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Exports, imports, and economic growth in Portugal: evidence from causality and cointegration analysis

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Abstract

This paper investigates the Granger-causality between exports, imports, and economic growth in Portugal over the period 1865–1998. The role of the import variable in the investigation of exports–output causality is emphasized, enabling one to test for the cases direct causality, indirect causality, and spurious causality between export growth and output growth. The empirical results do not confirm a unidirectional causality between the variables considered. There is a feedback effect between exports–output growth and imports–output growth. More interestingly, there is no kind of significant causality between import–export growth. Both results seem to support the conclusion that the growth of output for the Portuguese economy during that period revealed a shape associated with a small dual economy in which the intra-industry transactions were very limited.

1. Introduction

Export growth is often considered to be a main determinant of the production and employment growth of an economy. This so-called hypothesis of export-led growth (ELG) is, as a rule, substantiated by the following four arguments. First, export growth leads, by the foreign trade multiplier, to an expansion of production and employment. Second, the foreign exchange made available by export growth allows the importation of capital goods which, in turn, increase the production

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potential of an economy. Third, the volume of and the competition in exports markets causes economies of scale and an acceleration of technical progress in production. Fourth, given the theoretical arguments mentioned above, the observed strong correlation of export and production growth is interpreted as empirical evidence in favour of the ELG hypothesis.

Most of these arguments are, however, less than convincing. The first two arguments are based on a short-run macro model of the Keynesian type, which is by its demand orientation not suitable to explain economic growth. Economies of scale and acceleration of technical change by international trade are potentially important sources of economic growth. The treatment of labour supply and technical progress as exogenous is not very convincing in neoclassical growth models. Thus, recent work on neoclassical models with endogenous growth is of major importance. These developments are especially interesting in our context because there are interesting links between these growth models and static models developed in the field of international trade (Helpman, 1988). On the one hand, we have to mention the growth models of Romer (1986) and Lucas (1988). The former approach postulates economies of scale, external to the firm but internal to the industry. These external economies of scale allow a compensation of the negative effect of capital accumulation on the marginal product of capital at the firm level and lead to an endogenous growth process. The latter model replaces exogenous labour supply growth by a human capital accumulation process. On the other hand, we have, e.g. the static model of economies of scale in the production of internationally traded intermediate goods as formulated by Eithier (1982), which is related to Romer's approach. In addition, we may see a relationship between the theory of acquired comparative advantage and the theory of human capital accumulation. Of course, these links have to be analyzed further on a theoretical level.

However, they point to a causal relationship between international trade and exports and economic growth. Finally and crucially, for the purpose of this paper, the strong correlation of export (import) and GDP growth rates has nothing to say about a relationship between the export (import) and the GDP trend development, as it may arise from a purely short-run relationship.[1] In order to test for the existence of a long-run or trend relationship among GDP and exports and imports, the theory of cointegration developed by Engle and Granger (1987), Johansen (1988) and Stock and Watson (1988) among others has to be applied. This is the purpose of this paper. To this end, we analyze annual data for Portugal, using the multivariate cointegration approach proposed by Johansen. In this frame, we test for a long-run relationship between GDP, exports and imports.

[1] Empirical work addressing the export–GDP relationship uses country cross-section data or time series data for a single country. For a recent overview and results, the reader is referred to Jung and Marshall (1985) and Marin (1992). As a rule, country cross-sections point to a strong interrelationship of GDP or GNP and export growth rates. There are many reasons to doubt the econometric specifications adopted in the first paper. I will mention only two problems: First, export growth is considered to be weakly exogenous. Second, the level of technology, which is presumably different across countries, is not properly accounted for.

The paper is organized as follows. In the following section we briefly describe and provide examples of the relationship between exports (imports) and GDP. In Section 3 the methodology, the data, and the results are presented. In Section 4 conclusions are presented.

2. The relationship between exports (imports) and GDP

Three possible relationships between exports and GDP are examined here: export-led growth, growth-driven exports, and the two-way causal relationship that we term feedback. Each relationship will be discussed in turn.

2.1. Export-led growth

Michaely (1977), Feder (1982), Marin (1992), Thornton (1996) found that countries exporting a large share of their output seem to grow faster than others. The growth of exports has a stimulating influence across the economy as a whole in the form of technological spillovers and other externalities.[2] Models by Grossman and Helpman (1991), Rivera-Batiz and Romer (1991), Romer (1990) posit that expanded international trade increases the number of specialized inputs, increasing growth rates as economies become open to international trade.[3] Buffie (1992) considers how export shocks can produce export-led growth. Oxley (1993), using Portuguese data (1865–1985), finds no support for the ELG hypothesis, quite the reverse, adding fuel to the controversy concerning programmes for growth.

2.2. Growth-driven exports

In contrast to the export-led growth hypothesis, scholars such as Bhagwati (1988) have noted that an increase in GDP generally leads to a corresponding expansion of trade, unless the pattern of growth-induced supply and corresponding demand creates an anti-trade bias. Neoclassical trade theory typically stresses the causality that runs from home-factor endowments and productivity to the supply of exports (see, e.g. Findlay, 1984). The product life cycle hypothesis developed by Vernon (1996) has also attracted considerable attention among international trade theorists in recent years. Segerstrom et al. (1990), for example, use the product life cycle hypothesis as a basis for analysing north–south trade in which research and

[2] Increased exports also can arise from reduced protectionism. For an excellent discussion regarding protectionism see Bhagwati (1988).

[3] For a good overview, see Pack (1994). Helpman and Krugman (1985), however, make it clear that the effect of trade on technical efficiency is not conclusive in models of imperfect competition and increasing returns to scale. In such cases the trade effect depends on the type of competition assumed on the domestic market, entry, and exit and on how market structures will change in response to a trade disturbance. As a result, the effect of trade on technical efficiency is an empirical issue.

development competition between firms determines the rate of product innovation in the north.

2.3. Feedback

The most interesting economic scenarios suggest a two-way causal relationship between growth and trade. According to Bhagwati (1988), increased trade produces more income (increased GDP), and more income facilitates more trade — the result being a 'virtuous circle'. This type of feedback has also been noted by Grossman and Helpman (1991) in their models of north–south trade.

3. Methodology

Whether exports cause GDP gains or losses, whether GDP gains cause exports, or whether a two-way causal relationship exists between exports and GDP can, in the end, be decided only empirically.

Our investigation proceeds by studying the integration properties of the data, undertaking a systems cointegrating analysis, and examining Granger causality tests.

3.1. The data

The data are annual Portuguese observations on real GDP, real exports, and real imports. Annual data on all variables are available from 1865 to 1998. Data definitions and sources are listed in Appendix A.

Plots of the logarithms of the three time series are shown in Fig. 1. Fig. 1 demonstrates that the natural logarithms of real GDP, y, the real exports, x, and the real imports, m, exhibits strong upward trends. This provides anecdotal evidence that the three series tend to move together. Summary statistics of y, x, and m indicate that these variables have means equal to 2910, 511, 814 with associated standard deviations of 3360, 956, 1392, and coefficient of variation 1.15, 1.87, 1.71, respectively.

3.2. Testing for integration

In order to investigate the stationarity properties of the data, a univariate analysis of each of the three time series (real GDP, real exports, and real imports) was carried out by testing for the presence of a unit root. Dickey–Fuller (DF), Augmented Dickey–Fuller (ADF) t-tests (Dickey and Fuller, 1979) and Phillips and Perron (1988) $Z(t\hat{\alpha})$-tests for the individual time series and their first differences are shown in Table 1. The lag length for the ADF tests was selected to ensure that the residuals were white noise. It is obvious from the DF, ADF and Phillips and Perron (PP) tests that at conventional levels of significance, none of the variables represents a stationary process. DF, ADF and PP tests computed using the first

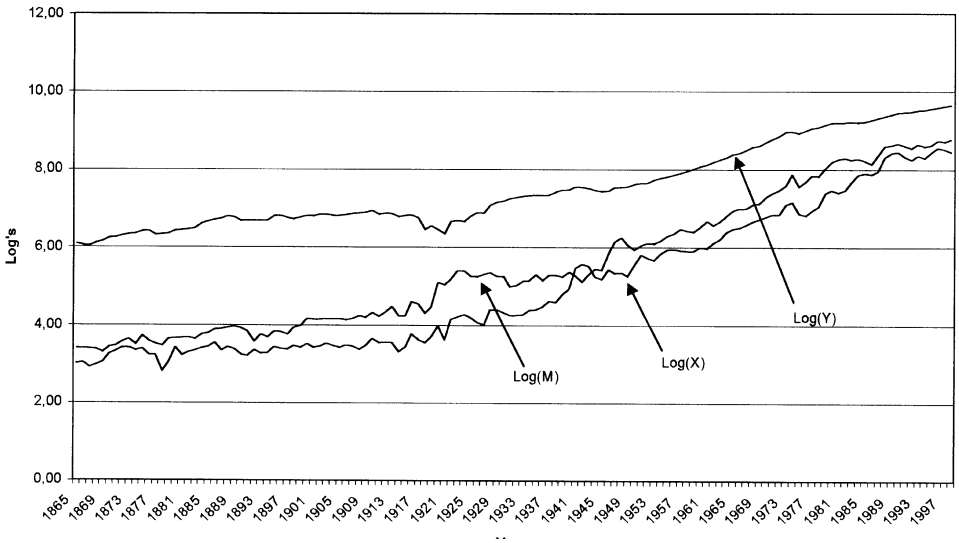

Fig. 1. Natural logarithm of real GDP, Exp, and lmp.

difference of y, x, and m indicate that these tests are individually significant at the 1% level of significance. As differencing once produces stationarity, I conclude that each of the series y, x, and m is integrated in order 1, $I(1)$.

Given the low power of standard unit root tests against fractional alternatives (Diebold and Rudebusch, 1991) we apply the semi-non-parametric procedure suggested by Geweke and Porter-Hudak (1983) to the y, x, and m series. The GPH test avoids the knife-edged $I(1)$ and $I(0)$ distinction in the PP test by allowing the integration order to take on any real value (fractional integration). Table 2 reports the empirical estimates for the fractional differencing parameter. We find no evidence in support of the fractional alternative for any of our sample series. We

Table 1
Tests for integration

Series	Single unit root			Second unit root		
	DF	ADF	PP	DF	ADF	PP
y	−0.97	−1.06	−0.57	−3.88[a]	−4.27[a]	−5.64[a]
x	−0.76	−1.20	−0.63	−4.52[a]	−4.86[a]	−6.51[a]
m	−0.70	−1.12	−0.77	−4.73[a]	−5.91[a]	−6.20[a]

[a]*Notes*. Statistically significantly different from zero at the 0.01 significance level. The optimal lag used for conducting the ADF test statistic was selected based on an optimal criterion (Akaike's FPE), using a range of lags. The truncation lag parameter l used for PP tests was selected using a window choice of $w(s, l) = 1 - s/(1 + l)$ where the order is the highest significant lag from either the autocorrelation or partial autocorrelation function of the first differenced series (see Newey and West, 1987).

Table 2
Empirical estimates for the fractional-differencing parameter $\tilde{d}$[a]

Series	$\tilde{d}$ (0.50)	$\tilde{d}$ (0.55)	$\tilde{d}$ (0.60)
y	0.079 (0.625)	−0.053 (−0.324)	−0.203 (−1.637)*
x	−0.045 (−0.254)	0.012 (0.092)	−0.157 (−1.279)*
m	0.048 (0.412)	0.091 (0.965)	−0.183 (−1.317)*

[a]*Notes*. d is the fractional differencing parameter corresponding to the y, x, and m series whereas $\tilde{d}$ is the fractional differencing parameter corresponding to the y, x, and m change series ($d = 1 + \tilde{d}$). $\tilde{d}(0.50)$, $\tilde{d}(0.55)$, and $\tilde{d}(0.60)$ give the $\tilde{d}$ estimates corresponding to the GPH spectral regression of sample size $\nu = T^{0.50}$, $\nu = T^{0.55}$, and $\nu = T^{0.60}$, respectively. The t-statistic are given in parentheses and are constructed imposing the known theoretical error variance of $\pi^2/6$. The superscripts ***, **, * indicate statistical significance for the null hypothesis $\tilde{d} = 0$ ($d = 1$) against the alternative $\tilde{d} \neq 0$ ($d \neq 1$) at the 1, 5, and 10% levels, respectively.

therefore conclude that all series are integrated processes of order one. This is a necessary step in order to test the cointegration of the variables.

3.3. Testing for cointegration

Using the concept of a stochastic trend, we may ask whether our series are driven by common trends (Stock and Watson, 1988) or, equivalently, whether they are cointegrated (Engle and Granger, 1987). This amounts to testing for the existence of linear independent so-called cointegrating relationships:

$$\sum_{j=1}^{3} \beta_{ji} Z_{jt} = \varepsilon_{it}, \qquad i = 1,...,r \tag{1}$$

The ε_{it} are $I(0)$ series, although the Z_{jt} are $I(1)$ variables. Given the $I(0)$ characteristic of ε_{it}, it is evident that the long-run behaviour of $Z_{jt}(j = 1,...3)$ is determined by 3-r common trends. An hypothesis on the number of cointegrating relationships and certain linear restrictions on β_{ji} can be tested using the approach

Table 3
Johansen's test for multiple cointegrating vectors[a]

Hypothesized cointegrating H_0	Number of relationships H_1	Test statistics		Critical values (95%)	
		Max. eigenvalue	Trace	Max. eigenvalue	Trace
r = 0	r > 0	24.02*	35.12*	20.78	29.51
r ≤ 1	r > 1	15.96*	19.44*	14.03	15.19
r ≤ 2	r = 3	2.17	3.07	3.96	s3.96

[a]*Notes*. r indicates the number of cointegrating relationships. The optimal lag structure of the VAR was selected by minimizing the Akaike's FPE criterion. Critical values are taken from Johansen and Juselius (1990). * indicates rejection at the 95% critical values.

proposed by Johansen (1988) and Johansen and Juselius (1990). Table 3 contains the results obtained by the application of Johansen's procedure. Thereby, the lag length of the level VAR system was determined by minimizing the Akaike Information Criterion (AIC). Concerning the number of cointegrating vectors, r, the results support the existence of two cointegrating relations.

3.4. Granger-causality in the ECM-VAR

The number of cointegrating relationships found in Table 3 will result in a corresponding number of residual series, and hence error correction terms (ECTs), to be used in the subsequent vector error correction model (VECM).[4] The systems we consider are equivalent to the following one, where the ECM must be seen as correcting towards an 'equilibrium subspace' which in this case is two-dimensional.[5]

$$\Delta y = \alpha_{11}\varepsilon_{1,t-l} + \alpha_{12}\varepsilon_{2,t-l} + \sum_{l=1}^{m}\phi_{11,l}\Delta y_{t-l} + \sum_{l=1}^{m}\phi_{12,l}\Delta x_{t-l} + \sum_{l=1}^{m}\phi_{13,l}\Delta m_{t-l} + u_1 \tag{2a}$$

$$\Delta x = \alpha_{21}\varepsilon_{1,t-l} + \alpha_{22}\varepsilon_{2,t-l} + \sum_{l=1}^{m}\phi_{21,l}\Delta y_{t-l} + \sum_{l=1}^{m}\phi_{22,l}\Delta x_{t-l} + \sum_{l=1}^{m}\phi_{23,l}\Delta m_{t-l} + u_2 \tag{2b}$$

$$\Delta m = \alpha_{31}\varepsilon_{1,t-l} + \alpha_{32}\varepsilon_{2,t-l} + \sum_{l=1}^{m}\phi_{31,l}\Delta y_{t-l} + \sum_{l=1}^{m}\phi_{32,l}\Delta x_{t-l} + \sum_{l=1}^{m}\phi_{33,l}\Delta m_{t-l} + u_3 \tag{2c}$$

[4] I estimate ECM–VARs or cointegrated VARs instead of level VARs, as suggested by Toda and Phillips (1993). Toda and Phillips (1993) (TP) provide evidence that the Granger causality tests in ECMs still contain the possibility of incorrect inference; they also suffer from nuisance parameter dependency asymptotically in some cases (see TP for details). All of these indicate that there may be no satisfactory statistical basis for using Granger causality tests in levels or in difference VAR models or even in ECM. The sequential Wald tests of TP Toda and Phillips (1993) are designed to avoid these problems. Asymptotic theory indicates that their limiting distributions are standard and free of nuisance problems.

[5] Such an apparent indeterminacy in the long-run equilibrium properties of the model is clearly unappealing from the economic point of view. However, this property derives from the fact that a number of variables may be tied together in different ways in the long run in such a multivariate framework. In the absence of a strong theory able to identify from the available data the single long-run relationship of interest a standard solution is to consider as a device for the 'estimation' of that relationship an unrestricted linear combination of the cointegrating vectors obtained (see 3.4). In this same direction goes the interpretation proposed by (Darnell, 1994, p. 207–208).

The results of the causality tests are presented in Table 4. They support the two-way causal relationship between income–export growth and between income–import growths. Nevertheless, there is no relevant causality between import and export growths. These results supersede the previous work based on a bivariate cointegrated system (Oxley, 1993) where the ELG hypothesis was rejected in favour of a strict reverse causality income growth export growth. However, it seems to confirm the now classical explanation of the fact that the small Portuguese economy did not start its industrialisation process in the late XIX century, like some of the 'peripheral' European countries (the paradigm for this issue is Sweden). The fact that the feedback effect seems to dominate over the export-led growth theory strengthens the now traditional explanation for the fact that Portugal did not have 'a trade off' similar to the countries with identical levels of development. The main cause for this failure is considered to be: (a) the effect of the comparatively small openness and international interdependence of Portugal since the second part of the 1800s until at least the end of 1950 (Neves, 1994); (b) the lack of any abundant natural resources in Portugal, which did not allow exports to be used to finance industrialisation as well as they did elsewhere; (c) associated with the previous point is the conclusion about the absence of relevant intra industrial trade at international level for the Portuguese economy (i.e. the GPV of the exports contains practically no quote of import value), as the absence of any significant causality between export–import growths indicates. This fact is the consequence of Portugal having maintained a strict role in the international division of labour during the period examined;[6] (d) another relevant point is the existence of a feedback effect between import growth and income growth. The interpretation of the statistical results obtained must be heeded. The main explanation eventually lies in the fact that the import growth was supported through wealth transfers towards the urban classes created by GDP growth. However, this would intuitively imply a unidirectional causality running from economic growth to imports. The feedback effect seems more difficult to explain. An element which appears essential for such an explanation and which would need more research is the inclusion into the framework used of the role of emigrant remittances in all this process. In fact a great part of import financing was made after 1865 through this external flow. It is possible that the import growth would imply a multiplied effect on public expenditure which would be financed by emigrant remittances. This kind of extension will be submitted to future research.

4. Conclusions

There has been much interest in applying endogenous growth theory to economic policy. An important example is international trade policy (mainly the policy of

[6] It is not by chance that the comparative advantages of international product specialisation were first illustrated by David Ricardo himself through the Methuen Treaty which implied a clear labour division between Portugal (wine export country) and the United Kingdom (textile industry export country).

Table 4
Temporal causality results based on vector error correction model (VECM)[a]

Dependent variable	Significant levels of F-statistics			*t*-statistics	
	Δy	Δx	Δm	$\varepsilon_{1,t-1}$	$\varepsilon_{2,t-1}$
Δy	–	0.01^{***}	0.04^{**}	-6.45^{***}	-4.19^{***}
Δx	0.05^{**}	–	0.22	-2.61^{**}	-2.37^{**}
Δm	0.05^{**}	0.13	–	-4.02^{**}	-4.16^{**}

[a]*Notes*. The ECTs were derived by normalizing the two cointegrating vectors on y, thereby resulting in two sets of residuals. The residuals were also checked for stationarity by way of unit root testing procedures applied earlier and inspection of their autocorrelation function respectively. The VECM was based on an optimally determined criterion (Akaike's FPE) lag structure and a constant. ***, and ** indicate significance at the 1%, and 5% levels.

reducing barriers to international trade). Indeed, this is an area where the new research has been used in practice and has influenced public debate. However, while intending to arrive at a tractable framework allowing us to define a testable hypothesis about the configuration of the relationships between economic growth and international trade liberalisation, the models are generally limited to the consideration of a single external factor. In this research, we overcome that shortcoming by introducing a multiple framework to analyse the causality relationships (if they exist) among output growth, export growth and import growth. This methodology allowed us to reconsider the results of previous works which used a bivariate model. The basic conclusions are:

1. the one external factor methodology (such as that of Oxley, 1993) leads to biased conclusions. Furthermore, if the results do not support the reverse causality between income growth and exports growth proposed by Oxley, they legitimise the rejection of the ELG hypothesis for the Portuguese case. Moreover, the feedback effects found between export growth–income growth and import growth–income growth fit well with the case of a small country where the openness was too limited during the period analysed to allow the rise of an exogenous virtuous cycle of development.
2. The introduction into this paper of a trivariate system permitted us to identify the path of the Portuguese economy during this period as one where the international specialisation in traditional tradeables was associated with a dual economy where the intra-industry trade was practically meaningless for all the period.
3. The results obtained for the causality relationships between import growth and income growth must be considered cautiously. This may be a consequence of a country specific characteristic: the fact that during practically all the period considered the Portuguese economy could have a sustainable absorption capacity superior to the internal production. The main source of the financing of this

disequilibrium was the emigrant remittances. The introduction of this factor into the framework is a promising start for future research.

4. The consideration of a long period always raises the issue of the stability of the relationships among the variables. An interesting extension of this research would be to verify whether the main characteristics of the path of the Portuguese economy (in particular the level of its openness) did not suffer radical changes during the referred period and what implications those eventual changes could have in the causality directions found for all the period.

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Appendix A

- Total GDP, 1914 prices, 1833–1998, million escudos.
- GDP deflator, 1833–1998, 1914 = 1.
- Exports and Imports, 1865–1998, in millions of current Portuguese escudos.

All values denoted in current Portuguese escudos were expressed in real terms using the GDP deflator (1914 = 1).

Sources: 1833–1985 — Nunes et al. (1989).
1986–1992 — Neves (1994).
1993–1998 — International Statistics Yearbook.

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