

TRADE LIBERALIZATION AND ECONOMIC EXPANSION: A SENSITIVITY ANALYSIS

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Abstract

The relation between trade liberalization and economic expansion is a controversial topic in economics. Despite the differences in their econometric techniques, various authors have tried to answer the question: What is the mechanism by which higher rates of growth of exports are associated with higher growth rates of real output? This paper re-examines the export-led growth hypothesis employing data from four European countries, Greece, Ireland, Portugal and Spain. For a long period of time these countries experienced similar macroeconomic features and constituted a competitive group in the European Union. The interesting aspect of the econometric framework adopted in this paper is that Granger multivariate tests based on error correction modeling are examined for robustness using impulse response functions. Such an empirical procedure will, it is hoped, provide insights into the appropriate long-run strategy that should be applied by Greece, Ireland, Portugal and Spain, if they pursue the increase of exports in order to enhance the level of economic growth. The sensitivity analysis of this paper provides evidence for the export-led growth hypothesis for Ireland but the hypothesis is rejected for the other three countries.

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Keywords: Export-led growth hypothesis, error correction modeling, multivariate causality

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1. Introduction

Although the level of economic development for a country and its growth rates depend substantially on internal conditions, a considerable number of economists believe that international trade can contribute significantly to its economic development.¹ International trade can have considerable beneficial effects on economic development, because trade can contribute to the full utilization of underemployed domestic resources. As known, a point inside the production possibility frontier curve is an inefficient one. A country with unutilized domestic resources can move from a point inside its production frontier curve to a point on the curve with international trade.

Recent empirical studies show that the promotion of exports plays a significant role in the faster growth of various countries. What is the mechanism by which higher rates of growth of exports are associated with higher growth rates of real output? According to the identity of aggregate demand, exports are simply a component of GDP. Thus, one might infer that growth in exports is simply a share of GDP growth. However, exports may not add to GDP growth if they crowd out growth in domestic consumption and investment. The idea that export promotion causes faster growth rates of GDP is an assertion that exports contribute to the overall capacity of the economy to grow faster than it would if production of goods and services were domestically focused. Exportable goods contribute to greater total productivity, because the export sector has spillover effects on the production process of the rest of the economy.

Actually, given that exportable goods are produced for the world market, economies of scale arise for the overall economy. Large export firms often operate close to full capacity and attain lower average costs, because part of their production is destined for the world market. As firms produce for the world market, they have incentives to increase R & D in order to keep up with foreign competition. Another possible reason why export production might cause faster growth rates is that exports may speed up the adoption of new practices. Firms that operate in the world economy are forced to remain efficient and competitive by adopting the latest technological developments in their production process. Export liberalization puts competitive pressure on various sectors, increasing the demand for domestically produced commodities and so leading to higher capacity.

1. Note that for over a century a remarkable number of authors have debated the relationship between trade liberalization and economic growth. In this field there are two main schools of thought which have been debated. Liberal economists argue that freer trade leads to faster growth rates, whereas protectionists contend that the application of protectionist measures may result in better economic performance. In spite of extensive empirical evidence which indicates that openness has benefited growth, the controversy between liberals and protectionists continues today. For more details on this issue, see Rodrik (1995) and Salvatore (2007).

In many countries the major goals of economic policy are to improve their export performance and their overall efficiency in resource allocation. Taking into account that export performance encourages faster growth rates, economic growth is said to be export-led. This idea has become well-known in the field as the Export-Led Growth Hypothesis (ELGH). ELGH claims that exports promote or cause economic growth. The nature, strength and pattern of causality between exports and economic growth have important policy implications for a country. If export promotion contributes positively to economic growth, then exported growth policies are appropriate for the country under study. In cases where a causal chain runs in the opposite direction, implying an impact from output expansion to exports, then the achievement of a certain level of economic development may be a prerequisite for the country to improve its export performance.

Despite the logic and popularity of the ELGH, the empirical evidence has led to mixed results. Cross-section type methodologies and time-series techniques fail to provide uniform results for the validity of the ELGH. Recent papers by Darrat (1987), Moshos (1989), Afxentiou and Serletis (1991), Oxley (1993), Jenkins (1996), Shan and Sun (1998) have found a weak relationship between export promotion and economic growth or have indicated the rejection of the hypothesis. Other authors such as Marin (1992), Harrison (1994), Riezman *et al.* (1996), Edwards (1998), Ahmed (2000), Awokuse (2006) have provided results consistent with the hypothesis.

This paper attempts to contribute to the literature in two ways. First, the paper tries to establish whether a causal relationship between exports and GDP growth exists for four European countries, Greece, Ireland, Portugal and Spain. The selection of the four countries was dictated by the fact that for a long period of time these economies experienced similar macroeconomic characteristics and represented a competitive group in the European Union. Second, the recent time-series techniques of error-correction modeling, Granger multivariate causality and structural vector autoregression have been used in the estimation procedure. Such an empirical procedure, it is hoped, will provide insights into the appropriate long-run strategy that should be applied by Greece, Ireland, Portugal and Spain, if they pursue the increase of exports in order to enhance the level of economic growth.

The rest of the paper is organized in the following manner. Section II presents the data and provides an analysis of the empirical procedure. Section III reports the results and provides a sensitivity analysis to check the robustness of Granger multivariate tests. Finally, Section IV summarizes the paper and suggests policy implications.

2. Data, Integration, Cointegration

2.1 Data

The data used in this paper are taken from various European Commission sources. We have at our disposal annual observations that cover the period 1960-1999 for Greece, Ireland, Portugal and Spain. The collection of the data set is governed by the availability of sufficient observations to ensure adequate degrees of freedom for the estimation procedure. Note that various authors such as Afxentiou and Serletis (1991), Marin (1992), Oxley (1993), Sengupta and Espana (1994), Riezman *et al.* (1996), among others, investigating for Granger causality between exports and growth, have employed a similar set of variables to those used in this paper. The time series used and their definitions are the following: Y is the real GDP; X is the share of exports of goods and services in GDP; P is the inflation rate calculated by the GDP deflator; and R is the nominal effective exchange rate.

The use of Y as a scale variable indicates that a country's exports may depend not only on export prices but also on the output capacity of the country. Therefore, Y is used as a capacity utilization variable. The nominal effective exchange rate R brings together changes in domestic and world prices. Considering that innovations in R affect the level of the real effective exchange rate, it is evident that the R series as a proxy constitutes an index of export competitiveness. In this study, P and R are introduced as control variables, because changes in P and R have effects on the traded goods sector, so affecting the course of real economic activity. For example, if the currency devaluation causes rising exports, investment may increase as a result of the profitability of exports. Thus, the positive effects of a devaluation on the traded goods sector lead to substantial increases in growth rates.

2.2 Tests for integration

Granger causality tests require stationary time series. Otherwise, the F-statistics from the Granger tests will have nonstandard distributions and the derived results could lead to misleading conclusions. Hence, the first step of the empirical procedure is to test the data for integration. The integration properties in each series are tested by applying Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit-root tests. To conduct ADF tests, consider the following data generating process:

$$\Delta Y_t = a + pY_{t-1} + bT + \sum_{i=1}^k a_i \Delta Y_{t-i} + u_t \quad (1)$$

where Δ is the first-order time difference (i.e. $\Delta Y_t = Y_t - Y_{t-1}$); Y_t denotes the relevant variable; T is the linear time trend; k is the lag order; t stands for time; and u_t is

independent white noise with zero mean. Regression (1) is with-constant and with-time trend. The null hypothesis $H_0: p=0$ against the alternative $H_1: p \neq 0$ is tested by comparing the computed t-statistics of p with the critical values from MacKinnon's tables (1996). If the computed t-statistics is less than the critical t-value, then the null hypothesis of non-stationarity (unit root) is not rejected. The acceptance of the alternative hypothesis indicates that the series Y_t is integrated of order zero, $I[0]$. If it is found that the variable Y_t is integrated of order one, $I[1]$, Y_t is said to be stationary in first difference.

Phillips and Perron (1988) propose a unit root test which controls for higher-order serial correlation in a time series. The PP unit root test also relies on regression (1). Performing PP tests, the Newey-West (1987) correction is used to adjust for heteroskedasticity and serial correlation. Note that ADF and PP tests have the same asymptotic distributions of t-statistics. The optimal lag order for the ADF and PP unit root tests is collected using the Akaike information criterion (AIC). Minimizing the AIC, a range of lags running from one to five is used. Unit root tests are reported in Table 1. A unit root in the time series reflects a test for a second unit root. The results of ADF and PP tests indicate that the hypothesis of a second root is rejected, suggesting that the variables are stationary in first differences in all countries.²

Table 1. Tests for Integration, 1960-1999

| Variables | Greece | | Ireland | | Portugal | | Spain | |
|------------|------------|-----------|------------|-----------|------------|-----------|------------|-----------|
| | ADF | PP | ADF | PP | ADF | PP | ADF | PP |
| Y | -1.98(3) | -2.65(3) | -2.06(2) | -3.04(2) | -2.88(4) | -1.98(4) | -2.05(2) | -2.80(2) |
| X | -1.12(2) | -1.51(2) | -1.13(1) | -0.94(1) | -2.71(2) | -2.48(2) | -2.69(1) | -1.72(1) |
| P | -1.00(1) | -1.16(1) | -2.09(1) | -2.48(1) | -0.83(1) | -0.97(1) | -1.48(2) | -1.49(2) |
| R | -1.89(1) | -1.21(1) | -1.35(3) | -1.29(3) | -1.86(2) | -1.55(3) | -2.42(3) | -2.16(3) |
| ΔY | -5.37*(2) | -13.2*(2) | -7.07*(1) | -8.60*(1) | -4.19**(2) | -8.49*(2) | -4.51*(1) | -7.32*(2) |
| ΔX | -5.23*(1) | -4.86*(1) | -4.83*(2) | -5.52*(2) | -3.91**(3) | -4.51*(3) | -3.55**(1) | -4.22*(1) |
| ΔP | -3.86**(2) | -7.13*(2) | -4.89*(2) | -8.74*(2) | -5.20*(1) | -7.06*(1) | -4.37*(1) | -6.61*(1) |
| ΔR | -3.78**(1) | -4.24*(1) | -3.92**(1) | -5.12*(1) | -3.70**(1) | 4.28*(1) | -4.06**(2) | -4.71*(2) |

*, ** denotes that the null hypothesis of a unit root is rejected at the 1%, 5% significance level, respectively.

Notes: ADF and PP unit root tests are conducted with a constant and a time trend. Figures in parentheses are lags determined by using the AIC. Δ is a difference operator. All numbers given are t-values. Critical values are from MacKinnon (1996).

2. Using the Schwarz information criterion (SIC), ADF and PP test results lead to conclusions similar to those of Table 1. However, since the stationarity tests appeared invariant to the lag length selection criteria, and in order to conserve space, we only report unit root tests using AIC.

According to Hassler and Wolters (1994), the ADF test and to a great extent the PP test perform very poorly, if the number of lagged differences in the estimation procedure increases. They argue that the absolute t-values of ADF and PP tests decrease monotonically with increasing number k of lagged differences, becoming insignificant from a certain k . However, performing ADF and PP unit root tests and determining the appropriate lag order via AIC, the problem suggested by Hassler and Wolters (1994) is not confronted in the estimation procedure. In this way, the results of ADF and PP tests reported in Table 1 appear robust and highly significant.

2.3 Cointegration analysis

Consider the VAR (vector autoregression) model of the form:

$$Z_t = d_1 Z_{t-1} + d_2 Z_{t-2} + \dots + d_k Z_{t-k} + \mu + u_t, \quad t=1,2,\dots,T \quad (2)$$

where Z_t is a vector containing the system variables; d_1, d_2, \dots, d_k are parameters; μ is the deterministic element of the VAR model; and u_t is the vector of random errors which is distributed with zero mean and Ω variance matrix. Given that ADF and PP tests indicated that the time series Y, X, P and R are integrated of order one $I[1]$, the notion of cointegration examines the possibility of a long-run equilibrium to which a system variable converges.

VAR model (2) can be specified as follows:

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \dots + \Gamma_{k-1} \Delta Z_{t-k+1} + \Pi \Psi_{t-k} + \mu + u_t, \quad t=1,2,\dots,T \quad (3)$$

where Δ is the difference operator; Γ 's are estimable parameters; Ψ_{t-k} is a vector of deterministic variables; Π is the long-run parameter matrix; and μ, u_t are as defined above. Considering r cointegrating vectors, Π has rank r and can be presented as $\Pi=ab'$, where a and b are both matrices. The matrix a represents the adjustment coefficients which measure the strength of the cointegrating relationships. b are the parameters in the cointegrating vectors.

The Johansen cointegration strategy (1991, 1996) allows us to estimate the cointegrating vectors between the nonstationary variables of the model, using a maximum likelihood technique which tests the cointegrating rank r and estimates the parameters b of these cointegrating vectors. A number of empirical studies have shown that Johansen's procedure sometimes produces inconsistent results in small samples. Ho and Sorensen (1996) argue that when the Johansen maximum likelihood technique is performed in small samples, the precision of the estimator is much better when the lag specification is not long. The results of testing for cointegration between the four variables are reported in Table 2. The AIC is used to select the appropriate lag length required to execute Johansen's cointegration tests. It is worth noting that in Greece,

Ireland, Portugal and Spain the results indicate the rejection of the null hypothesis $r=0$ in favour of the alternative $r=1$. The results show that the null hypotheses of $r\leq 1$, $r\leq 2$ and $r\leq 3$ cannot be rejected, concluding that among the four series Y , X , P and R there is only one cointegrating vector. Either using or not using deterministic trend in data and intercept in the cointegrating equations (CE), cointegration tests seem robust accepting the alternative hypothesis of one cointegrating vector.³

Table 2. Tests for Cointegration, 1960-1999

| | Greece (2) | Ireland (1) | Portugal (1) | Spain (3) |
|--|------------|-------------|--------------|-----------|
| I. Deterministic trend in data and intercept in CE | | | | |
| $r=0$ | 51.8** | 55.9* | 63.2* | 57.9* |
| $r\leq 1$ | 28.9 | 24.1 | 27.5 | 22.0 |
| $r\leq 2$ | 10.0 | 5.5 | 13.7 | 6.2 |
| $r\leq 3$ | 1.4 | 0.9 | 3.4 | 0.5 |
| II. No deterministic trend in data and intercept in CE | | | | |
| $r=0$ | 62.8* | 65.1* | 67.1* | 62.9* |
| $r\leq 1$ | 32.8 | 33.3 | 31.3 | 27.0 |
| $r\leq 2$ | 12.1 | 13.2 | 14.5 | 10.2 |
| $r\leq 3$ | 3.5 | 4.6 | 5.3 | 3.6 |

*, ** denotes rejection of the null hypothesis of no cointegration at the 1%, 5% significance level, respectively.

Notes: Johansen cointegration tests are applied to the four-variable system (Y , X , R , P). Critical values of the likelihood ratio test statistics are taken from Osterwald-Lenum (1992). For Greece, Ireland, Portugal and Spain the optimum lag order is determined using AIC. r indicates numbers of cointegrating relationships.

3. Although the variables under study are I[1] processes and their first differences are stationary, it is interesting to note that modern time series techniques have focused on the statistical analysis of I[2] VAR models. For an analytical discussion on I[2] VAR models, see Johansen (1997) and Rahbek *et al.* (1999).

3. Multivariate Causality, Sensitivity Analysis

3.1 Framework, Granger causality tests

According to the Granger representation theorem, if two or more variables are cointegrated they can always be transformed into an error correction mechanism (ECM). ECM procedures are very useful in modern time series analysis, because they investigate the short- and long-run properties of the system variable. The variables in their differenced form reflect the short-run dynamics of the model, while the long-run relationship is incorporated in the estimation procedure by including the lagged cointegrating vector. Regarding the links between Y and X, note that the inclusion of P and R in a system variable may have serious effects on both variables. From a policy perspective, inflation and exchange rate depict overall economic activity, and thus may affect the causal relationship between real output and exports.

Considering that the series P and R may very possibly influence the causation between Y and X, then according to the rationale of the Granger representation theorem, Y and X may be generated by the ECM model of the form:

$$\Delta Y_t = a_0 + \sum_{i=1}^n a_{1i} \Delta X_{t-i} + \sum_{i=1}^n a_{2i} \Delta Y_{t-i} + \sum_{i=1}^n a_{3i} \Delta P_{t-i} + \sum_{i=1}^n a_{4i} \Delta R_{t-i} + \delta ECT_{t-1} + u_t \quad (4)$$

$$\Delta X_t = b_0 + \sum_{i=1}^n b_{1i} \Delta X_{t-i} + \sum_{i=1}^n b_{2i} \Delta Y_{t-i} + \sum_{i=1}^n b_{3i} \Delta P_{t-i} + \sum_{i=1}^n b_{4i} \Delta R_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad (5)$$

where ECT_{t-1} is the error-correction term lagged one period; δ and λ are coefficients which capture the adjustments of ΔY_t and ΔX_t towards long-run equilibrium; a_{1i} , a_{2i} , a_{3i} , a_{4i} , b_{1i} , b_{2i} , b_{3i} and b_{4i} are parameters which reflect the short-run dynamics of the system; Δ is the first difference notation; L denotes the lag operator; and u_t , ε_t are white noise disturbance terms. In the ECM representation (4) and (5), exports do not Granger cause output, if the group of coefficients on ΔX_{t-i} in the output equation are jointly insignificant and the error-correction coefficient, δ , is not statistically significant.

Table 3 contains Granger multivariate tests for Greece, Ireland, Portugal and Spain. The AIC is used to determine the lag structure, n , in the estimation procedure. Given that the data are annual, a lag length of four years is sufficient to capture any short-run dynamics of system variables. Various aspects of Granger multivariate tests are quite interesting. First, the results appear inconsistent with the ELGH in the case

of Greece, Portugal and Spain⁴. Both the Wald F-statistics and the t-statistics on the error-correction term ECT_{t-1} indicate that export performance does not Granger cause output growth whether in the short-run or in the long-run. Second, for Greece the null hypothesis of noncausality from Y to X is rejected, suggesting that output has significant causal effects on exports⁵. The coefficient, λ , is statistically significant, showing an obvious causality from Y to X in the long-run. Third, testing the null of noncausality, powerful evidence in favour of the ELGH is found for Ireland⁶. The error-correction coefficient, δ , is statistically significant at the 1% level, has the correct sign, and indicates a high speed of convergence to equilibrium. Fourth, BG, ARCH and Chow diagnostic tests provide support for the statistical significance of Granger multivariate causality results. The BG statistics are well below their critical values, so there is no suggestion of autocorrelation in the residuals. The ARCH tests do not show any autoregressive conditional heteroskedasticity in the residuals. The Chow tests examine the stability of the regression model over different subsamples. The observation of 1979 is chosen as a break date point, because it represents the mid-point of the entire period. The Chow tests do not indicate structural shifts over the time period 1960-1999.

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4. Ramos (2001) employing annual data examines the pattern of Granger causality between real GDP, real exports and real imports in Portugal over the period 1865-1998. Estimating vector error correction models (VECM) and using the cointegrating vectors in the empirical procedure, he reports results supporting a causal feedback effect between exports-output growth and imports-output growth. His findings show that there is no kind of significant causal relationship between imports and export growth. Balaguer and Cantavella-Jorda (2001) using annual data from 1901 to 1999 examine the ELGH for the Spanish economy. Dividing the entire period in the sub-samples 1901-1958 and 1959-1999, they found that the ELGH is only valid for the second sub-period. When the whole period is considered their findings indicate a unidirectional causal chain from real domestic income to exports.
 5. Note that Panas and Vamvoukas (2002), employing annual data from the Greek economy over the time frame 1948-1997, found equivalent results. In particular, their findings based on multivariate Granger causality tests and IRFs suggest a powerful and obvious causation from output growth to exports in the long run.
 6. Doyle (1998) provides empirical evidence in line with ELGH in the case of Ireland. On the other hand, Afxentiou and Serletis (1991) contend that there is not any causal effect from exports to output growth for the Irish economy. Dar and Amirkhalkhali (2003) employing both time series and cross-sectional data over the 1971-1999 period examine the export-growth linkage for a group of 19 OECD countries. Their GLS estimates show that in the case of Greece, Ireland, Portugal and Spain, export growth rates have a statistically significant positive effect on economic development. Despite rich empirical work on the rationale of ELGH, the mixed results may be attributed to the application of different econometric methods, data frequency and sample frames.

Table 3. Granger multivariate causality tests, 1960-1999

| | <u>ΔX does not Granger cause ΔY</u> | | <u>ΔY does not Granger cause ΔX</u> | |
|-----------------|---|-----------------------------|---|---------------------|
| | F-statistics | δECT_{t-1} | F-statistics | λECT_{t-1} |
| Greece | | | | |
| AIC | 1.830[4,3,1,1] ^a | -1.085(-1.460) ^b | 0.245[1,3,2,2] ^c | -0.489(-3.157)* |
| BG (2) | 0.255 | | 2.125 | |
| BG (3) | 1.680 | | 2.530 | |
| ARCH (2) | 0.208 | | 0.291 | |
| ARCH (3) | 0.457 | | 0.363 | |
| Chow (1979) | 1.852 | | 1.726 | |
| Ireland | | | | |
| AIC | 3.731[3,1,2,1]* | -0.871(-5.558)* | 0.598[2,3,4,2] | 0.191(1.308) |
| BG (2) | 0.662 | | 0.533 | |
| BG (3) | 0.900 | | 0.509 | |
| ARCH (2) | 0.562 | | 0.344 | |
| ARCH (3) | 0.545 | | 0.311 | |
| Chow (1979) | 1.139 | | 2.123 | |
| Portugal | | | | |
| AIC | 0.716[2,2,4,4] | -0.758(-1.180) | 0.103[3,3,2,2] | -0.321(-1.216) |
| BG (2) | 2.473 | | 2.755 | |
| BG (3) | 1.850 | | 2.157 | |
| ARCH (2) | 0.886 | | 0.106 | |
| ARCH (3) | 0.934 | | 0.226 | |
| Chow (1979) | 0.525 | | 1.737 | |
| Spain | | | | |
| AIC | 1.404[2,3,3,3] | -0.540(1.324) | 0.658[1,3,4,1] | -0.070(-0.644) |
| BG (2) | 1.930 | | 1.111 | |
| BG (3) | 1.750 | | 0.737 | |
| ARCH (2) | 0.268 | | 0.137 | |
| ARCH (3) | 0.433 | | 0.376 | |
| Chow (1979) | 0.982 | | 0.257 | |

*, ** denotes significance at the 1%, 5% level, respectively.

Notes: a. The Wald F-statistics test that all the coefficients of the lagged values of the independent variable are jointly significant. The numbers in square brackets represent the lag length selection of Y, X and the control variables P, R, respectively; b. Asymptotic t-statistics in parentheses. The error-correction term (ECT), lagged one period, is the residuals from the cointegration regression. The coefficients δ and λ of ECT provide evidence of the long-run dynamics between Y and X; c. Figures in parentheses are the lag length collection of X, Y and the control variables P, R, respectively. BG is the Breusch-Godfrey F-statistic for residual serial correlation. ARCH is the AutoRegressive Conditional Heteroskedasticity F-statistic. In BG and ARCH tests, numbers in parentheses are the lag lengths. Chow is the F-statistic for structural change in 1979.

3.2 Robustness checks

The robustness of the Granger multivariate tests has been investigated employing the methodology of impulse response functions (IRF)⁷. The purpose of applying IRF is to treat all the variables as jointly determined and to specify the relative impact of each variable in interpreting shocks in Y and X. Thus, the sensitivity analysis tries to provide an indication of the dynamic and causal properties of the four-variable system. The dynamic effects of exports and output are reported in Figures 1, 2, 3 and 4. The vertical axes display the plus/minus one standard deviation band, alongside the impulse responses. The horizontal axes denote time in years. Impulse responses at horizons 1-10 years have been computed. The solid lines are point estimates.

Conducting impulse responses, the cointegrating vector for each country is used as instrument. Considering that the variables of the system are cointegrated, the VAR models are estimated in levels. IRFs plotted in Figures 1 to 4 generate results consistent with Granger multivariate tests. The Wold ordering of the variables involved is (Y, X, R, P)⁸. In Figure 2, IRF results indicate that in the case of Ireland export promotion has a significant contribution to determining changes in output. The responses of Y to X innovations are positive at all horizons. On the other hand, output growth has a limited effect on exports. Thus, the Granger-causal chain, indicated by impulse responses, shows that exports have positive effects on output growth. This result is consistent with the ELGH. In the case of Portugal and Spain, the first row of the second column of Figures 3 and 4, shows that output does not respond to export promotion innovations. This result coincides with Granger multivariate tests, suggesting the rejection of ELGH. IRF findings for Greece, presented in Figure 1, show that the ELGH is not valid. However, the results are plausible and consistent with a causality running from output growth to exports. Output growth has a significant contribution to determining changes in exports.

7. See Greene (2003) for a detailed discussion on impulse response functions.

8. Note that when alternative Wold orderings such as (X, Y, P, R) or (P, R, Y, X) are chosen, IRF results are consistent with those of Figures 1 to 4 (details of IRF results are available from the author upon request).

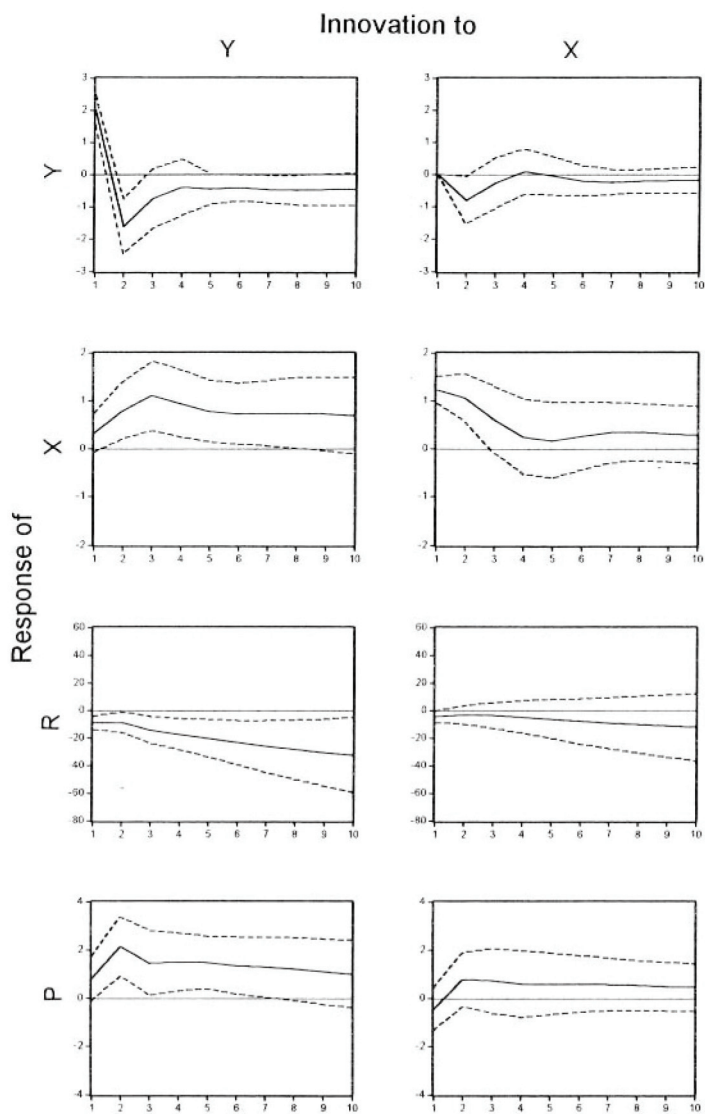


Figure 1. Impulse response functions for Greece

Notes: Impulse response functions have been calculated at a ten-year horizon for 1960-1999 time period. The vertical and horizontal axis scales are the same for all panels. For the solid lines, impulse responses are estimated as the orthogonalized innovations from the four-variable VAR model (Y, X, R, P). The dashed lines illustrate one standard deviation error band around the point estimates.

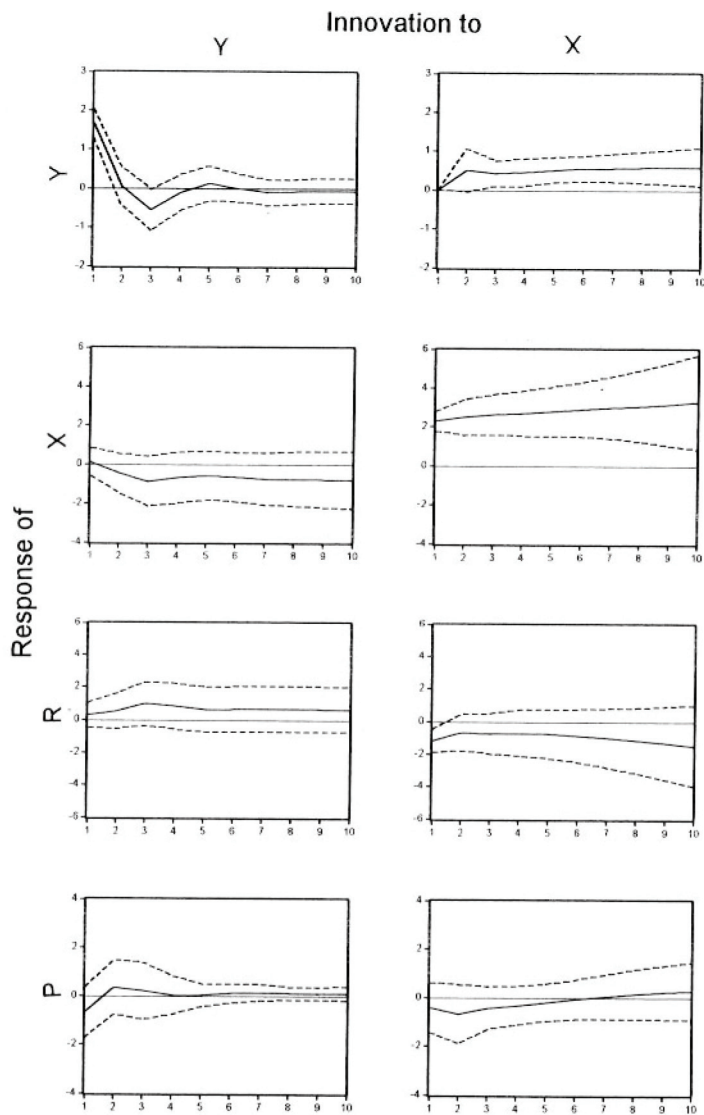


Figure 2. Impulse response functions for Ireland

Notes: See notes to Figure 1.

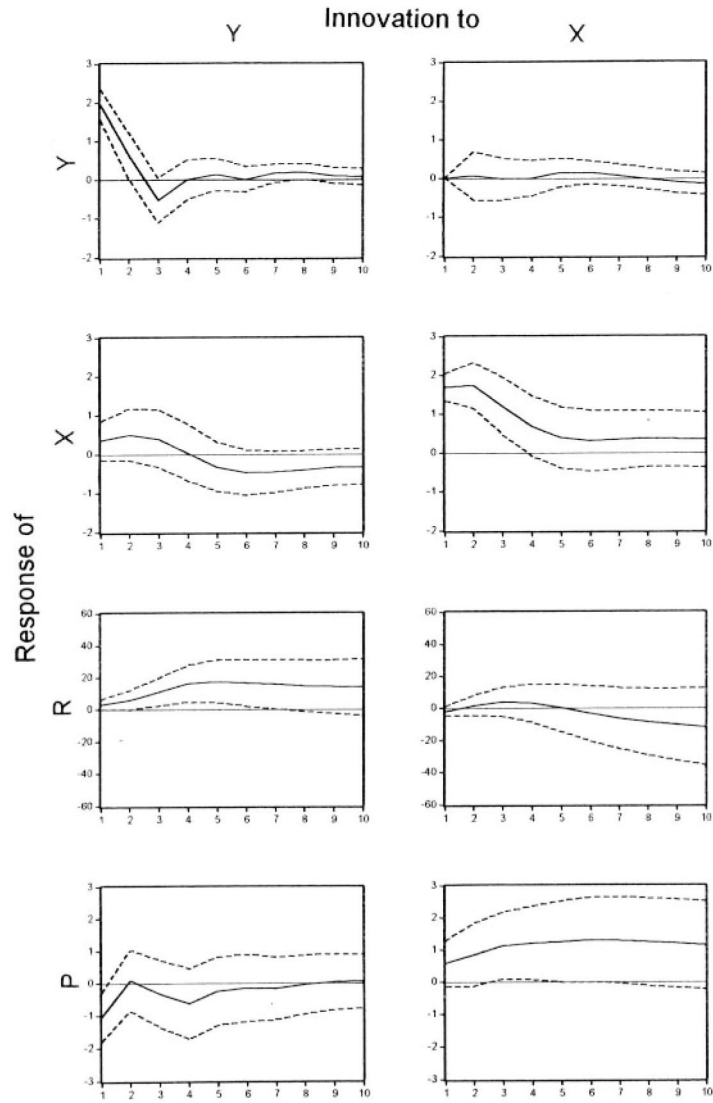


Figure 3. Impulse response functions for Portugal

Notes: See notes to Figure 1.

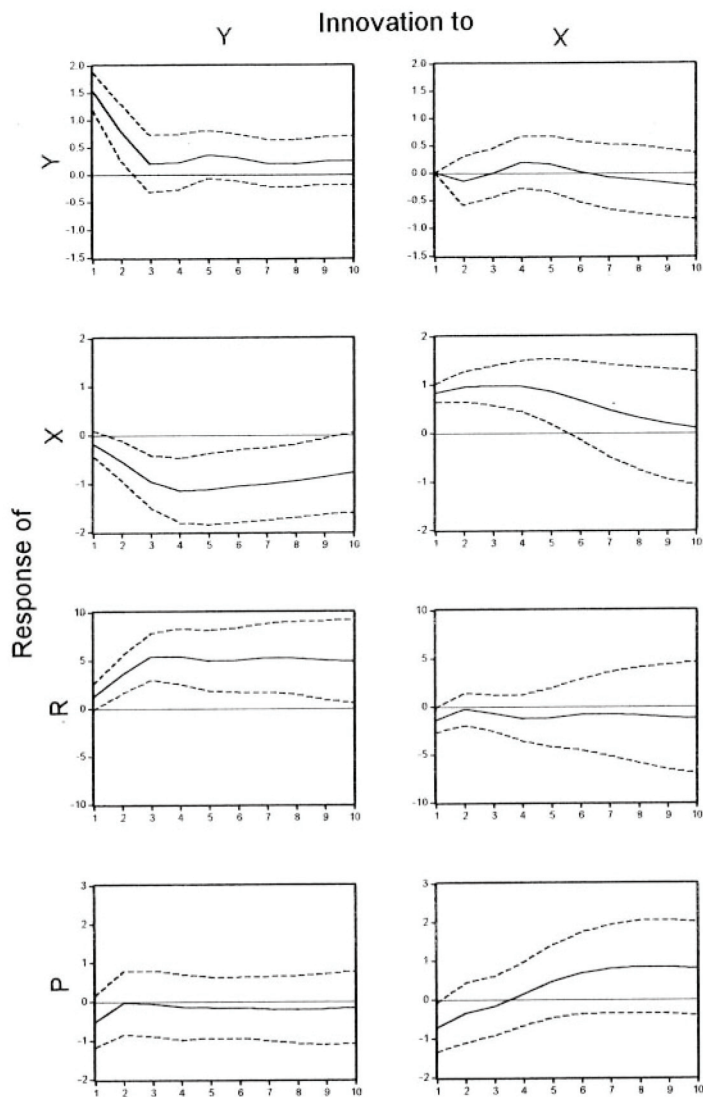


Figure 4. Impulse response functions for Spain

Notes: See notes to Figure 1.

4. Conclusion and Policy Implications

This paper is motivated by three considerations. First, the paper expresses scepticism about the empirical results of earlier studies which have used Granger causality tests. This scepticism is based on the fact that most of the earlier studies either use only bivariate models, or choose arbitrarily the lag length of system variables or apply Granger tests without exploring the direction of causality between exports and output growth in the framework of a multivariate VAR model. Second, it is of interest to investigate the ELGH for countries with similar macroeconomic characteristics like Greece, Portugal, Spain and Ireland. For a long period these countries have constituted a competitive group in the European Union. Third, the estimation procedure relies on error correction modelling, Granger multivariate causality and structural VAR analysis. This framework helps to examine the robustness of Granger multivariate tests using modern time series techniques. With the above considerations in mind, the present paper hopes to fill a gap in the available literature.

The interesting aspect of the econometric framework adopted in this paper is that Granger multivariate tests based on error correction modelling are examined for robustness using impulse response functions. The pattern of causality between Y and X has been investigated introducing P and R as control variables which reflect aggregate economic activity and influence the process of both Y and X. Granger multivariate tests and IRF results lead to similar conclusions. The ELGH is supported in the case of Ireland but not in Greece, Portugal and Spain. For Greece the results show a reverse causality running from output to exports.

Why do exports represent a fundamental determinant of economic performance in Ireland, whereas in the case of Greece, Portugal and Spain exports do not affect economic growth? To answer this question one has to bear in mind that countries vary in their resource endowment, goals of fiscal and monetary policies, the level of competitiveness, the institutional framework (e.g. education system), R & D, and other factors which determine the course of real economic activity. All these factors affect trade liberalization and influence the diversion of resources from the domestic to the export sector. In this way, it is very difficult to analyse the role of trade liberalization in economic performance and to determine the factors which affect the causal links between exports and real GDP. Actually, more empirical evidence from developed and developing countries is needed in order to examine the quantitative and qualitative factors which affect the direction of causality between exports and economic growth.

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