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A causal relationship between foreign direct investment, economic growth and export for Slovakia

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Abstract

The aim of this paper is to analyse the relation between foreign direct investment, economic growth and export in Slovakia. Estimation of effects on economic growth was performed for Slovakia in the period 2001-2010. The co-integration method and vector error correction model were applied on quarterly data. The results confirm the existence of long-term causal links between variables studied in Slovakia. We reveal a positive impact of foreign direct investment and positive impact of export on gross domestic product. On the basis of the research method and by means of available time series, the generally accepted opinion about the foreign direct investment positive effect on economic growth of a country was proved.

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Keywords: foreign direct investment; economic growth; export

1. Introduction

The paper is aimed to analyze long-term causal relations between foreign direct investment (FDI), economic growth and export. It is assumed that there might be a long-term link between these variables. Foreign direct investment and export are considered to be the determinant for economic growth. Export and growth of economy openness might lead to the growth of output level and increase of economy growth. As stated in theory, it is the foreign direct investment that contributes to the export performance increase of a country. Such

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effect happens when we speak about the export oriented FDI. In addition, positive impact on the economy growth of a country is attributed to the foreign direct investment according to the theory. These facts are pointed out by, for example Dritsaki et al., 2004, Feridun and Sissooko, 2011 and Pacheco-Lopéz, 2005.

The paper is divided into six chapters. First chapter is the introduction. The second chapter is aimed at the relevant bibliography overview. A model used and data are specified in the third chapter. The fourth chapter deals with the long-term links model between foreign direct investment, export and gross domestic product. The fifth chapter is about the vector error correction model. The last chapter includes causal relation model results between selected variables.

2. Literature overview

There is a series of empirical studies examining FDI effects on economic growth and export and relations between these variables. Such effects are examined by various approaches. The results of individual studies vary, which depends on the period selected, data processed, other variables included in the model or it depends on the econometric methods. Regression analysis, panel data analysis as well as VAR autoregressive model are used in order to examine relationships among the given variables. The results of selected relevant studies are cited in this chapter.

Regression analysis was used to examine the relationships between FDI, economic growth and export in the study by Borensztein et al., 1998. The research was implemented for 69 developing countries and for a period of 20 years. They found a positive impact of foreign direct investment on economic growth. VAR autoregressive model was used to examine the relationships between foreign direct investment, economic growth and export in the study by Dritsaki et al., 2004. The research was performed for Greece by means of annual data during1960 – 2002. The results of study point out the two-way relationship between export and economic growth. Moreover, the impact of foreign direct investment on export, as well as on economic growth in Greece was proven. Fabry, 2001 researched the relationship between foreign direct investment, economic growth and export by means of Johansen co-integration test and Granger causality test. The research was performed on a sample of countries from Central and Eastern Europe. According to the research, the impact of foreign direct investment on economic growth was proved in Albania and Russia. On the contrary, the impact of economic growth on foreign direct investment was proved in case of Hungary, Poland and Romania. The author states at the end of the research that export has stronger impact on the economic growth than it has on foreign direct investment in Central and Eastern Europe and, on the contrary, the impact of foreign direct investment on export has not been proved by the research in countries of Central and Eastern Europe. Pelinescu and Radulescu, 2009 deal with impact of foreign direct investment on economic growth in Romania. They use data of gross domestic product, foreign direct investment and export, which are quarterly calculated by logarithm and they are season adjusted, for the period 2001 – 2009. For this purpose they used VAR autoregressive model. In the study they conclude that FDI have slight, however positive influence on both the gross domestic product and export. Furthermore they state that in order to have stronger positive FDI impact on economic growth and export it is necessary to use longer time interval. Iqbal et al., 2010 examined impact of foreign direct investment on economic growth and export in Pakistan. For this purpose was used VAR autoregressive model. The empirical analysis was carried out with quarterly data for period 1998 – 2009. The results of research confirmed positive effect of foreign direct investment on export and economic growth in Pakistan.

3. Data and specification of the model

Dritsaki et al., 2004 use the above mentioned study from the methodology point of view of the causal relations model between foreign direct investment, economic growth and export. Causal relation between the variables shall be examined by VAR autoregressive model in the following form:

$$GDP = f(FDI, EXP) \tag{1}$$

Individual variables in an equation are:

- GDP = gross domestic product
- FDI = foreign direct investment
- EXP = export

Foreign direct investment defines the FDI stock in a country. Gross domestic product is expressed in market prices. Export represents the export of goods and services at regular prices. Each data is in million EUR. Model is tested on quarterly data for the period of Q2. 2001 – Q4. 2010.

The data describing gross domestic product and export are obtained from EUROSTAT. The data on FDI stock are gained from the central bank of the Slovak Republic. Gross domestic product and export are season clear. Season clear series is marked with "sa" at the end of the time series' title. Individual data were calculated by logarithm before the testing. Calculation by logarithm was performed for the purpose of the time series smaller dispersion and consequently to ensure stationarity of the time series. Individual time series calculated by logarithm are market with capital letter "L" before the each time series' title.

3.1. Unit root test

In order to perform cointegration that shall be used to test the long-term causal relations between selected variables it is necessary for the logarithmized time series being stationary on the first differences I(1) and nonstationary on its own values. Stationarity test is performed by Augmented Dickey – Fuller test (ADF test). Lag length of the time series in the ADF test was based on the Schwarz criterion. According to the development of logarithm adjusted data, a test stationary equation included a coefficient in case of FDI and EXP and it included a trend coefficient in case of gross domestic product. This is demonstrated by the following equation:

$$\Delta X_t = \delta_0 + \delta_1 t + \delta_2 X_{t-1} + \sum_{i=1}^{k} \alpha_i \Delta X_{t-i} + u_t \tag{2}$$

ADF test is used to determine a unit root X_t on the level of each variable calculated by logarithm in time *t*. Variable ΔX_{t-i} determines the first difference with lag length and u_t suggests the autocorrelation of the error. Coefficients δ_0, δ_1, δ_2 and α_i are suggested. Null and alternative hypothesis for the existence of a unit root in variable X_t is: H_0: $\delta_2 = 0$, H_e: $\delta_2 < 0$, Dickey and Fuller, 1979.

Results of ADF test are shown in Table 1. The first part of the table contains of data showing the value of tested non-stationary time series at their values, and the second part of the table records data indicating the stationary of time series at first differences. The assumption for further test and research of long term relationships between specified variables is met since the time series stationarity was proved in the first differences.

Table 1. ADF Unit root tests

	Levels		1st differences	
	Lagged	Test statistic ADF	Lagged	Test statistic ADF
LEXP_sa	9	(-0.985)	9	(-3.720)[a]
LFDI	9	(-2.861)	9	(-6.748)[a]
LGDP_sa	9	(-0.655)	9	(-4.046)[b]

Note: "a", "b" denote significance at 1 % and 5 % respectively

4. Long term relationship test between FDI, GDP and EXP

Johansen test for co-integration was used to test long term relationships between FDI, GDP and EXP. It is necessary to define appropriate time lag length within this test. Here, an Akaike criterion was used while determining the appropriate lag length, which was applied for the non-differentiated VAR model estimation. Two periods with an appropriate lag length was proved. Long term relationships test between FDI, GDP and EXP was performed on the basis of the following equation (3):

$$LGDP\_sa = \alpha + \beta_1 LFDI + \beta_2 LEXP\_sa + \mu \quad (3)$$

The dependent variable is gross domestic product and independent variables are foreign direct investment and export. Long term relationships between variables in Johansen test are examined on the basis of two test, and that is a Trace test and Max-eigenvalue test. Cointegration test results are shown in Table 2. We argue that the existence of long-term relationship was established between the variables and the cointegration link was found.

Table 2. Johansen co-integration test

Null Hypothesis	Trace Statistic	Critical Values 0.05	Max-Eigen Statistic	Critical Values 0.05
r=0	38.65633	35.19275	22.70358	22.29962
r<=1	15.95274	20.26184	11.13284	15.89210
r<=2	4.819906	9.164546	4.819906	9.164546

Cointegration equation has the following form:

$$LGDP\_sa = \underset{(0.063)}{0.074} LFDI + \underset{(0.080)}{0.731} LEPX\_sa + \underset{(0.201)}{2.047} \quad (4)$$

The above equation shows that if the FDI increases by 1 % then there is a growth in gross domestic products of 0.074 % and if EXP increases by 1 % there is an increase in gross domestic products of 0.731 %.

5. Vector error correction model

Cointegration test demonstrated that there is long term dependence between those variables. However, cointegration is leaving aside the possibility of the short-term fluctuations between the two examined variables.

The vector error correction model (VECM) is used for detection of these fluctuations during cointegration. Vector error correction model is ad adequate tool to analyze short-term deviations, necessary to achieve long-term balance between the two variables, Cipra, 2008. Vector error correction model has the following form:

$$\Delta LGDP_t = lagged(\Delta LGDP, \Delta LFDI_t, \Delta LEXP_t) + \lambda u_{t-1} + V_t \quad (5)$$

where lagged represents a certain number of delays explaining variables. The optimal number of delays is determined by Akaike criteria. Δ means the first difference of the variable, u_{t-1} is the estimated residual components of the long-term relationship, determined from cointegration test $1 < \lambda < 0$ is the rate of return to long-term balance and V_t is a random component of white noise. Appropriate adjustment of the model was tested by several tests of residual components. Specifically, it was a test of autocorrelation (LM-test, which is based on Lagranger´s multiplier) test of normality and heteroscedasticity test. Testing ruled out the existence of all three events and confirmed that the model is properly chosen. The result of an vector error correction model is depicted in Table 3:

Table 3. Vector error correction model

Variables	D(L_GDP_sa)
CointEq1	-0.331[a]
	(-3.885)
D(L_GDP_sa(-1))	-0.220
	(-1.448)
D(L_GDP_sa(-2))	-0.241
	(-1.610)
D(L_PZI_(-1))	-0.090
	(-1.681)
D(L_PZI(-2))	0.082
	(1.561)
D(L_EXP_sa(-1))	0.159
	(2.188)
D(L_EXP_sa(-2))	-0.002
	(-0.030)
C	0.036
	(4.237)
R-squared	0.708
Adj. R-squared	0.628
Sum sq. resids	0.006
S.E. equation	0.015
F-statistic	9.461

Note: “a”, “b” denote significance at 1 %, values authoritative deviations are in parenthesis

In case of Slovakia and GDP dependent, the results of adjusted coefficient are high and they 33.1 % of short term deviations from the balance condition are adjusted by changes in the model dependent variable with the

lag length of two quarters. The result is that the rate of convergence towards the balance condition is very satisfying in this case.

6. Conclusion

This paper examines the causal relationship between foreign direct investment, gross domestic product and export in Slovakia. The research used quarterly data of the years 2001 – 2010. First, the data were adjusted for the calculations. Gross domestic product and export were seasonally adjusted. Subsequently, they were used for initial testing and testing for stationarity. Test results showed that all three time series are stationary up to its first difference. This result enabled a continuance with further research and after finding the time lag the cointegration Johansen test was carried. The test has demonstrated positive long-term relationship between variables. Cointegration equation had shown a positive relationship between foreign direct investment and gross domestic product and between export and gross domestic product. This fact demonstrates the generally accepted argument that foreign direct investment is a positive force for the economic growth of the country and in small open economy export encourages economic growth. As a last step of research vector error correction model was carried out. This explains the approximate 33 % rate of convergence to long-term equilibrium relation to formation of short-term shocks. The result is that the rate of convergence towards the balance condition is very satisfying in this case.

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