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How well the balance-of- payments constraint approach explains the Portuguese growth performance. Empirical evidence for the 1965-2008 period.

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Abstract

The present study aims to verify whether the balance-of-payments constrained growth approach is suitable for explaining the Portuguese growth performance during the last decades. For that, we adopt "Thirlwall's Law" that predicts actual growth by the ratio of the exports growth relative to the income-elasticity of the demand for imports. The income-elasticity of imports, essential for the entire analysis, is obtained from the estimation of the imports function by *2SLS*, assuming that domestic growth is endogenous.

To smooth cyclical variations, 15-year overlapping periods are considered in the computation of "Thirlwall's Law", assuming that income-elasticity with respect to imports is either constant or variable over time. It is found that the Law is a good instrument for predicting actual growth in Portugal and this result is reinforced by performing the McCombie test.

Our results reveal that Portugal grew slightly higher relatively to the OECD countries in the entire period and this is consistent with the income-elasticity of the demand for exports exceeding that of imports, as "Thirlwall's Law" implies. Portugal also grew slightly faster than the rate consistent with the balance-of-payments equilibrium, accumulating external deficits over time. Dividing the sample in the pre and post-adhesion period to the EU, it is shown that Portugal grew at a lower rate in the latter, and this is consistent with lower export growth and higher income-elasticity with respect to imports. To overcome this problem, policies are needed to improve the supply characteristics of exports related to non-price competitiveness and reduce the imports sensitivity with respect to domestic income changes.

JEL code: C13, E12, F43, O24

Keywords: balance-of-payments equilibrium growth rate, income-elasticities with respect to trade, overlapping periods, 2SLS regressions

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1. Introduction

In the core of the debate between the supply-constrained and the demand-led growth stands the very relevant contribution of Thirlwall, under the Post Keynesian framework, through what became known as "Thirlwall's Law". The growth of an economy is ultimately determined by effective demand, especially external demand, instead of being explained by the accumulation of factor inputs as the neoclassical theory assumes. The balance-of-payments equilibrium growth rate is determined by the growth of exports over the income-elasticity of the demand for imports and this is related to the Harrod foreign trade multiplier when it is expressed in a dynamic form.

The general proposition of "Thirlwall's Law" is that whenever an economy grows at a rate higher than that consistent with the balance-of-payments equilibrium, it will run into external deficits which are not sustainable in the long-run, unless capital inflows can finance the ever growing imbalances. In case a country falls in such a trap, domestic production must be adjusted downwards resulting in higher unemployment. Therefore, income is adjusted to bring the economy back to equilibrium and not relative prices as the neoclassical theory assumes. Compatible devaluations are not the solution, since in the long-run they aggravate domestic inflation, lowering competitiveness and worsening even farther external imbalances. Structural solutions are needed to turn exports more attractive in external markets and imports less sensitive to changes in domestic income.

The aim of this paper is to analyse whether "Thirlwall's Law" predicts accurately the actual growth in Portugal over the 1965-2008 period, a task that has not been yet undertaken, at least at the authors' knowledge. More specifically, the study is carried out not only for the global period but also for smaller overlapping stages, to which the McCombie test is applied to assess the validity of the Law. The whole sample is also divided in the pre and post-adhesion periods to detect different tendencies in growth performance. In section 2 we reconsider the model developed by Thirlwall to predict a country's actual growth. In section 3 we explain the variables and the data behaviour over the time period considered. Unit root tests are also performed to justify the specification of the exports and imports demand functions. The exports and imports demand functions are estimated in section 4, to provide the income-elasticities of demand for imports and exports necessary to set up "Thirlwall's Law". In section 5 we compute the growth rates consistent with the balance-of-payments equilibrium and

compare them to the actual growth rates, for 15-year overlapping periods either using a constant or a varying income-elasticity of demand for imports over time. The final section concludes on the accuracy of "Thirlwall's Law" as an instrument for predicting actual growth in Portugal.

2. "Thirlwall's Law" reconsidered

In this section we focus on "Thirlwall's Law" (Thirlwall, 1979) assuming both that the current account is initially in equilibrium[1] and relative prices are sticky, at least in the long-run. The reason for this specification may rest in the existence of competitive markets or oligopolistic market structures (Thirlwall, 1986). "Thirlwall's Law" serves to predict the growth rate of the economy consistent with the balance-of-payments equilibrium (on current account). Although it is an old-fashioned approach, the model brings very important insights which become very relevant in the era of globalization and regional integration. The Law can be computed by assuming that the demand for imports is a function of domestic income and relative prices of imports and the demand for exports is a function of foreign income and relative prices of exports. The model can be described by expressing the imports and exports demand functions, as well as, the equilibrium condition on current account, in growth rates:

$$gm_t = \pi\, gy_t + \psi\left(pd_t - pf_t - e_t\right) \qquad \text{Imports demand function} \qquad (1)$$

$$gx_t = \varepsilon\, gz_t + \eta\left(pd_t - pf_t - e_t\right) \qquad \text{Exports demand function} \qquad (2)$$

$$pd_t + gx_t = pf_t + e_t + gm_t \qquad \text{Current account equilibrium} \qquad (3)$$

In these equations gm_t, gx_t, gy_t and gz_t are the rates of growth of real imports, exports, domestic and foreign income, respectively.[2] As for the remaining variables, pd_t and pf_t are the rates of growth of domestic and import prices and e_t is the rate of change of the exchange rate. π and ε are the income-elasticities of demand for imports and exports, both expected to be positive and ψ and η are the price-elasticities of demand for imports and exports ($\psi>0$ and $\eta<0$).

[1] Thirlwall and Hussain (1982) also consider a model starting from disequilibrium in current account (implying the existence of capital inflows). We will not adopt that version in the present study.
[2] For a description of the variables and data sources, see the Appendix.

Substituting equations (1) and (2) into (3) and solving for gy_t, we obtain the economy's rate of growth consistent with the balance-of-payments equilibrium ($gy_{BP,t}$) given by:

$$gy_{BP,t} = \frac{(1+\eta-\psi)(pd_t - pf_t - e_t) + \varepsilon(gz_t)}{\pi} \tag{4}$$

Assuming that relative prices remain unchanged in the long-run, that is, $pd_t - pf_t - e_t = 0$ the expression simplifies to:

$$gy_{BP,t} = \frac{\varepsilon(gz_t)}{\pi} \tag{5a}$$

or

$$gy_{BP,t} = \frac{gx_t}{\pi} \tag{5b}$$[3]

Generally speaking, the rate of growth of a country is approximately given by the ratio of the exports growth relative to the income-elasticity of demand for imports (5b). That is to say, the balance-of-payments constrained growth rate is given by the growth of exports and the Harrod foreign trade multiplier $\left(1/\pi\right)$.[4] Therefore, it is income that adjusts to preserve equilibrium and not relative prices. If a country wishes to control external deficits (coming from $gy > gy_{BP}$) it must increase the constraint on the balance-of-payments, either through an increase in exports growth (gx) or a decrease in the income-elasticity of the demand for imports (π), or combining both cases.

Alternatively equation (5a) can be rewritten as:

$$\frac{gy_{BP,t}}{gz_t} = \frac{\varepsilon}{\pi} \tag{5c}$$

This expression tells us that relative income growth between the domestic country and the rest of the world is given by the ratio of the income-elasticity of the demand for exports over the income-elasticity of the demand for imports of the domestic economy. In other words, a country can grow faster than the rest of the world ($gy_{BP} > gz$) without

[3] Equation (5b) is obtained from the restriction $pd_t - pf_t - e_t = 0$ on equation (2).

[4] For details on this explanation, see Thirlwall (1982).

creating balance-of-payments problems only if its income-elasticity with respect to exports is higher than that of its imports ($\varepsilon > \pi$). This interpretation is interesting and connected to the concept of convergence or catching-up, where competitiveness is the key factor for such tendency to occur. In terms of policy, the country has to improve the supply characteristics of the goods and services produced and turn the economy more competitive in international markets. These supply characteristics are related to the quality, design, product differentiation, innovation, post sale services, etc., which determine the non-price competitiveness.

The hypothesis of constant relative prices has been criticised in the literature for long (McGregor and Swales, 1985; 1991; Alonso and Garcimartín, 1998-99). By adopting this specification in the present study we do not assume that relative prices do not mater in international trade performance; only that it is of minor significance. In most empirical studies in this field relative prices have been shown to be statistically insignificant and even when they are significant the price-elasticities with respect to imports and exports are very low when compared to the income-elasticities, showing that imports and exports are less sensitive to price changes than to income changes. In our study, when relative prices are regressed on a time trend there is evidence of absence of a significant trend during the period of analysis showing that the hypothesis of constant relative prices in the long-run is reasonable.

"Thirlwall's Law" as has been defined in equation (5b) will be tested empirically for the Portuguese economy over the period 1965-2008 in the following sections.

3. Variables and data analysis

The empirical analysis is focused on Portugal, for the period 1965-2008 (44 annual observations). Our aim is to examine whether the balance-of-payments constrained growth approach is adequate to explain the performance of the Portuguese economy over this period. Despite the controversy involving the type of the variables to be used – levels or rates of growth - we opt for the latter to avoid the existence of spurious relations since in principle variables in growth rates are stationary. Thus, the option for dynamic imports and exports demand functions is suitable and in line with other studies, as in Bairam (1993).

Imports and Exports growth performance

The first step is to analyse informally the temporal evolution of the variables to detect whether some regular tendencies exist for the whole period, as well as for the periods of the pre and post-adhesion to the EU. Combining the information from **Table 1** (the two first rows) and **Chart 1**, we observe that the peak for the growth of imports and exports (*gm* and *gx*, respectively) is 1987 and 1979, whereas the lowest record is registered for both in 1975. The annual average growth rate of exports (6.05%) is slightly lower than that of imports (6.53%) in the whole period. 1979 is the year with the highest growth of net exports, whereas in 1974 (year of the change of the political regime) the most negative growth is achieved. From 1993 onwards the gap between the growth of imports and exports is more stable which coincides with the post Maastricht period and the effort made towards a nominal convergence and a fixed exchange rate regime. Additionally, dividing the global sample in the pre and post-adhesion periods, it is observed that imports grow faster in the post-adhesion period (7.6% against 5.37%) and exports grow slower in the same period (5.51% against 6.65%).[5] Another remarkable result is that exports growth (6.65%) is higher than imports growth (5.37%) in the pre-adhesion period but this tendency is reversed in the post-adhesion period, with 5.51% for exports and 7.6% for imports. Therefore, Portugal is loosing competitiveness in the post-adhesion period competing in a free market and moving towards a fixed exchange rate system.

[Insert Table 1 around here]

[Insert Chart 1 around here]

Relative income growth performance

From the analysis of **Table 1** (rows 3 and 4) and mostly from **Chart 2**, it is shown that both the growth of domestic income (*gy*) and the growth of foreign income (*gz*) [6] follow a downward trend throughout the whole period. Still, for the global period the annual average growth rate of domestic income (3.58%) surpasses that of external income

[5] Moreover, the estimation of the imports function by *2SLS* (as in section 4) with an additive dummy variable for the 1986-2008 period indicates that the adhesion to the EU increased the growth rate of imports. The results are available upon request.

[6] Foreign income is proxied by the growth rate of the OECD countries. This is a reasonable proxy, since more than 80% of Portuguese imports and exports are associated with these countries. For details on the computation of *gz*, see the Appendix.

(3.19%) showing evidence of moderate convergence. However, there are signs of divergence in many occasions: 1966, 1969, 1975, 1978, 1981, 1983-1985, 1992-1994, 2000 and finally from 2002 onwards, where Portugal is growing at a slower rate than that of the OECD countries. It is important to note that Portugal grows at a higher rate in the pre-adhesion period (4.39%) than in the post-adhesion period (2.84%) and that the difference between the growth of the Portuguese economy and that of the OECD countries is higher in the former (0.69 percentage points - p.p.) than in the latter (0.12 p.p.). Therefore, not only Portugal grows more rapidly in the pre-adhesion period but also faster relatively to the OECD countries. In fact, the ratio of relative income growth for the global period, (gy/gz), is about 1.12, but it is higher in the pre-adhesion period (1.19) than in the post-adhesion period (1.04). In general, the data shows that Portugal grew on average at a slightly higher rate than that of the rest of the world and for that to be feasible, according to equation (5c), the income-elasticity of the demand for exports (ε) must be higher than that of imports (π).

[Insert Chart 2 around here]

Relative prices of imports and exports

Turning to the analysis of relative prices in **Chart 3** (and **Table 1**, rows 7 and 8), the annual growth rate of relative prices of imports (*grpm*), defined as the difference between the growth of domestic and imports prices, reaches a minimum in 1974 (gain in price competitiveness) and the highest value in 1986 (loss of price competitiveness). As for the relative prices of exports (*grpx*), defined as the growth of exports less imports prices, the behaviour is similar. For both proxies, the 1965-1985 negative average implies a favourable position in terms of price competitiveness, since domestic (for *grpm*) and exports prices (for *grpx*) are not growing as much as imports prices, and this is the pre-adhesion period. That pattern is reversed during 1986-2008 (the post-adhesion period), with import prices growing at a slower rate than domestic and exports prices. This tendency is of course explained by the removal of import tariffs and exchange rate stability not allowing competitive devaluations. Combining these results with the exports and imports behaviour of **Chart 1**, we conclude that Portugal looses competitiveness after joining the EU in 1986, and this is associated with a lower growth performance in the same period relatively to the pre-adhesion period.

An interesting aspect to notice is a long-run movement of relative prices of imports and exports towards zero. This can be taken as evidence that relative prices remain constant in the long-run ($pd_t - pf_t - e_t = 0$) thus justifying the use of equations (5a) or (5b) for predicting the Portuguese actual growth.

[Insert Chart 3 around here]

Consumption and investment growth behaviour

Private consumption (*gc*) and investment (*gi*) growth rates will be used as instruments for domestic growth in the *2SLS* estimation of the imports function. This is the reason why these two variables appear in **Table 1** (rows 5 and 6) and they exhibit different growth behaviours. Consumption growth performance is more or less stable, although in the post-adhesion period a small fall occurs (3.12% against 3.66%). On the contrary, investment has been growing faster after Portugal has joined the EU (4.29% against 3.21%). Therefore, the slower growth rate of the Portuguese economy in the post-adhesion period is not due to the lack of investment but rather to the poorer performance of exports and loss of competitiveness of the economy as we observed before.

Current account performance

The last row of **Table 1** reports the current account average (as a percentage of GDP) for the whole period and the two sub-periods before and after Portugal has joined the EU. The current account average is always negative, but the striking evidence is that the average external deficit is twice higher in the post-adhesion than in the pre-adhesion period (-5.51% against -2.73%). This is consistent with the poorer performance of exports and the relatively higher increase in imports in the post-adhesion period as we have seen before. The accumulation of higher external deficits could explain the slower growth performance of the Portuguese economy in the latter period and this is consistent with the balance-of-payments constraint hypothesis which will be tested in the following sections. The correlation coefficient between *gy* and *ca* is positive as expected (0.5367) and significant at the 5% level (see **Table 3**) and through the analysis of **Chart 4** it is possible to observe that generally, both variables move in the same direction.

[Insert Chart 4 around here]

Unit root tests

In time series analysis it is prudent to ensure that the series used are stationary, to avoid the existence of spurious relations. Thus, we use Augmented Dickey-Fuller tests (*ADF*) to check for unit roots based on three alternative specifications: with no constant and no trend; with constant and no trend; with constant and trend. The choice of the lag length that ensures the absence of serial autocorrelation follows Adkins and Hill (2008). We start with four lags, testing the statistical significance of the last lagged coefficient and eliminating it in case of statistical insignificance. The process ends when the last lag is significant at least at a 10% level. Additionally, a Breusch-Godfrey LM test is performed after the *ADF* regressions to check the existence of serial autocorrelation in the residuals. The idea is to choose the most parsimonious *ADF* model with no error autocorrelation.

Alternatively, the Phillips-Perron (*PP*) test for unit root is also performed to check if the conclusions from the *ADF* tests are robust, using Newey-West standard errors to account for serial correlation. *ADF* tests are criticized for failing whenever a structural break occurs in the period under analysis, for not considering the change in the mean that it implies (McCombie, 1997).

The unit root tests are displayed in **Table 2**. In the same table we include also those variables that will be used as extra instruments in the estimation of the imports demand function: the growth of private consumption (*gc*) and the growth of real investment (*gi*).

[Insert Table 2 around here]

All variables are integrated of order 0, *I(0)*, implying that we always reject the null hypothesis of the existence of a unit root. Therefore, all variables we consider in the estimation approach are stationary when expressed in growth rates ensuring that no spurious relations are involved when the imports and exports functions are estimated.

4. Estimation of the imports and exports demand functions

As a starting point, in **Table 3** we present a simple correlation matrix containing only the significant correlations (at the 5% significance level) between the variables to consider in the estimation approach. This preliminary analysis may help us finding the most relevant explanatory variables both in the exports and imports demand functions.

Moreover, it also enables us to check the variables more closely linked to the (endogenous) domestic growth, to justify the choice of instruments.

[Insert Table 3 around here]

The first aspect to notice is that the growth of imports (*gm*) is linearly and positively correlated with the growth of domestic output (*gy*), and exports growth (*gx*) is positively correlated with the external output growth (*gz*) as expected. The expected positive correlation between imports growth *(gm)* and relative prices of imports growth (*grpm)* is only statistically confirmed when lagged values are used for the latter. As for exports growth (*gx*), it is positively correlated either with the relative prices of exports growth (*grpx)* or its lagged value ($grpx_{t-1}$). However this correlation is modest, 0.32, and has a wrong sign. Regarding the growth of domestic output (*gy*), it is positively related to private consumption *(gc*), investment (*gi*), exports (*gx*) and external output growth (*gz*), as expected. It is important to highlight here that the correlation between domestic growth and the current account is positive (0.54) implying that higher current account deficits are associated with lower growth rates, or what it turns to be the same thing, higher current account surpluses are associated with higher growth rates of domestic output, and this is consistent with the balance-of-payments constrained growth hypothesis.

Accordingly, the imports demand function is specified as follows:

$$gm_t = a + \pi\,(gy_t) + \psi\,(grpm_{t-1}) + \omega_t \qquad (6)$$

It is expected that the growth of imports is positively related to the growth of domestic income and the lagged value of the growth of relative prices of imports (defined as the difference between the growth of domestic and imports prices). We use lagged instead of current prices essentially because the latter displays no statistical significance. In theoretical terms, it may be justified by the fact that relative price changes have not an immediate impact on imports growth, given that international transactions are based in contracts with fixed terms in the short-run. It is thus in conformity with the J-curve effect (Atesoglu, 1993).

Analogically, the exports demand function is defined as:

$$gx_t = \beta + \varepsilon\,(gz_t) + \eta\,(grpx_{t-1}) + \nu_t \qquad (7)$$

It is expected that a higher growth of foreign income (OECD countries) stimulates the growth of exports and that the lagged relative price of exports (defined as the difference between the growth of exports and imports prices) have a negative impact on exports growth.

The first step is to estimate separately each equation by *OLS* and these results are available on **Table 4**. [7]

[Insert Table 4 around here]

The outcomes for the exports function reveal a positive and statistically significant income-elasticity of the demand for exports but the price-elasticity carries a wrong positive sign and it is statistically significant only at the 10% level.[8] An interesting aspect to highlight is that the income-elasticity of the demand for exports (2.57) is higher than that of imports (1.56) and this justifies our earlier finding from the previous section that Portugal grew on average at a higher rate than that of the OECD countries over the whole period, reflecting some kind of convergence or catching-up tendency.

Our focus is on the imports demand function and we observe that both the income-elasticity and price-elasticity of the demand for imports display their expected signs and are statistically significant at the 1% level. However, they may be biased and inconsistent due to the endogeneity of the growth of domestic income. Two reasons can explain this endogeneity, with adverse tendencies: a higher domestic growth may induce more imports and if imports rely on raw materials, machinery and investment equipment, then growth will be induced farther. The second reason is from the balance-of-payments perspective: a higher increase in imports relatively to export may deteriorate the trade balance position affecting negatively the growth of domestic income. Thus, an instrumental variables approach is required to turn the results more consistent. From the correlation analysis of **Table 3**, we suggest as instruments for (*gy)* the growth of private consumption (*gc*), the growth of investment (*gi*) and the growth of

[7] The regressions were run in Stata 10.
[8] The (unexpected) positive impact of relative prices on exports was also found by Bairam (1988), for Portugal, during 1970-1985. However, the magnitude of the impact is very low when compared to that of income.

exports (*gx*). The suitability of these instruments will be tested in the *2SLS* estimation approach.

Before turning to the instrumental variables estimation, we jointly run the exports and imports demand functions by the *SUR* (Seemingly Unrelated Regression) estimation technique (see **Table 4**). In case the error terms across equations are contemporaneously correlated, there are gains in efficiency from using this method in comparison to *OLS* (AlDakhil, 1998; Baum, 2006). The drawback is that in *SUR* all regressors are exogenous (contradicting our assumption of *gy* being endogenous). The results from the *SUR* estimation do not differ substantially from those of *OLS* and according to the Breusch-Pagan (*BP*) test of cross error independence we reject the null hypothesis of error independence between equations at the 5% significance level but only marginally (at the 1% significance level the null is not rejected). Thus, no significant efficiency gains arise from using full information estimation techniques applied to system equations.

Since our aim is to obtain estimates for the income-elasticity of demand for imports ($\hat{\pi}$) in order to determine the balance-of-payments equilibrium growth rate relying on the assumption that *gy* is endogenous, we estimate the imports demand function using the *2SLS* method,[9] as in Bairam (1988), Atesoglu (1993; 1995) and Léon-Ledesma (1999).

The estimates of income and price-elasticities display the expected signs and are statistically significant. The income-elasticity of demand for imports (2.15) is higher than in the *OLS* (1.56) and *SUR* (1.53) methods. Comparing the ratio of the elasticities ($\varepsilon_{OLS}/\pi_{2SLS}$=1.20) with the relative income ratio (gy/gz =1.12) the approximation is closer than with the *OLS* (ε/π=1.65) and *SUR* (ε/π=1.81) methods, giving evidence in favour of "Thirlwall's Law" as has been expressed in equation (5c).

The Pagan-Hall heteroscedasticity test indicates the existence of homoscedasticity and thus there is no need for robust standard errors. Additionally, the Cumby-Huizinga test[10] shows the absence of 1st order error autocorrelation. The diagnostic tests from the *2SLS* regression are satisfactory. The rank condition for identification is checked through the

[9] For more information on instrumental variables estimation, see Baum et al. (2003).

10 The Cumby-Huizinga test is a generalization of the Breusch-Godfrey procedure to analyse the independence of the regression errors. It becomes especially useful in contexts of endogenous regressors, existence of overlapping data and conditional heteroscedasticity of the regression error term (Baum et al., 2007).

Anderson canonical correlation LM statistic and shows that the excluded instruments are correlated with the endogenous regressor and the equation is thus identified. Furthermore, the Cragg-Donald Wald F-statistic indicates that the instruments are not weak. The endogeneity test for *gy* reveals that this variable cannot be treated as exogenous in the imports demand function. We also confirm the hypotheses of exogeneity of the instruments and of non-redundancy (for *gx*, *gi* and *gc*).[11] Finally, the Sargan statistic leads us to accept the validity of the instruments set.

5. Balance-of-payments equilibrium growth rate

Overall, pre and post-adhesion periods

After the estimation of the imports demand function, it is possible to compute the growth rate consistent with the balance-of-payments equilibrium to compare it with the actual growth rate of the economy over the period 1965-2008. The expression (5b) is the preferred one to compute the balance-of-payments constrained growth rate (Bairam, 1997), due to the instability of the income-elasticity of demand for exports over time. The results can be observed in **Table 5**.

[Insert Table 5 around here]

The annual average growth rate of domestic income for the global period is about 3.58% (taken from **Table 1**), which is higher than the average growth rate consistent with the balance-of-payments equilibrium (2.82%), meaning that during the period 1965-2008 Portugal was growing beyond its capacity, accumulating balance-of-payments deficits. In fact, the average current account deficit (as percentage of GDP at market prices), *ca*, is -4.18% for the whole period.

Considering once more the pre and post-adhesion periods to EU there are some interesting remarks to make. In the post-adhesion period, Portugal not only grows at a lower rate both in terms of income and exports (as we mentioned earlier) but additionally, the income-elasticity with respect to imports is higher in this period (2.66) relatively to the pre-adhesion period (2.22). As a consequence, the growth rate consistent with the balance-of-payments equilibrium is lower in this period (2.07)

[11] The exogeneity and redundancy tests are not included in the article for reasons of space, but are available upon authors' request.

relatively to the pre-adhesion period (2.99). Therefore, the increase in the income-elasticity of demand for imports after Portugal joining the EU was not counterbalanced by the growth of exports to allow a higher growth of domestic income. On the other hand, the increase in imports and the poorer performance in exports growth explain the higher external imbalances in the post-adhesion period measured by the current account deficit (-5.51) which more than doubled relatively to the pre-adhesion period (-2.73).

Table 5 also shows how close is the balance-of-payments equilibrium growth rate (gy_{BP}) to the actual growth rate (gy) in Portugal. Comparing the difference between the two (gy_{BP}-gy) we observe that it is always negative, revealing that Portugal grew at a higher rate than that consistent with the balance-of-payments equilibrium and this is in line with the current account deficits accumulated over time. The approximation between the two growth rates is closer for the whole period (0.76 p.p. unexplained) and the post-adhesion period (0.77 p.p. unexplained) but wider in the pre-adhesion period (1.40 p.p. unexplained). Overall, "Thirlwall's Law" is a useful instrument for predicting the growth performance in Portugal.

Overlapping periods with constant income-elasticity of imports

Criticisms on "Thirlwall's Law" refer that the computation of a single growth rate for the global period is a short-sided vision (Atesoglu, 1993). Therefore, we opted for analysing the same Law considering 30 overlapping periods with a 15-year span. Firstly, we test the validity of the Law by considering that income-elasticity of the demand for imports is the same for all periods, in line with Léon-Ledesma (1999). The results are reported in **Table 6**, where we also display averages of the current account (ca), the annual growth rates of domestic income (gy) and exports (gx), the annual growth rate of income consistent with the balance-of-payments equilibrium given by $gy_{BP} = \frac{gx}{\hat{\pi}}$, as well as the corresponding differences relatively to the actual growth rates (gy_{BP}-gy). Following McCombie (1989) we also report $\pi^* = \frac{gx}{gy}$, that is, the income-elasticity of demand for imports assuming equilibrium in the balance-of-payments (on current account). If the average π^* for the set of overlapping periods is not significantly different from $\hat{\pi}$, neither is gy from gy_{BP}, confirming therefore the validity of "Thirlwall's Law".

[Insert Table 6 around here]

The difference between gy_{BP} and gy is negative in most of the periods, meaning that the growth rate of the economy surpasses that compatible with the balance-of-payments equilibrium, which in the long-run can not be sustainable. In eleven out of the thirty overlapping periods, from 1976 to 1997 and later from 1992 to 2008, the difference is positive, which would theoretically imply that Portugal was growing less than it was capable of from the point of view of the balance-of-payments equilibrium and was therefore reducing the external imbalances. From the second column of **Table 6** the reduction in current account deficits is confirmed for the former but not for the latter overlapping periods. This result could either suggest that $\hat{\pi}$ is not stable over time or the consideration of capital inflows (in the form of structural funds) is needed in the analysis, for gy_{BP} to predict more accurately the actual growth rate in Portugal.

Following McCombie (1989), the average π^* for the 30 overlapping periods is 1.89. When we estimate the imports function for the global period and test whether $\pi = \pi^*$ using the *t-test*, we conclude that they are statistically equal implying that the condition $gy_{BP} = gy$ is valid. Therefore, "Thirlwall's Law" is apparently relevant to predict the Portuguese actual growth rate for the period 1965-2008.

Overlapping periods with income-elasticity of imports changing over time

Contrary to Léon-Ledesma (1999), we compute the income-elasticity of demand for imports by estimating the imports demand function for each of the 15-year overlapping periods. The specification of the equation is the same as for the global period, i.e., the growth of imports is related to the growth of domestic income and the growth of lagged relative prices of imports and the estimation method is again *2SLS*, assuming that domestic income is endogenous. Apart from the two first overlapping periods, the results indicate that the equations are identified. Still, we present the results even for those two problematic estimations, to be coherent with the global period 1965-2008, defined in the beginning of the analysis.

In **Table 7** we display the income-elasticity of demand for imports obtained from the *2SLS* regression for each overlapping period and from **Chart 5** we are able to detect its general tendency.

[Insert Chart 5 around here]

As we may infer from the chart, there is a general favourable downward tendency up to 1986. After the adhesion to the EU, there is a sharp increase in the income-elasticity of imports that is maintained approximately till 1990. In fact, the EU membership turned the Portuguese economy more vulnerable to imports due to the free circulation of goods and services and abolishment of any kind of tariffs on imports. In the following periods, the elasticity drops from the 3% barrier and keeps more or less stable around that limit until 2004. In the last periods the income-elasticity of the demand of imports is declining moderately, but its value remains higher than 2 implying an increase in imports growth twice higher than the increase in domestic income.

Also in **Table 7**, we replicate the income-elasticity of the demand for imports (π^*) compatible with the equilibrium in the balance-of-payments (on current account) for an easier comparison of the results. The McCombie test is performed for each of the overlapping periods and the absolute value of the *t-test* is displayed.

[Insert Table 7 around here]

Comparing the estimated income-elasticity of demand for imports π derived from the *2SLS* regressions to π^*, the hypothesis that gy_{BP} is a good predictor of gy (that is $\pi = \pi^*$) is never rejected at the 5% significance level (the Law is rejected three times only, at the 10% significance level: 1974-1988, 1985-1999 and 1987-2001). Thus, by implementing the McCombie test our evidence shows that "Thirlwall's Law" is accurate for predicting actual growth in Portugal, for the period considered.

Also relevant is the fact that in this table the actual growth rate is always higher than that compatible with the balance-of-payments equilibrium (except for the last overlapping period), indicating the existence of external deficits. This evidence is now much more in conformity with the negative averages of the current account (as a percentage of GDP) found for each overlapping stage, as reported in **Table 6**.

The approach based on the overlapping periods' estimation of the income-elasticity of the demand of imports is apparently more appropriate to analyse "Thirlwall's Law", instead of considering a single π estimated for the global period and then using it to compute the balance-of-payments equilibrium growth rate either for the total period or

for each of the overlapping stages. With the approach from **Table 7**, the McCombie test enables us to analyse the performance of "Thirlwall's Law" period by period. The general conclusion is that the Law predicts accurately actual growth of the Portuguese economy giving support to the balance-of-payments constraint hypothesis.

6. Conclusions

The present study analyses whether the demand-orientated approach based on the balance-of-payments constraint hypothesis is suitable for explaining the Portuguese growth in the 1965-2008 period. The model developed by Thirlwall to compute the balance-of-payments equilibrium growth rate is adopted, assuming constant relative prices in the long-run (a plausible hypothesis) and initial equilibrium on current account. The imports and exports demand functions are estimated to obtain the income-elasticities with respect to imports and exports, which are crucial parameters for computing "Thirlwall's Law".

A preliminary data analysis shows that Portugal grew on average at a higher rate than the OECD countries in the whole period, 1965-2008, and this is consistent with the empirical finding that the income-elasticity of the demand for exports is higher than that of imports, as "Thirlwall's Law" implies. This corroborates the hypothesis that a country can grow faster than the rest of the world only when its income-elasticity of the demand for exports exceeds that of imports, unless capital inflows can compensate external imbalances. It is also observed that Portugal grew faster in the pre than in the post-adhesion period to the EU and this is consistent with higher current account deficits accumulated in the latter as a result of both higher imports growth and lower exports growth.

The crucial parameter of the income-elasticity of the demand for imports is obtained by estimating the imports demand function by *2SLS*, with domestic income growth being endogenous. Knowing that parameter, the balance-of-payments equilibrium growth rates are computed for a series of 15-year overlapping periods and are compared to the actual growth rates. The approximation of the two rates is quite close, validating "Thirlwall's Law" as a good instrument for predicting actual growth of the Portuguese economy. The McCombie test reinforces this conclusion. Generally it is found that Portugal grew slightly higher than the rate consistent with the balance-of-payments

equilibrium, and this is consistent with the accumulation of current account deficits over the period considered.

Alternatively the income-elasticity of the demand of imports is estimated individually for each overlapping period and it is observed a sharp increase of its value after Portugal joining the EU. Assuming that the income-elasticity of imports is changing over time the confirmation of "Thirlwall's Law" becomes more satisfactory. When the McCombie test is performed, it shows that the actual growth in Portugal can be accurately predicted by the balance-of-payments equilibrium growth approach in almost all the overlapping periods.

The overall analysis shows that external demand constraints are crucial for explaining the growth performance of the Portuguese economy, especially in the post-adhesion period. For the country to achieve sustainable growth rates exports must increase and imports sensitivity to domestic income changes must be reduced, turning the economy more competitive both in domestic and foreign markets and this is compatible with the increase in the balance-of-payments equilibrium growth rate. At the micro level, policies are needed to improve the non-price characteristics of the goods and services associated to quality, design, innovation, product differentiation, marketing and efficient distribution.

Appendix

- **gx** – Annual growth rate of real exports.

Exports of goods and services at 1995 (2000) prices (national currency; annual percentage change).

- **gm** – Annual growth rate of real imports.

Imports of goods and services at 1995 (2000) prices (national currency; annual percentage change).

- **gy** – Annual growth rate of real GDP.

GDP at 1995 (2000) market prices (national currency; annual percentage change).

- **gc** – Annual growth rate of real private consumption.

Private final consumption expenditure at 1995 (2000) prices (national currency; annual percentage change).

- **gi** – Annual growth rate of real investment.

Gross fixed capital formation at 1995 (2000) prices (national currency; annual percentage change).

- **gpx** – Annual growth rate of export prices.

Price deflator exports of goods and services (national currency; annual percentage change).

- **gpm** – Annual growth rate of import prices.

Price deflator imports of goods and services (national currency; annual percentage change).

- **gpy** – Annual growth rate of domestic prices.

Price deflator GDP at market prices (national currency; annual percentage change).

- **grpm** – Annual growth rate of the relative price of imports (gpy-gpm).

- **grpx** – Annual growth rate of the relative price of exports (gpx-gpm).

- **ca** –Balance on current transactions with the rest of the world (%of GDP at market prices).

- **gz** – Annual growth rate of real foreign income (OECD countries). Computed by the authors from 1965 to 1994.

1965–1970: GDP at the price levels and exchange rates of 1990 (billions of US dollars) – OECD (1997)
1971–1994: GDP at the price levels and exchange rates of 2000 (billions of US dollars) – OECD (2006)
1995-2008: Real GDP (% change from previous year) – OECD(2009)

Notes:
Data on *gx*, *gm*, *gy*, *gc*, *gi*, *gpx*, *gpm*, *gpy* and *ca* was taken from European Commission (2002, 2009). Constant figures are at 1995 prices (for 1965-1980) and 2000 prices (for 1981-2008), depending on the Statistical Annex from which they were obtained (2002 and 2009, respectively).

Table 1. Descriptive statistics of variables

Variable	Period	Obs	Mean	Std. Deviation	Min	Max
(1) gm % Imports	1965-2008	44	6.53	7.78	-24.2	23.1
	1965-1985	21	5.37	9.03	-24.2	14.6
	1986-2008	23	7.60	6.46	-3.3	23.1
(2) gx % Exports	1965-2008	44	6.05	7.82	-16.4	33.0
	1965-1985	21	6.65	10.66	-16.4	33.0
	1986-2008	23	5.51	3.95	-3.3	12.2
(3) gy % Domestic income	1965-2008	44	3.58	3.24	-4.3	11.2
	1965-1985	21	4.39	3.85	-4.3	11.2
	1986-2008	23	2.84	2.41	-2.0	7.5
(4) gz % Foreign income	1965-2008	44	3.19	1.52	0.1	6.3
	1965-1985	21	3.70	1.83	0.1	6.3
	1986-2008	23	2.72	0.99	0.8	4.6
(5) gc % Consumption	1965-2008	44	3.38	3.20	-2.9	13.0
	1965-1985	21	3.66	4.18	-2.9	13.0
	1986-2008	23	3.12	2.00	-0.1	6.9
(6) gi % Investment	1965-2008	44	3.78	7.87	-17.4	18.0
	1965-1985	21	3.21	9.28	-17.4	17.9
	1986-2008	23	4.29	6.49	-7.4	18.0
(7) grpm % Relative price of imports	1965-2008	44	1.14	7.76	-24.9	27.3
	1965-1985	21	-1.55	7.95	-24.9	8.7
	1986-2008	23	3.60	6.85	-5.5	27.3
(8) grpx % Relative price of exports	1965-2008	44	0.10	3.99	-12.9	11.3
	1965-1985	21	-1.04	4.74	-12.9	6.1
	1986-2008	23	1.14	2.88	-3.2	11.3
(9) ca Current account	1965-2008	44	-4.18	5.03	-13.5	5.5
	1965-1985	21	-2.73	5.59	-13.5	5.5
	1986-2008	23	-5.51	4.14	-11.9	2.1

Notes:

Variables (1) to (8) are annual growth rates.
Variable (9) is current account as a percentage of GDP at market prices.

Chart 1. Annual growth rate of exports (*gx*) and imports (*gm*), 1965-2008

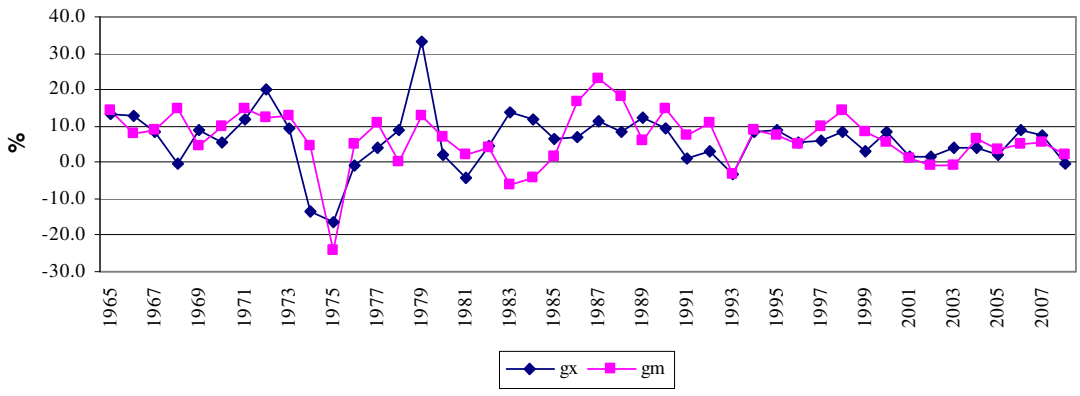

Chart 2. Annual growth rate of domestic (*gy*) and foreign income (*gz*), 1965-2008

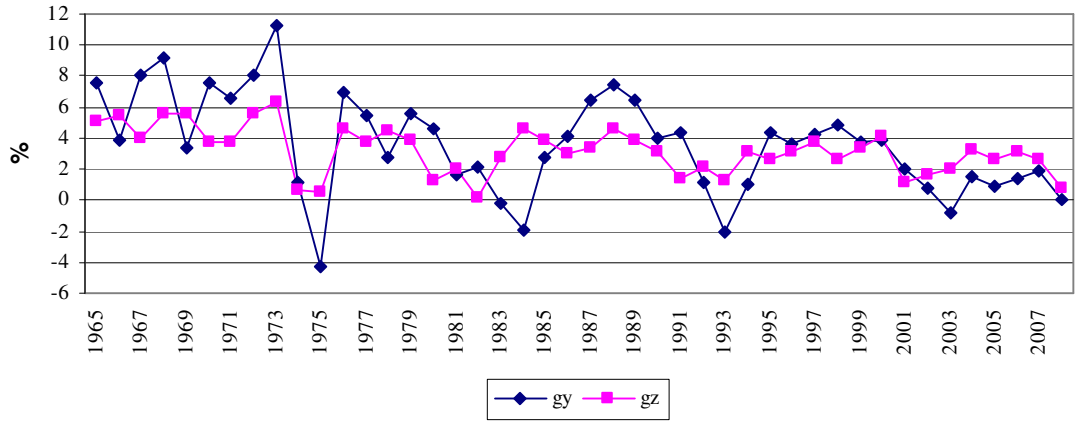

Chart 3. Annual growth rate of relative price of imports (*grpm*) and exports (*grpx*), 1965-2008

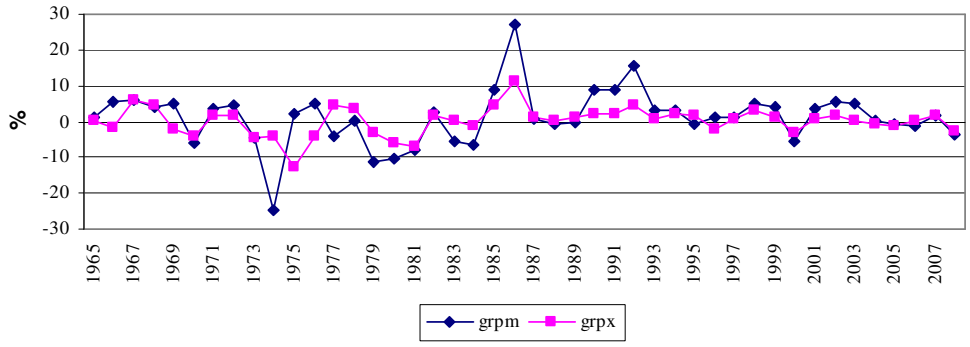

Chart 4. Evolution of actual growth rate (*gy*) and the current account (*ca*), 1965-2008

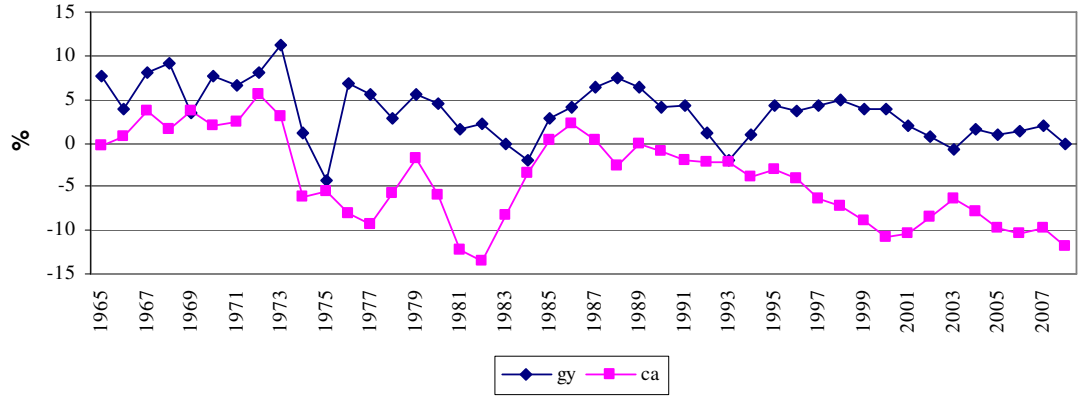

Table 2. Unit root tests, 1965-2008

	Z(t)		1% critical value	
Variable	**ADF**	**PP**	**ADF**	**PP**
gm	-3.959***	-4.750***	-3.648	-3.628
gx	-5.388***	-4.468***	-3.634	-3.628
gy	-4.517***	-4.602***	-4.242	-4.214
gz	-5.116***	-4.634***	-4.224	-4.214
gc	-3.876***	-3.887***	-3.628	-3.628
gi	-5.416***	-3.421***	-3.634	-2.631
grpm	-4.781***	-4.694***	-2.631	-2.631
grpx	-5.016***	-4.213***	-2.633	-2.631

Notes:

ADF - Augmented Dickey-Fuller test for unit root

Regression without constant and trend for: *grpm* and *grpx*.
Regression with constant and with no trend for: *gm*, *gx*, *gc* and *gi*.
Regression with constant and trend for: *gy* and *gz*.
0 lags for *gc* and *grpm*, 1 lag for *gx*, *gz*, *gi* and *grpx*, 3 lags for *gm* and *gy*.

PP - Phillips-Perron test for unit root

Regression without constant and trend for: *gi*, *grpm* and *grpx*.
Regression with constant and with no trend for: *gm*, *gx* and *gc*.
Regression with constant and trend for: *gy* and *gz*.
3 Newey-West lags.

*** Coefficient significant at the 1% significance level.
Critical values are provided by Stata.

Table 3. Correlation matrix, 1965-2008

	gm	**gx**	**gy**	**gz**	**gc**	**gi**	**grpm**	**grpx**	**ca**
gm	1.0000								
gx	0.4823	1.0000							
gy	0.7657	0.4333	1.0000						
gz	0.4451	0.5671	0.6568	1.0000					
gc	0.5574		0.6153		1.0000				
gi	0.6998	0.3488	0.6282	0.3613	0.3686	1.0000			
grpm							1.0000		
grpx	0.4833	0.3204					0.6138	1.0000	
ca	0.3995	0.3776	0.5367	0.5832	0.4328	0.3091	0.2991		1.0000

Notes:

The significance of the correlation coefficient is given by the following *t-test*: $t = r * \sqrt{\frac{n-2}{1-r^2}}$, where n is the number of observations and r the correlation coefficient. The null hypothesis is that the correlation between a pair of variables is null in the population.
The correlations displayed are statistically significant at the 5% significance level.

Table 4. Estimation results from the exports and imports demand functions

Variable	OLS		SUR		2SLS
	Exports	**Imports**	**Exports**	**Imports**	**Imports**
gz	2.5736***		2.7690***		
	(3.81)		(4.37)		
grpx (-1)	0.4730*		0.4263*		
	(1.86)		(1.79)		
gy		1.5590***		1.5280***	2.1483***
		(7.04)		(7.35)	(7.22)
grpm (-1)		0.3639***		0.3670***	0.2881***
		(3.99)		(4.30)	(2.84)
Constant	-2.2876	0.4612	-2.8944	0.5653	-1.4985
	(-0.98)	(0.46)	(-1.32)	(0.59)	(-1.22)
Obs	43	43	43		43
R-squared	0.36	0.70			0.79
F (2,40)	11.42	45.98			44.12
	(0.0001)	(0.0000)			(0.0000)
BP test of error independence across equations			$\chi_1^2 = 3.890$		(0.0486)
Pagan-Hall heteroscedasticity test			$\chi_4^2 = 6.5$		(0.1648)
Cumby-Huizinga autocorrelation test			$\chi_1^2 = 0.0611$		(0.8048)
Anderson canon. corr. LM statistic			$\chi_3^2 = 28.076$		(0.0000)
Cragg-Donald Wald F- statistic #			$F(3,38) = 23.83$		(0.0000)
Endogeneity test			$\chi_1^2 = 14.305$		(0.0002)
Sargan statistic			$\chi_2^2 = 0.908$		(0.6351)

Notes:
Numbers in parenthesis are t-ratio (for estimated coefficients) and p-values (for tests).
*** Coefficient significant at the 1% level.
** Coefficient significant at the 5% level.
* Coefficient significant at the 10% level.
#A statistic higher than 10 indicates no weak instruments and consequently, no biases in the coefficients.

Table 5. Evidence from "Thirlwall's Law"

	gy	**gx**	**π**	**gy_{BP}=gx/π**	**(gy_{BP}-gy)**	**ca**
1965-2008	3.58	6.05	2.15	2.82	-0.76	-4.18
1965-1985	4.39	6.65	2.22	2.99	-1.40	-2.73
1986-2008	2.84	5.51	2.66	2.07	-0.77	-5.51

Notes:
gy, *gx* and *ca* were taken from **Table 1**.
$\pi_{1965\text{-}2008}$ was taken from the *2SLS* estimation in **Table 4**.
$\pi_{1965\text{-}1985}$ and $\pi_{1986\text{-}2008}$ come from the *2SLS* regressions for the corresponding sub-periods (the results are available upon request).
In the 1965-1985 period, there is a problem with the endogeneity of *gy* and the instruments are weak. For 1986-2008, *gc* is redundant, but its removal worsens the global results. Bearing in mind these limitations, the main purpose is to have a global view of the performance of the most important variables before and after the adhesion to the EU.

Table 6. Actual and balance-of-payments equilibrium growth rates, 15-year overlapping periods.

Period	ca	gy	gx	gy_{BP}	(gy_{BP} - gy)	π^*
1965-1979	-0.96	5.55	7.01	3.26	-2.28	1.26
1966-1980	-1.33	5.35	6.26	2.91	-2.43	1.17
1967-1981	-2.19	5.19	5.11	2.38	-2.81	0.98
1968-1982	-3.34	4.79	4.87	2.27	-2.52	1.02
1969-1983	-3.99	4.17	5.81	2.71	-1.46	1.40
1970-1984	-4.46	3.81	6.01	2.80	-1.02	1.58
1971-1985	-4.56	3.49	6.09	2.84	-0.66	1.74
1972-1986	-4.59	3.33	5.75	2.68	-0.65	1.73
1973-1987	-4.93	3.22	5.15	2.40	-0.82	1.60
1974-1988	-5.31	2.97	5.09	2.37	-0.61	1.71
1975-1989	-4.90	3.33	6.79	3.16	-0.17	2.04
1976-1990	-4.60	3.88	8.51	3.96	0.08	2.19
1977-1991	-4.20	3.71	8.65	4.02	0.31	2.33
1978-1992	-3.73	3.42	8.59	4.00	0.58	2.51
1979-1993	-3.49	3.10	7.76	3.61	0.51	2.50
1980-1994	-3.63	2.79	6.12	2.85	0.06	2.19
1981-1995	-3.43	2.77	6.56	3.05	0.28	2.37
1982-1996	-2.89	2.91	7.23	3.37	0.46	2.49
1983-1997	-2.41	3.05	7.33	3.41	0.36	2.40
1984-1998	-2.35	3.39	6.99	3.25	-0.13	2.06
1985-1999	-2.71	3.77	6.41	2.99	-0.78	1.70
1986-2000	-3.45	3.84	6.53	3.04	-0.80	1.70
1987-2001	-4.29	3.70	6.19	2.88	-0.82	1.67
1988-2002	-4.87	3.33	5.55	2.58	-0.74	1.67
1989-2003	-5.13	2.77	5.26	2.45	-0.32	1.90
1990-2004	-5.64	2.45	4.71	2.19	-0.25	1.93
1991-2005	-6.23	2.24	4.21	1.96	-0.28	1.88
1992-2006	-6.79	2.04	4.71	2.19	0.15	2.31
1993-2007	-7.28	2.09	5.00	2.33	0.23	2.39
1994-2008	-7.93	2.23	5.19	2.41	0.19	2.33
Average						1.89

Notes:
ca – Current account as % of GDP at market prices
gy – Annual growth rate of real GDP
gx – Annual growth rate of real exports

gy_{BP} - balance-of-payments equilibrium growth rate, given by $gy_{BP} = \frac{gx}{\hat{\pi}}$

$\pi^* = \frac{gx}{gy}$ - income-elasticity of demand for imports assuming a balanced current account

Chart 5. Evolution of the estimated income-elasticity of demand for imports in the overlapping periods

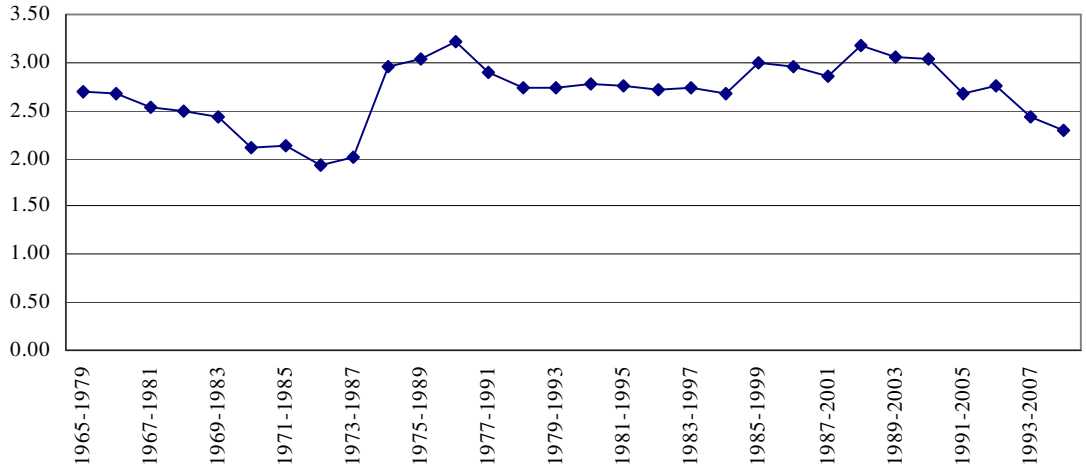

Table 7. Balance-of-payments equilibrium growth rates with income-elasticity of imports varying over the 15-year overlapping periods.

Period	π [(1)]	π^*	Abs. value of the t-test [(2)]	gy_{BP}	$(gy_{BP} - gy)$
1965-1979	2.70	1.26	1.31	2.60	-2.95
1966-1980	2.67	1.17	1.35	2.34	-3.01
1967-1981	2.53	0.98	1.55	2.02	-3.17
1968-1982	2.49	1.02	1.50	1.96	-2.84
1969-1983	2.43	1.40	1.64	2.39	-1.78
1970-1984	2.10	1.58	1.02	2.85	-0.96
1971-1985	2.13	1.74	0.74	2.86	-0.63
1972-1986	1.93	1.73	0.33	2.98	-0.34
1973-1987	2.01	1.60	0.67	2.57	-0.65
1974-1988	2.96	1.71	1.80*	1.72	-1.25
1975-1989	3.04	2.04	1.37	2.24	-1.09
1976-1990	3.22	2.19	1.10	2.64	-1.24
1977-1991	2.89	2.33	0.89	2.99	-0.72
1978-1992	2.73	2.51	0.35	3.15	-0.27
1979-1993	2.74	2.50	0.48	2.84	-0.26
1980-1994	2.77	2.19	1.08	2.21	-0.59
1981-1995	2.76	2.37	0.70	2.38	-0.40
1982-1996	2.72	2.49	0.42	2.65	-0.25
1983-1997	2.74	2.40	0.60	2.68	-0.37
1984-1998	2.68	2.06	1.11	2.61	-0.78
1985-1999	2.99	1.70	1.81*	2.14	-1.62
1986-2000	2.96	1.70	1.71	2.21	-1.63
1987-2001	2.85	1.67	1.78*	2.17	-1.53
1988-2002	3.18	1.67	1.67	1.75	-1.58
1989-2003	3.05	1.90	1.25	1.73	-1.05
1990-2004	3.03	1.93	1.38	1.56	-0.89
1991-2005	2.68	1.88	1.20	1.57	-0.67
1992-2006	2.75	2.31	0.68	1.72	-0.32
1993-2007	2.44	2.39	0.10	2.05	-0.05
1994-2008	2.30	2.33	0.06	2.26	0.03

Notes:

[(1)] The estimated coefficient from the *2SLS* regression is always statistically significant.

The Anderson canonical correlation LM statistic indicates that the equation is underidentified, for the two first sub-periods.

[(2)] The null hypothesis is that $\pi = \pi^*$, for each overlapping period.

$\pi = \pi^*$ always for a 5% significance level.

* denotes that $\pi \neq \pi^*$, for a 10% significance level.

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