Trade Openness and Economic Growth: A Panel Cointegration and Causality Analysis for the Newest EU Countries.

Nikolaos Dritsakis [1]
Pavlos Stamatiou [2]

This paper explores the relationship between trade openness and economic growth using data for the thirteen newest European Union members. The study covers the period of 1995–2013. We have applied panel cointegration and causality approaches to examine the long-run and the causal relationship between the variables. Empirical results confirm the presence of a cointegrating vector between trade openness and economic growth, in this group of the thirteen countries. An error correction model (ECM), followed by the two steps of Engle and Granger was used to capture the short and long-run dynamics. The impact of economic growth and trade openness is found to be positive. Finally, the panel Granger causality analysis reveals a unidirectional causal relationship running from trade openness to economic growth, both in the short and in the long-run.

Keywords: Trade openness, Economic Growth, Vector Error Correction Model, Panel Cointegration, Panel Causality
JEL Classifications: C22, E31, E50

[1] **Nikolaos Dritsakis** , University of Macedonia,Thessaloniki Greece, drits@uom.gr
2**Pavlos Stamatiou**, University of Macedonia,Thessaloniki Greece, stamatiou@uom.edu.gr

1. Introduction

The enlargement of the European Union (EU) is a very ambitious project since it is in essence the reunification of the European continent which has been divided after the last world war. The EU will continue growing. Since 2004, thirteen new members have joined the union (Bulgaria, Czech Republic, Estonia, Croatia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Romania, Slovenia, and Slovakia) and five are on the road to EU membership (AMECO, 2015).

For the countries of Central and Eastern Europe (majority of thirteen new members) the integration in EU symbolizes democracy, the transformation of their economies into market economies within the institutional framework of the union, as well as the implementation of structural reforms. The rapid increase of trade flows means new opportunities for business and investments, reduction of unemployment and consequently more growth in these countries. However, EU in order to consolidate and expand these benefits has to respond in the current challenges that is facing.

The financial crisis of 2008, proved the interdependence of the financial markets. Even today, several years after the outbreak of the crisis, there are European countries that are facing serious problems such as decreased growth rates, high unemployment, budget deficits and large public debt.

Many economists believe that growth in trade can be a powerful engine in order to promote economic growth. Trade liberalization is a structural reform beneficial for the welfare of a country. Openness to trade can boost productivity through greater competition. Trade in combination with countries' comparative advantage allows more effective allocation of the sources. Trade openness and capital movement liberalization can be the trigger for new ideas, for greater incentives for innovation and for more inward investments.

The aim of this paper is to examine the relationship between trade openness and economic growth for the thirteen newest EU countries using panel data over the period 1995-2013. Most of these countries

were under communist regimes until 1989 and the last 20 years are trying to convert their economies to market economies. EU membership is the strongest guarantee for these countries to establish market economies with higher growth rates. Trade openness can be seen as catalysts for development.

There are many studies that investigate the causality between trade openness and economic growth in these countries, on a certain country level. However, a weak point of these studies is the absence of a general examination on cross-county level. In addition, this paper includes new time series from 1995-2013 which were excluded in earlier studies.

The remainder o this paper is organized as follows: Section 2 briefly reviews the literature. Section 3 presents data and methodology and section 4 presents the empirical results. Conclusions and policy implications remarks are given in the final section.

2. Literature Review

The relationship between openness and economic growth receives a growing interest in the literature the last decades. Over these years, the global trading system is becoming open and competitive. Trade openness can play a vital role in an economy, since it promotes the efficient allocation of sources through comparative advantage, transfers knowledge in the workforce and encourages competition in international and domestic markets (Chang, Kaltani and Loayza, 2009). In recent literature, most of the published studies have shown that openness to trade is a significant explanatory variable for economic growth.

Gries and Redlin (2012) studied the causal dynamics between trade openness and economic growth for 158 countries over the period 1970-2009. The obtained results, using panel error correction models in combination with GMM estimation, reveal a positive significant causality from openness to growth and vice versa, implying that trade liberalization is an important factor for growth in the long-run.

Zeren and Ari (2013) examined the causal relations among trade openness and economic growth for the G7 countries between 1970-2011. The panel causality results show a bidirectional relationship between the examined variables. Promotion in openness increases growth in the G7 countries and subsequently the increase in growth increases openness.

A similar study (Mercan, et. al., 2013) examined the relationship between trade openness and growth for BRIC–T countries using data from 1989 to 2010. Findings derived from the panel data analysis show that the effect of openness on economic growth is positive and statistically significant according to theoretical expectations.

Habibi (2015) investigated the relationship between trade openness and growth for 120 countries, over the period 2000-2013, separating the data set into four subpanels according to the income classification (low, lower-middle, upper-middle and high-income economies). The results of panel error correction models show bidirectional causalities among economic growth and trade openness in all panels, except low income group. Also, unidirectional causation from trade openness to economic growth was obtained in the case of low income economies.

However, it is worth to say that there are also studies in the literature that failed to show such relationships. The results seem to depend on the econometric methods, the countries and the period that analysis were carried out.

3. Data and Methodology

Data

The variables that are used in this study are trade openness (TO) measured by the sum of exports and imports as a percentage of GDP at 2005 constant prices and GDP per capita (GDP) which is PPP converted GDP per capita at 2005 constant prices in international dollar per person. The data are annual covering the period 1995-2013. All data needed, collected from World Development Indicators (WDI, 2015) and Annual Macro-Economic database (AMECO, 2015).

Methodology

The test for causal relationship between trade openness (TO) and economic growth (GDP) will be performed following three steps. We begin by testing the stationarity of these variables applying panel data unit root tests. After the order of integration has been defined, the next step is to examine the long-run relationship among the variables using panel cointegration analysis. As the variables are cointegrated, we use ECMs to explore the bilateral short-run and long-run dynamics between these variables (two-step Engle and Granger (1987) method).

Panel Unit Root Tests

In literature, there are several approaches aiming at detecting the presence of unit roots on panel data. Considering that these methods may give different results, we select tests suggested by Breitung (2000), Levin, Lin and Chu (2002) (LLC), Im, Pesaran and Shin (2003) W-test (IPS), ADF-Fisher Chi-square test (ADF-Fisher), PP Fisher Chi-Square test (PP-Fisher), Maddala and Wu (1999), and Hadri (2000). In all these cases except Hadri, the null hypothesis is that the variable contains a unit root.

Levin et al. (LLC) and Breitung's tests assume homogeneity in the dynamics of the autoregressive coefficients for all individuals of the panel. Phillips and Sul (2003) proved that this hypothesis in many cases can lead to the rejection of the null hypothesis incorrectly. However, the rest tests are not so restrictive.

Im-Pesaran-Shin proposed an alternative since it allows for heterogeneous coefficients in the panel. Moreover, Maddala and Wu proposed two different tests, based on the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests, in order to check the stationarity in panel data. In these tests, the null and alternative hypotheses are the same as in the IPS test. Finally, Hadri suggested a residual based Lagrange multiplier test for the null that the time series

are stationary, for each *i*, around a deterministic trend against the alternative of a unit root in panel data (see Dritsakis and Stamatiou, 2014).

Panel Cointegration Analysis

We continue applying panel cointegration tests developed by Pedroni (1999; 2004), Kao (1999) and Maddala and Wu (1999). Pedroni proposed two types of tests. The first includes four statistics and is based on the within dimension of the panel while the second includes three statistics based on between-dimension (see Apendix). The null hypothesis (no cointegration) is the same for all statistics, $H_0 = p_i = 1$ for all *i*. On the other, for the within-dimension statistics the alternative is $H_1 = p = p_i < 1$ for all i and for the between-dimension test the alternative is $H_1 = p_i < 1$, for at least one i. So, the between dimension statistics allow for heterogeneous coefficients across cross units. The second test applied, is the residual based cointegration test proposed by Kao to estimate the homogeneous cointegration relationship. Kao describes two tests under the null of no cointegration. One is a Dickey Fuller type test and the other an Augmented Dickey Fuller. Finally, the third panel cointegration test is the Johansen-Fisher developed by Maddala and Wu, using Fisher's test (1932). This approach tests for coinetgartion in the full panel combining the individual cross-sections statistics.

Panel Granger Causality

The existence of cointegration between the variables implies that there is causality relationship between them in at least one direction. We continue applying the two-step Engle and Granger (1987) approach. This method allows dynamic models to control for panel heterogeneity. So, in order to find the short and long-run causality relations among the examined variables the following models are estimated:

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

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

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

4. Empirical Results

Panel Unit Root Results

The preliminary step in analyzing the relationships between trade openness (TO) and economic growth (GDP) is to check stationary properties of variables. The results of the panel unit root tests are presented in table 1.

Table 1

Panel Unit Root Results

Level				
	GDP		**TO**	
	Intercept	**Intercept-Trend**	**Intercept**	**Intercept-Trend**
LLC	-0.968 (0.166)	2.375 (0.991)	-1.547 (0.060)	-2.241 (0.012)**
Breitung		2.976 (0.998)		-0.344 (0.365)
IPS	2.128 (0.983)	0.240 (0.595)	1.997 (0.977)	-1.194 (0.116)
ADF	13.269 (0.981)	29.800 (0.276)	17.11 (0.905)	30.40 (0.251)

PP	12.128 (0.990)	8.102 (0.999)	16.56 (0.921)	26.57 (0.431)
Hadri	8.261 (0.000)***	7.265 (0.000)***	9.57 (0.000)***	5.694 (0.000)***
First Differences				
	ΔGDP		**ΔTO**	
	Intercept	**Intercept-Trend**	**Intercept**	**Intercept-Trend**
LLC	-7.456 (0.000)***	-8.431 (0.000)***	-11.97 (0.000)***	-11.11 (0.000)***
Breitung		-5.030 (0.000)***		-8.082 (0.000)***
IPS	-4881 (0.000)***	-3.562 (0.000)***	-9.056 (0.000)***	-7.837 (0.000)***
ADF	68.719 (0.000)***	52.025 (0.001)***	122.9 (0.000)***	98.67 (0.000)***
PP	63.042 (0.000)***	42.165 (0.020)**	178.3 (0.000)***	172.4 (0.000)***
Hadri	2.882 (0.002)***	6.474 (0.000)***	2.953 (0.001)***	8.085 (0.000)***

Notes: Numbers in parentheses denote p-values. ***, ** denotes rejection of null hypothesis at 1% and 5% level of significance. Lag length selection automatic based on Schwarz criterion.

The above results showed that the variables contain a unit root in levels. Moreover, findings indicated that all variables are stationary in their first differences, so they are integrated of order one *I*(1).

Panel Cointegration Results

We continue applying panel cointegration analysis to examine the long-run relationship among the variables. Table 2 presents the results of tests proposed by Pedroni, Kao and Maddala and Wu.

Table 2

Panel Cointegration Results

Pedroni (GDP as dependent variable)				
	Test statistic	**Probability**		
Within-Dimension				
Panel-v	2.114**	0.017		
Panel-rho	-0.063	0.474		
Panel-PP	-1.771**	0.038		
Panel-ADF	-11.762***	0.000		
Between-Dimension				
Group-rho	1.977	0.976		
Group-PP	-1.980**	0.024		
Group-ADF	-2.426***	0.007		
Kao (GDP as dependent variable)				
	t-statistic	**Probability**		
ADF	-1.909**	0.028		
Johansen-Fisher				
	trace	**Probability**	**max-eigen**	**Probability**
None	65.58***	0.000	66.16***	0.000
At most 1	23.94	0.579	23.94	0.579

Notes: Under the null tests, all variables are distributed normal, N(0, 1). *** and ** significant at 1% and %5 levels. Fisher's test applied regardless of the dependent variable. Asymptotic p-values are computed using X^2 distribution.

The results of table 2 show that there is a cointegrating vector between the examined variables for the group of the thirteen EU countries.

Panel Causality Results

The panel data results on the short and long-run dynamics between economic growth and trade openness for the thirteen new EU members are provided in the next table.

Table 3

Panel Causality Results

Dependent Variable	Source of Causation (independent variables)		t-test
	F-statistic		
	Short-run		Long-run
	ΔGDP	ΔTO	ECT
ΔGDP		3.741**	2.915***
ΔTO	2.222		1.563

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

From the results of table 3 we see that there is a short-run causal relationship running from trade openness to economic growth. The estimated coefficient $\lambda_{1,i}$ of $ECT_{i,t-1}$ in equation (1) is statistically significant at 1% level of significant implying that economic growth could play an important adjustment role in the long-run equilibrium. Consequently, findings suggest that there is a positive unidirectional causal relationship both in the short and in the long-run with direction from trade openness to economic growth for the thirteen countries, viewed as group.

5. Conclusion and Policy Implications

The last decades more and more countries are expressing the desire to join European Union. Full membership provides them social benefits that strengthen democracy through the transformation of their economies into market economies as well as creates opportunities for direct investments and for a stable business environment. The rapid increase of trade flows can boost productivity through greater competition and help in reducing unemployment.

The present study empirically investigates relationship between trade openness and economic growth for the newest EU members using data covering the period 1995-2013. In this study, panel unit root tests, panel cointegration tests and dynamic panel causality test with error correction model are applied. The panel cointegration tests, by Pedroni, Kao and Maddala and Wu, suggest that there is a strong evidence of cointegration among the variables.

An error correction model followed by the two steps of Engle and Granger was used to capture the short and long-run dynamics. Findings indicate a positive unidirectional causal relationship, both in the short and in the long-run, running from trade openness to economic growth. The increase in openness, which informs about the country's dependence on foreign markets, increases economic growth for this group of economies.

The results support the openness-led growth hypothesis as suggested by the endogenous theory. Trade openness could promote technical progress which can make long-run growth permanent. The promotion of technical progress could be happened by stronger capital goods imports, the attraction of more foreign direct investments (FDI) and the incentives for innovation in fields that are positively linked to trade liberalization (Nowak-Lehmann, 2000).

The governments of these countries should implement trade and investment promotion strategies which will be consistent with an overall national strategy. For this reason the proper coordination between the public and the private sector is precondition. Trade promotion consists of a large set of policy instruments, related mainly with the provision of trade intelligence in domestic companies in order to reduce transaction cost and obtain a competitive advantage against foreign companies.

Moreover, strategies associated with the promotion of exports have to be applied. For the countries out of Eurozone currency devaluation could be the first step. Then, the next step is the attraction of FDI.

Export promotion combined with FDI and a stable exchange rate can create a favorable environment for sustainable growth.

References

AMECO, 2015. *European Commission Economic and Financial Affairs.* [online] Available at: http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm [Accessed 8 January 2016].

Breitung, J., 2000. The Local Power of Some Unit Root Tests for Panel Data. In: B. Baltagi, ed. *Advances in Econometrics.* Amsterdam: JAI Press. pp. 161-178.

Chang, R., Kaltani, L. and Loayza, N., 2009. Openness is Good for Growth: The Role of Policy Complementarities. *Journal of Development Economics,* 90, pp. 33-49.

Dickey, D.A. and Fuller, W.A., 1979. Distributions of the Estimators for Autoregressive Time Series with a Unit Root. *Journal of American Statistical Association,* 74(366), pp. 427- 431.

Dickey, D.A. and Fuller, W.A., 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a UnitRroot. *Econometrica*, 49(4),pp. 1057-1072.

Dritsakis, N. and Stamatiou, P., 2014. Exports, Foreign Direct Investment and Economic Growth for Five European Countries: Granger Causality Tests in Panel Data. *Applied Economics Quarterly*, 60(4), pp. 253-272.

Dritsaki, M. and Dritsaki, C., 2013. The Bound Testing Approach for Cointegration and Causality between Financial Development, Trade Openness and Economic Growth in Bulgaria. *The IUP Journal of Applied Economics,* 12(1), pp. 1-18.

Engle, R.F. and Granger, C.W.J., 1987. Cointegration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, 55(2), pp. 251-276.

Fisher, R.A., 1932. *Statistical Methods for Research Workers.* 4th ed. Edinburgh: Olliver and Boyd.

Gries, T. and Redlin, M., 2012. Trade Openness and Economic Growth: A Panel Causality Analysis. Center for Integration Economics Working Paper, No. 2011-06.
Habibi F., 2015. Does Trade Openness Influence Economic Growth? *International Journal of Economics and Business Administration*, 1(2), pp. 120-127.
Hadri, K., 2000. Testing for Stationarity in Heterogeneous Panel Data. *Econometrics Journal*, 3(2), pp.48-161
Im, K.S., Pesaran, M.H. and Shin, Y., 2003. Testing for Unit Roots in Heterogeneous Panels. *Journal of Econometrics,* 115(1), pp. 53-74.
Johansen, S., 1988. Statistical Analysis of Cointegration Vectors. *Journal of Economic and Control*, 12(2-3), pp. 231-254.
Kao, C., 1999. Spurious Regression and Residual-Based Tests for Cointegration in Panel Data. *Journal of Econometrics*, 90(1), pp. 1-44.
Levin, A., Lin C.F. and Chu, J., 2002. Unit Root Test in Panel Data: Asymptotic and Finite-Sample Properties. *Journal of econometrics*, 108, pp. 1-24.
Maddala, G.S. and Wu, S., 1999. A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test. *Oxford Bulletin of Economics and Statistics,* 61(S1), pp. 631-652.
Mercan, M., Gocer, I., Bulut, S. and Dam, M., 2013. The Effect of Openness on Economic Growth for BRIC-T countries: Panel Data Analysis. *Eurasian Journal of Business and Economics*, 6(11), pp. 1-14.
Nowak-Lehmann, F.D., 2000. Trade Policy and Its Impact on Economic Growth: Can Openness Speed Up Output Growth? Ibero-America institute for economic research Discussion Paper, No. 75.
Pedroni, P., 1999. Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. *Oxford Bulletin of Economics and Statistics,* 61, pp. 653–669.
Pedroni, P., 2004. Panel Cointegration: Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis. *Econometric Theory*, 20(3), pp. 597-625.

Phillips, P.C.B. and Perron, P. 1988. Testing for a Unit Root in Time Series Regression. *Biometrika,* 75(2), pp. 335-346.
Phillips, P.C.B. and Sul, D., 2003. Dynamic panel estimation and homogeneity testing under cross section dependence. *Econometrics Journal,* 6(1), pp. 217-259.
WDI, 2015. *World Development Indicators, The World Bank*. [online] Available at: http://data.worldbank.org/data-catalog/world-development-indicators [Accessed 10 January 2016].
Zeren, F. and Ari, A., 2013. Trade Openness and Economic Growth: A Panel Causality Test. *International Journal of Business and Social Science,* 4(9).

Appendix

Pedroni Test Statistics

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

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

2. **Panel *ϱ*-Statistic**

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

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

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

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

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

5. **Group *ϱ*-Statistic**

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

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

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

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

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