger causality relationship between the real growth rate of construction output and the real growth rate of GDP in Hong Kong longitudinally from 1984 to 2002. The obtained results show that the real growth rate of GDP influences/leads construction output. Ramachandra *et al.* (2013) investigated the causal relationship between construction and the economy of Sri Lanka as the developing country, using empirical data on the selected economic and construction indicators for the period from 1990 to 2009. The results obtained from Granger causality tests show that the economy drives the construction sector and not vice versa. This supports the opinions of Lopes *et al.* (2011) that there is, in the long-run, a weakly unidirectional relationship between GDP and construction output.

The aim of the study is to investigate and examine the effect of foreign direct investment in construction (CFDI) on economic growth in the Baltic States with quarterly data covering the period 2000–2011. In testing the cointergation and causal relationship between foreign direct investment in construction (CFDI) and the construction industry's contribution to gross domestic product (GDP), the time series model of the ADF unit root test and the Granger causality model have been employed.

This research seeks to take data about the shape of the construction industry in the Baltic States during the period in question, to structure data and to build an econometric model for identifying the causes that triggered economic changes in the construction industry. Research objectives are as follows:

1. To account for the effects of foreign direct investment in construction on the growth of the construction industry, and how it has affected the growth in all three Baltic economies.
2. To trace correlation, formulate a regression equation, calculate the coefficient of determination for the Baltic States and to define the relationship between foreign direct investment in construction and value added by the construction sector.
3. To formulate Granger causality equations and to determine causal relationships between foreign direct investment in construction and value added by the construction sector.

The question we address empirically in this article, although, there are already signs of a rapid growth in the economies and construction sectors of the Baltic States, may have FDI spur the growth of the construction sector.

The rest of the paper is organized as follows. Section 1 highlights the impact of the construction industry on a national economy. Section 2 presents the methodology and models that we employ in causality tests. Section 3 reports empirical results from correlation and regression analysis, Dickey-Fuller test and Granger causality test. Finally, the last section presents our conclusions.

1. Construction industry and its role in a national economy

The construction sector represents a strategically important sector of the European Union thus providing building and infrastructure on which all sectors of economy depend. In Europe, construction accounts for 10% of EU GDP and 7% of its workforce. The sector employs directly 12 million EU citizens, and 26 million workers are dependent on the sector (EISC 2012). The sector is characterised by cyclic and seasonal work and rather low productivity in comparison with other industries.

The construction sector plays a powerful role in the industrial and economic development of the country. Construction activity promotes job creation not only in the construction sector but also in other related businesses (CBI 2012; Crowe *et al.* 2013). Anaman and Osei-Amponsah (2007) point out that the construction industry is often seen as a driver of economic growth especially in developing countries. The industry can mobilize and effectively utilize local human and material resources in the development and maintenance of housing and infrastructure to promote local employment and improve economic efficiency. The principal aim of construction, according to Carassus (2004), is not to produce and manage necessary structures for living and working environment, but rather to produce and manage the services rendered to end users by these structures throughout their physical life-cycle (production, use, improvement, through to demolition).

Construction often feels the effect of multiple contingencies that determine both the shape and other particulars of a construction object and the overall economic situation. The effect of external factors, that crop up when a project is complete, differ case-by-case; it is, therefore, difficult to compare one object to another and treat an object as a standard case.

Ofori (2001) argues that it may be tricky to formulate or apply indicators in the development of the construction industry. First, due to the nature of the construction industry and a host of integrated links to other sectors, it may be a challenge to apply actual indicators. The second reason is that one needs dozens of indicators to get a general picture and to provide maximum information. It may, however, prove an issue, as developing countries lack the experience of data collection. Third, the collection and use of data relevant to economic indicators may prove difficult, because the information offered by developing countries – with a few special information systems deployed – is inadequate and inaccurate, especially in those areas of the construction industry that make data collection a serious challenge. Finally, the factors related to construction business are ever-changing and dynamic; each country, therefore, needs to keep collecting and structuring data and some countries may struggle with this task.

2. Methodology

To analyse the construction industry of the Baltic States, the period 2000–2011 has been selected with a focus on foreign direct investment (FDI) to the construction sector and construction industry's contribution to gross domestic product (GDP). The conducted analysis consists of the following steps:

Step 1. To discover the relationship between FDI in the construction sector and construction industry's contribution to GDP, correlation and regression analyses have been made.

Correlation quantifies the strength of a linear relationship between a pair of variables and indicates the direction of the relationship, whereas regression expresses the relationship in the form of an equation (Brown, Berthouex 2002; Cohen *et al.* 2003; Kleinbaum *et al.* 2014). A scatter plot and a regression model have been used for investigating the relationship between variables. In a regression equation, the relationship between variables is described by a mathematical model that expresses the effect of one or more factors on the phenomenon in question. The shape of a function is often of key interest in regression analysis (Heckman, Zamar 2000). Our research has examined the linear and multi-type (logarithmic, first-order polynomial, second-order parabolic and curvilinear) relationship.

The closeness of a relationship defines the degree of the relationship, which shows what proportion of variations in the effect feature is determined by variations in the cause feature. The main indicators for closeness are correlation index R, the coefficient of determination R^2 and correlation coefficient r. The coefficient of determination shows what portion of the overall variation of one feature can be explained by the variation of the other feature. As the value of the indicator is approaching one, the relationship becomes closer. Another way to estimate closeness is the correlation coefficient the application of which is a matter of the type of the relationship – linear or curvilinear – between two variables.

Step 2. To detect stationarity in data on the time series, the Augmented Dickey-Fuller test has been used.

As for this step, any effects of seasonality are removed with the help of an additive model in which the seasonal component is independent of the overall level of series. Seasonality is removed when time series are non-stationary and are subject to cyclic fluctuations. Time series $I(1)$ must be decomposed into four components (Mimmack *et al.* 2001; Sharma 2010):

$$Y_t = S_t + T_t + C_t + I_t, \quad (1)$$

where: S_t is a seasonal component, T_t is a trend component, C_t is a cyclical component and I_t is an irregular component.

The removal of seasonality from the time series $I(1)$ is likely to affect its stationarity (series becomes stationary). To verify the stationarity of the first-order integrated time series with its removed seasonality component, the ADF criterion must be used.

A number of statistical tests on determining the integration order of a time series have been developed (Brooks 2008). The Augmented Dickey-Fuller (ADF, hereinafter) test (Dickey, Fuller 1981) is a commonly used unit-root test. The purpose of the ADF test is to determine whether the time series is consistent with the $I(1)$ process with a stochastic trend, or if it is consistent with the $I(0)$ process that is stationary with a deterministic trend.

The ADF test involves the following regression:

$$\Delta Y_t = \alpha + \beta \cdot t + \gamma \cdot Y_{t-1} + \delta_1 \cdot \Delta Y_{t-1} + \ldots + \delta_p \cdot \Delta Y_{t-p} + e_t; \quad (2)$$

where: α is an intercept constant, β is the coefficient on a time trend, γ is the coefficient presenting the process root, p is the lag order and e_t is white noise.

The null and alternative hypotheses are written as:

$$H_0 : (\alpha, \beta, \gamma) = (c, 0, 0); \quad (3)$$

$$H_1 : (\alpha, \beta, \gamma) \neq (c, 0, 0). \quad (4)$$

Step 3. To identify the relationship between FDI in the construction sector and construction industry's contribution to GDP, the *Granger* causality test (Granger 1969) has been used.

Testing causality, in the Granger sense, involves using F-tests to examine whether lagged information on variable Y provides any statistically significant information about variable X in the presence of lagged X. If not, then "Y does not Granger-cause X".

The Granger causality test (Granger 1969, 1980) uses regression to find causal relationships between two variables X_t and Y_t. Following Anaman and Osei-Amponsah (2007), Khan *et al.* (2014), Vintila and Gherghina (2013), causal relations between stationary series X_t and Y_t can be established based on the following regression equations:

$$X_t = \alpha_0 + \alpha_1 X_{t-1} + ... + \alpha_p X_{t-p} + \beta_1 Y_{t-1} + ... + \beta_p Y_{t-p} + u_t; \quad (5)$$

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + ... + \alpha_p Y_{t-p} + \beta_1 X_{t-1} + ... + \beta_p X_{t-p} + \varepsilon_t, \quad (6)$$

where u_t and ε_t are uncorrelated error terms.

The F-test (sometimes referred as the Wald test (Djokoto 2014; Nguyen 2011)) has been carried out for the null hypothesis of no Granger causality:

$$H_0 : \beta_1 = \beta_2 = ... = \beta_p = 0 . \quad (7)$$

If F statistic is greater than a certain critical value of F distribution, then, we reject the null hypothesis that Y does not Granger-cause X (Eqn (5)), which means Y Granger-causes X.

3. Analysis of the construction industry in the Baltic States

3.1. Identifying correlation and formulating the regression equation

The present study is based on quarterly time series data covering the time period from 2000 to 2011 for the Baltic States (Lithuania, Latvia and Estonia). The data set of foreign direct investment in construction (mil Euro) and construction's contribution to GDP (mil Euro) has been taken from Statistics Lithuania, the Central Statistical Bureau of Latvia and Statistics Estonia.

To determine the relationship between CFDI and the construction's contribution to the GDP, correlation and regression analysis was performed, and its results are summarised in Table 1.

Table 1 shows that the *Student's* coefficient is 9.9818 and 9.2854 for Lithuania (LT) and Latvia (LV), respectively, while $F > F_{cr}$; the hypothesis that the averages of both samples are reliable when $\alpha = 0.05$ with an error very unlikely is then right. In the case of Estonia (EST) $F < F_{cr}$, the hypothesis that the variances of both samples diverge statistically with an error very likely is wrong (probability of 88.6%).

To verify the significance of the coefficient of determination, the F test (or Fisher's test) is used. Since the actual value of F-statistics – both in the case of Lithuania (2.9901 > 1.6325) and Latvia (6.583 > 1.6325) – is above its theoretical value, the calculated coefficients of determination are significant and the hypothesis about statistical difference between the variances of both samples (with an error very unlikely) is, then, right. In the case of Estonia $F < F_{cr}$, the hypothesis that the variances of both samples differ statistically (with an error rather likely: the probability of 21.79 %) is wrong. Figures 1–3 show a graphic representation of correlations between CFDI and the construction's contribution to the GDP.

In the case of Lithuania (Fig. 1), the coefficient of determination shows that 64.47% of variations in the construction's contribution to the GDP are explained by variations in FDI while the remaining 35.53% of variations are associated with other variables not captured in the model. In the case of Latvia (Fig. 2), 64.44% variations in the construction's contribution to GDP are explained by variations in FDI while the remaining 35.56% of variations are related to other variables not captured in the model. In the case of Estonia (Fig. 3), 71.52% of variations in the construction's contribution to GDP are explained by variations in FDI while the remaining 28.48% of variations are associated with other variables not captured in the model.

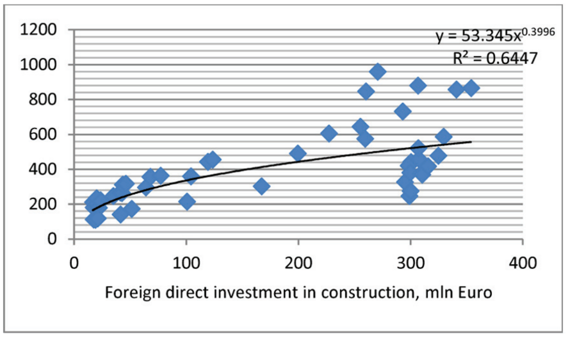

Fig. 1. The correlation between foreign direct investment in construction and value added by the Lithuanian construction sector

Table 1. Estimation results of the relationship between CFDI and the construction's contribution to GDP

Variables	Correlation coefficient, r	Significance of the correlation coefficient		Significance of the determination coefficient	
		Critical *Student* t-value	*Student* t-value	Critical F-value	F-value
CFDI to LT construction GDP	0.70839	2.0129	9.9818	1.6325	2.9901
CFDI to LV construction GDP	0.71087	2.0129	9.2854	1.6325	6.5830
CFDI to EST construction GDP	0.77980	2.0129	–0.1443	1.6325	1.2602

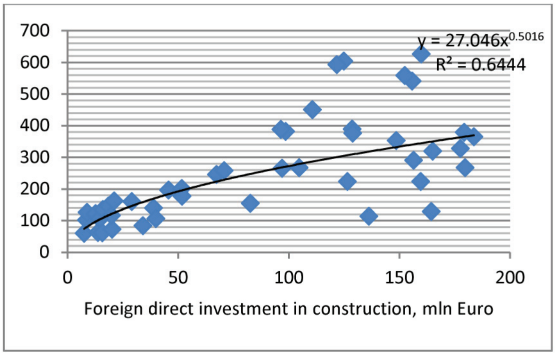

Fig. 2. The correlation between foreign direct investment in construction and value added by the Latvian construction sector

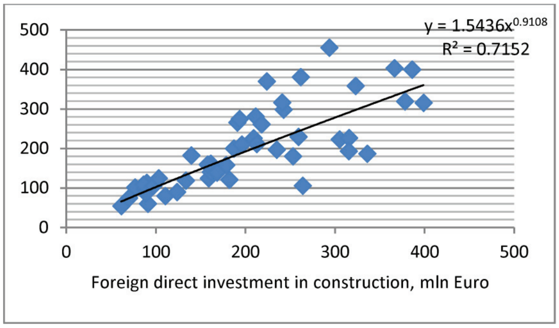

Fig. 3. The correlation between foreign direct investment in construction and value added by the Estonian construction sector

3.2. Verifying the stationarity of variables

The first step in analysis is to verify the time series that are broadly stationary. The process is broadly stationary if (Rackauskas 2003):

$$EY_t^2 < \infty, \text{ for } t \in T; \tag{8}$$

$$EY_t^2 = EY_{0,}; \text{ for } t \in T; \tag{9}$$

$$\mathrm{cov}(t, s) = \mathrm{cov}(t+h, s+h) \text{ for } t, s, h \in T. \tag{10}$$

The next step is time series plots.

Each time series is plotted for a visual assessment of their variation over time. Time series plots help with the preliminary identification of the time-series trend and observation outliers. The charts in Figures 4–6 show the linear growth trend of each time series. It may be assumed that data in question are non-stationary, because the aforesaid stationarity premises are obviously not met.

3.3. Series autocorrelation plots

Autocorrelation functions are formulated for each time series. The charts of the functions make it possible to observe the estimates of the autocorrelation coefficients of

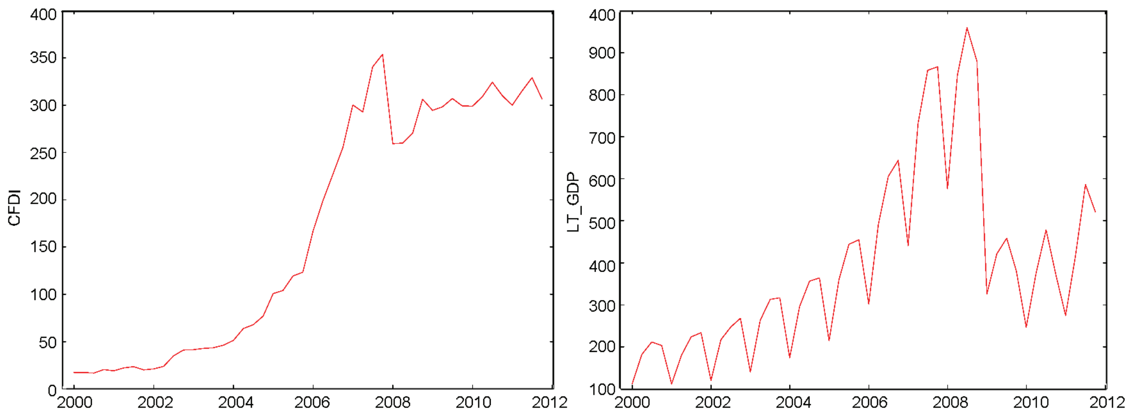

Fig. 4. Time series plots of Lithuania's CFDI and the construction's contribution to GDP

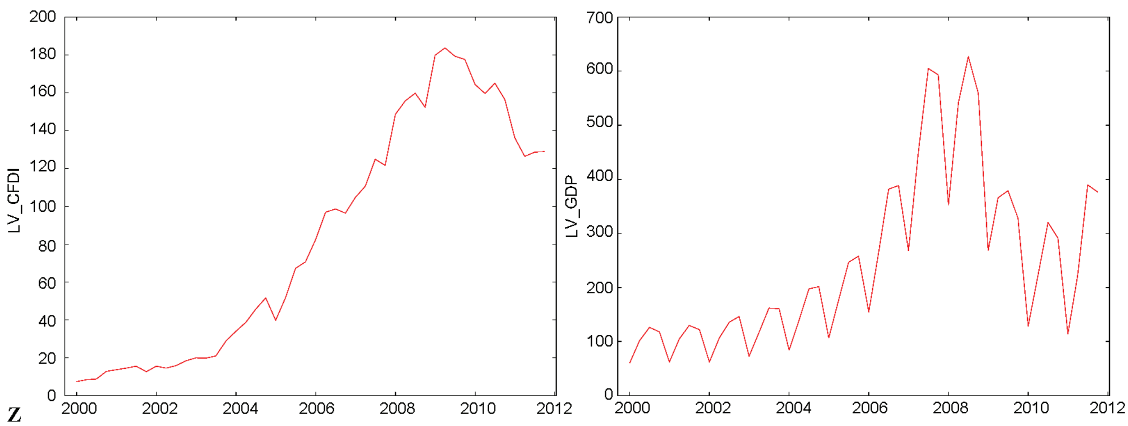

Fig. 5. Time series plots of Latvia's CFDI and the construction's contribution to GDP

Fig. 6. Time series plots of Estonia's CFDI and the construction's contribution to GDP

errors at different lags. If the relationship strength of observations is known, we may make an assumption about the stationarity of the time series.

To choose the number of lags for quarterly data, the following equation is used:

$$\min\left(T-5.14\right)=\min\left(48-5.14\right)=43. \qquad (11)$$

The number of lags calculated by Eqn (11) is used for plotting time-series variations in autocorrelation and partial autocorrelation functions.

Correlograms in Figures 7–9 show that time series are non-stationary, because autocorrelation coefficients are decreasing slowly; in other words, autocorrelation functions "are fading" slowly in all-time series, which means the errors of time series are related.

3.4. First difference transformations of the time series, *I*(1)

Most economic variables are of the first-order integration. A formal proof is to verify the variances of the time series. Let us verify variances *I*(1) and *I*(2); Table 2 shows that standard deviations from time series *I*(1) are lower than those of time series *I*(2).

Table 2. Variance of the time series

Variable *I*(1)	S.D.
d_LT_CFDI	21.2586
d_LT_GDP	147.354
d_LV_CFDI	8.81453
d_LV_GDP	103.548
d_EST_CFDI	25.6461
d_EST_GDP	51.6899
Variable *I*(2)	S.D.
d_d_LT_CFDI	28.8913
d_d_LT_GDP	224.564
d_d_LV_CFDI	11.6475
d_d_LV_GDP	154.309
d_d_EST_CFDI	36.4853
d_d_EST_GDP	73.3901

Time series *I*(1) are plotted in one diagram (Fig. 10). Unlike the original time series, these time series show how an indicator has changed quarter-on-quarter.

The correlograms in Figures 11–13 show that difference transformation made the time series in part stationary. Nevertheless, for all three states, GDP time series (*I*(1)) fail to meet the stationarity criterion, because their

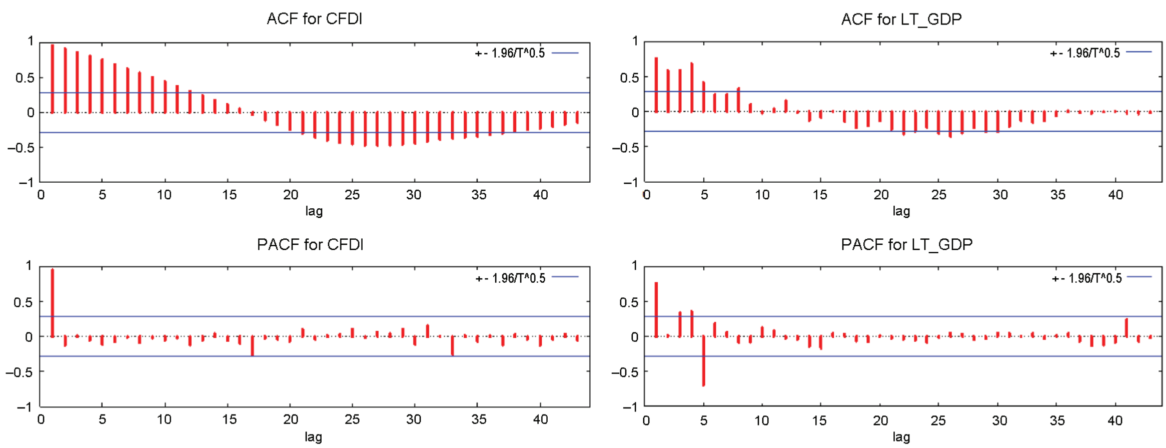

Fig. 7. Plotting the autocorrelation function (ACF) and partial autocorrelation function (PACF) for Lithuania's CFDI and the construction's contribution to GDP

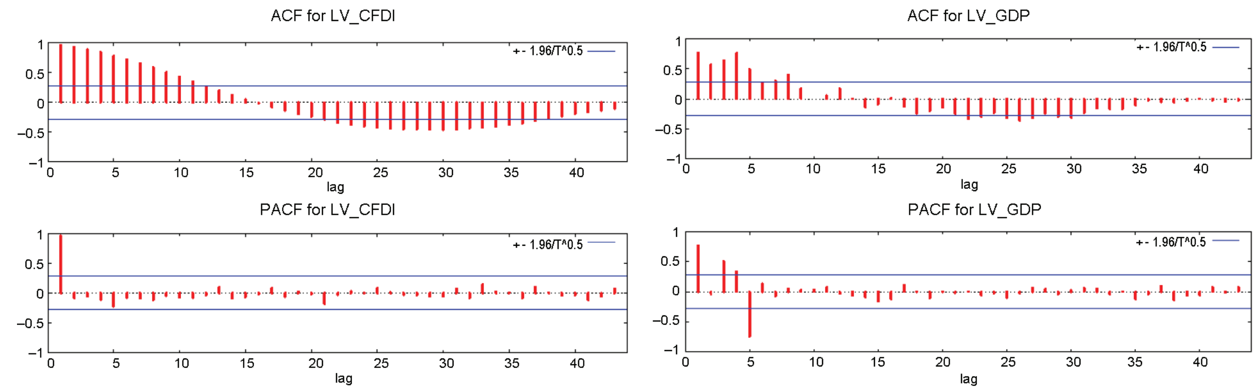

Fig. 8. Plotting the autocorrelation function (ACF) and partial autocorrelation function (PACF) for Latvia's CFDI and the construction's contribution to the GDP

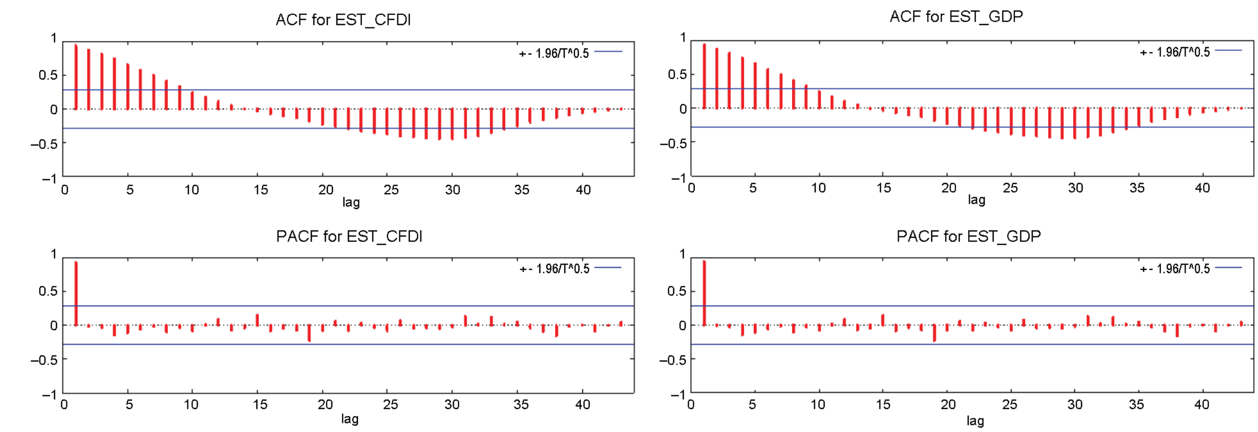

Fig. 9. Plotting the autocorrelation function (ACF) and partial autocorrelation function (PACF) for Estonia's CFDI and the construction's contribution to GDP

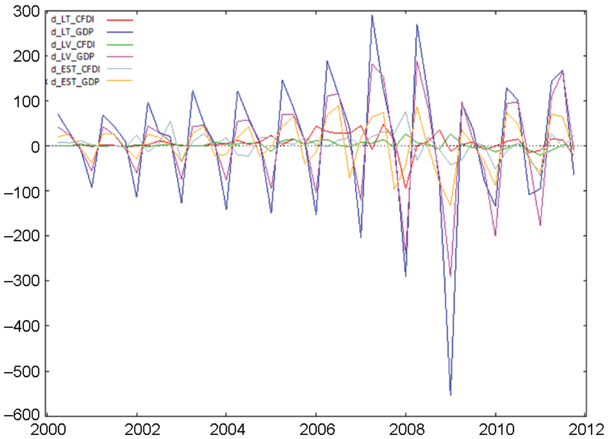

Fig. 10. The chart of the first-order integration time series for CFDI and the construction's contribution to GDP in Lithuania, Latvia and Estonia

autocorrelation coefficients decrease slowly and are outside the range of the autocorrelation function.

Based on the statistics of ADF criterion $Tau(\tau)$ (Table 3), the asymptotic probability of the criterion is $p > 0.05$ for all variables (time series $I(1)$ with seasonality removed); hence, the hypothesis that the unit root exists has not been rejected.

Based on the character of the processes in the non-stationary time series with the unit root, the $\Delta Y_t = Y_t - Y_{t-1}$ process $I(0)$ is difference-stationary if the process of time series Y_t (with unit root) is not stationary. Figure 14 shows non-stationary processes for each time series. Figure 15 shows difference-stationary processes $\Delta Y_t = Y_t - Y_{t-1}$.

Figures 14 and 15 show that the dispersion of difference-stationary processes on the horizontal axis is more random than the dispersion of processes $I(1)$ on the horizontal axis. To verify the stationarity of ΔY_t, the ADF criterion, mentioned before, will be used.

Based on the statistics of ADF criterion $Tau(\tau)$ (Table 4), the asymptotic probability of the criterion is $p < 0.05$ for all processes ΔY_t. Consequently, time series are stationary (with a linear trend).

3.5. Engle-Granger causality criterion

Engle-Granger (hereinafter *EG*) causality is a measure for showing if $CFDI_{t-p}$ has an explanatory effect on the regression equation, i.e. whether $CFDI_{t-p}$ explains GDP_t variations caused by $CFDI_{t-p}$ and GDP_{t-p} variations.

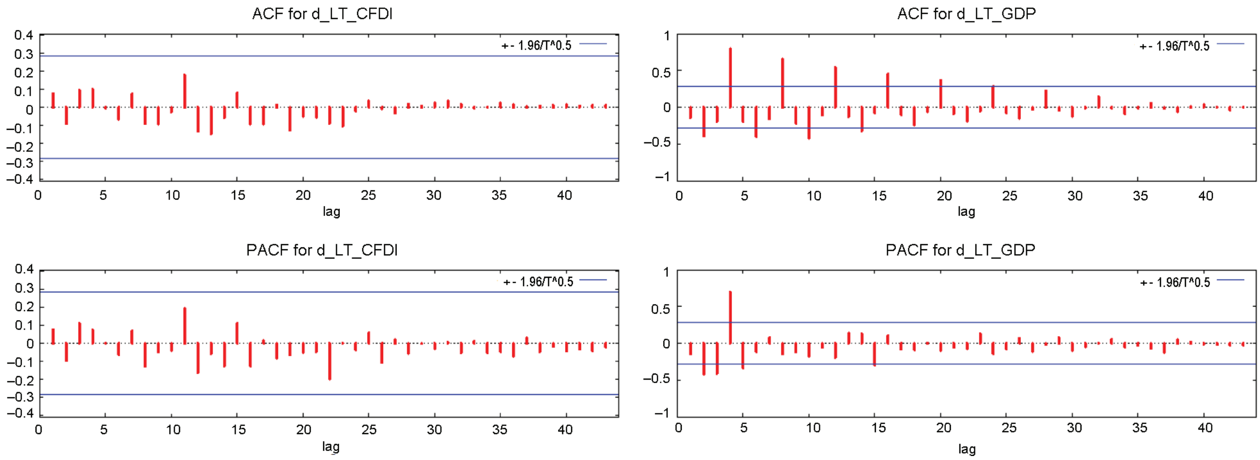

Fig. 11. Time series plots of the first-order integration autocorrelation function (ACF) and partial autocorrelation function (PACF) for Lithuania's CFDI and the construction's contribution to GDP

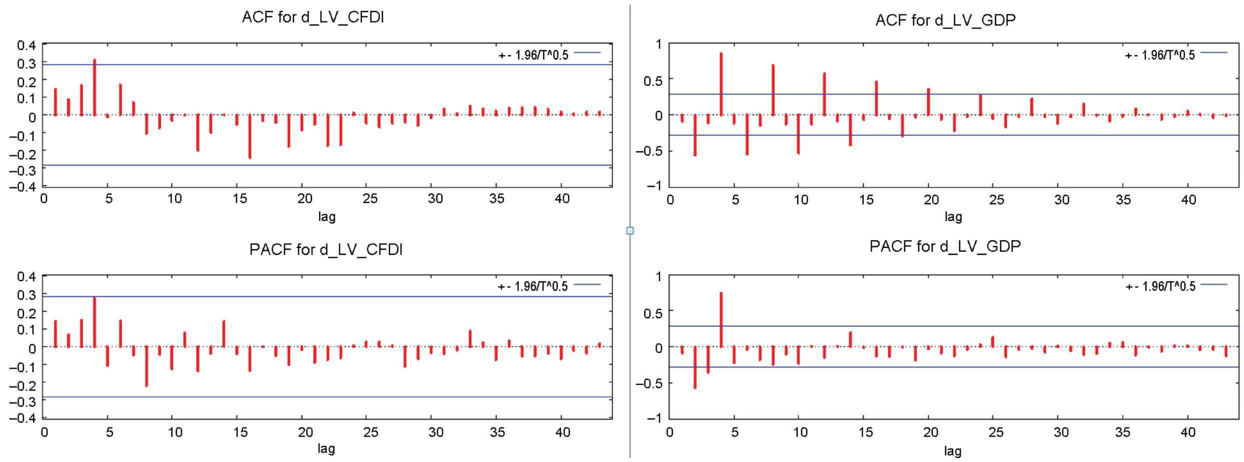

Fig. 12. Time series plots of the first-order integration autocorrelation function (ACF) and partial autocorrelation function (PACF) for Latvia's CFDI and the construction's contribution to GDP

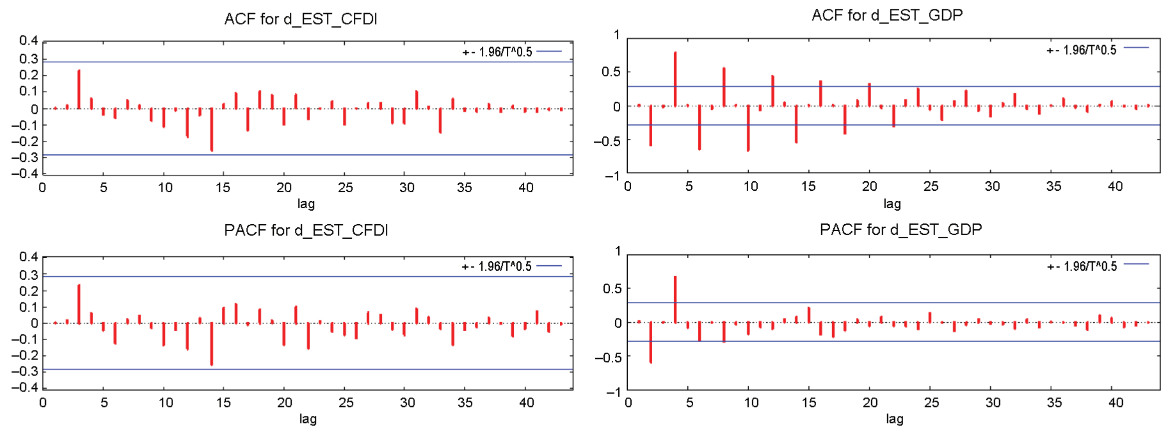

Fig. 13. Time series plots of the first-order integration autocorrelation function (ACF) and partial autocorrelation function (PACF) for Estonia's CFDI and the construction's contribution to GDP

Table 3. ADF test results

Variable	Lag = 4	ADF value	*p*-value	Lag = 4	ADF value	*p*-value	Remarks
LT_CFDI	constant + trend	–1.84	0.683	constant	–1.91	0.325	*I*(1)
LT_GDP	constant + trend	–1.27	0.894	constant	–1.43	0.567	*I*(1)
LV_CFDI	constant + trend	–1.68	0.756	constant	–1.64	0.460	*I*(1)
LV_GDP	constant + trend	–1.79	0.706	constant	–1.74	0.411	*I*(1)
EST_CFDI	constant + trend	–2.51	0.321	constant	–2.61	0.090	*I*(1)
EST_GDP	constant + trend	–0.66	0.974	constant	–1.25	0.653	*I*(1)

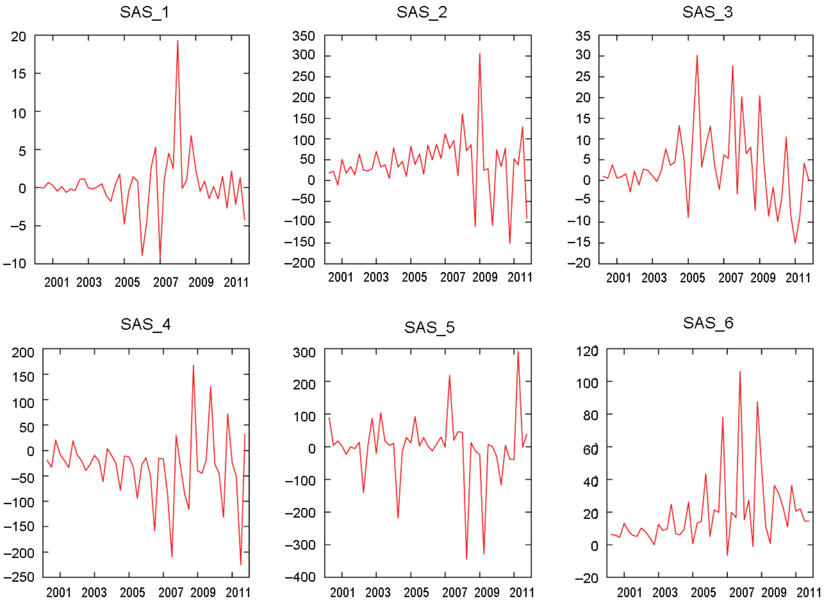

Fig. 14. The non-stationary $Y_t = I(1)$ time series

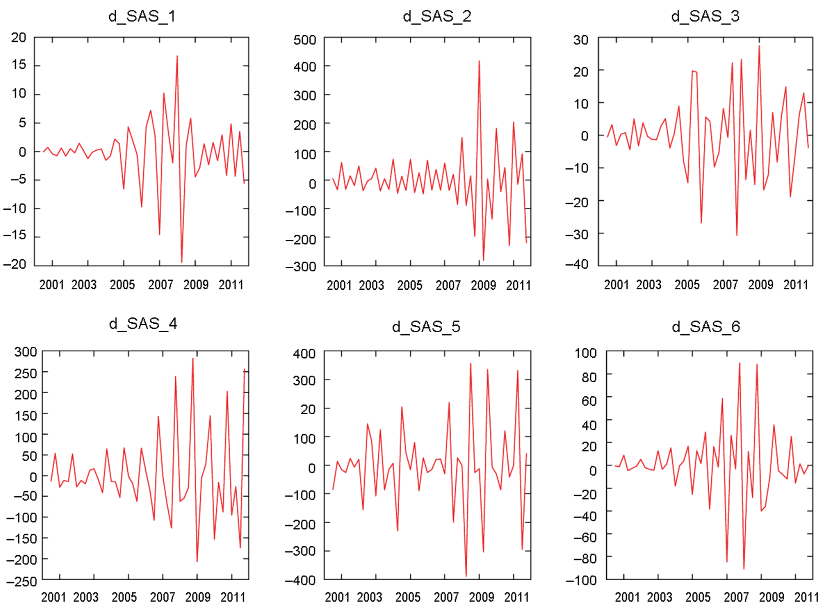

Fig. 15. The stationary $\Delta Y_t = Y_t - Y_{t-1}$ time series

Table 4. Test results of ADF

Variable	Lag = 4	ADF value	*p*-value	Remarks
LT_dCFDI	constant and trend	–8.80	< 0.001	*I*(0)
LT_dGDP	constant and trend	–7.35	< 0.001	*I*(0)
LV_dCFDI	constant and trend	–5.02	< 0.001	*I*(0)
LV_dGDP	constant and trend	–4.00	0.008	*I*(0)
EST_dCFDI	constant and trend	–8.20	< 0.001	*I*(0)
EST_dGDP	constant and trend	–17.02	< 0.001	*I*(0)

Formally, when CFDI_t is not the Granger cause of GDP_t, the following expression is used:

$$E(\text{GDP}_t \mid GDP_{t-1}, CFDI_{t-1}\ CFDI_{t-2}, ..., CFDI_{t-p}) = E(GDP_t \mid GDP_{t-1}), \quad (12)$$

where *p* is the number of lags.

A case of the Engle-Granger test in Lithuania when variables are LT_GDP and LT_CFDI. Let us verify whether some additional information – adding LT_GDP to the regression model – improves LT_CFDI prediction:

$$\text{LT\_CFDI}_t = \beta_0 + \beta_1 \cdot \text{LT}_{\text{CFDI}_{t-1}} + ... + \beta_4 \cdot \text{LT}_{\text{CFDI}_{t-4}} + \gamma_1 \cdot \text{LT}_{\text{GDP}_{t-1}} + ... + \gamma_4 \cdot \text{LT}_{\text{GDP}_{t-4}} + \varepsilon_t, \quad (13)$$

where $p = 4$ is the number of lags, and $\alpha = 0.05$ is the significance level.

Let us verify whether some additional information – adding LT_CFDI to the regression model – improves LT_GDP prediction:

$$\text{LT\_GPD}_t = \beta_0 + \beta_1 \cdot \text{LT}_{\text{GDP}_{t-1}} + ... + \beta_4 \cdot \text{LT}_{\text{GDP}_{t-4}} + \gamma_1 \cdot \text{LT}_{\text{CFDI}_{t-1}} + ... + \gamma_4 \cdot \text{LT}_{\text{CFDI}_{t-4}} + \varepsilon_t. \quad (14)$$

In the case of Lithuania (Table 5), regression equations used for calculating cointegration were statistically insignificant because the asymptotic *p*-value of the *Student t*-value was outside the significance range, as $p > 0.05$ in CFDI and GDP equations.

For the constant, $p = 0.92$ and $p = 0.90$, and for the parameters of the exogenous variable, $p = 0.35$ in both equations. However, in the case of errors in the model, the hypothesis about the existence of the unit root has been rejected, i.e. *I*(0) is met because $p = 0.001 < 0.05$ in both equations. The conclusion regarding errors in the model is one of the assumptions about the cointegration of variables.

A case of the Engle-Granger test in Latvia when variables are LV_GDP and LV_CFDI. Let us verify whether some additional information – adding LV_GDP to the regression model – improves LV_CFDI prediction:

$$\text{LV\_CFDI}_t = \beta_0 + \beta_1 \cdot \text{LV}_{\text{CFDI}_{t-1}} + ... + \beta_4 \cdot \text{LV}_{\text{STUI}_{t-4}} + \gamma_1 \cdot \text{LV}_{\text{GDP}_{t-1}} + ... + \gamma_4 \cdot \text{LV}_{\text{GDP}_{t-4}} + \varepsilon_t, \quad (15)$$

where $p = 4$ is the number of lags, and $\alpha = 0.05$ is the significance level.

Let us verify whether some additional information – adding LV_CFDI to the regression model – improves LV_GDP prediction:

$$\text{LV\_GDP}_t = \beta_0 + \beta_1 \cdot \text{LV}_{\text{GDP}_{t-1}} + ... + \beta_4 \cdot \text{LV}_{\text{GDP}_{t-4}} + \gamma_1 \cdot \text{LV}_{\text{CFDI}_{t-1}} + ... + \gamma_4 \cdot \text{LV}_{\text{CFDI}_{t-4}} + \varepsilon_t. \quad (16)$$

In the case of Latvia (Table 6), both regression equations used for calculating cointegration were statistically significant, because the asymptotic probability of the *Student t*-value was $p < 0.05$ (without a constant), i.e. in the case of the parameters of the exogenous variable, $p = 0.001 < 0.05$ in both equations. In the case of the GDP equation, though, the hypothesis about the existence

Table 5. Results of *EG* cointegration tests for Lithuania

	Student t-value	*p*-value	R^2	Std. error	Remarks
Dependent variable: LT_CFDI					
const	–0.09	0.92	0.019	< 0.001	Cointegrated
LT_GDP	0.93	0.35			
Dependent variable: LT_GDP					
const	–0.12	0.90	0.019	< 0.001	Cointegrated
LT_CFDI	0.93	0.35			

Table 6. Results of *EG* cointegration tests for Latvia

	Student's t-value	*p*-value	R^2	Std. error	Remarks
Dependent variable: LV_CFDI					
const	0.03	0.971	0.29	0.001	Cointegrated
LV_GDP	–4.29	< 0.001			
Dependent variable: LV_GDP					
const	0.08	0.936	0.29	0.063	Not cointegrated
LV_CFDI	–4.29	< 0.001			

Table 7. Results of *EG* cointegration tests for Estonia

	Student's t-value	*p*-value	R^2	Std. error	Remarks
Dependent variable: EST_CFDI					
const	–0.05	0.960	< 0.001	0.004	Cointegrated
EST_GDP	0.18	0.850			
Dependent variable: EST_GDP					
const	0.03	0.969	< 0.001	0.006	Cointegrated
EST_CFDI	0.18	0.850			

of the unit root for errors in the model has not been rejected because $p = 0.063 > 0.05$. Only in the CFDI equation, errors meet the *I*(0) definition. It may be assumed, then, that GDP is the Granger cause of CFDI.

A case of the Engle-Granger test in Estonia when variables are EST_GDP and EST_CFDI. Let us verify whether some additional information – adding EST_GDP to the regression model – improves EST_CFDI prediction:

$$\text{EST\_CFDI}_t = \beta_0 + \beta_1 \cdot \text{EST}_{\text{CFDI}_{t-1}} + ... + \beta_4 \cdot \text{EST}_{\text{STUI}_{t-4}} + \gamma_1 \cdot \text{EST}_{\text{GDP}_{t-1}} + ... + \gamma_4 \cdot \text{EST}_{\text{GDP}_{t-4}} + \varepsilon_t, \quad (17)$$

where $p = 4$ is the number of lags, and $\alpha = 0.05$ is the significance level.

Let us verify whether some additional information – adding EST_CFDI to the regression model – improves EST_GDP prediction:

$$\text{EST\_GDP}_t = \beta_0 + \beta_1 \cdot \text{EST}_{\text{GDP}_{t-1}} + ... + \beta_4 \cdot \text{EST}_{\text{GDP}_{t-4}} + \gamma_1 \cdot \text{EST}_{\text{CFDI}_{t-1}} + ... + \gamma_4 \cdot \text{EST}_{\text{CFDI}_{t-4}} + \varepsilon_t. \quad (18)$$

In the case of Estonia (Table 7), the regression equations that were used for calculating cointegration were statistically insignificant because the asymptotic *p*-value of the *Student t*-value was outside the significance range, as $p > 0.05$ in CFDI and GDP equations.

For the constant, $p = 0.96$ and $p = 0.969$, and for the parameters of the exogenous variable, $p = 0.85$ (in both equations). Nevertheless, in the case of errors in the model, the hypothesis about the existence of the unit root has been rejected, i.e. *I*(0) is met because $p < 0.05$ (in both equations). The conclusion regarding errors in the model is one of the assumptions about the cointegration of the variables.

Conclusions

The analysis of literature suggests that the construction industry plays an important role in national economies; the industry makes a huge effect on a country's economy, its business activities are critical in efforts to achieve the country's social and economic development goals and contribute to infrastructure and attempts to cut unemployment.

The study has empirically researched the effects of foreign direct investment in construction on a rise in the construction industry, and how it has affected the growth of the economies of the Baltic States. In order to determine the relationship between foreign direct investment in construction and the added value of the construction sector, the correlation coefficient has been calculated and regression equations have been formulated. All three Baltic States proved to have a strong correlation between foreign direct investment in construction and value added by the construction sector. In the case of Lithuania, the coefficient of determination shows that 64.47% of variations in the construction's contribution to GDP are explained by variations in FDI, while the remaining 35.53% is the result of the influence of other variables not included in the model. In the case of Latvia, 64.44% of variations in the construction's contribution to GDP are explained by variations in FDI, while the remaining 35.56% is the result of the influence of other variables not included in the model. In the case of Estonia, the coefficient of determination recorded the highest value (71.52%). The remaining 28.48% of variations are the result of the influence of other variables not included in the model.

To make a statistical assessment of Granger causality relationships between foreign direct investment in construction and value added by the construction sector, the Granger causality procedure has been employed. In the cases of Lithuania and Estonia, foreign direct investment in construction is not the Granger cause of value added regarding a growth in the construction sector; conversely, value added by the construction sector is not the Granger cause of FDI into the sector. It turns out that a growth in the construction sector is not a precondition for attracting FDI to the sector. Thus, a growth in the construction sector may be pursued for reasons other than attracting FDI. Following from the above, the Government requires stimuli other than FDI to induce a growth in the construction sector. There are several market development opportunities for the building retrofit. State and local governments operate numerous facilities, including office buildings, public education and healthcare buildings. Many of these facilities are old, energy inefficient, have poor operational efficiency and suffer from health and safety deficiencies. Moreover, there is an ongoing need to improve the structural and thermal efficiency of the residential building stock, whilst Lithuania, Latvia and Estonia have the highest rate of construction within the 'modern' period (1961–1990). State subsidies and other financing incentives can be used by building and apartment owners for financing renovations leading to energy performance, e.g. the Programme for the Refurbishment

(Modernisation) of Apartment Buildings approved by the Lithuanian government in 2004, investments of 348 mil. Euros in 2012–2015 and 724 mil. Euros in 2016–2020 are planned for the refurbishment (Government of the Republic of Lithuania 2013). Municipalities and other local authorities provide and maintain social housing in their area; therefore, retrofit, repair and new social housing construction may stimulate local economic development. In the case of Latvia, it has been established that foreign direct investment in construction is not the Granger cause of value added by the construction sector, but once the variables are switched, it may be assumed that value added by the construction sector is the Granger cause of foreign direct investment in construction. This implies that a growth in the construction sector has a positive impact on FDI flows into the sector. *Therefore*, if the Latvian *government* seeks to attract such FDI, stronger international policy coordination is needed. All three Baltic States face the challenge of renewing their ageing infrastructure such as developing new high-performance and cost-effective buildings at the same time. This will be a significant multi-year issue that supports and stimulates economic activity.

References

Abdel-Wahab, M.; Vogl, B. 2011. Trends of productivity growth in the construction industry across Europe, US and Japan, *Construction Management and Economics* 29(6): 635–644. http://dx.doi.org/10.1080/01446193.2011.573568

Anaman, K. A.; Osei-Amponsah, C. 2007. Analysis of the causality links between the growth of the construction industry and the growth of the macro-economy in Ghana, *Construction Management and Economics* 25(9): 951–961. http://dx.doi.org/10.1080/01446190701411208

Bennett, R. 2005. Marketing policies of companies in a cyclical sector: an empirical study of the construction industry in the United Kingdom, *Journal of Business & Industrial Marketing* 20(3): 118–126. http://dx.doi.org/10.1108/08858620510592731

Bevan, A. A.; Estrin, S. 2004. The determinants of foreign direct investment into European transition economies, *Journal of Comparative Economics* 32(4): 775–787. http://dx.doi.org/10.1016/j.jce.2004.08.006

Brooks, C. 2008. *Introductory econometrics for finance*. 2nd ed. Cambridge: Cambridge University Press. 674 p.

Brown, L. C.; Berthouex, P. M. 2002. *Statistics for environmental engineers*. 2nd ed. Boca Raton: CRC Press. 512 p.

Carassus, J. 2004. From the construction industry to the construction sector system, in J. Carassus (Ed.). *The construction sector system: an international comparison*. Report by CIB W55-W65 Construction Industry Comparative Analysis Project Group, CIB Publication 293. CIB Rotterdam, 5–18.

CBI. 2012. *Bridging the gap: Backing the construction sector to generate jobs*. Business environment directorate, CBI (Confederation of British Industry) [online], [cited 7 June 2013]. Available from Internet: http://www.cbi.org.uk/media/1547179/bridging_the_gap_-_backing_the_construction_sector_to_generate_jobs.pdf

Choe, J. I. 2003. Do foreign direct investment and gross domestic investment promote economic growth?, *Review of Development Economics* 7(1): 44–57. http://dx.doi.org/10.1111/1467-9361.00174

Cohen, J.; Cohen, P.; West, S. G.; Aiken, L. S. 2003. *Applied multiple regression/correlation analysis for the behavioral sciences*. 3rd ed. Mahwah: L. Erlbaum Associates. 736 p.

Crosthwaite, D. 2000. The global construction market: a cross-sectional analysis, *Construction Management and Economics* 18(5): 619–627. http://dx.doi.org/10.1080/014461900407428

Crowe, C.; Dell'Ariccia, G.; Igan, D.; Rabanal, P. 2013. How to deal with real estate booms: lessons from country experiences, *Journal of Financial Stability* 9(3): 300–319. http://dx.doi.org/10.1016/j.jfs.2013.05.003

Dickey, D. A.; Fuller, W. A. 1981. Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica* 49(4): 1057–1072. http://dx.doi.org/10.2307/1912517

Djokoto, J. G. 2014. Inward foreign direct investment flows, growth, and agriculture in Ghana: A Granger causal analysis, *International Journal of Economics and Finance* 3(6): 188–197. http://dx.doi.org/10.5539/ijef.v3n6p188

Égert, B.; Martin, R. 2008. Real estate, construction and growth in Central and Eastern Europe: Impact on competitiveness, *Focus on European Economic Integration* 2: 52–72.

EISC. 2012. *Construction sector overview in the UK*. European Information Service Centre Ltd. [online], [cited 10 May 2014]. Available from Internet: http://www.prismenvironment.eu/reports_prism/UK_PRISM_Environment_Report_EN.pdf

Estrin, S.; Uvalic, M. 2014. FDI into transition economies, *Economics of Transition* 22(2): 281–312. http://dx.doi.org/10.1111/ecot.12040

Engle, R. E.; Granger, C. W. J. 1987. Cointegration and error correction: Representation, estimation and testing, *Econometrica* 55(2): 251–276.

European Investment Bank. 2013. *Investment and investment finance in Europe*. A. Kolev; T. Tanayama; R. Wagenvoort (Eds). Economics Department, EIB [online], [cited 8 September 2013]. Available from Internet: http://www.eib.org/attachments/efs/investment_and_investment_finance_in_europe_en.pdf

Giang, D. T. H.; Sui Pheng, L. 2011. Role of construction in economic development: Review of key concepts in the past 40 years, *Habitat International* 35(1): 118–125. http://dx.doi.org/10.1016/j.habitatint.2010.06.003

Gorodnichenko, Y.; Svejnar, J.; Terrell, K. 2014. When does FDI have positive spillovers? Evidence from 17 transition market economies, *Journal of Comparative Economics* 42(4): 954–969. http://dx.doi.org/10.1016/j.jce.2014.08.003

Government of the Republic of Lithuania. 2013. Dėl Lietuvos Respublikos Vyriausybės 2004 m. rugsėjo 23 d. nutarimo Nr. 1213 „Dėl Daugiabučių namų atnaujinimo (modernizavimo) programos ir Valstybės paramos daugiabučiams namams modernizuoti teikimo ir investicijų projektų energinio efektyvumo nustatymo taisyklių patvirtinimo" pakeitimo, *Valstybės žinios*, 2013, Nr. 83-4153 (in Lithuanian).

Granger, C. W. J. 1969. Investigating causal relations by econometric models and cross-spectral methods, *Econometrica* 37(3): 424–438.

Granger, C. W. J. 1980. Testing for causality, a personal viewpoint, *Journal of Economic Dynamics and Control* 2: 329–352. http://dx.doi.org/10.1016/0165-1889(80)90069-X

Grigas, A.; Kasekamp, A.; Maslauskaite, K.; Zorgenfreija, L. 2013. The Baltic States in the EU: yesterday, today and tomorrow, *Studies & Reports No 98,* Notre Europe – Jacques Delors Institute, July 2013 [online], [cited 10 January 2014]. Available from Internet: http://www.notre-europe.eu/media/balticstateseu-grigaskasekampmaslauskaitezorgenfreija-ne-jdi-july13.pdf?pdf=ok

Hansen, H.; Rand, J. 2006. On the causal links between FDI and growth in developing countries, *The World Economy* 29(1): 21–41. http://dx.doi.org/10.1111/j.1467-9701.2006.00756.x

Heckman, N. E.; Zamar, R. H. 2000. Comparing the shapes of regression functions, *Biometrika* 87(1): 135–144. http://dx.doi.org/10.1093/biomet/87.1.135
Jensen, C. 2006. Foreign direct investment and economic transition: Panacea or pain killer?, *Europe–Asia Studies* 58(6): 881–902. http://dx.doi.org/10.1080/09668130600831084
Kaklauskas, A.; Zavadskas, E. K.; Bagdonavicius, A.; Kelpsiene, L.; Bardauskiene, D.; Kutut, V. 2010. Conceptual modelling of construction and real estate crisis with emphasis on comparative qualitative aspects description, *Transformations in Business & Economics* 9(1): 42–61.
Khan, M. A.; Khan, M. Z.; Zaman, K.; Irfan, D.; Khatab, H. 2014. Questing the three key growth determinants: Energy consumption, foreign direct investment and financial development in South Asia, *Renewable Energy* 68: 203–215. http://dx.doi.org/10.1016/j.renene.2014.02.021
Kleinbaum, D. G.; Kupper, L. L.; Nizam, A.; Rosenberg, E. 2014. *Applied regression analysis and other multivariable methods*. 5th ed. Boston: Cengage Learning. 1051 p.
Liu, X.; Burridge, P.; Sinclair, P. J. N. 2002. Relationships between economic growth, foreign direct investment and trade: evidence from China, *Applied Economics* 34(11): 1433–1440. http://dx.doi.org/10.1080/00036840110100835
Lopes, J.; Balsa, C.; Nunes, A. 2011. The long-run relationship between the construction sector and the national economy in Cape Verde, *International Journal of Strategic Property Management* 15(1): 48–59. http://dx.doi.org/10.3846/1648715X.2011.565909
Mimmack, G.; Manas, G.; Meyer, D. 2001. *Introductory statistics for business.* Cape Town: Pearson Education. 570 p.
Misiūnas, A. 2011. Changes of real estate sector in context of economy Lithuania, *Lithuanian Journal of Statistics* 50(1): 49–57 (in Lithuanian).
Nguyen, H. T. 2011. *Exports, imports, fdi and economic growth*. Working Paper No. 11-03. Discussion papers in economics. Department of Economics, University of Colorado at Boulder, Boulder, Colorado [online], [cited 12 May 2014]. Available from Internet: http://www.colorado.edu/economics/papers/wps-11/wp11-03/wp11-03.pdf
Nistorescu, T.; Ploscaru, C. 2010. Impact of economic and financial crisis in the construction industry, *Management & Marketing* 8(1): 25–36.
Öcal, E.; Oral, E. L.; Erdis, E. 2006. Crisis management in Turkish construction industry, *Building and Environment* 41(11): 1498–1503. http://dx.doi.org/10.1016/j.buildenv.2005.05.042
Ofori, G. 2001. Indicators for measuring construction industry development in developing countries, *Building Research & Information* 29(1): 40–50. http://dx.doi.org/10.1080/09613210150208787
Ozkan, F.; Ozkan, O.; Gunduz, M. 2012. Causal relationship between construction investment policy and economic growth in Turkey, *Technological Forecasting and Social Change* 79(2): 362–370. http://dx.doi.org/10.1016/j.techfore.2011.04.007
Puapan, P. 2014. *Assessment of FDI impact on Thailand's production sectors: implications for investment promotion activities.* IDE Discussion Papers No. 443. Institute of Developing Economies, Japan External Trade Organization, Japan [online], [cited 10 September 2014]. Available from Internet: http://ir.ide.go.jp/dspace/bitstream/2344/1297/1/ARRIDE_Discussion_No.443_puapan.pdf
Popescu, G. H. 2014. FDI and Economic Growth in Central and Eastern Europe, *Sustainability* 6(11): 8149–8163. http://dx.doi.org/10.3390/su6118149
Rackauskas, A. 2003. *Basics of econometrics* [online], [cited 1 February 2014]. Available from Internet: http://www.eka.mif.vu.lt/wp-content/uploads/2012/01/Ekapz.pdf (in Lithuanian).
Ramachandra, T.; Rotimi, J. O. B.; Rameezdeen, R. 2013. Direction of the causal relationship between construction and the national economy of Sri Lanka, *Journal of Construction in Developing Countries* 18(2): 49–63. http://dx/doi.org/10.1007/978-3-642-35548-6_128
Ruddock, L.; Lopes, J. 2006. The construction sector and economic development: the 'Bon curve', *Construction Management and Economics* 24(7): 717–723. http://dx.doi.org/10.1080/01446190500435218
Sharma, J. K. 2010. *Fundamentals of business statistics*. 1st ed. New Delhi: Pearson Education. 504 p.
Simelyte, A.; Antanaviciene, J. 2014. Formation of foreign direct investment policy: Case of Estonia, *Inzinerine Ekonomika-Engineering Economics* 25(2): 177–185. http://dx.doi.org/10.5755/j01.ee.25.2.4263
Sommers, J.; Wolfson, C. 2014. Introduction: the Baltics and the political economy of austerity, in J. Sommers, C. Wolfson (Eds). *The contradictions of austerity: the socio-economic costs of the neoliberal Baltic model*. New York: Routledge, Taylor and Francis Group, 11–16.
Staehr, K. 2013. Austerity in the Baltic states during the global financial crisis, *Intereconomics* 48(5): 293–302. http://dx.doi.org/10.1007/s10272-013-0472-9
Stawińska, A. 2010. The EU-27 construction sector: from boom to gloom. Industry, trade and services, *Statistics in Focus* 7: 1–7.
Vintila, G.; Gherghina, S. C. 2013. Board of directors independence and firm value: empirical evidence based on the Bucharest stock exchange listed companies, *International Journal of Economics and Financial Issues* 3(4): 885–900.
Wigren, R.; Wilhelmsson, M. 2007. Construction investments and economic growth in Western Europe, *Journal of Policy Modeling* 29(3): 439–451. http://dx.doi.org/10.1016/j.jpolmod.2006.10.001
Wilkinson, A.; Johnstone, S.; Townsend, K. 2012. Changing patterns of human resource management in construction, *Construction Management and Economics* 30(7): 507–512. http://dx.doi.org/10.1080/01446193.2012.711562
Yiu, C. Y.; Lu, X. H.; Leung, M. Y.; Jin, W. X. 2004. A longitudinal analysis on the relationship between construction output and GDP in Hong Kong, *Construction Management and Economics* 22(4): 339–345. http://dx.doi.org/10.1080/0144619042000176465

Nerija BANAITIENĖ. Associate Professor in the Department of Construction Economics and Property Management at Vilnius Gediminas Technical University. Her research interests include project/risk management, total quality management, building life cycle analysis, multiple criteria decision making: applications in construction.

Audrius BANAITIS. Professor in the Department of Construction Economics and Property Management at Vilnius Gediminas Technical University. His research interests include project/risk management and project success, property management, sustainability and construction industry development, multiple criteria decision making: applications in construction.

Mindaugas LAUČYS. Lecturer in the Department of Construction, Deputy Director for Infrastructure at Klaipeda State College. His research interests include construction economics, concrete construction methods and materials, sustainable construction, construction design management.