1. Exports-Economic Growth Causality: Evidence from CEE Countries[1]

Monica Ioana POP SILAGHI*

Abstract

This paper examines the export-led growth hypothesis (ELG) and growth-led export hypothesis (GLE) for the Central and Eastern European Countries (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia, Slovakia) through cointegration and causality tests. The estimation is carried out within finite-order vector autoregressive (VAR) models in levels, in first-differences and error correction models. When considering bivariate systems, causality from exports to GDP is obtained for Bulgaria, the Czech Republic, Estonia, Latvia and Lithuania. Causality from GDP to exports is indicated for Bulgaria, the Czech Republic, Estonia, Hungary, Lithuania, Romania and Slovenia. We also investigate if the above results still hold when including the other relevant component of the foreign trade, i.e. imports. In trivariate systems, ELG remains valid in the Czech Republic only and becomes valid in Lithuania while GLE is validated in Hungary, Romania and Slovenia.

Keywords: CEE countries, exports, economic growth, imports, cointegration, Granger causality

JEL Classification: F43, C32, O57

1. Introduction

The idea that exports might influence growth is not new, but the empirical research exploring it is still developing. In cross-sectional studies (Michaely, 1977; Tyler, 1981; Feder, 1983; Kavoussi, 1984; Balassa, 1985) the statistical significant relationships found between exports and GDP show a contemporaneous correlation between variables and provide no insights about causality. Their results can be equally

[1] *This paper is a dissemination of main results from my PhD thesis. It is a revised work after several presentations at conferences and staff seminars.*

* *Lecturer, Ph.D., Babeş Bolyai University, Faculty of Economics and Business Administration, Cluj-Napoca, Romania, Email: monica.pop@econ.ubbcluj.ro*

compatible with export-led growth hypothesis (ELG), growth-led export hypothesis (GLE) or even both.

To detect the causal link between exports and GDP, further empirical studies [Jung and Marshall (1985), Afxentiou and Serletis (1991), Love (1994), Konya (2004), Abu-Qarn and Abu-Bader (2004), Dristsakis (2004), Awokuse (2007)] have adopted the concept of causality proposed by Granger (1969) and Sims (1972). According to Granger (1969), the export variable is said to Granger cause the output variable if the forecast for the output variable improves when the lagged export variables are included (empirical support for export-led growth - ELG). Similarly, the output variable is said to cause the export variable in Granger's sense if the forecast for the export variable carries a smaller mean square error when the lagged output variables are included (evidence for growth-led exports - GLE)[2].

For Central and Eastern European (CEE)[3] countries, there is an obvious lack of studies that examine the effect of exports on economic growth by using the latest time series techniques. The existing studies on this issue are focused only on one up to three transition countries [Dristsakis (2004) for Romania and Bulgaria, Konya (2004) for Hungary among 25 OECD countries, Awokuse (2007) for Bulgaria, the Czech Republic and Poland].

In this paper we investigate the degree to which the relationship between exports and economic growth is genuine (in both directions) in all CEE countries. To our knowledge, the present work is the first attempt to analyze such a causal relationship for all these countries in a comparative framework before their accession to the EU. We contribute to the literature by providing empirical evidence for all CEE countries from causality tests on ELG and GLE in bivariate and trivariate systems. In this way, besides a direct effect of exports on economic growth (or of growth on exports), we allow for an indirect effect induced by imports. Serletis (1992) and Riezman *et al*. (1996) suggest that imports may contribute to the establishment of cointegration and should be especially taken into account for testing long-term equilibrium between economic growth and exports. Moreover, there are other economic reasons to justify the inclusion of imports in our econometric estimations. On one hand, for the countries that recently joined the EU, the export expansion still requires the import of some goods that lack in domestic market, especially capital and technology goods. Such goods play an essential role in exports, in particular in exports of manufactured goods. On the other hand, the exports play a role in accumulating foreign exchange to pay the imports of capital goods.

The rest of the paper is organized as follows. Section 2 discusses the data and empirical methodological issues. Section 3 presents the empirical findings of this paper for the group of transition countries while section 4 concludes.

---

[2] *See Giles and Williams (2000) for a comprehensive survey of the empirical literature. They provide a full debate on the three time series approaches in the empirical literature that investigates ELG: formal tests of restrictions, generation of impulse response functions (IRFs) and forecast error variance decompositions (FEVDs), the limitations and practical linkages between them.*

[3] *Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia, Slovakia.*

2. Data and Empirical Methodology

Data used in this study are obtained from *Eurostat* database, section "Quarterly National Accounts, Economy and Finance". Depending on their availability, for each country the data are for sub-periods included in the main transition and pre-accession period, i. e. 1990:1-2004:3 for the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia, Slovakia and 1990:1-2006:4 for Romania and Bulgaria, respectively[4]. Variables used in our paper and their definitions are the following: *Exp* is the natural logarithm of real total exports, *GDPn* is the natural logarithm of real non-exportable GDP and *Imp* is the natural logarithm of real imports.

We use the common approach of testing the hypothesis of non-causality as a test of linear restrictions on the coefficients of a finite dynamic model, which can be a vector autoregressive in the level data (VARL), a vector autoregressive in differentiated data (DVAR) or a vector error correction model (VECM). The model type is given by the number of cointegrating vectors. Before applying the causality tests, we must determine if cointegration exists. Johansen and Juselius' (1990) multivariate cointegration model is based on error correction representation given by the following equation:

$$\nabla Z_t = \Pi Z_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \nabla Z_{t-i} + A_t \qquad (1)$$

where: Z_t is a $3X1$ vector of three nonstationary variables, ∇ is backward differentiation operator, Π and Γ_i represent the coefficient matrices, i.e. $\Pi = -(I - \sum_{i=1}^{p} \phi_i)$; $\Gamma_i = -\sum_{j=i+1}^{p} \phi_j$, *p-1* represents the number of lags and A_t is a $3X1$ vector of independent and identically distributed errors. The equation (1) describes the representation of type *VECM (p-1)* of the stochastic system. The stationarity of ∇z_t is verified by the requiring that the roots of the equation $I - \sum_{i=1}^{p} \phi_i X = 0$ lie outside the unit circle. The rank of the matrix Π contains information about the long-run relationship.

In a cointegrated system the Wald test for non-causality will be asymptotically chi-quared if "sufficient" cointegration exists (Toda and Philipps (1993, 1994). If the set of processes from the system can be split into three categories x_1, x_2, x_3 so that $z_t = (x_1^T, x_2^T, x_3^T)$ and we want to test $x_{3t} \underset{1}{\not\rightarrow} x_{1t}$, then cointegration is sufficient. We

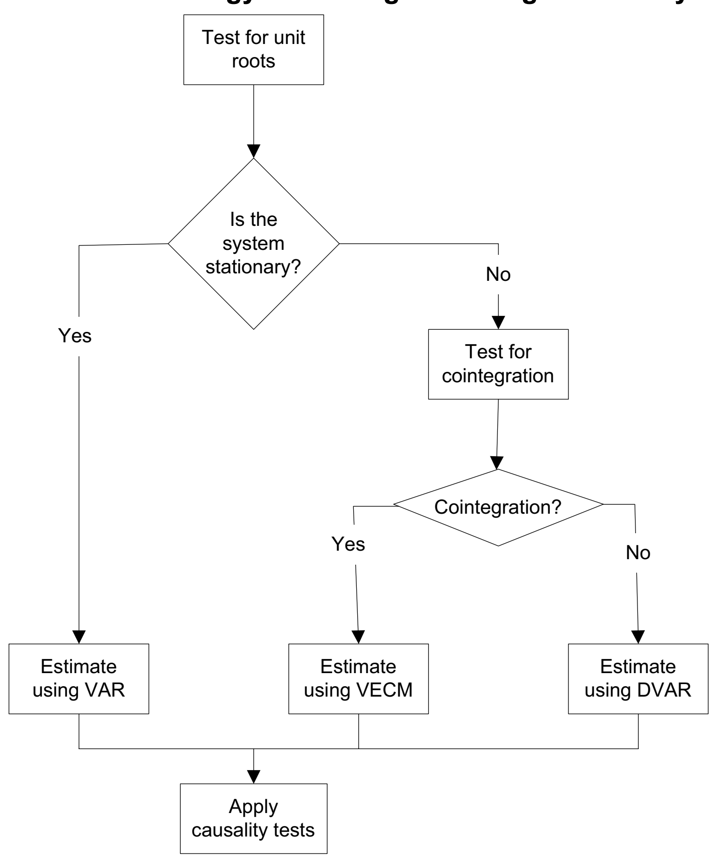
[4] *Tables with number of observations for each country can be provided upon request. Future work comparing results before accession to the EU with results after the accession to the EU is a short term objective of our research.*

can apply the Wald test to restrictions of the coefficients if K_3 , the dimension order of x_3 is also the rank of sub-matrix corresponding to x_3 in the cointegration matrix β . The implication of this condition is that in a bivariate system, the existence of the cointegration is always a sufficient condition for testing Granger causality through the Wald test. This implication is extremely important for our paper, as we will work on bivariate systems, as well as on trivariate ones.

Figure 1 depicts the methodology we use, which we constructed using Giles &Williams (2000) as well as Box and Jenkins (1996).

Figure 1

The methodology for testing the Granger causality



3. Empirical findings

The Augmented Dickey Fuller t-tests (Dickey and Fuller 1979), using an optimal lag length of four, for the individual time series and their first difference are shown in

Table 1 in Appendix. From the ADF test it is obvious that none of the variables represents a stationary process when they are considered in levels. ADF tests, computed by using the first differences of the variables indicate that these tests are significant at different levels of significance, showing one unit root in all the cases. Based on these results, we conclude that each of the series is integrated of order 1, i.e. I(1).

The next step is to test for cointegration among the variables of each country applying the Johansen maximum likelihood cointegration tests. These tests were employed for each pair (real non-exportable GDP - exports, real non-exportable GDP – exports and imports and real non-exportable GDP - imports measured in natural logarithms) for each country from the sample. In Table 2 in Appendix, we show the number of cointegrating vectors that we obtained at the 5% level, based on trace test and λ max test statistics.

The empirical support of one cointegrating vector among all three variables in eight of ten countries (Bulgaria, the Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Slovenia) from our sample proves that they follow a common long-run path. Thus, the cointegration analysis provides a justification for the inclusion of imports in the analysis of export-led growth hypothesis for Central and Eastern European countries as mentioned earlier in the paper. However, the coefficients of imports found in the cointegration relations prove their role in the economic growth in an expected way.

In case one cointegrating vector is found, the detailed VECM representation is estimated. The non-existence of cointegration determines the use of the VAR autoregressive model on the differenced process (DVAR) and the existence of a number of cointegrating vectors equal with the number of variables determines the use of the VAR model on level data, as the methodology requires. In these cases, we do not have cointegrating coefficients.

The cointegration test results give a clue about the type of the model we have to employ in order to test for causality. Probability values for various F-statistics in the case of export-led growth hypothesis are presented in Table 3 in Appendix. We notice that a direct ELG relationship can be inferred in the following cases: Slovakia, Slovenia, the Czech Republic, Bulgaria, Estonia, and Latvia. These results confirm that for some of the analyzed countries, the ELG hypothesis is confirmed, i.e. the information on exports can be useful for predicting GDP on long term. In other countries, such as Hungary, Lithuania, Poland, Romania, the relation is not verified. In these countries, exports are not relevant in predicting economic growth on long term[5].

Further, we introduced imports as an important trade variable that can affect the ELG hypothesis validation, keeping GDP as the dependent variable (Table 4 in Appendix). In this way, besides a direct effect of exports on economic growth (or of growth on exports), we allow for an indirect effect induced by imports.

In Table 4, we see that only in the case of the Czech Republic the ELG is valid in the presence of imports. This implies a direct effect on trade upon growth via the effect of

[5] *For simplicity, we will use the term exports, GDP, imports instead of changes of exports, changes of non-exportable GDP and changes of imports.*

exports on income but also an indirect effect through imports. In this country exports contribute to economic growth via the channel of imports. In the other cases, the hypothesis that exports lead to economic growth via an indirect effect that involves imports is not validated anymore in Slovakia, Slovenia, Bulgaria, Estonia, and Latvia during the period under analysis. It can be inferred that the omission of import variable in the bivariate system might have overstated the effect of exports on income.

In the case of Lithuania, the inclusion of imports changed the results in a positive way. This means that the omission of imports in the bivariate system for this country hid significant causality between exports and income.

In testing the GLE relationship in bivariate models, a positive result is obtained in the case of Slovenia, Lithuania, the Czech Republic, Estonia, and Romania (Table 5 in Appendix). In three cases: the Czech Republic, Slovenia, Estonia, both ELG and GLE relationships in the bivariate systems are valid, hence the bidirectional causality is confirmed. These three countries developed very rapidly after the fall of communism. They confirm Marin's (1992) statement that the feedback effect is more likely to be obtained within small and organized economies.

Introduction of imports in testing the growth-led export hypothesis affects the results (Table 6 in Appendix). The Czech Republic, Lithuania, Estonia do not show the GLE relationship any more. In Hungary, the GLE becomes valid in presence of imports, while in Romania and Slovenia the growth-led exports hypothesis operates both: directly, that is more output generates more export in a causal sense, and indirectly through imports, i.e. more GDP stimulates imports of technology and capital goods.

4. Conclusions

Using the latest econometric time series techniques, we tried to detect a causal relationship between exports and economic growth for all Central and Eastern European countries in bivariate and trivariate systems.

Empirical evidence from Granger causality tests using VARL, DVAR or VECM models indicates that in three cases (Bulgaria, the Czech Republic and Estonia) there is a feedback effect between exports and GDP. The Czech Republic is a small country with the best economic performances out of the 10 countries that adhered to EU; also Estonia is developing fast, while for Bulgaria, the presence of the Monetary Council might assure this partial support of positive relationship between exports and growth. While imports are included, ELG remains valid in the Czech Republic only and becomes valid in Lithuania, while GLE is validated in Hungary, Romania and Slovenia. Lack or inconsistency of policies as macroeconomic and political stability, adequate infrastructure and highly trained labour force can explain the lack of support for the ELG hypothesis in many of CEE countries. Strong policies that promote exports are more than desired.

The inclusion of other potential variables such as exchange rate, investments, employment, government sector and the focus on other engines of economic growth, apart of trade, will be a very desired task in future for all CEE countries.

Acknowledgements

I would like to thank the participants in European Economics and Finance Society Conference, 2006, especially to Prof. Subrata Ghatak and to Prof. Paul Levine. Also, I would like to thank the participants in the staff seminar at Kingston University where I presented a version as a Discussion Paper and to Dr. Cristian Litan for their helpful comments.

References

Afxentiou, P. C.; Serletis, A., (1991), "Exports and GNP causality in the industrial countries 1950-1985", *Kyklos,* 44, 167-179.

Awokuse, O. Titus, (2007), "Causality between exports, imports and economic growth: Evidence from transition countries", *Economics Letters,* 94, 389-395.

Abu-Qarn, Aamer; Abu-Bader, Suleiman, (2004), "The validity of the ELG hypothesis in the MENA region: cointegration and error correction model analysis", *Applied Economics,* 36, 1685- 1695.

Balassa, Bela, (1985), "Exports, Policy Choices and Economic Growth in Developing Countries after the 1973 Oil Shock", *Journal of Development Economics,* 18, 23-35.

Bhagwati, J. (1988), *Protectionism,* Cambridge, MA: MIT Press.

Box, G., Jenkings, G. Reinsel G., (1994), *Time Series Analysis-Forecasting and Control*, Prentice Hall.

Dickey, D.A., Fuller, W.A., (1979), "Distributions of the estimators for autoregressive time series with a unit root", *Journal of the American Statistical Association,* 74, 427-81.

Dodaro, S., (1993), Export and growth: A reconsideration of causality", *Journal of Developing Areas,* 27, 227–244.

Doraisami, A., (1996), "Export growth and economic growth: A re-examination of some time-series evidence of the Malaysian experience", *Journal of Developing Areas,* 30, 223–230.

Dritsakis, N., (2004), "Exports, Investments and Economic Development of pre-accession countries of the European Union: an empirical investigation of Bulgaria and Romania", *Applied Economics*, 36, 1831 – 1838.

Engle, R.F., Granger, C.W.J., (1987) "Cointegration and error correction: representation, estimation and testing", *Econometrica,* 55, 251-76.

Feder, Gerhson, (1983), "On Exports and Economic Growth", *Journal of Development Economics,* 12, 59-73.

Giles, J.A., Williams C.L., (2000), "Export-Led Growth: A Survey of the Empirical Literature and Some Noncausality Results", Part 1, *Journal of International Trade and Economic Development,* 9, 261-337.

Ghatak, Subrata; Price, Wheatley Stephen, (1997) "Export composition and Economic Growth: Cointegration and Causality Evidence for India", WeltwirtchaftlichesArchiv: *Review of World Economics,* Institute fur Weltwirtschaft, Kiel.

Granger, C., (1969), "Investigating Causal Relations by Econometric Models and Cross Spectral Methods," *Econometrica* 37, 424 – 438.

Helpman, E., Krugman, Paul, (1985), *Market Structure and Foreign Trade. Increasing Returns, Imperfect Competition, and the International Economy*, Cambridge MA, London: MIT Press.

Johansen, S., (1988), "Statistical analysis of cointegration vectors", *Journal of Economic Dynamics and Control,* 12, 231-54.

Johansen, S., (1991), "Estimation and hypothesis test of cointegrating vectors in Gaussian vector autoregressive models", *Econometrica,* 59, 1551-1580.

Johansen, S., Juselius, K., (1990), "Maximum likelihood estimation and inference with applications for the demand for money", *Oxford Bulletin for Economics and Statistics,* 52, 169-210.

Jung, W. S., Marshall, P. J., (1985), "Exports, Growth and Causality in Developing Countries*", Journal of Development Economics,* 18, 1-12.

Kavoussi, R. M, (1984), "International Trade and Economic Development: the Recent Experience of Developing Countries", *Journal of Developing Areas, 19*, 379-392.

Konya , L., (2004), "Export-Led Growth, Growth-Driven Export, Both or None? Granger Causality Analysis on OECD Countries," *Applied Econometrics and International Development,* 4, 73-94.

Krugman, Paul; Helpman, E., (1988) *Imperfect Competition and International Trade: Evidence from fourteen Industrial Countries*, Cambridge: Harvard University Press.

Love, J., (1994), "Engines of growth: The exports and government sectors", *World Economy,* 17, 203–218.

Marin, D., (1992), "Is the Export-led- Growth Hypothesis Valid for Industrialized Countries?"*, Review of Economics and Statistics,* 74, 678-688.

Michaely, Michael, (1977), "Exports and Growth: an empirical investigation", *Journal of Development Economics,* 4, 49-53.

Pop Silaghi Monica Ioana, *România în tranziție, Comerțul exterior şi creşterea economică*, Editura Economică, Bucureşti, 2006.

Radelet, S., (1999), “Manufactured exports, export platforms and economic growth”, *CAER II Discussion Paper No.43*, HIID, Cambridge, MA.

Riezman, R.G., Summers, P.M. and Whiteman, C.H, (1996), “The engine of growth or its handmaiden? A time series assessment of export led growth”, *Empirical Economics,* 21, 77-113.

Tyler, William, (1981), “Growth and Export Expansion in Developing Countries”, *Journal of Development Economics,* 9, 121-130.

Toda, H.Y.; Philips, P.C.B, (1993), “Vector autoregressions and causality”, *Econometrica,* 61, 1367- 93.

Toda, H.Y; Philips, P.C.B, (1994), “Vector autoregressions and causality: a theoretical overview and simulation study”, *Econometric Reviews,* 13, 259-85.

Serletis, A., (1992), “Export growth and Canadian economic development”, *Journal of Development Economics,* 38, 133-45.

Sims, C. A., (1972), “Money, Income and Causality,” *American Economic Review* 62, 540 – 552.

Appendix

Table 1

Unit root tests

	ADF initial series	ADF first difference
Bulgaria – Exp	-0.3792	-3.6152***
Bulgaria – GDPn	-1.2121	-3.9434***
Bulgaria – Imp	-0.1024	-3.6149***
Czech Republic – Exp	-0.0901	-3.2782***
Czech Republic – GDPn	-0.3450	-4.1622***
Czech Republic – Imp	-0.0448	-2.8866*
Estonia – Exp	-1.3507	-3.2980**
Estonia – GDPn	-2.8697	-2.8187*
Estonia – Imp	-1.2099	-3.3071**
Hungary – Exp	-1.4127	-2.7442*
Hungary – Imp	-2.3520	-2.7985*
Hungary –GDPn	-0.3416	-2.7782*
Lithuania – Exp	-1.0693	-3.2787**
Lithuania – GDPn	-0.6896	-4.0783***
Lithuania – Imp	-1.1637	-2.6386*
Lithuania – Exp	-0.8361	-2.7122*
Lithuania – Imp	-1.2041	-2.7921*
Lithuania –GDPn	-1.6533	-2.8940*
Poland – Exp	-0.1115	-3.4025**
Poland – GDPn	-1.2731	-2.6639*
Poland – Imp	-1.2958	-2.9452*
Romania – Exp	-2.7331	-2.7749*
Romania – GDPn	-0.8019	-3.0812**
Romania – Imp	-1.5287	-2.6584*
Slovakia – Exp.	-0.4289	-3.9633***
Slovakia – Imp	-0.3698	-3.3832**
Slovakia –GDPn	-0.2954	-2.9406*
Slovenia – Exp	-0.4982	-2.8526*
Slovenia – GDPn	-1.1795	-2.9388*
Slovenia – Imp	-0.1496	-2.8742*

*Notes: ***, **, and * denote that a test statistic is significant at 1 per cent, 5 per cent, and 10 per cent levels of significance, respectively. Critical values were taken from Fuller (1976, p. 373). Variables in levels were the natural logarithms of non-exportable real GDP, exports and imports.*

Table 2

The cointegration tests

	No. of cointegration relations	Coefficients of the cointegration relation			
		(a_1) Log (GDPn)	(a_2) Log (Exp)	(a_3) Log (Imp)	(a_0) Free term
Bulgaria, GDPn, Exp	0				
Bulgaria, GDPn, Exp, Imp	1	1	1.05761	-1.5452	-4.3425
Bulgaria, GDPn, Imp	1	1		-0.6802	-2.9267
Czech Republic, GDPn Exp	0				
Czech Republic, GDP, Exp, Imp	1	1		-0.0472	-5.9983
Czech Republic, GDPn, Imp	0				
Estonia, GDPn Exp	1	1	-1.0931		2.4683
Estonia, GDPn, Exp, Imp	1	1	-0.07665	-2.3021	12.1338
Estonia, GDPn Imp	1	1		-0.5781	-1.5309
Hungary, GDPn Exp	0				
Hungary, GDPn, Exp, Imp	1	1	-19.0704	14.2515	-158.937
Hungary, GDPn Imp	1	1		5.2347	63.8766
Latvia, GDPn, Exp	1	1	-1.0519		0.0212
Latvia, GDPn, Exp, Imp	3				
Latvia, GDPn, Imp	2				
Lithuania, GDPn, Exp	0				
Lithuania, GDPn, Exp, Imp	1	1	3.4681	-4.3574	-0.4472
Lithuania, GDPn, Imp	1	1		-0.34283	-5.1238
Poland, GDPn, Exp	0				
Poland, GDPn, Exp, Imp	1	1	3.1607	-6.8699	25.7107
Poland, GDPn, Imp	0				
Romania, GDPn, Exp	2				
Romania, GDPn, Exp, Imp	1	1	-0.6266	-0.6095	-3.6523
Romania, GDPn Imp	1	1		-0.3904	-5.5818
Slovakia GDPn, Exp, Imp	0				
Slovakia, GDPn, Exp	0				
Slovakia, GDPn, Imp	0				
Slovenia, GDPn, Exp	2				
Slovenia, GDPn, Exp, Imp	1	1	0.4977	-1.0281	-3.6226
Slovenia, GDPn, Imp	2				

Notes: When one cointegrating vector is found, both trace statistical test and max-eigenvalue test indicate that a co-integrating rank of one is present. The coefficients of the cointegration are derived from equation: $a_0 + a_1 LogGDP + a_2 LogEXP + a_3 LogIMP = 0$.

Table 3

Export led growth hypothesis- bivariate models

	Model type	Value F	Prob.	Conclusion
Bulgaria	DVAR	3.3483	0.0221**	**ELG is validated**
Czech Republic	DVAR	2.7996	0.0467**	**ELG is validated**
Estonia	VECM	3.0725	0.0286**	**ELG is validated**
Hungary	DVAR	1.7840	0.1623	ELG is invalidated
Latvia	VARL	5.4714	0.0016**	**ELG is validated**
Lithuania	VARL	1.4447	0.2476	ELG is invalidated
Poland	DVAR	0.6696	0.6189	ELG is invalidated
Romania	VARL	0.86819	0.5087	ELG is invalidated
Slovakia	DVAR	2.6925	0.0472**	**ELG is validated**
Slovenia	VARL	5.88875	0.0016***	**ELG is validated**

*Notes: ***, **, * denote significance at the 1 per cent, 5 per cent, and 10 per cent levels of significance, respectively. Model type represents the framework on which the testing was performed based on cointegration results and F value is the computed statistics for the Wald test.*

Table 4

Export led growth hypothesis in the presence of imports

Country	Model type	Value F	Prob.	Conclusion
Bulgaria	VECM	0.78190	0.5472	ELG is invalidated
Czech Republic	VECM	3.84077	0.0170**	**ELG is validated**
Estonia	VECM	1.2872	0.2979	ELG is invalidated
Hungary	VECM	1.08364	0.3899	ELG is invalidated
Latvia	VARL	2.46078	0.0667	ELG is invalidated
Lithuania	VECM	3.26941	0.0301**	**ELG is validated**
Poland	VECM	1.4018	0.2661	ELG is invalidated
Romania	VECM	0.8523	0.5306	ELG is invalidated
Slovakia	DVAR	1.9509	0.1277	ELG is invalidated
Slovenia	VECM	1.6551	0.1962	ELG is invalidated

*Notes: ***, **, * denote significance at the 1 per cent, 5 per cent, and 10 per cent levels of significance, respectively. Model type represents the framework on which the testing was performed based on cointegration results and F value is the computed statistics for the Wald test.*

Table 5

Growth led export hypothesis- bivariate models

	Model type	Value F	Prob.	Conclusion
Bulgaria	DVAR	1.7251	0.17048	GLE is invalidated
Czech Republic	DVAR	3.8675	0.0135**	**GLE is validated**
Estonia	VECM	2.7820	0.0416**	**GLE is validated**
Hungary	DVAR	0.6608	0.6247	GLE is invalidated
Latvia	VECM	1.5560	0.2084	GLE is invalidated
Lithuania	VARL	2.9686	0.03816**	**GLE is validated**
Poland	DVAR	0.6614	0.6244	GLE is invalidated
Romania	DVAR	3.96063	0.0257**	**GLE is validated**
Slovakia	DVAR	1.6080	0.1948	GLE is invalidated
Slovenia	DVAR	5.7681	0.0018***	**GLE is validated**

*Notes: ***, **, * denote significance at the 1 per cent, 5 per cent, and 10 per cent levels of significance, respectively. Model type represents the framework on which the testing was performed based on cointegration results and F value is the computed statistics for the Wald test.*

Table 6

Growth led export hypothesis in the presence of imports

	Model type	Value F	Prob.	Conclusion
Bulgaria	VECM	0.78190	0.5472	GLE is invalidated
Czech Republic	VECM	2.33453	0.0889	GLE is invalidated
Estonia	VECM	1.58693	0.2053	GLE is invalidated
Hungary	VECM	8.10210	0.0004*	**GLE is validated**
Latvia	DVAR	0.07581	0.9891	GLE is invalidated
Lithuania	VECM	1.08079	0.3910	GLE is invalidated
Poland	VECM	1.22999	0.3283	GLE is invalidated
Romania	VECM	5.69734	0.0181*	**GLE is validated**
Slovakia	DVAR	1.2977	0.2932	GLE is invalidated
Slovenia	VECM	4.92902	0.0043*	**GLE is validated**

*Notes: ***, **, * denote significance at the 1 per cent, 5 per cent, and 10 per cent levels of significance, respectively. Model type represents the framework on which the testing was performed based on cointegration results and F value is the computed statistics for the Wald test.*