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Foreign direct investment, exports and economic growth: evidence from two panels of developing countries

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ABSTRACT

The purpose of this article is to examine the causal relationship between foreign direct investment (FDI), exports and economic growth in two panels of developing countries (eight European developing countries and eight Asian developing countries). Panel-VECM causality is employed for investigating a tri-variate model of FDI, exports and GDP. Causality results in the European developing panel indicate bidirectional causality between GDP and FDI, and unidirectional causality from GDP and FDI to exports in the short-run. The empirical results of the Asian developing panel indicate bidirectional causality between exports and economic growth in the short-run. Moreover, there is evidence of long-run causality from export and FDI to economic growth, and long-run causality from economic growth and export to FDI for both of the aforementioned panels.

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1. Introduction

The relationship between foreign direct investment (FDI), exports and economic growth is an important issue among economists and many of the researchers who are studying in the field of international economics. Revealing this relationship is more important for developing countries, as they suffer more from economic problems. FDI was the principal source of flow to developing countries in 1990. Unlike other capital flows, FDI has a fewer degrees of volatility and does not follow a pro-cyclical behaviour. The FDI inflows have increased rapidly since the late 1980s and the 1990s almost worldwide. This issue makes it necessary to reveal the costs and benefits of FDI inflows (Acaravci & Ozturk, 2012).

According to the World Trade Organization's (WTO) definition, FDI occurs when an investor based in one country (the home country) acquires an asset in another country (the host country) with the intent to manage that asset. The management dimension is what distinguishes FDI from portfolio investment in foreign stocks, bonds and other financial instruments. According to one of the major conferences, 'Brussels Declaration and Programme of Action for the LDCs' (BPoA), which has been organised by the United Nations on less

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developed countries (LDC) over the last three decades, FDI inflows are one of the basic policies for supporting development and economic growth in LDCs. The BPoA states that foreign demand for exports is more critical for economic growth than the domestic demand. Moreover, FDI is a major source of finance and can facilitate the entrance of technology from advanced and developed countries to the host developing country and through this channel the host country will be able to compete in international markets (Tekin, 2012). Also, in a Keynesian national accounts framework, net export represents external demand for the country's output, what can lead to the improvement of real output. To summarise, there are different channels between exports/FDI and growth, which introduced export-led and FDI-led growth hypothesis. Based on this hypothesis outward-looking economies can experiment higher growth rates. FDI enhances the efficiency of production and can promote specialisation and productivity in the host country (Xing & Pradhananga, 2013). Moreover, FDI improves employment, job skills, managerial expertise, export markets and tax revenues.

With this viewpoint, this article aims to survey the causal relationship between FDI, exports and economic growth for two panels of developing countries (seven European developing countries and eight Asian developing countries) by employing panel-VECM causality. To this end, the rest of the article is organised as follows: Section 2 reviews a summarisation of empirical studies concerning this issue, Section 3 discusses the model and the data, Section 4 presents the methodology and empirical results and finally in Section 5 we will conclude and propose policy implications.

2. Literature review

Despite the multitude of studies about the relationship between FDI, exports, and economic growth, there are no common consensuses regarding this issue between different studies, so working on this issue is still required. The absence of common consensus can be due to the different time periods, countries and econometric method employed in these studies.

Nath (2009) employed a fixed effect panel data approach to examine the effects of trade and FDI on the growth of per capita real GDP in 13 transition economies of Central and Eastern Europe and the Baltic region from 1991 to 2005. He found a significant positive effect of trade on growth, but FDI has had no significant impact on growth in these transition economies. However, when controlling the effects of domestic investment and trade on FDI, Nath expressed that it appears to be a significant determinant of growth for the period after 1995.

The study of Katircioglu (2009) investigates the causality relationship between FDI inflows and economic growth for turkey over 1970 to 2005 years by employing ARDL-Bounds test and Granger causality test. When real GDP is the dependent variable, the Bounds test suggests the existence of a level relationship between real GDP and FDI. The results of causality indicated unidirectional causality from GDP growth to FDI in the long-run.

Hsiao and Hsiao (2006) examined Granger causality relations between GDP, exports, and FDI in East and Southeast Asia by using time-series and panel data from 1986 to 2004. Empirical analysis of time-series indicated that each country has a different causality relation, and results of panel-VAR causality indicated that FDI has unidirectional effects on GDP directly and also indirectly through exports, and there also exists bidirectional causality between exports and GDP. Finally, with respect to the panel data causality analysis, Hsiao suggested that export may be a good substitute for, if not complementary to, human capital or financial development through its relations with FDI and GDP.

Alexiou and Tsaliki (2007) examined the FDI-led growth hypothesis for Greece during the 1945–2003 years. Empirical findings showed a long-run relationship between FDI and GDP. But with respect to the Granger causality test, no evidence suggesting the existence of causality between FDI and economic growth had been found. In other words, the FDI-led growth hypothesis had been rejected.

Kersan-Skabic and Zubin (2009) determined the impact of FDI on macroeconomic indicators (GDP, Employment, and Export) of the Croatian economy. The results indicate that FDI has a negative effect on employment while it does not have an effect on GDP growth and export. So, the positive expected effect had failed because of the low share of Greenfield investments.

Borensztein, Gregorio, and Lee (1998) studied the effect of FDI on economic growth in a cross-country regression framework, by utilising data on FDI flows from industrial countries to 69 developing countries. The results of this paper suggest that FDI is an important vehicle for transferring technology and it contributes relatively more to economic growth than domestic investment. They argued higher productivity of FDI holds only when the host country has a minimum threshold stock of human capital.

Miankhel, Thangavelu, and Kalirajan (2009) employed a VECM framework for examining the causality between export, FDI and GDP for six emerging countries (Chile, India, Mexico, Malaysia, Pakistan and Thailand). The results support the export-led growth (ELG) hypothesis. The results of long-run investigations indicate the existence of causality from GDP to other variables such as export in Pakistan and FDI in the case of India. The results indicate bidirectional causality between GDP and FDI in Malaysia. The findings also show causality from export to FDI and GDP in Latin American countries.

Chowdhury and Mavrotas (2006) examined the causality between FDI and economic growth by employing the Toda-Yamamoto test for three developing countries (Chile, Malaysia and Thailand). They found a unidirectional causality from GDP to FDI in Chile and strong evidence of bidirectional causality in Malaysia and Thailand.

The study of Makki and Somwaru (2004) examined the role of FDI and trade in promoting economic growth for 66 developing countries. They found that FDI, trade, human capital and domestic investment are important sources of economic growth. Furthermore, they found a strong interaction between FDI and trade in achieving to economic growth.

Hansen and Rand (2006) studied the Granger causal relationship between FDI and GDP in 31 developing countries and found bidirectional causality between FDI and GDP. This finding may be interpreted as evidence in favour of the hypothesis that FDI has an impact on GDP via knowledge transfers and adoption of new technology.

The study by Yao and Wei (2007) presented and tested two propositions on the role of FDI in economic growth for newly industrialised economies. Firstly, FDI is an improving factor for production efficiency, because it helps reduce the gap between the actual level of production and a steady state production frontier. Secondly, FDI, being embedded with advanced technologies and knowledge, helps shift the host country's production frontier. Due to its dual role as a mover of production efficiency and a shifter of production frontier, FDI is a powerful driver of economic growth to help a newly industrialising economy catch up with world's most advanced countries.

Lim (2001) summarised his arguments and finding on the relationship between FDI and economic growth. The work of Lim indicated that while substantial support exists for positive spillovers from FDI, there is no consensus on causality. Also, he found that market size, infrastructure quality, political/economic stability and free trade zones are important for FDI.

Zhang (2001) investigated this issue in 11 countries of East Asia and Latin America. He expressed that FDI tends to be more likely to promote economic growth when host countries exert a liberalised trade regime, improved education and thereby human capital conditions, encouraged export-oriented FDI, and maintained macroeconomic stability.

However, this article examines the causality relationships between FDI, Exports and economic growth in European developing countries and Asian developing countries.

3. Model and data

3.1. Model

According to Hsiao and Hsiao (2006), for illustrating the relationship between FDI, exports and GDP, we assume the equilibrium in the money sector and the government sector. Therefore, the equilibrium conditions of the Keynesian model of aggregate demand and aggregate supply can be given as:

$$Y = C(Y) + I(Y, r) + F + X - M(Y, e) \tag{1}$$

where Y, C, I, F, X, M, r, and e are real GDP, real consumption, real domestic investment, real FDI inflows, real exports, real imports, interest rate, and exchange rate of foreign currency in terms of the domestic currency, respectively.

A more general implicit function form can be considered by ignoring the financial variables.

$$H(Y, X, F) = 0 \tag{2}$$

This function can be expanded to logarithm form, and then investigation of the causality relationship between the real variable's Y, X, and F can be performed by a Granger causality test. The panel vector error correction model (VECM) representation of this model is presented in Section 4.

3.2. Data

Baltagi (2005) points out several benefits of employing panel data: controlling for individual heterogeneity and giving more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency. Because of these benefits, this paper applied balanced panel data of real inward FDI, real exports and real GDP from two panels of selected developing counties, a panel of eight European developing countries: Albania, Belarus, Croatia, Latvia, Lithuania, Poland, Romania and Turkey for 1992 to 2013 years, and a panel of eight Asian developing countries: Bangladesh, India, Malaysia, Oman, Pakistan, Philippines, Srilanka and Thailand for 1986 to 2013. The selection of countries and time periods is limited by data availability. In addition, some countries are excluded due to negative values in FDI data.

Data of GDP, exports of goods and services and FDI were obtained from World Development Indicator (WDI). Variables are measured in constant 2000 US dollars, deflating by the GDP deflator. Natural logarithm has been applied to all the data; the natural logarithms of FDI, export and GDP are denoted as LFDI, LEX and LGDP respectively. We used Eviews' and Gauss software for investigation and data analysis.

4. Methodology and empirical results

The econometric methodology of this article follows three steps. First, we test for a panel unit root. Prompted by the existence of unit roots in the series, long-run co-integration relationship between variables was tested by using the panel co-integration test. Conditional on finding co-integration, the causal link between variables has been explored by employing the Granger causality test.

4.1. Panel unit root test

Several panel unit root tests have been presented for understanding stationary properties of panel data. We have employed the tests proposed by Levin et al. ([LLC] 2002), Im et al. ([IPS] 2003), Breitung (2000) and a Fisher-type test proposed by Maddala and Wu (1999) and Choi (2001) to test the null hypothesis of the existence of a unit root.

Following Dickey and Fuller (1979, 1981), Levin and Lin (1993), and Levin, Lin, and Chu (2002), consider a panel extension of the null hypothesis that each individual time series in the panel contains a unit root against the alternative hypothesis that all individual series are stationary. (Hsiao, 2003). The adjusted t-statistic of the LLC is:

$$t_\rho^* = \frac{t_\rho - N\tilde{T}\hat{S}_N\hat{\sigma}_{\tilde{\varepsilon}}^{-2}\hat{\sigma}(\hat{\rho})\mu_{m\tilde{T}}^*}{\sigma_{m\tilde{T}}^*} \quad (3)$$

where $\mu_{m\tilde{T}}^*$ and σ_{mT}^* are the mean and standard deviation adjustments provided by Table 2 of the LLC. The LLC shows that t_ρ^* is asymptotically distributed as $N\,(0, 1)$.

The IPS test (Im, Pesaran, & Shin, 2003) allows for a heterogeneous coefficient of y_{it-1} and propose an alternative testing procedure based on averaging individual unit root test statistics. The IPS test suggests an average of the augmented Dickey–Fuller (ADF) tests when u_{it} is serially correlated with different serial correlation properties across cross-sectional units. The t-statistic of IPS given as follows:

$$t_{IPS} = \frac{\sqrt{N}(\bar{t} - \frac{1}{N}\sum_{i=1}^{N} E[t_{iT}|\rho_i = 0])}{\sqrt{\frac{1}{N}\sum_{i=1}^{N} \mathrm{var}[t_{iT}|\rho_i = 0]}} \Rightarrow N(0,1) \quad (4)$$

Values of $E[t_{iT} \mid \rho_i = 0]$ and $\mathrm{var}[t_{iT} \mid \rho_i = 0]$ are obtained from the results of Monte Carlo simulations carried out by IPS.

Maddala and Wu (1999) and Choi (2001) proposed a Fisher-type test of unit root, which combines the *p*-values from unit root tests for each cross-section *i* to test for unit root in panel data. The Fisher test is nonparametric and distributed as chi-square with two degrees of freedom:

$$p\lambda = -2 \sum log_e \pi_i \tag{5}$$

As mentioned in Baltagi (2005), Breitung (2000) found that the LLC and IPS tests suffer from a dramatic loss of power if individual-specific trends are included. Breitung suggests a test statistic that does not employ a biased adjustment whose power is substantially higher than LLC or the IPS tests using Monte Carlo experiments. The statistic of Breitung is:

$$\lambda_B = \frac{\sum_{i=1}^{N} \sigma_1^{-2} y_i^{*'} x_i^{*'}}{\sqrt{\sum_{i=1}^{N} \sigma_1^{-2} x_i^{*'} A' A X_i^{*}}} \tag{6}$$

which has a standard normal distribution.

The results of Levin et al. ([LLC] 2002), Im et al. ([IPS] 2003), Breitung (2000) and Fisher-type panel unit root tests of European developing countries and Asian developing countries, respectively, are presented in Table 1 and Table 2.

As the results suggest, most of these tests are unable to reject the null hypothesis of unit root in levels, which means that LFDI, LEX and LGDP are non-stationary in levels, but results of panel unit root tests in the first difference indicate that all variables are stationary after the first difference. In other words, data series are integrated of order one I (1).

4.2. Panel co-integration test

On the basis of the panel unit root test results, which imply that the data series are non-stationary in level, at the second step, we proceed to test for the existence of a long-run relationship between variables by using panel co-integration test. Granger (1981) showed that when

Table 1. Panel unit root tests – European developing countries.

Variable	*LGDP*		*LEX*		*LFDI*	
Test	Levels	1st differences	Levels	1st differences	Levels	1st differences
LLC (2002)	2.28	−5.08***	0.24	−4.17***	−1.02	−4.83***
Im et al. (2003)	−0.19	−9.85***	0.03	−7.18***	0.03	−3.27***
Breitung (2000)	2.36	−1.92**	0.34	−2.82***	1.24	0.39
ADF-Fisher	14.30	174.17***	19.59	80.44***	20.26	45.77***
PP-Fisher	121.65**	437.69***	107.75**	792.71***	18.62	159.9***

Note: *** and ** denote statistical significance at the 1 and 5 % levels.
Source: Authors calculations.

Table 2. Panel unit root tests – Asian developing countries.

Variable	*LGDP*		*LEX*		*LFDI*	
Test	Levels	1st differences	Levels	1st differences	Levels	1st differences
LLC (2002)	0.46	-9.41***	-1.10	-7.56***	2.51	-5.46***
Im et al. (2003)	2.20	-7.67***	1.29	-7.48***	-1.65	-9.33***
Breitung (2000)	0.25	-7.16***	-0.51	-8.15***	-2.80*	-7.22***
ADF-Fisher	5.25	86.71***	10.46	83.73***	32.32**	119.33***
PP-Fisher	6.00	94.99***	18.15	129.69***	46.47**	522.59***

Note: *** and ** denote statistical significance at the 1 and 5 % levels.
Source: Authors calculations.

some series are integrated in order one (they become stationary after the first differencing), but a linear combination of them is already stationary without differencing, they are said to be co-integrated, which implies the existence of a long-run relationship between the series.

Several tests are proposed to examine the existence of co-integration in panel data. This article applied Pedroni (1999, 2004) and Kao (1999) panel co-integration test.

Pedroni (1999) considers the following time series panel regression:

$$y_{i,t} = \alpha_i + \delta_i t + \beta_{1i} x_{1i,t} + \beta_{2i} x_{2i,t} + \dots + \beta_{Mi} x_{Mi,t} + e_{i,t} \quad (7)$$

for $t = 1,\dots,T$; $i = 1,\dots,N$; $m = 1,\dots,M$

Where T refers to the number of observations over time, N refers to the number of individual members in the panel, and M refers to the number of regression variables.

Pedroni presented seven statistics for testing the null hypothesis of no co-integration versus co-integration in panel data. Four statistics called panel co-integration statistics, which are based on pooling along what is commonly referred to as the within-dimension. In addition to them, three statistics called group-mean panel co-integration statistics, which are based on pooling along what is commonly referred to as the between-dimension.

Panel v-Statistic

$$T^2 N^{3/2} Z_{\hat{v}N,T} \equiv T^2 N^{3/2} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \quad (8)$$

Panel ρ-Statistic

$$T\sqrt{N} Z_{\hat{\rho}N,T-1} \equiv T\sqrt{N} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (9)$$

Panel non-parametric (PP) t-statistic

$$Z_{t\,N,T} \equiv \left(\tilde{\sigma}_{N,T}^2 \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (10)$$

Panel parametric (ADF) t-statistic

$$Z_{t\,N,T}^{*} \equiv \left(\tilde{s}_{N,T}^{*2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*} \Delta \hat{e}_{i,t}^{*} \quad (11)$$

Group ρ-statistic

$$TN^{-1/2} \tilde{Z}_{\hat{\rho}n,T-1} \equiv TN^{-1/2} \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{e}_{i,t-1}^2 \right)^{-1} \sum_{t=1}^{T} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (12)$$

Group non-parametric t-statistic

$$N^{-1/2} \tilde{Z}_{tN,T} \equiv N^{-1/2} \sum_{i=1}^{N} \left(\hat{\sigma}_i^2 \sum_{t=1}^{T} \hat{e}_{i,t-1}^2 \right)^{-1/2} \sum_{t=1}^{T} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i) \quad (13)$$

Group parametric t-statistic

$$N^{-1/2} \tilde{Z}_{tN,T}^{*} \equiv N^{-1/2} \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{s}_i^{*2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \sum_{t=1}^{T} \hat{e}_{i,t-1}^{*} \Delta \hat{e}_{i,t}^{*} \quad (14)$$

All terms are properly defined in Pedroni (1999).

Kao (1999) introduced parametric residual-based panel co-integration. He expanded four DF-types and one ADF-type tests for testing the null hypothesis of no co-integration. The tests are based on the spurious Least Squares Dummy Variable (LSDV) panel regression equation with one single regressor. Kao's statistics are written as below:

$$DF_{\rho} = \frac{\sqrt{NT}(\hat{\rho} - 1) + 3\sqrt{N}}{\sqrt{10.2}} \tag{15}$$

$$DF_{t} = \sqrt{1.25t_{\rho}} + \sqrt{1.875N} \tag{16}$$

$$DF_{\rho}^{*} = \frac{\sqrt{NT}(\hat{\rho} - 1) + \frac{3\sqrt{N}\hat{\sigma}_{v}^{2}}{\hat{\sigma}_{OV}^{2}}}{\sqrt{3 + \frac{36\hat{\sigma}_{V}^{4}}{5\hat{\sigma}_{OV}^{4}}}} \tag{17}$$

$$DF_{t}^{*} = \frac{t_{\rho} + \frac{\sqrt{6N}\hat{\sigma}_{v}}{2\hat{\sigma}ov}}{\sqrt{\frac{\hat{\sigma}_{ov}^{2}}{2\hat{\sigma}_{v}^{2}} + \frac{3\hat{\sigma}_{v}^{2}}{10\hat{\sigma}_{ov}^{2}}}} \tag{18}$$

$$ADF = \frac{t_{ADF} + \frac{\sqrt{6N}\hat{\sigma}_{V}}{2\hat{\sigma}_{OV}}}{\sqrt{\frac{\hat{\sigma}_{ov}^{2}}{2\hat{\sigma}_{v}^{2}} + \frac{3\hat{\sigma}_{v}^{2}}{10\hat{\sigma}_{ov}^{2}}}} \tag{19}$$

The asymptotic distributions of DF_{ρ}, DF_{t}, DF_{ρ}^{*}, DF_{t}^{*} and ADF converge to a standard normal distribution $N(0, 1)$ by sequential limit theory.

Table 3 indicates the results of Pedroni panel co-integration tests for both panels. All statistics of Pedroni, except group parametric t-statistic, reject the null hypothesis of no co-integration and indicate the existence of co-integration between FDI, exports and GDP for European developing countries. Furthermore, all Pedroni's statistics except panel non-parametric t-statistic indicate the existence of co-integration for Asian developing countries.

The results of the Kao panel co-integration test are presented in table 4. All statistics of Kao except DF_{t} indicates the existence of co-integration for European developing panel. For the Asian developing countries, all the statistics except DF_{ρ} and DF_{t} indicate the existence of co-integration.

Overall, the results of Pedroni and Kao tests support the existence of co-integration between LGDP, LEX and LFDI in both European and Asian developing countries.

Table 3. Pedroni panel co-integration test.

Panel Group Statistics	European Developing Countries	Asian Developing Countries
Panel *v*-statistic	8.08***	18.04**
Panel *ρ*-statistic	−10.30***	−17.43*
Panel non-parametric (PP) *t*-statistic	−4.20***	−5.65
Panel parametric (ADF) *t*-statistic	−55.92***	−97.84***
Group *ρ*-statistic	−17.61***	−16.18***
Group non-parametric *t*-statistic	−5.61**	−5.31***
Group parametric *t*-statistic	−624	−5.13***

Note: ***, ** and * denote statistical significance at the 1, 5 and 10% levels, respectively.
Source: Authors calculations.

Table 4. Kao panel co-integration test.

Panel Group Statistics	European Developing Countries	Asian Developing Countries
DF_ρ	−0.96*	−0.95
DF_t	−1.06	−0.70
DF_ρ^*	−4.65***	−4.90***
DF_t^*	−1.90***	−1.65***
ADF	−1.62**	−1.90**

Note: ***, ** and * denote statistical significance at the 1, 5 and 10% levels, respectively.
Source: Authors calculations.

4.3. Panel Causality Test

The finding of co-integration implies that there exists a causal relationship between the series, but it does not indicate the direction of causality. Engle and Granger (1987) show that if non-stationary variables are co-integrated, a vector autoregression (VAR) in the first differences will be misspecified, because of the removed long-run information in the first differencing, but a VECM can avoid this shortcoming. In addition, unlike the usual Granger causality test, the VECM can identify sources of causation and can distinguish between a long-run and a short-run relationship in the series.

We specify a model with a dynamic error-correction representation. This means that the VAR model is augmented with one period lagged error correction term (ECT), which is obtained from the estimated residuals of the co-integrated model. A tri-variate panel-VECM for examining the causality between FDI, exports and economic growth can be written as follows:

$$\Delta LGDP_{it} = c_{1i} + \sum_{i=1}^{k} \alpha_{1ik}\Delta LGDP_{it-k} + \sum_{i=1}^{k} \beta_{1ik}\Delta LEX_{it-k} + \sum_{i=1}^{k} \gamma_{1ik}\Delta LFDI_{it-k} + \varphi_{1i}ECT_{t-1} + \varepsilon_{it} \quad (20)$$

$$\Delta LEX_{it} = c_{2i} + \sum_{i=1}^{k} \alpha_{2ik}\Delta LGDP_{it-k} + \sum_{i=1}^{k} \beta_{2ik}\Delta LEX_{it-k} + \sum_{i=1}^{k} \gamma_{2ik}\Delta LFDI_{it-k} + \varphi_{2i}ECT_{t-1} + \upsilon_{it} \quad (21)$$

$$\Delta LFDI_{it} = c_{3i} + \sum_{i=1}^{k} \alpha_{3ik}\Delta LGDP_{it-k} + \sum_{i=1}^{k} \beta_{3ik}\Delta LEX_{it-k} + \sum_{i=1}^{k} \gamma_{3ik}\Delta LFDI_{it-k} + \varphi_{3i}ECT_{t-1} + \epsilon_{it} \quad (22)$$

Table 5. Panel-VECM causality – European developing countries.

	Source of causation (independent variables)			
	Short-run			Long-run
Dependent variable	ΔLGDP	ΔLEX	ΔLFDI	ECT
ΔLGDP	–	2.17	2.29*	4.59***
ΔLEX	22.69***	–	8.24***	0.16
ΔLFDI	4.66*	1.37	–	23.76***

Note: The table reports F statistics. ***, ** and * denote statistical significance at the 1, 5 and 10% levels, respectively.
Source: Authors calculations.

Table 6. Panel-VECM causality – Asian developing countries.

	Source of causation (independent variables)			
	Short-run			Long-run
Dependent variable	ΔLGDP	ΔLEX	ΔLFDI	ECT
ΔLGDP	–	4.00**	0.06	11.82***
ΔLEX	3.50**	–	0.17	1.15
ΔLFDI	0.58	0.01	–	28.39***

Note: The table reports F statistics. *** and **denote statistical significance at the 1% and 5% levels.
Source: Authors' calculations.

where Δ is the first difference operator; ECT_{t-1} is the lagged error correction term; k is the lag length; and ε_{it}, υ_{it} and ϵ_{it} are the serially uncorrelated error terms.

The direction of panel causations can be identified by testing for the significance of the coefficient of dependent variables in Eqs. (20–22). We test $H_0{:}\beta_{1ik} = 0\,\forall i, k$ and $H_0{:}\gamma_{1ik} = 0\,\forall i, k$ to determine short-run Granger causality from export and FDI to GDP, respectively; $H_0{:}\alpha_{2ik} = 0\,\forall i, k$ and $H_0{:}\gamma_{2ik} = 0\,\forall i, k$ to determine short-run Granger causality from GDP and FDI to export; and $H_0{:}\alpha_{3ik} = 0\,\forall i, k$ and $H_0{:}\beta_{3ik} = 0\,\forall i, k$ to indicate short-run Granger causality from GDP and export to FDI. Finally, for long-run causality, we test $H_0{:}\varphi_i = 0\,\forall i, k$ in each Eq. (20–22). (Notice: the null hypothesis implies no Granger causality.)

Lag-length selection using Akaike's information criterion (AIC) and Schwarz criterion (SC) indicated two lags for the European developing panel and one lag for the Asian developing panel. The results of panel causality are displayed in Tables 5 and 6.

The results of panel causality in developing European countries indicate bidirectional causality between GDP and FDI, and unidirectional causality from GDP and FDI to exports in short-run. For the Asian developing countries, we found bidirectional causality between exports and economic growth in short-run.

The significance of the ECT is useful for interpreting long-run causality. There is evidence of long-run causality from export and FDI to economic growth, and long-run causality from economic growth and export to FDI for both of the European and Asian developing panels.

5. Conclusion

There are many theoretical and empirical studies on the tri-variate causality between FDI, exports and GDP, but there are no common consequences regarding these relationships, so working on this issue is still required. Therefore, this article examined the causality relationship between FDI, exports and economic growth in eight European developing countries for 1992 through 2013, and eight Asian developing countries over 1986 to 2013. Firstly, panel unit root tests were performed and indicated that all variables are integrated of order one. Furthermore, Panel co-integration tests support the existence of co-integration in both panels.

Finally, the Panel-VECM causality was performed for both panels, which indicated bidirectional causality between GDP and FDI, and unidirectional causality from GDP and FDI to exports in short-run for the European developing countries. The results of short-run causality in Asian developing countries indicated bidirectional causality between exports and economic growth. Furthermore, there is evidence of long-run causality from export and FDI to economic growth and long-run causality from economic growth and export to FDI for both of the European and Asian developing panels. Some policy implications can be proposed with respect to the short and long-run causality results. Countries in the two considered panels, especially the European ones, can stimulate and promote economic growth via attracting FDI inflows, which can be made possible by, for example, expanding free trade zones, increasing security in economical, political and other dimensions. Moreover, countries belonging to both of these panels, especially Asian developing countries, can experience higher economic growth by increasing exports of goods and services. To do so, they can decrease the export taxes and trade barriers, encourage the industrial-based export, and improve quality control and training programmes.

Disclosure statement

No potential conflict of interest was reported by the authors.

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