

Why Thirlwall's law is not a tautology: More on the debate over the law

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Abstract. *This paper reconsiders the argument first debated in the 1980s and revisited by Blecker (2016) and Razmi (2016), inter alios, that Thirlwall's law is nothing but a near identity. It is shown theoretically and by simulation analysis that this proposition is erroneous. It is also demonstrated that Razmi's (2016) specification of the balance-of-payments constrained growth model is problematical. The paper concludes by assessing the effectiveness of the rate of change of relative prices for export and import growth. Recent evidence provides further support for the importance of non-price competitiveness in international trade and, hence, for Thirlwall's law.*

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1. INTRODUCTION

Thirlwall's law (1979) is now 40 years old and since the publication of the seminal article there have been numerous papers both confirming Thirlwall's law and extending it theoretically and empirically. When Thirlwall's paper was first published there were a number of early criticisms and lively debates. One was concerned with whether or not the law is merely a tautology (McCombie, 1981; Thirlwall, 1981, McCombie 2011). The outcome of the debate is that the criticism is invalid: the law is not a tautology. However, ironically, the same argument criticising the law has recently been put forward again. See, *inter alios*, Blecker (2016) and (Razmi 2016).

This paper first shows that the earlier conclusion that the criticism is untenable is confirmed with respect to Blecker's restatement of it. It is further shown that Razmi's reformulation of Thirlwall's model suffers from a number of problems. The paper concludes with an assessment of the effectiveness of changes in relative prices with respect to Thirlwall's law.

2. THIRLWALL'S LAW IS NOT A TAUTOLOGY

The standard test of Thirlwall's law, which goes back to Thirlwall's (1979) seminal paper, is to test the closeness of the fit between $y_b = \left(\frac{\hat{\varepsilon}}{\hat{\pi}}\right) w$ and y , where y_b is the balance-of-payments constrained growth rate of income, y is the actual rate of growth and w is the growth of world income. $\hat{\varepsilon}$ and $\hat{\pi}$ are the econometric estimates of the income elasticities of demand for exports and imports respectively. They are the values derived from the estimation of the standard macroeconomic export and import demand functions. These regressions include a relative price term and normally use annual data. w and y used in the test mentioned above are the average exponential growth rates of world and domestic income respectively, calculated using the terminal and initial level

figures of the period. The law is considered to be not refuted if the estimate of y_b is sufficiently close to y . A corollary of this test is that the estimated income elasticities should both be statistically significant. (See Thirlwall (2011) for a history of the development of the law.)

However, Blecker (2016, p.276) claims that “in recent years a number of heterodox critics [...] have questioned both the theoretical logic of Thirlwall’s law and the empirical evidence in its favour”. He contends that “tests of Thirlwall’s law are testing a near-identity that is likely to be satisfied for almost any country regardless of whether its growth is BP- [balance-of-payments] constrained in the sense of Thirlwall or not” (p.277). The implication is that the law is likely to be confirmed for any data set where the “the quantities of exports and imports grow at approximately the same rate in the long run” (p.277). Razmi (2016) takes a similar view concluding that the “the traditional approach to testing the BPCG [balance-of-payments constrained growth] model is really a test of whether or not exports and imports grow at similar rates” (p.1585).² Razmi assumes that changes in relative prices are negligibly small. We return to this point below. Consequently, Blecker terms Thirlwall’s law a “near-tautology” or “near-identity”.

However, in this section, which is an elaboration of the argument in Thirlwall (1981) and McCombie (1981, 2011, section 2), we show that the error is entirely on the part of the current critics. They have made the mistake of assuming that the mathematical calculation of a total income elasticity, using the long-run average growth rates, *must* give a value that is always the same (or nearly the same) as the value of the statistical estimation of that coefficient. It does not.

² In the monetary approach to the balance of payments, the law of one price is assumed to hold, the growth of exports equals imports (which is ultimately determined by the growth of base money) and output is at its maximum potential (Frenkle and Mussa, 1985). This is the antithesis of Thirlwall’s approach. It shows that whereas the equality of the growth of imports and the growth of exports is a necessary condition for Thirlwall’s law to hold, it is not a sufficient condition.

We concentrate on the argument espoused by Blecker (2016), who follows Cortes and Ros (2015), and show that it rests on a fundamental confusion between the *mathematical* calculation of an elasticity and its *econometric* estimation. Of course, the principle of testing and determining whether or not relationships in economics are statistically significant is the whole rationale for econometric analysis. Regression coefficients are statistically estimated and not merely arithmetically (or deterministically) calculated from the data. We will show that the failure to make this important distinction is the reason why it is erroneous to assume that Thirlwall's law is a near-identity.

To see this, let us consider Blecker's argument about the law being a tautology. For reasons of generality, we confine ourselves to discussing what is known as the 'strong version' of Thirlwall's law. As we have seen, Thirlwall's law is given by:

$$y_b = \left(\frac{\varepsilon}{\pi}\right)w \quad (1)$$

Blecker's argument that the law is merely a tautology is based on using the calculated (not statistically estimated) values of ε and π , namely, $\varepsilon^* = x/w$ and $\pi^* = m/y$. x and m are the growth rates of exports and imports. x , m , w and y are the average exponential growth rates calculated over a period of years. In other words, for example, $x = (1/T)(\ln X_T - \ln X_0)$, where X is the level of exports and T is the length of the period in years and the subscripts T and 0 denote the terminal and base year.

Substitution of these two equations for ε^* and π^* into equation (1) and rearranging gives:

$$y_b \equiv \frac{x}{m}y \quad (2)$$

Hence, the assertion is that, so long as $x = m$, Thirlwall's law is unambiguously a tautology, namely, $y_b \equiv y$.

Blecker (2016, p.277) seeks to justify this result by arguing that:

According to the near-tautology (or near-identity) argument, the *econometric* estimates of $[\hat{\varepsilon}]$ and $[\hat{\pi}]$ are likely to approximate the ratios of the growth rates of each trade variable (the volume of exports and imports) to the corresponding income growth rate (foreign or domestic), that is, $[\hat{\varepsilon} \approx \frac{x}{w}]$ and $[\hat{\pi} \approx \frac{m}{y}]$ [...] – especially if relative price effects are negligible in the long run (emphasis added).

Blecker (2016, p.278) concedes that the inclusion of the relative price term means the law is not an identity, Nevertheless, he argues that as a matter of logic that “if relative prices are small or insignificant, then the estimated income elasticities should be *closer* to the observed ratios $[x/w]$ and $[m/y]$ than if relative prices were large and significant” (emphasis in the original). Hence, this is seen as reinforcing the argument that Thirlwall’s law is a “near identity”.³

However, there is no econometric reason why in a regression of a variable on, say, two regressors if one regressor is statistically insignificant, this will necessarily make the other regressor better determined or will significantly affect its estimated value.

The fundamental flaw in the argument that Thirlwall’s law is a near identity, even if changes in relative prices are statistically insignificant, is that there is nothing in econometric theory that necessarily implies $\varepsilon^* \approx \hat{\varepsilon}$ and $\pi^* \approx \hat{\pi}$. Whether or not they do is an empirical matter. ε^* and π^* are both derived from a deterministic calculation based on two data points and there is no error term. It is also a calculation of a total, rather than a partial, elasticity.

Consequently, for a given x , w and y , there is a precise value of ε^* . $\hat{\varepsilon}$, however, is an estimated partial elasticity using numerous observations. There is no reason why it should not be statistically significantly different from ε^* or, indeed from

³ Blecker argues that if the relative price term is endogenous, its estimated coefficient may be biased downwards. Romero and McCombie (2016, 2018) and Christodoulopoulou and Tkačevs (2016) control for simultaneity and find that the relative price term is quantitatively unimportant and/or statistically insignificant for a wide range of developed countries.

zero, at the chosen confidence level. To put this another way, there is no *a priori* reason, for example, why $\varepsilon^* \approx \hat{\varepsilon}$. The reason that this may be likely to occur is because the results of the estimation of the export and import demand functions empirically confirm Thirlwall's law. There is no *logical* reason that ε^* and $\hat{\varepsilon}$, (or π^* and $\hat{\pi}$) should be approximately equal. It is an empirical issue.

We may see this, at the risk of some repetition, by further considering the argument. The supposed tautological nature of Thirlwall's law stems from the use of the numerical *calculations* of export and import income elasticities calculated using only data at the end and beginning of the period. Consequently,

$$\varepsilon^* \equiv \frac{\ln(X_T/X_0)/T}{\ln(W_T/W_0)/T} \equiv \frac{x}{w} \quad (3)$$

where W is the level of world income.

It will be recalled that the star on the elasticities serves to remind us that this estimate is an arithmetical value and not an estimated value, which, as above, we denote by $\hat{\varepsilon}$.

The same argument applies to the income elasticity of demand for imports

$$\pi^* \equiv \frac{\ln(M_T/M_0)/T}{\ln(Y_T/Y_0)/T} \equiv \frac{m}{y} \quad (4)$$

where M and Y are the levels of imports and domestic income.

Thirlwall's law, as we have seen, according to Blecker's argument, is given by the equation:

$$y_b^* \equiv \frac{\varepsilon^*}{\pi^*} w \equiv y \quad (5)$$

where y_b^* is the balance-of-payments constrained growth rate using the mathematically calculated elasticities.

Thus, if we substitute equations (3) and (4) into (5), we do indeed derive a quasi-identity because of the way ε^* and π^* have been calculated, namely:

$$y_b^* \equiv \frac{x/w}{m/y} w \equiv y \quad (6)$$

This derivation is, as Blecker correctly notes, a tautology provided that the growth of x and m , mathematically calculated over the long run are equal, which empirically holds for many countries.

However, in practice, the estimates of the elasticities are obtained by estimating the following equations, in their simplest form:

$$\ln X_t = c_1 + b_1 \ln W_t + b_2 \ln P_t + \mu_t, \quad (7)$$

and

$$\ln M_t = c_2 + b_3 \ln Y_t + b_4 P'_t + \varphi_t \quad (8)$$

where P_t and P'_t are the appropriately defined relative price terms. μ_t and φ_t are the error terms and c_1 and c_2 are constants.⁴ The subscript t denotes the year and we assume, for comparability with equations (1) and (2), that t runs from the base year to T .

The econometric and consequently *correct* test of Thirlwall's law is whether or not $y_b = \frac{\hat{\varepsilon}}{\hat{\pi}} w$ closely approximates to y and $\hat{\varepsilon}$ and $\hat{\pi}$ are both statistically significant. In this test, w and y are again the long-run exponentially calculated growth rates of world and domestic income.

⁴ The seminal empirical papers of Houthakker and Magee (1969) and Goldstein and Khan (1978) omit the time trend. The autonomous growth of exports and imports of the various countries are captured in the (differing) estimates of the respective income elasticities of demand.

We are now in a position easily to see the problem with Blecker's argument. Blecker uses the calculated values of the elasticities, whereas the correct test is to use the econometric estimates of the partial elasticities, the values for which we have no *a priori* information. For Blecker's tautological argument to have any meaning it is necessary for ε^* and π^* not just to be empirically the same as $\hat{\varepsilon}$ and $\hat{\pi}$ respectively, but for these equalities to be due to a *definitional* relationship.

Suppose we estimate equation (7). There is nothing in econometric theory that states that, using the same data set, the estimate of $\hat{\varepsilon}$ should equal to ε^* . The same is true for equation (8). They are not identities. There is no *a priori* reason why $\hat{\varepsilon} / \hat{\pi}$ should equal ε^* / π^* .

One reason that the estimates of the income elasticities could be statistically insignificant is that that the variance of the logarithm of exports (or imports) is almost completely explained by the logarithm of the relative price term; e.g., the neoclassical law of one price empirically holds. In this case, the estimates of the income elasticities are likely to be *statistically* insignificant. There is no necessary reason why the estimated income elasticities should be always statistically significant. Thirlwall (1981) made this point nearly forty years ago.

The issue is actually more general than this. There is no econometric reason why the estimated coefficients in a regression equation should not *all* be statistically insignificant. After all, they are derived from behavioural relationships and this is why elasticities are estimated econometrically and not simply calculated arithmetically.

As has been shown, the argument that Thirlwall's law is simply a tautology is based on a confusion between a statistically estimated elasticity and an arithmetically calculated one. In order to illustrate this argument, we estimated some export and import demand functions in a simulation analysis.

3. THIRLWALL'S LAW AND A SIMULATION EXERCISE

It should be emphasized that the simulations have no implications as to whether or not Thirlwall's law actually empirically holds. But what they do show is that the issue is an empirical, and not a tautological, one. This is in spite of the fact that in all the simulation exercises we impose the condition that, over the period of the data set, the average growth rates of exports and imports are exactly equal. It will be recalled that, according to Blecker, *inter alios*, this relationship is *all* that is necessary to ensure that Thirlwall's law is a tautology.

We report the results of only five regressions of export and import demand functions out of the many that have been run, but they all have the same implications for the theoretical argument.

The various five simulation databases consist of annual indices of the volumes of imports, exports, world income domestic income and relative prices. The data consist of ten years' annual observations.⁵ The long-run average growth of world income and domestic income were set equal to 3 per cent per annum in all the databases. These specific figures do not have any significant role to play in the argument and we could equally have used any values. But what does matter is the fact that the long-run growth of imports and exports are constrained to be equal and average 6 per cent per annum. The data were constructed so that the volume of exports equals the volume of imports at the beginning of the sample, and there is no long-term growth of capital flows.

From all five databases, the numerical calculation of the elasticities is $\varepsilon^* \equiv 6\%/3\% = 2$ and $\pi^* \equiv 6\%/3\% = 2$. These equalities consequently hold for all the

⁵ We ran other simulations with 20 and 30 observations. Our argument, though, is not dependent on the sample size.

simulations, although the annual observations of the variables differ between the databases. Nothing depends on the particular values of the elasticities.

Thirlwall's law, using this numerical method, is given by $y_b \equiv \varepsilon^*w/\pi^* = 3\%$ per year, which given the way it is calculated, is indeed a tautology. However, the whole point of obtaining statistical values for the income elasticities of export and import demand functions, since Houthakker and Magee (1969), is to determine whether or not the estimates are statistically significant and what predictive power they have.

Consequently, we estimated the export and import demand functions using the very different annual values from the five simulation databases. We obtain the following results reported in Table 1. Equations 1(a) and 1(b) refer to the results using database 1, equations 2(a) and 2(b) using database 2, etc. Table 2 reports a summary of the elasticities and the calculation of Thirlwall's law. The results are based on the use of OLS regression analysis. As the point we are making is about the difference in effect of using statistical estimates of the elasticities, *per se*, compared with their numerical calculation, the exact method of estimation is unimportant. Hence, we also do not report the usual regression diagnostic tests.

**Table 1. Estimated Export and Import Demand Functions:
Results Using Five Databases**

1(a)	$\ln X = 13.911 + 0.191\ln W - 2.205\ln P$ (9.15) (1.166) (-10.30)	$\bar{R}^2 = 0.959$
1(b)	$\ln M = 13.186 + 0.248\ln Y - 2.088\ln P'$ (9.15) (0.89) (-5.06)	$\bar{R}^2 = 0.828$
2(a)	$\ln X = 0.129 + 1.010\ln W$ (0.05) (1.98)	$\bar{R}^2 = 0.245$
2(b)	$\ln M = 1.342 + 0.739\ln Y$ (-0.08) (1.40)	$\bar{R}^2 = 0.197$
3(a)	$\ln X = -4.437 + 1.971\ln W$ (-0.08) (27.39)	$\bar{R}^2 = 0.989$
3(b)	$\ln M = -3.886 + 1.845\ln Y$ (-6.92) (15.69)	$\bar{R}^2 = 0.968$
4(a)	$\ln X = -0.495 + 1.117\ln W$ (-0.25) (2.65)	$\bar{R}^2 = 0.467$
4(b)	$\ln M = 0.034 + 1.001\ln Y$ (0.03) (4.13)	$\bar{R}^2 = 0.680$
5(a)	$\ln X = 0.741 + 0.861\ln W$ (0.35) (1.97)	$\bar{R}^2 = 0.243$
5(b)	$\ln M = -3.836 + 1.851\ln Y$ (-3.43) (7.86)	$\bar{R}^2 = 0.871$

Notes. In all regressions the long-run growth of exports equals the growth of imports and is 6 % per annum. The long-run growth of world and domestic income equals 3 % per annum. The values of cumulative imports equal cumulative exports over the period. The annual values of exports and imports differ between the databases. Figures in parentheses are t-values.

As the *estimation* of the various coefficients is an econometric matter, it is not possible to predict the values of the coefficients *a priori*. Using database 1 the results are given by equations 1(a) and 1(b) and the estimated coefficients of both $\ln W$ (i.e. $\hat{\epsilon}$) and $\ln Y$ (i.e. $\hat{\pi}$) are statistically insignificant. The variation in logarithm of exports and imports are statistically significantly explained by variations in the logarithms of the relative price terms ($\ln P$ and $\ln P'$) and not by the logarithms of the income terms.

Using databases 2, 3, 4 and 5 the relative price terms are insignificant and, consequently, are dropped from the specification of the regression. This has the advantage that we are now comparing the different ways of determining the values for the total, and not partial, income elasticities. Using database 2, the estimates of $\hat{\epsilon}$ is just significant and $\hat{\pi}$ is statistically insignificant at the 95% confidence level. However, using database 3, the income elasticities are both statistically significant (a necessary, but not sufficient condition, for the non-refutation of Thirlwall's law). Using databases 4 and 5, the elasticities are statistically significant, but their values are very different from ϵ^* and π^* .

For convenience, these estimates are summarized in Table 2, together with the estimates of y_b . As the estimates of the import and export functions are independent of each other, we also report Thirlwall's law using the estimates of the income elasticities from equations 1(a) and 3(b) and also 3(a) and 1(b). It should be noted that equations 1(a) and 3(b) use the export and import statistics from databases 1 and 3 respectively. Similarly, equations 3(a) and 1(b) use the export and import statistics from databases 3 and 1.

Table 2 Income Elasticities and Thirlwall's Law

Equations	$\hat{\varepsilon}$	$\hat{\pi}$	\tilde{y}_b	ε^*	π^*	y_b^*	y
1(a) & 1(b)	0.191 [§]	0.248 [§]	2.310	2.0	2.0	3.0	3.0
2(a) & 2(b)	1.010 [#]	0.739 [§]	4.100	2.0	2.0	3.0	3.0
3(a) & 3(b)	1.971 [#]	1.845 [#]	3.205	2.0	2.0	3.0	3.0
4(a) & 4(b)	1.117 [#]	1.001 [#]	3.348	2.0	2.0	3.0	3.0
5(a) & 5(b)	0.861 [#]	1.851 [#]	1.395	2.0	2.0	3.0	3.0
1(a) & 3(b)	0.191 [§]	1.845 [#]	0.311	2.0	2.0	3.0	3.0
3(a) & 1(b)	1.971 [#]	0.248 [§]	23.843	2.0	2.0	3.0	3.0

Notes: § denotes the estimated coefficient is not significant at the 95% confidence level and # that it is. \tilde{y}_b is the output growth calculated from estimate income elasticities of the export and import demand functions. y_b^* is the predicted output growth from the tautology and y is the actual growth of output.

It can be seen that Thirlwall's law using ε^* and π^* in all five databases is not, and cannot, be refuted because of the way that the elasticities are arithmetically calculated. In other words, $y_b^* \equiv (\varepsilon^*/\pi^*)w \equiv y$. Furthermore, in the light of previous discussion, they not surprisingly give identical results for all five databases. *This is Blecker's tautology and is not a test of Thirlwall's law.*

In four of the databases the calculated income elasticities are not even close to the estimated values. These are the estimates of databases 1, 2, 4 and 5 reported in Table 1. Thirlwall's law is refuted in databases 1 and 2 where one of the values of the elasticities is statistically insignificant. This is true for the combinations of equations 1(a) and 3(b) as well as 3(a) and 1(b). This is not the case for database 3 where the estimated income elasticities are very close to the

arithmetically calculated ones. But there is nothing that ensures, *a priori*, this must be the case. Database 4 is an interesting case because Thirlwall's law is not refuted even though the values of $\hat{\varepsilon}$ and $\hat{\pi}$ are not close to ε^* and π^* . This is because the *ratio* of the estimated elasticities is close to the *ratio* of the calculated one. The regressions using database 5 give estimates of both export and import elasticities that are statistically significant but give a value of \hat{y}_b , the estimated balance of payments equilibrium growth rate that is very different from the actual growth rate, y .

These various estimates, of course, do not have any implications for the actual estimates of Thirlwall's law. They are merely designed to demonstrate that the law is not a tautology. The empirical testing of the law usually confirms the law, but can in principle refute it. The tautology, by definition, must always confirm it, but this should not be confused with the results of the regressions that also confirm the law. The latter results are not because of the tautology.

4. SOME PROBLEMS WITH RAZMI'S (2016) MODEL

As a result the erroneous interpretation of Thirlwall's law as a tautology, Razmi (2016) has proposed a theoretical re-specification of the balance-of-payments equilibrium growth equation, which explicitly incorporates the supply side. The revised theoretical equation for the balance-of-payments equilibrium growth rate is given by a hybrid of demand and supply variables, namely,

$$y_b = \beta_1 w + \beta_2 k + \beta_3 e \quad (9)$$

where the β coefficients consist of various demand and supply price elasticities of imports and exports, e is the growth of the nominal exchange rate, and k is the *exogenous* growth of the capital stock of the export sector. (In the subsequent empirical analysis, k is proxied by the growth of the total capital stock.) w is

again the exogenous growth of world income. Razmi estimates a specification similar to equation (9) using panel-data and single-equation methods for a number of developed and developing countries. The former generally uses growth rates and the latter log-levels. We shall concentrate on the former. The growth of the nominal exchange rate is excluded. The logarithm of Rodrik's (2008) measure of the level of the real exchange rate undervaluation,⁶ the growth of relative export and import prices and the logarithm of external debt to income ratio are also included as controls

. (The equation is similar to Thirlwall's law, but with the growth of the capital stock included as an additional regressor.) Razmi finds that, empirically, the estimated coefficient of k is statistically significant and that of w is often significant, but the size of its coefficient is reduced when k is included. Consequently, the regression results mean that an exogenous increase in the growth of the capital stock, due to, say, an increase in entrepreneurs' "animal spirits", raises the growth of exports and hence the balance-of-payments equilibrium growth rate. This is holding the other independent variables constant, notably the relative price terms and the growth of world income. An autonomous increase in the growth of world income, via an induced increase in exports can, in turn, in the model, increase the growth of output, again holding the other regressors constant. These somewhat paradoxical results are derived from the underlying theoretical assumptions of the model.

Razmi's (2016, p.1593, equation (9)) theoretical specification of the export-supply function, in dynamic form, is a function of the *exogenous* growth of the

⁶ This is the divergence of the tradable from the non-tradable exchange rate, adjusted for the Balassa–Samuelson affect. It is not derived from the estimation of import and export demand functions. Rodrik (2008) found that it was only important for the low-income countries. Woodford (2008), Goncalves and Rodrigues (2017) and Ribeiro, McCombie and Lima (2019), *inter alios*, find little or no support for this result.

export sector's capital stock, together with the growth of the *nominal* export price. Hence, the former is treated as autonomous in the specification of the theoretical model. Razmi (p.1593, fn. 19) cites Goldstein and Khan (1985) in support of the inclusion of an exogenous scaling factor, who consider either trend income or trend exports. However, Goldstein and Khan (1985, p. 1060) justify the latter in terms of the assumptions underlying the Lucas New Classical 'surprise' function. Furthermore, they explicitly state that they assume that long-run output growth is determined by the supply side. Both assumptions are the antitheses of those underlying the balance-of-payments constrained growth model.

In the balance-of-payments constrained growth model, the growth of the flow of export-capital services is more plausibly assumed to be endogenous, determined by the growth of exports. Williamson (1983, p.153) argues that, in the short-run, "the [exporting] manufacturer sets the price and is pleased to sell everything that is demanded at that price". Firms keep a planned margin of excess capacity (and inventories) to meet a short-term increase in demand, which, if sustained, is met by increased capacity and capital accumulation. As Lavoie (2014, p.154) puts it "there are good theoretical as well as practical reasons, as well as good strategic and technical ones, to explain why corporations generally aim at operating much below their full capacity".

In the long-run, the Kaldorian approach is that "In the case of industrial activities ('manufactures') the impact effect of exogenous changes in demand will be on production rather than on prices. 'Supply', at any rate long-run supply, is normally in excess of demand – in the sense that producers would be willing to produce more, and to sell more, at the prevailing price (or even at a lower price) in response to an increased flow of orders" (Kaldor 1970, p. 485). So, in this approach, it is the growth of demand for a country's exports that endogenously determines the growth of capital in the export-sector, and not vice versa.

The use of the nominal price by Razmi in the theoretical specification of the export-supply (and the import-supply) functions is implausible as it implies firms are money illusioned. Goldstein and Khan (1978, p.276, 1985, p.1045) state that the correct variable is the price of a country's exports relative to its domestic price. As this increases, it becomes more profitable to export. If the country only produces one good, as Razmi assumes, then the relative price will be unity. Razmi cites Dornbusch (1975) and Isard (1995) as cases where nominal prices are used in the context of the standard derivation of the Marshall-Lerner conditions. But having done this, both Dornbusch (1975, p.860) and Isard (1995, p.95) subsequently criticise the approach for not using relative prices.⁷

As we have noted, the inclusion of the assumed exogenous growth of the total capital stock as a proxy for the export sector's capital stock is statistically significant in the various regression analyses. But this result does not necessarily provide evidence for the importance, or otherwise, of the supply side. This is because this result will always largely be determined by an underlying accounting identity and so does not necessarily reflect a behavioural relationship. The share of capital in the total value of output is given by $a \equiv rK/Y$, where r is the rate of profit, K is the capital stock and Y is output. The growth of output is *definitionally* equal to $y \equiv (g_r - g_a) + k$, where g_r and g_a are the growth rates of r and a . If the share of capital and the rate of profit are approximately constant, which empirically is often the case, a regression of y on k must definitionally give a very close goodness of fit, with a value of the slope coefficient of about unity. (This is one of Kaldor's stylized facts.) Even if a and r do change over time, there is still likely to be a close statistical fit between y and k because of the identity. This is true even when k is included in a multivariate

⁷ Razmi (2016, p.1593, fn. 16) states that if the demand for imports and exports are also based on nominal prices, it makes no difference to the model. But this does not solve the problem that relative prices should be used.

regression such as Razmi's estimated model, although its coefficient may differ from unity.

Razmi takes a very different approach to the traditional approach to testing whether or not growth is balance of payments constrained, originated by Thirlwall (1979). The latter is discussed below. Razmi describes equation (9) above as theoretically determining the balance-of-payments equilibrium growth rate, but he uses the actual growth of output as the regressor in his empirical approach. The interpretation of the regression results presumably seems to be that the magnitude of the coefficients of w and k reflect the relative contributions of the demand and supply side to the balance-of-payments constrained growth rate. As we noted above, the results of the regression analysis mean that either an increase in the growth of world demand, *ceteris paribus*, or an increase in growth of the capital stock, holding the other regressors constant, will each independently increase the rate of growth of output. In the light of this, in what sense can this be interpreted as a test of whether or not growth is balance-of-payments constrained or, alternatively, that the estimating equation is of the balance-of-payments constrained growth rate? A country can always relax the balance-of-payments constraint (i.e. increase the growth of output) in this approach simply by investing more in the export sector. This statistical result occurs because the growth of world income, the rate of change of relative prices and the other regressors are all held constant when considering the impact of the growth of the capital stock on the growth of output in the specification of the multiple regression. But clearly these variables are not plausibly theoretically independent of each other and so cannot be considered to be exogenous. Likewise, a growth in world income (demand) in this regression specification can increase the growth of output, implausibly holding all the other independent variables constant, including the growth of the capital stock.

In Thirlwall's approach to balance-of-payments constrained growth, the growth of the export-capital stock is endogenously determined by the growth of demand for exports. This is for the reasons discussed above. In this case, the growth of the capital stock should not appear as a regressor in the estimating equation, as in Razmi's model. As a simplification for expositional reasons, we have essentially the following model. First, the estimate of the balance-of-payments equilibrium growth rate of a country is determined by the growth of world demand, $y_b = f_1(w)$, calculated using the estimates of the elasticities from the export and import demand functions. As discussed in the next section, it is generally found that the rate of change of relative prices has a negligible effect on the growth of exports and imports and, hence, on y_b . y_b is then tested to determine whether or not it differs from the actual growth of output, which is a function of the supply-side factors.

Secondly, the growth of the export-capital stock is determined by the growth of exports, i.e., $k = f_2(x)$. It follows that k is also a function of the growth of world income, that is to say, $k = f_3(w)$, as x is a function of w . The last two equations are different specifications of the export-capital supply function.

Let us assume that $k = f_3(w)$ is estimated by regressing k on w and is found to be statistically significant. Consequently, we would expect that k could well be statistically significant if it is erroneously included as a regressor of y in the first equation ($y = f_1(w)$), as in Razmi's estimating equation. It should be noted that this inclusion is not a problem that can be overcome by the use of instrumental variable techniques, as it is a misspecification issue.

An important extension of the traditional Thirlwall approach is that of Lanzafame (2014). Lanzafame calculates y_b for a number of countries and tests whether it differs from the econometrically estimated endogenous natural (or maximum) rate of growth. (Lanzafame uses the methodology of León-Ledesma and Thirlwall (2002) to estimate the values of the natural rate of growth.) It proves

generally not to differ. He further uses panel Granger causality estimation methods in this approach and finds that there is a uni-directional causality from export growth to output growth. Moreover, y_n adjusts to y_b and thus it is “supply that responds to demand. This gives robust support to the Keynesian notion of growth as primarily determined on the demand side, with BOP [balance-of-payments] equilibrium acting as a long-run constraint and productive capacity adapting *endogenously* when actual growth is above the natural rate of growth” (Lanzafame, 2014, p.833, emphasis added).

The use of the actual growth rate of output as the regressand in Razmi’s individual country regression analyses makes it not possible to test which countries are, and which are not, balance-of-payments constrained as in the traditional (Thirlwall) approach discussed above.

Consequently, the preferable approach to the testing of whether or not the growth of a country is balance-of-payments constrained is still the original method using Thirlwall’s law.

5. THE IMPACT OF RELATIVE PRICES AND THIRLWALL’S LAW

A sine qua non of the balance-of-payments constrained growth model is that the rate of change of relative prices plays a quantitatively small role in the determination of the growth of exports and imports. The empirical evidence suggests that this is nearly always the case.

A recent comprehensive survey of estimates of the Marshall-Lerner condition found that “the results of our analysis are clear: The M-L [Marshall-Lerner] condition does not [statistically] hold in a large fraction of cases in which it is claimed to do so” (Bahmani, Harvey and Hegerty, 2013, p.435). They also provided their own estimates and further conclude that “those who draw on previous studies to support certain expected benefits from a currency

depreciation should think twice before they rely too heavily on such estimates” (p.349). Recall that even when the Marshall-Lerner condition is met, given the specification of the import and export demand functions discussed, it necessary for the rate of change of relative prices to be continuous for it to increase the balance-of-payments constrained growth rate. This is implausible. Even for relatively homogenous agricultural commodities the evidence that the neoclassical law of one price holds is not convincing (Thursby, Johnson and Grennes, 1986; Ardeni, 1989).

There are now numerous estimations of Thirlwall’s law (and other econometric estimations of export and import demand functions) that confirm the unimportance of relative prices for a wide range of countries. Recent studies include Lanzafame (2014), which has been discussed above. Christodouloupoulou and Tkačevs (2016) find this unimportance to be true for the euro area countries, using a variety of relative price measures. Romero and McCombie (2016, 2018) also show this using export data for industries and quality-adjusted relative prices for a number of developed countries. As noted above, these three studies correct for any simultaneous equation bias.

There is the substantial research emanating from the European Central Bank’s Research Competitiveness Network which has confirmed the overwhelming importance of non-price competitiveness in explaining changes in both cumulative export market shares and export performance. This analysis has become possible in recent years with the construction of large data sets with highly disaggregated international products and prices.

The approach, *inter alia*, is to construct two separate aggregate indices of trade prices using data at high level of disaggregation. The first is the “conventional” relative unit value (value per physical measure of goods such as tonnage), or conventional relative export price (RXP), and measures only price competitiveness. The second is the “relative” export price adjusted for quality

and taste. It is “measure of price per unit of utility”.⁸ A comparison of the two indices reflects the contribution of non-price factors to changes in export prices (Benkovskis and Wörz, 2015. See also Benkovskis and Wörz, 2012, 2016).

The problem has been posed by Benkovskis and Wörz, (2015) in their aptly titled paper – “cost competitiveness: a dangerous obsession”. They ask, “How can we reconcile real effective exchange rate (REER) – and hence an apparent deterioration in cost competitiveness – with rising world market share – a clear sign of improved competitiveness”. (This is the Kaldor (1978) paradox.) They point out that many emerging market economies have increased their share of world markets with increasing relative prices, while other countries have lost global market share despite increasing cost competitiveness. They show that it is due to changes in non-price competitiveness. The first result that is in accordance with Allard’s (2009) findings for four Central European economies, *inter alia*.

In the case of the US, for example, since about the year 2000 the conventional RXP has depreciated, but so also has the US market share. What accounts for this paradox? The answer, according to Benkovskis and Wörz (2015) is that the relative export price, after it has been adjusted for quality, has increased markedly over this period, suggesting a decline in non-price competitiveness. The fall in the conventional real exchange rate has been more than offset by a decline in the relative (although not absolute) quality of US exports. Moreover, China, in particular, owes its export success to the substantial gains in its non-price competitiveness, and not to the increasing relative cheapness of its exports. This confirms the conclusions of both Pula and Santabárbara (2011) and Fu, Kaplinsky and Zhang (2012) using regression analysis.

This method quantifies and “highlights the crucial importance of non-price competitiveness in assessing emerging countries’ performance on external markets”, as well as for the developed countries (Benkovskis and Wörz, 2016,

⁸ Some studies break these down into further indices including changes in tastes.

p.706). It also demonstrates that the effect of non-price competitiveness differs from country to country.

Boggio and Barbieri (2017) find that the growth of export market shares of 33 countries are significantly determined by the levels of unit labour costs (ULCs), but not their growth rate. When the level of per capita GDP is introduced as a variable capturing technological capabilities, the coefficient of the ULC variable becomes insignificant, suggesting the importance of the former. However, Felipe and Kumar (2014) present skeptical reasons about the use of ULCs as a measure of cost competitiveness.

Overall, the evidence discussed above confirms the crucial importance of non-price competitiveness in determining trade flows, as originally emphasized by Thirlwall (1979).

6. CONCLUDING COMMENTS

The argument that all that tests of Thirlwall's law are doing is estimating a tautology has been shown to be both theoretically and econometrically erroneous. This has been confirmed by a simulation analysis. This hare was set running in 1981 by McCombie, but who, as a result of an interchange with Thirlwall in 1981, subsequently changed his mind.

We have confirmed Thirlwall's view by showing that the test of the law is an econometric matter and this, by itself, is sufficient to show that the law is not a tautology. There is nothing, *a priori*, to stop the estimates of both the income elasticities and price elasticities being statistically insignificant. This would empirically refute the law and, of course, a tautology cannot be refuted.

We have further shown that Razmi's (2016) attempt to reformulate Thirlwall's law is not compelling, particularly as it includes both the demand-side and the supply-side variables at the same time in a single estimating equation.

The evidence of the importance of non-price competitiveness, emphasised by Thirlwall (1979) has also been confirmed by studies that adjust relative price

changes to reflect quality changes. The latter play an important part in explaining a country's changes in its cumulative export shares. Generally, changes in relative prices have little, or no effect, on the growth of exports and the Marshall-Lerner conditions are usually not met. The balance-of-payments constraint is important in understanding why growth rates differ.

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