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The remarkable durability of Thirlwall's Law

MARK SETTERFIELD*

1. Introduction

The ambition of this paper is to discuss the remarkable resilience of Thirlwall's Law. Of particular interest is the propensity of the simplest statement of the Law – which claims that the equilibrium growth rate in any one region is a product of the world income growth rate and the ratio of the income elasticities of demand for exports and imports – to continually reassert itself as a good approximation of growth outcomes, even as the underlying balance-of-payments-constrained growth (BPCG) model from which Thirlwall's Law is derived is extended to take account of (*inter alia*) relative price dynamics, international financial flows, multi-sector growth, cumulative causation, and the interaction between the actual and potential rates of growth.

The focus of the paper is on theoretical developments. It ignores the impressively large empirical literature that demonstrates the applicability of Thirlwall's Law to a large number and variety of national and regional economies (on which see Thirlwall, 2011, in this issue). A basic conjecture of this paper, however, is that the empirical success of Thirlwall's Law across time, space, and estimation procedures is in no small part due to the theoretical robustness of the Law that is the focus of this paper.[1]

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* Department of Economics, Trinity College, Hartford (CT). Email: mark.setterfield@trincoll.edu. Revised version of the keynote address prepared for the *Workshop on Thirlwall's Law and Balance-of-Payments Constrained Growth*, Faculty of Economics, University of Coimbra, Portugal, 24-25 June 2011. Parts of this paper draw on a lecture given at the University of Paris XIII in November 2009. I would like to thank Angel Asensio for his comments on this earlier work. I would also like to thank two anonymous referees for their helpful remarks. Any remaining errors are my own.

[1] We reject from the outset the proposition due to Krugman (1989) that faster growth in any one country automatically causes an increase in the rate of growth of its exports, events that will simultaneously raise the "apparent" income elasticity of exports and lower the "apparent" income elasticity of imports, giving rise to the "appearance" of Thirlwall's

The remainder of the paper is organized as follows. Section 2 provides a brief primer on Thirlwall's Law, including the Kaldorian roots of the BPCG theory from which Thirlwall's Law is derived. Sections 3, 4, 5, and 6 discuss various extensions of BPCG theory, including (respectively) multi-sector growth, the role of relative prices, international finance, and the interaction between the actual and potential rates of growth. Section 7 offers some conclusions.

2. Balance-of-payments-constrained growth and Thirlwall's Law: a brief primer

i) Trade and growth: the Kaldorian view

Much of modern Kaldorian growth theory builds on Adam Smith's principle that "the division of labour depends on the extent of the market".[2] In Smith, the reverse is also true: deepening the division of labour (i.e. adding to the supply potential of the economy) creates additional demand for goods and services, through the operation of Say's Law. For Kaldor and Kaldorians, however, the extent of the market is ultimately determined by the operation of Keynes' principle of effective demand. From this perspective, economic expansion (i.e. growth) is *demand-led*: the role of demand is privileged in the cumulative interaction of demand and supply in Smith's schema, because while the supply-side is understood to be generally accommodative of expansions in demand, there is little possibility that additions to supply will automatically create their own demand. Moreover, *external* demand (i.e. exports) is understood to be the key driver of expansions of aggregate demand in the Kaldorian vision. Taken together, these basic principles

Law. As noted by Thirlwall (1991), this argument presupposes that supply automatically creates its own demand, whereas a basic premise of this paper (as will become clear in what follows) is that growth is fundamentally demand-led.

[2] See King (2010) for a recent overview of Kaldorian growth theory, and its antecedents in Kaldor's own work.

establish an immediate connection between trade and growth. Indeed, for Kaldorians, the basic "equation of motion" in growth theory is:

$$y = \lambda x \quad , \quad \lambda > 0 \tag{1}$$

where y is the rate of growth of real output, x is the rate of growth of real exports, and λ is the dynamic foreign trade multiplier.

But if equation (1) describes growth, does this mean that growing economies must accumulate (increasing?) trade surpluses? If so, then it can immediately be argued that equation (1) lacks generality, because obviously, not all economies can simultaneously accumulate trade surpluses. Fortunately, the answer to the question posed above is: not necessarily. Hence according to Palumbo (2009), Kaldor's own foundation for the statement in equation (1) was based on an aggregate structural model along the following lines:

$$Y = C + I + (X - M) \tag{2}$$

$$C = cY \quad , \quad 0 < c < 1 \tag{3}$$

$$I = v\Delta Y = vyY \quad , \quad v > 0 \tag{4}$$

$$M = mY \quad , \quad m > 0 \tag{5}$$

where Y is real output, C, I, X and M are (respectively) consumption, investment, exports and imports (all in real terms), c, v and m are (respectively) the propensity to consume, the (fixed) capital-output ratio and the propensity to import, and it is assumed for simplicity that there is no public sector.[3] Solution of (2) – (5) yields:

[3] It can be argued that equations (3) and (4), by describing changes in C and I as determined exclusively by prior changes in Y, portray internal demand as playing too passive a role in the growth process. Moreover, there is no explicit description of how changes in these expenditures are *financed* in the model above (although it is consistent with Kaldor's own views to regard an endogenous money supply process as implicitly

$$Y = \frac{1}{1-(c+vy)+m} X$$

Suppose we now assume that $c + vy = 1$. This amounts to the claim that the saving to income and investment to income ratios ($1 - c$ and vy, respectively) are the same, so that in equilibrium, saving is always exactly equal to investment regardless of the presence of other injections and leakages in the circular flow of income. It follows that:

$$Y = \frac{1}{m} X \tag{6}$$

Now note that, on the basis of (5) and (6), we can write:[4]

$$\dot{M} = m\dot{Y} \tag{7}$$

$$\dot{Y} = \frac{1}{m} \dot{X} \tag{8}$$

Finally, combining (7) and (8) yields:

$$\dot{M} = m\frac{1}{m}\dot{X} = \dot{X}$$

In other words, starting from a position of external balance ($X = M$), and assuming that the private sector runs neither a persistent surplus nor deficit (so that $I = S$),[5] any expansion of output due to an expansion of exports will automatically be consistent with the *maintenance of external*

accommodating real sector expansion – see for example Kaldor, 1983). We abstract from these concerns in the discussion that follows.

[4] Note that in the model developed here, it follows from (8) that we must have $\lambda = 1$ in equation (1).

[5] This last condition could, of course, be relaxed with the introduction of a public sector into the model.

balance. In sum, the notion that export-led growth as described in equation (1) suffers a simple fallacy of composition (i.e. not all countries can pursue it simultaneously) is false. This result is, of course, intuitive. It holds for the same reason that, in any domestic economy, an increase in the size of firm A does not necessarily come at the expense of firm B, since both firms can expand simultaneously as a result of a *general expansion of trade*.

ii) Balance-of-payments-constrained growth theory and Thirlwall's Law

In modern Kaldorian theory, the view that international trade can drive long run growth *without* creating external imbalances is formalized in *balance-of-payments-constrained growth theory*. The express purpose of BPCG theory is to study the trade/growth interaction – specifically, the notion that growth is demand-led and demand is trade-led – consistent with perpetual external balance (where the value of exports is equal to the value of imports). Indeed, a fundamental premise of BPCG theory in its original form is that we *must* observe trade balance, either: a) because countries are *unable* to run chronic trade deficits (they cannot attract permanent net inflows of financial capital from abroad); or b) because countries are *unwilling* to run chronic trade deficits (they do not wish to attract permanent net inflows of financial capital from abroad, because of the resulting accumulation of foreign indebtedness and consequent debt servicing commitments).

The essential insights of BPCG theory are captured by the following aggregate structural model:

$$P_d X = P_f M E \tag{9}$$

$$M = a\left(\frac{P_f E}{P_d}\right)^{\psi} Y^{\pi} \quad , \quad a,\pi > 0,\ \psi < 0 \tag{10}$$

$$X = b\left(\frac{P_d}{P_f E}\right)^{\eta} Z^{\varepsilon} \quad , \quad b, \varepsilon > 0, \ \eta < 0 \tag{11}$$

where P_d is the price of exports (in domestic currency), P_f is the price of imports (in foreign currency), E is the nominal exchange rate (the domestic price of foreign currency), Z is world income, and ψ, π, η, and ε are the price elasticity of imports, the income elasticity of imports, the price elasticity of exports and the income elasticity of exports, respectively.

It follows from (9) – (11) that:

$$p_d + x = p_f + m + e \tag{12}$$

$$m = \psi(p_f + e - p_d) + \pi y \tag{13}$$

$$x = \eta(p_d - p_f - e) + \varepsilon z \tag{14}$$

where lower-case variables denote proportional rates of growth. Substituting (13) and (14) into (12) and solving for y yields:[6]

$$y = \frac{(1 + \eta + \psi)(p_d - p_f - e) + \varepsilon z}{\pi} \tag{15}$$

where $|\eta + \psi| > 1$ (so that $1 + \eta + \psi < 0$) means that the Marshall-Lerner conditions hold – i.e. exchange rate depreciations (appreciations) improve (worsen) the balance of trade. Finally, if we take the rate of growth of world income as exogenously given, so that:

$$z = \bar{z} \tag{16}$$

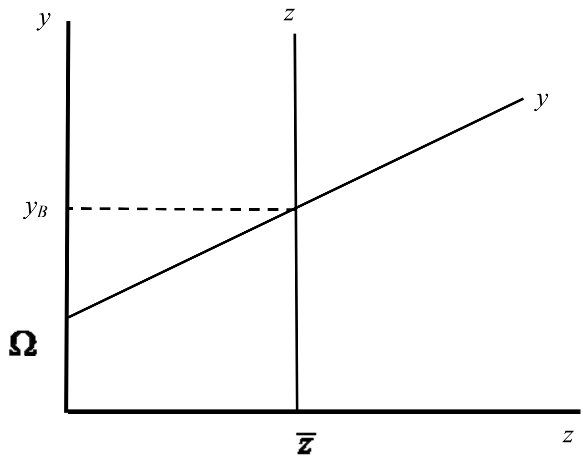
[6] Note that since E has been defined as the domestic price of foreign currency, $e > 0$ captures an exchange rate *depreciation* (or devaluation in the case of a fixed exchange rate regime).

then combining (15) and (16) yields:

$$y_B = \frac{(1+\eta+\psi)(p_d - p_f - e) + \varepsilon \bar{z}}{\pi} \tag{17}$$

where y_B denotes the *balance-of-payments-constrained equilibrium growth rate*. As defined here, then, y_B is the equilibrium rate of growth that is compatible with continuous trade balance (as in equation (9)), and the rate of growth towards which the economy will automatically tend, given that countries are unwilling or unable to attract permanent net inflows of financial capital.[7] The determination of the balance-of-payments-constrained equilibrium growth rate can be illustrated graphically by the intersection of schedules representing equations (15) and (16), as in figure 1.

Figure 1 – *Determination of the balance-of-payments-constrained equilibrium growth rate*



[7] In other words, the balance-of-payments-constrained equilibrium growth rate is *stable*, given the assumptions upon which the model developed above is predicated.

Note: by assumption , $\Omega = \frac{(1+\eta+\psi)(p_d - p_f - e)}{\pi} > 0$

Derivation of Thirlwall's Law is straightforward from the expression in (17). Hence if we assume that *either*:

$$p_d = p_f + e \tag{18}$$

or:

$$1+\eta+\psi = 0 \tag{19}$$

then it follows upon substitution into (17) that:

$$y_B = \frac{\varepsilon \bar{z}}{\pi} \tag{20}$$

This last expression is *Thirlwall's Law*, as originally stated by Thirlwall (1979). It is the canonical expression for the long run equilibrium growth rate in BPCG theory. The outcome associated with Thirlwall's Law can be captured in figure 1 by setting Ω = 0.

As is obvious by inspection, Thirlwall's Law is a remarkably parsimonious expression for the long run equilibrium rate of growth. What it suggests is that, given the rate of growth of world income, the long run equilibrium rate of growth in any individual economy depends on the ratio of the income elasticities of exports and imports. Note that, if Thirlwall's Law holds:

- "price effects" (i.e. $p_d \neq p_f + e$) or international financial flows (i.e. $P_d X \neq P_f ME$) can only influence short-run growth: in the long run, due to (9) and either (18) or (19), growth will revert to the rate shown in (20);

- policies designed to increase productive capacity will not stimulate the equilibrium growth rate, because the latter is demand-determined;

- policies designed to stimulate the growth of *domestic* demand can only increase growth in the short-run, because they will increase m resulting in violation of (12). As (12) re-asserts itself in the long run, growth will revert to the rate described in (20);

- the only way that growth can be increased in the long run is by either: (a) making domestic goods more attractive to foreigners (increasing the income elasticity of exports, ε) and/or foreign goods less attractive to domestic populace (decreasing the income elasticity of imports, π) – which amounts to a sort of "supply-side Keynesianism" (or what is sometimes referred to as "neo-mercantilism"); or (b) through "global Keynesianism" (increasing world income growth, z).

3. Multi-sector growth and Thirlwall's Law

The BPCG model developed in the previous section, from which Thirlwall's Law is derived, is a one-sector aggregate structural model featuring a single, composite commodity. Inspired by the multi-sector growth framework of Pasinetti (1981; 1993), Araújo and Lima (2007) develop a multi-sector BPCG model, from which a multi-sector analog of equation (20) can be derived.[8]

In a multi-sector context, the total value of imports (exports) comprises the total value of imports (exports) from each distinct sector of the economy:

$$P_f M = \sum_{j=1}^{k} P_{fj} M_j$$

[8] See also Nell (2003) and Razmi (2011) for qualitatively similar, disaggregated variants of the BPCG model. As in the model of Araújo and Lima (2007) discussed above, Thirlwall's Law remains "close to the surface" of the growth results derived from these models.

$$P_d X = \sum_{i=1}^{l} P_{di} X_i$$

or:

$$M = \sum_{j=1}^{k} \frac{P_{fj}}{P_f} M_j$$

$$X = \sum_{i=1}^{l} \frac{P_{di}}{P_d} X_i$$

where we assume that there are *k* imported goods and *l* exported goods in the economy under consideration. If we assume that the relative prices of imported and exported goods remain constant in the long run,[9] it follows from the expressions above that:

$$m = \sum_{j=1}^{k} \omega_{mj} m_j$$

$$x = \sum_{i=1}^{l} \omega_{xi} x_i$$

where ω_{mj} (ω_{xi}) denotes the share of the j^{th} (i^{th}) good in total imports (exports). Meanwhile if, following Araújo and Lima (2007), we assume that the import (export) demand functions for each individual imported (exported) commodity conform to the Cobb-Douglas functional form utilized in equations (10) and (11), we can write:

[9] This is a counterpart of the assumption in equation (18) from which Thirlwall's Law can be derived. See section 4 below for further discussion.

$$M_j = a_j \left(\frac{P_{fj}E}{P_{dj}} \right)^{\psi_j} Y^{\pi_j} \tag{10a}$$

$$X_i = b_i \left(\frac{P_{di}}{P_{fi}E} \right)^{\eta_i} Z^{\varepsilon_i} \tag{11a}$$

From which it follows (assuming that equation (18) holds for each individual good i, j) that:

$$m_j = \pi_j y \tag{13a}$$

$$x_i = \varepsilon_i z \tag{14a}$$

Substituting equations (13a) and (14a) into the expressions for aggregate real import and export growth derived above, we arrive at:

$$m = y \sum_{j=1}^{k} \omega_{mj} \pi_j \tag{13b}$$

$$x = z \sum_{i=1}^{l} \omega_{xi} \varepsilon_i \tag{14b}$$

Given that it follows from equations (12) and (18) that:

$$x = m \tag{12a}$$

and substituting (13b) and (14b) into (12a), we arrive at:

$$y \sum_{j=1}^{k} \omega_{mj} \pi_j = z \sum_{i=1}^{l} \omega_{xi} \varepsilon_i$$

Finally, combining this last expression with equation (16) and solving for y yields:

$$y_B^* = \bar{z}\frac{\sum_{i=1}^{l}\omega_{xi}\varepsilon_i}{\sum_{j=1}^{k}\omega_{mj}\pi_j} \tag{20a}$$

Equation (20a) is the expression for Thirlwall's Law in a multi-sector context.

It is immediately clear by inspection that equation (20a) differs little from the one-sector version of Thirlwall's Law in equation (20). Specifically, the aggregate income elasticities ε and π in (20) are replaced in (20a) by the weighted average of the sectoral income elasticities ε_i and π_j. But this is very much the spirit in which the aggregates ε and π are conceived in the first place. As Araújo and Lima (2007, pp. 766-767) point out, the expression in (20a) does explicitly suggest that, even given ε_i and π_j for all i and j, growth can still be enhanced (or reduced) by structural change that alters the sectoral composition of exports/imports (i.e. ω_{xi} and/or ω_{mj}) – and as Thirlwall (2011, p. 24) notes, this observation in turn lends support to traditional policies of sector-specific import substitution and/or export promotion designed to boost growth. But it is important to bear in mind that there is a common pattern of structural change that all economies undergo in the course of growth and development (see, for example, Rowthorn and Wells, 1987). This suggests that, absent the sort of policy interventions envisaged by Thirlwall (2011), differences in economic structure (as captured by ω_{xi} and ω_{mj}) are likely to explain less of the variation in growth rates among countries at a similar stage of development than are differences in the income elasticities of demand for their imports and exports (explained by differences in non-price competitiveness among nations). And since it is precisely these income elasticities that are the focus of the original (one-sector) expression for Thirlwall's Law in equation (20), this last conjecture reasserts the essential importance of Thirlwall's Law in its original form as an explanation for long-run growth outcomes, even in a multi-sector context.

4. Relative price effects reconsidered

As noted in section 2, Thirlwall's Law is a special case of the more general balance-of-payments-constrained equilibrium growth rate in (17), which emerges when the conditions in *either* equation (18) *or* equation (19) are true. As such, it is worthwhile examining these conditions in greater detail.

Interpretation of equation (18) is quite straightforward. Hence note that it follows from (18) that:

$$\frac{P_f E}{P_d} = \mu \tag{21}$$

where μ is some constant. Equation (21) implies a constant real exchange rate, which is, in turn, consistent with the notion that relative purchasing power parity (RPPP) attains in the long run.

Equation (19), meanwhile, expresses what has come to be known as "elasticity pessimism:" the absolute values of the price elasticities of imports and exports are small, so that the Marshall-Lerner condition does not hold. This is consistent with the notion that, even if relative prices do change in the long run (i.e. equation (18) does not hold), *non*-price competition is prevalent in international trade, so that price competition has a negligible impact on the long run balance-of-payments-constrained equilibrium growth rate – as claimed by Thirlwall's Law (see, for example, McCombie and Thirlwall, 1994, ch. 4).

The empirical standing of both equations (18) and (19) has recently been surveyed by Blecker (2009, pp. 10-12). The conclusion reached by Blecker is that, while the evidence on both the Marshall-Lerner condition and RPPP is mixed, *both* the Marshall-Lerner condition *and* RPPP are more likely to assert themselves in the long run. This conclusion is reached on the basis of basic economic principles and Blecker's reading of the empirical evidence. Hence the standard logic of the J-curve – according to which an exchange rate depreciation (or equivalent change in the terms of trade) will harm the balance of trade in the short term but improve it in the long term – suggests that "elasticity pessimism" is less likely to be appropriate in the long run. Meanwhile, the available evidence suggests that RPPP is more likely to apply over very long periods of time (half a century or more) than over shorter periods of just several decades. What all this suggests is that over time, we are *less* likely to observe the condition in (19) but *more* likely to observe that in (18) – and, of course, the latter suffices to derive Thirlwall's Law from the more general balance-of-payments-constrained equilibrium growth rate in (17).

None of this is to say that relative prices have no effect on trade and growth in the short run, which may here refer to a period of several decades (see Blecker, 2009, p. 12). Nor does it exclude changes in relative prices from a more specific role in assisting in the transitional dynamics that bring about the conditions (such as equation (9)) necessary for the emergence of Thirlwall's Law in the long run (see, for example, Garcimartín *et al.*, 2010). However, the discussion above demonstrates that Thirlwall's Law once again asserts itself as a good approximation of the long run equilibrium growth rate, even if relative prices cannot be ignored as determinants of international trade patterns and hence trade-based growth in the shorter term.

5. International finance and Thirlwall's Law

Part of the foundation of BPCG theory as described in section 3 – and, by extension, Thirlwall's Law – is the notion that, in the long run, export revenues must pay for imports (equation (9)). However, it is possible to argue that this assumption is too restrictive, and that some economies (e.g. the US) can and do attract (quasi) permanent net inflows of financial capital that cause long-term deviations from equation (9). The question that we confront, then, is the following: how is long run growth affected by relaxation of the condition in (9) – one of the core assumptions of the canonical BPCG model – to allow for chronic trade imbalances and (correspondingly) permanent net inflows or outflows of financial capital? The answer is, perhaps surprisingly, very little.

To see this, we begin by modifying the external constraint in the canonical BPCG model by writing:

$$P_d X + F = P_f ME \tag{9a}$$

where F denotes nominal net inflows of financial capital in domestic currency (see for example Thirlwall and Hussein, 1982; McCombie and Thirlwall, 1994, ch. 3). Note that, by construction, $F = P_f ME - P_d X$ also measures the value of the trade deficit. Re-writing (9a) as:

$$X + F_R = \frac{P_f ME}{P_d}$$

where $F_R = F/P_d$ denotes net financial inflows in real terms, it follows that:

$$\omega x + (1-\omega) f = m + p_f + e - p_d \tag{12b}$$

where f is the rate of growth of real net financial inflows and $\omega = X / \left(X + F_R\right)$ is the share of export earnings in total real foreign exchange earnings. Substituting (13), (14) and (by appeal to RPPP) (18) into (12b) and solving for y now yields:

$$y = \frac{\omega \varepsilon z + (1-\omega) f}{\pi}$$

and combining this last expression with (16) gives us:

$$y_B^{**} = \frac{\omega\varepsilon\bar{z} + (1-\omega)f}{\pi} \tag{20b}$$

Equation (20b) is Thirlwall's Law revised to take into account net financial inflows.

Note that we can re-write equation (20) as:

$$y_B = \frac{\omega\varepsilon\bar{z} + (1-\omega)\varepsilon\bar{z}}{\pi}$$

Comparing this last expression with (20b), it is clear that we will observe $y_B^{**} > y_B$ (i.e., $f > 0$ will boost growth) if:

$$(1-\omega)f > (1-\omega)\varepsilon\bar{z} \;\Rightarrow f > \varepsilon\bar{z} = x$$

Note, however, that:

$$\omega = \frac{X}{X + F_R} = \frac{1}{1 + F_R / X}$$

If $f > x$, then:

$$\lim_{t\to\infty}(F_R / X) = \infty$$

so that:

$$\lim_{t\to\infty}\omega = 0$$

In other words, in the limit, *all* foreign exchange earnings will be from net financial inflows. But this is scarcely plausible – lending from abroad will surely cease before this point is reached. This, in turn, suggests that the propensity of $f > 0$ to boost growth must be regarded as a strictly short-run result – so that (20b) cannot represent the long-run equilibrium growth rate. If we invoke $f = x = \varepsilon\bar{z}$ – so that $\omega = \bar{\omega}$ – as the appropriate constraint on the behaviour of *f* in the long run, then:

$$y_B^{**} = \frac{\omega\varepsilon\bar{z} + (1-\omega)f}{\pi} = \frac{\omega\varepsilon\bar{z} + (1-\omega)\varepsilon\bar{z}}{\pi} = \frac{\varepsilon\bar{z}}{\pi} = y_B$$

In other words, Thirlwall's Law as originally stated in equation (20) reasserts itself, and we find that $f > 0$ has *no effect* on the long run equilibrium growth rate.[10]

But before we rush to conclusions, suppose, instead, that the relevant constraint on the growth of financial inflows in the long run is $f = y$ (Moreno-Brid, 1998). This will ensure that the trade deficit to income ratio remains constant over time,[11] and that the debt to income ratio will stabilize at a constant (albeit indeterminate) value.[12] Given that the long run equilibrium rate of growth is determined in (20b), then it follows that if $f = y = y_B^{**}$:

$$y_B^{**} = \frac{\omega\varepsilon\bar{z} + (1-\omega)y_B^{**}}{\pi} \Rightarrow y_B^{**} = \frac{\omega\varepsilon\bar{z}}{\pi - 1 + \omega} \qquad (21)$$

[10] See also Thirlwall and Hussein (1982).

[11] Recall that *F* simultaneously measures the value of net financial inflows and the size of the trade deficit.

[12] The precise value of the debt to income ratio will depend on the size of the deficit to income ratio and the rate of growth since, using *D* to denote the real value of total foreign indebtedness, a constant debt to income ratio requires that:

$$\frac{\dot{D}}{D} = \frac{F_R}{D} = y \Rightarrow \frac{F_R}{Y}\frac{Y}{D} = y \Rightarrow \frac{D}{Y} = \frac{F_R / Y}{y}$$

Even if an economy maintains a constant deficit to income ratio, then, financial markets may "veto" the resulting growth regime if the maximum *debt* to income ratio that they deem acceptable is less than the constant debt to income ratio that emerges from the calculation above.

The modification of (20a) that appears in equation (21) is different again from the original Thirlwall's Law in equation (20), and it is certainly difficult to ascertain by inspection how *much* different.[13] But as McCombie and Roberts (2002) show, the difference is unlikely to be very great. Suppose for example that, following McCombie and Roberts (2002, pp. 93-96), we assume that the maximum sustainable trade deficit to income ratio is $F_R / Y = 0.02$, the share of exports in GDP is $X / Y = 0.3$ and $\pi = 1.5$. Then:

$$\omega = \frac{X}{X + F_R} = \frac{X / Y}{(X / Y) + (F_R / Y)} = 0.94$$

and, as a result (recalling the value of π):

$$y_B^{**} = \frac{\omega \varepsilon \overline{z}}{\pi - 1 + \omega} = \frac{0.94 \varepsilon \overline{z}}{1.5 - 1 + 0.94} = 0.65 \varepsilon \overline{z}$$

whereas:

$$y_B = \frac{\varepsilon \overline{z}}{\pi} = \frac{\varepsilon \overline{z}}{1.5} = 0.67 \varepsilon \overline{z}$$

What this calculation suggests is that financial flows have a negligible effect on the long run equilibrium growth rate. Financial flows may be important in the short run and/or as part of the transitional dynamics towards the long-run equilibrium described by Thirlwall's Law

[13] Note also that it follows from the expression in (21) that we will only observe $f = x = y_B^{**}$ (and hence $\omega = \overline{\omega}$) in the special case where $\pi = 1$. If $\pi > 1$ then $\pi - 1 + \omega > \omega$ and we will observe $f = y_B^{**} < x$, whereas if $\pi < 1$ then $\pi - 1 + \omega < \omega$ and we will observe $f = y_B^{**} > x$. This draws attention to the fact that, even with a constant deficit to income ratio and an implied debt to income ratio that are acceptable to financial markets, the growth regime will not automatically imply $\omega = \overline{\omega}$ and need not, therefore, be sustainable.

(see Garcimartín *et al.*, 2010). But what the discussion above demonstrates above all else is that, even when permanent net inflows of financial capital (i.e. structural balance of trade deficits) are allowed for, Thirlwall's Law as stated in equation (20) continues to provide a good approximation of the long run equilibrium rate of growth.

6. Interaction between the actual (BPC) and natural rates of growth

i) Endogeneity of the natural rate of growth

As we have already established, according to Thirlwall's Law, long-run growth is determined as:

$$y_B = \frac{\varepsilon \overline{z}}{\pi} \tag{20}$$

which is consistent with the external constraint:[14]

$$P_d X = P_f ME \tag{9}$$

But there is also an *internal* constraint on growth that stems from the upper limit on economic activity at any point in time that is determined by the productive potential of the economy. Hence note that we can write:

$$Y_p \equiv \frac{Y_p}{L} L$$

[14] In this section we overlook the possible existence of net financial inflows and accompanying trade imbalances for the sake of simplicity, on the basis of the result established in the previous section that financial flows have little effect on the long-run equilibrium growth rate.

where Y_p is potential real output – i.e. the maximum output that the economy can produce at any given point in time given available resources and production technology – and L is the labour force.[15] It follows that:

$$y_p \equiv q + n \qquad (22)$$

where q denotes the rate of growth of labour productivity and n the rate of growth of the population (we assume that the labour force participation rate is constant in the long run). This is, of course, Harrod's *natural rate of growth* – the maximum rate of growth that the economy can achieve in the long run. In the first instance, then, the natural rate constitutes a "growth ceiling."

In Kaldorian growth theory, however, the natural rate of growth is regarded as endogenous – not just in the narrow sense that it is explained within the theory (rather than taken as exogenously given), but also in the more specific sense that it is *dependent on the actual rate of growth itself*.[16] The most common expression of this relationship is Verdoorn's Law, which can be stated as:[17]

$$q = \alpha + \beta y \qquad \alpha>0,\ \beta>0 \qquad (23)$$

where α captures exogenous influences on productivity growth, and β – the Verdoorn coefficient – captures the sensitivity of productivity growth

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[15] Note that by associating potential output with the employment of the entire labour force in the identity above, we are implicitly assuming that the economy is never capital constrained – specifically, that supply-side constraints imposed by production technology and the size of the capitalist sector do not imply that potential output is reached before the labour force is fully employed, resulting in Classical (Marxian) unemployment. Formally, the potential output constraint on economic activity at any point in time is modelled as:

$$Y_p = \min\left[\frac{L}{u}, \frac{K}{v}\right] = \frac{L}{u}$$

where K is the total available capital stock, u is the labour-output ratio, and all other variables are as previously defined.

[16] See Roberts and Setterfield (2007) for further discussion of this distinction.

[17] See also the productivity growth equation developed by Sylos Labini (1984; 1995), which incorporates the Verdoorn effect postulated in equation (23).

to output growth. The basis of the relationship in (23) has been discussed extensively elsewhere (see for example McCombie *et al*., 2002). For the purposes of the present analysis, we need only note that Verdoorn's Law codifies the Smithian (and subsequently, Kaldorian) theme that "the division of labour depends on the extent of the market," first mentioned at the beginning of section 2.

Combining (22) and (23) yields:[18]

$$y_p = \alpha + n + \beta y \qquad (24)$$

With the growth process described by equations (20) *and* (24), our model now determines both the actual (equilibrium) rate of growth (in equation (20)) *and* the natural rate of growth (via equation (24)). This co-determination of the actual and natural rates of growth in a macrodynamic system that is dominated by the operation of Thirlwall's Law is illustrated in figure 2. Clearly, the economy's "growth ceiling" cannot be regarded as exogenous to this system: it will vary with the actual (equilibrium) rate of growth experienced by the economy, as established by Thirlwall's Law. In this way, the natural rate becomes *path dependent*, in the sense that a different historical growth experience will result in a different natural rate of growth, and hence a different limit (or "ceiling") on the growth capacity of the economy. From the point of view of the internal constraint originally described in the identity in (22), the growth process influences its own upper bound.

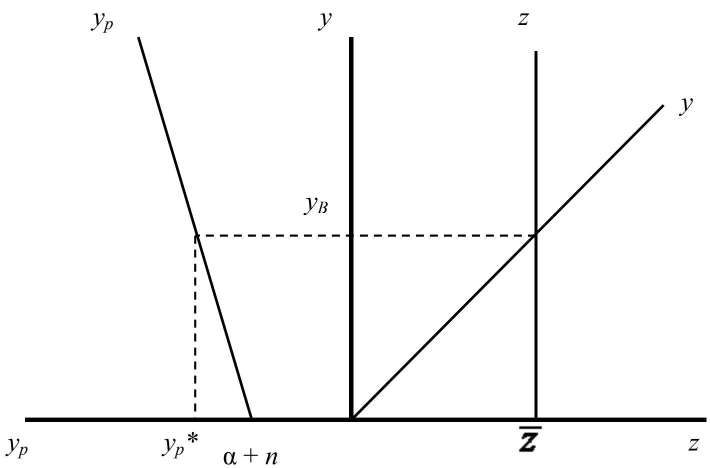
ii) Cumulative causation

Having introduced the influence of output growth on productivity growth (and hence the natural rate), we are now in a position to contemplate the reverse direction of causality, running from productivity

[18] See León-Ledesma and Thirlwall (2000; 2002) and León-Ledesma and Lanzafame (2010) for empirical evidence on the relationship postulated in equation (24).

growth to output growth. This will complete the "Smithian circle" (by entertaining the simultaneous interaction of productivity and output growth – i.e. the "division of labour" and the "extent of the market") and in the process, facilitate discussion of another prominent theme in Kaldorian growth theory: cumulative causation.[19]

Figure 2 – *Co-determination of the actual and natural rates of growth*



The canonical Kaldorian model of cumulative causation was developed by Dixon and Thirlwall (1975), and thus precedes the development of BPCG theory. It is, however, a straightforward exercise to incorporate cumulative causation into BPCG theory. As Blecker (2009, pp. 19-22) has shown, this exercise can be accomplished using precisely the same channel of influence of productivity growth on output growth contemplated by Dixon and Thirlwall (1975), operating via the cost competitiveness of exports and hence relative prices, as long as we use equation (17) as our expression for the balance-of-payments-constrained

[19] See for example Kaldor (1970; 1985; 1996).

equilibrium growth rate. But as was discussed in section 3, either elasticity pessimism or RPPP establish Thirlwall's Law as the preferred expression for the balance-of-payments-constrained equilibrium growth rate. And since there are no relative price effects on long run growth in Thirlwall's Law through which the Dixon-Thirlwall channel could operate, does this imply that Thirlwall's Law is incompatible with cumulative causation? Or in other words, to the extent that cumulative causation is taken to be a feature of real-world growth processes, is Thirlwall's Law now revealed to be inadequate as a description of long run growth?

The answer to this last question is no: Thirlwall's Law once again emerges unscathed from the challenge arising from the assumed existence of cumulative causation. To see this, we begin by appealing to the importance of *non*-price competition in international trade that undergirds elasticity pessimism (see, for example, McCombie and Thirlwall, 1994, ch. 4). If productivity improvements (induced by growth, via Verdoorn's Law) are used by firms to improve the *quality* of their output rather than to cut costs and hence prices, and if consumers value quality, then it makes sense to think of the income elasticities of demand for exports and imports as being sensitive to the levels of productivity at home and abroad (respectively). The basic hypothesis here is that the higher is the level of productivity, the higher is the quality of goods produced in a particular region, and so the larger will be the increase in demand for the region's output associated with any given increase in income (*ceteris paribus*).

The analysis here suggests that we can write:

$$\varepsilon = \gamma Q$$

$$\pi = \delta Q_w$$

where Q denotes the level of productivity, a w-subscript denotes the "rest of the world," and $\gamma, \delta > 0$. Combining the expressions above yields:

$$\frac{\varepsilon}{\pi} = \kappa = \frac{\gamma Q}{\delta Q_w} \qquad \Rightarrow \dot{\kappa} = \kappa(q - q_w) \qquad (25)$$

Recall that:

$$q = \alpha + \beta y \qquad [23]$$

Now assume (following Setterfield, 1997) that:

$$q_w = \alpha + \beta z \qquad (23a)$$

Substituting (23) and (23a) into (25), we arrive at:

$$\dot{\kappa} = \kappa\beta(y - z) \qquad (26)$$

and since:

$$z = \overline{z} \qquad (16)$$

and:

$$y = y_B = \frac{\varepsilon \overline{z}}{\pi} = \kappa \overline{z} \qquad (20)$$

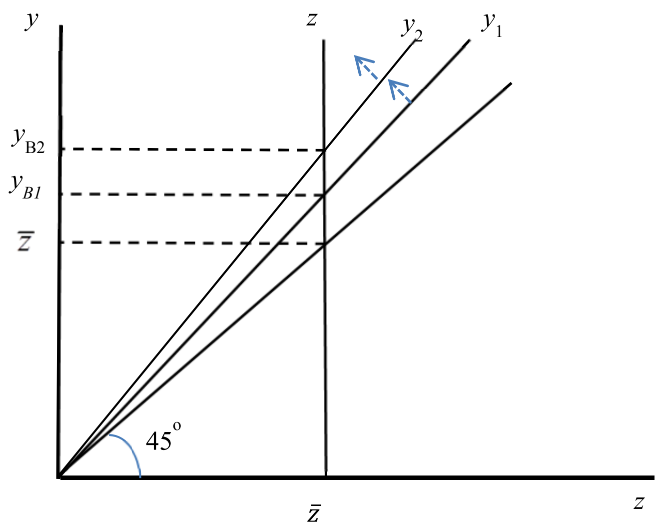
it follows, upon substitution of (16) and (20) into (26), that:

$$\dot{\kappa} = \beta\kappa(\kappa - 1)\overline{z} \qquad (27)$$

Now note that if $\kappa = 1$, so that $y = \overline{z}$ in (20) and we observe balanced growth globally, then $\dot{\kappa} = 0$ in (27), as a result of which the balanced growth outcome derived above will be self-perpetuating. If, however, $\kappa > 1$, implying that $y = \kappa\overline{z} > \overline{z}$ in (20), then we will observe

$\dot{\kappa} > 0$ in (27). In this case, the initial growth advantage ($y > \bar{z}$) established by the home nation will be self-reinforcing: y will increase relative to $\bar{z}$ over time in a process of cumulative causation (specifically, a virtuous circle) similar to that discussed by Cornwall (1977, ch. IX). This is captured in figure 3 by the anti-clockwise rotation of the y schedule in response to $y = y_B > \bar{z}$ initially (as indicated by the dashed arrow), resulting in ongoing divergence between the two growth rates.

Figure 3 – *Cumulative causation and Thirlwall's Law*



The model sketched above is best regarded as a local approximation of a more complicated, non-linear process – and one that may even break down, due to the existence of additional dynamics (on which, see Setterfield, 1997). As such, the notion that cumulative causation involves an *ever-increasing* difference between y and $\bar{z}$ (as suggested by figure 3) should not be taken literally.[20] But as a first approximation, it serves to illustrate that cumulative causation resulting from the simultaneous interaction of output and productivity growth is perfectly consistent with Thirlwall's Law – or in other words, that the existence of cumulative causation does not in any sense negate the value of Thirlwall's Law as a description of long-run growth outcomes.

iii) Achieving internal balance: Thirlwall's Law and the first Harrod problem

BPCG theory focuses on bringing about reconciliation between the equilibrium rate of growth and the external constraint on growth imposed by the balance of trade. But what about the internal constraint imposed by the natural rate of growth? Is it possible for BPCG theory – and in particular, Thirlwall's law – to describe an equilibrium rate of growth consistent with both the external and internal constraints on growth?

In the first instance, there is no reason to believe that such reconciliation is likely to occur. Hence note that from (20) and (22), it is likely that we will have:

$$y_B = \frac{\varepsilon \bar{z}}{\pi} \neq q + n \equiv y_p$$

In other words, the economy may experience the first Harrod problem: equilibrium growth may differ from the natural rate. Even with an endogenous natural rate (as contemplated in the two preceding sub-sections), the first Harrod problem is likely to arise. Hence while:

$$y_B = \frac{\varepsilon \bar{z}}{\pi} \tag{20}$$

it follows from (24) (with $y = y_B$) that:

[20] This outcome, which involves perpetually *accelerating* growth by the "home" nation, is certainly not supported by the long run growth record. See Maddison (1991).

$$y_p^* = \alpha + n + \frac{\beta\varepsilon\bar{z}}{\pi} \tag{25}$$

Now suppose that:

$$y_p^* = y_B$$

Then it follows from (25) that:

$$y_B = \frac{\alpha + n}{1 - \beta}$$

and combining this expression with (20) we get:

$$\frac{\alpha + n}{1 - \beta} = \frac{\varepsilon\bar{z}}{\pi} \tag{26}$$

What equation (26) demonstrates is that equality of the actual (equilibrium) and natural rates of growth ($y_p^* = y_B$) – i.e. absence of the first Harrod problem – is possible but unlikely. This follows from observation of the fact that the expression in (26) is made up of a collection of independently-determined parameters, and is therefore a special case.

The BPCG model is by no means unique among demand-led growth models in giving rise to the first Harrod problem. But unfortunately, the result above does present a potential problem for Thirlwall's Law, if we are to interpret the latter as an expression for the long-run equilibrium rate of growth. To see this, first define the rate of employment as:

$$\xi \equiv \frac{N}{L}$$

where N is total employment. This expression can be re-written as:

$$\xi \equiv \frac{\frac{N}{Y}Y}{\frac{L}{Y_p}Y_p}$$

Now assume that, at any point in time, output per worker depends only on the state of technology, and is invariant with respect to the precise levels of output and employment – as will be the case, for example, if production is governed by a Leontieff (fixed-coefficient) technology. Then $(N/Y) = (L/Y_p)$, and:

$$\xi = \frac{Y}{Y_p}$$

from which it follows that:

$$\dot{\xi} = \xi(y_B - y_p^*) \tag{27}$$

(where $y = y_B$ by Thirlwall's Law, and $y_p = y_p^*$ is the corresponding equilibrium value of the natural rate of growth).

Equation (27) brings into focus the problem that is presented by $y_p^* \neq y_B$. Specifically, $y_B \neq y^*_P$ implies that $\xi \neq 0$ due to (27). But since ξ is, by definition, bounded above and below (by 1 and 0, respectively), we cannot have a long-run equilibrium value of. $\hat{\xi} = \frac{\dot{\xi}}{\xi} \neq 0$. In other words, any outcome of our model that produces the result $y_p^* \neq y_B$ is not *sustainable* as a steady-state growth outcome: it will eventually violate the internal constraint on growth imposed by the logical requirement that $0 \leq \xi \leq 1$. Taken at face value, this suggests that Thirlwall's Law cannot describe the long-run equilibrium rate of growth except as a special case, in which the condition in equation (26) is observed.[21]

However, this is not the end of the story. Several solutions to the problem identified above exist. These solutions suggest that we can extend the BPCG model so that Thirlwall's Law describes a sustainable steady state growth outcome (i.e. a growth equilibrium that is consistent with the maintenance of *both* external *and* internal balance).

Consider first the solution proposed by Palley (2002). Palley suggests that:

$$\pi = \pi(\xi) \quad , \quad \pi' > 0 \tag{28}$$

The rationale for equation (28) is straightforward: as ξ rises, bottlenecks emerge in domestic production, so that firms and households increasingly turn to imported goods to satisfy demand, raising the income elasticity of demand for imports. This mechanism is consistent with the empirical evidence presented by White and Thirlwall (1974) and Hughes and Thirlwall (1979), showing that a tightening of the aggregate labour market in the US and UK is associated with local supply bottlenecks, and hence a deterioration of the balance of trade over and above what would otherwise have occurred.

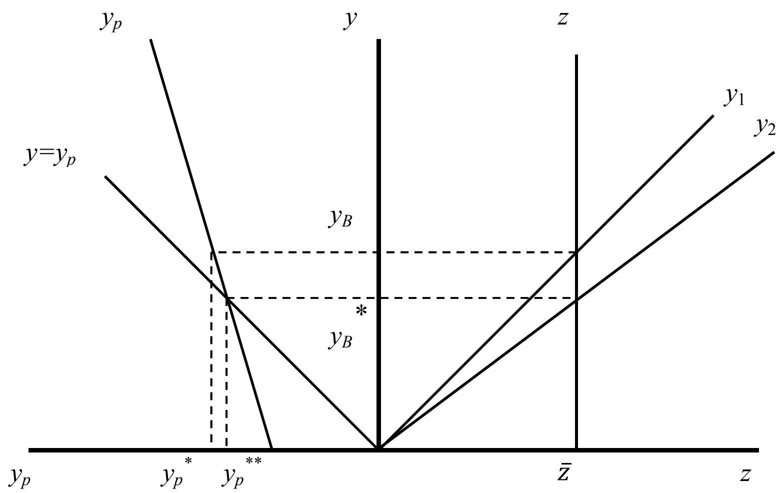
With the growth of the economy now described by equations (20), (25), (27) and (28), any excess of the equilibrium rate of growth over the natural rate (i.e. $y_B > y_p^*$) will induce a rise in ξ (in equation (27)) and hence a rise in π (in equation (28)), resulting in a fall in the value of y_B in equation (20). This last event will induce a fall in y_p via equation (25), but as long as $\beta < 1$, we will observe $|dy_B| > |dy_P| = |\beta dy_B|$, so that the gap between y_B and y_p will close. The sequence of so-described adjustments will continue until the actual and natural rates of growth

[21] Of course, it is possible to evade the problem presented here by appealing to the notion of a dual economy, in which labour is so abundant that the upper limit $\xi = 1$ is never practically tested. But this is not an altogether satisfactory solution given that Thirlwall's Law is believed to apply to advanced capitalist (as well as less developed) economies, and that such economies do periodically test the upper bound on activity imposed by full employment.

are equal, at which point we have sustainable steady-state growth. This is illustrated in figure 4, which shows the y_1 schedule rotating towards y_2 in response to the rise in π induced by $y_B > y_p^*$ initially. The process of adjustment is complete when the equilibrium rate of growth reaches $y_B^* = y_p^{**}$ in figure 4.

But according to Setterfield (2006), the sustainable steady-state growth outcome in figure 4 constitutes "semi supply-determined growth". This is because the ostensibly demand-determined equilibrium rate of growth (described by Thirlwall's Law) adjusts to accommodate the

Figure 4 – *Reconciliation of the actual and natural rates of growth*



natural rate of growth (although as described above, the latter is, in turn, affected by this adjustment – hence the designation of the final rate of growth as *semi* supply-determined). On this interpretation, while Thirlwall's Law survives as a description of equilibrium growth, it does so only in a compromised fashion that is reminiscent of its role in

Krugman's (1989) 45-degree rule. Specifically, the demand-side is robbed of its status as the unambiguous "leading element" in the determination of long-run growth.

But consider now the solution to the same problem proposed by Setterfield (2006), which suggests that:

$$\beta = \beta(\xi) \quad , \quad \beta' > 0 \tag{29}$$

The rationale for equation (29) is that as ξ rises, the tightening of the labour and (by extension) goods markets induces firms to engage in more productivity-enhancing innovation and technical change in response to any given rate of growth of output. In other words, the size of the Verdoorn coefficient, β, is enhanced by the absence of economic "slack." This is consistent with the empirical evidence presented by Cornwall and Cornwall (2002), which shows that productivity growth varies directly with growth of the components of autonomous demand deemed responsible for driving output growth (including exports), but also varies inversely with the unemployment rate.

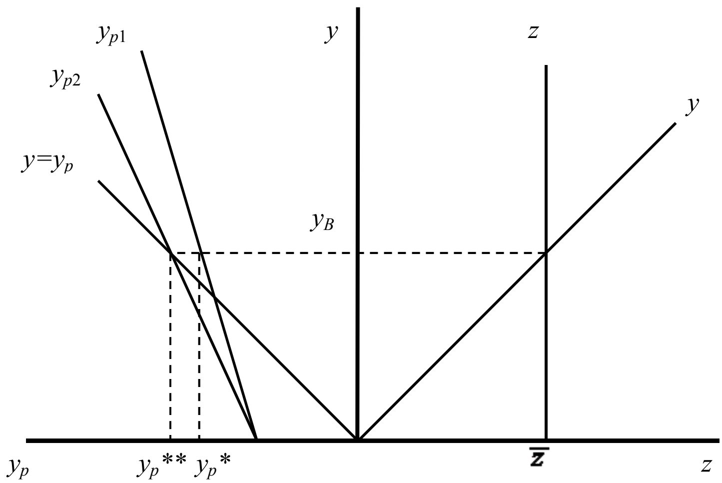
With growth now described by equations (20), (25), (27) and (29), any initial growth equilibrium characterized by $y_B > y_p^*$ will again induce a rise in ξ (via equation (27)), which will now cause an increase in β in equation (29), and hence a rise in the equilibrium value of y_p in equation (25). This sequence of adjustments will continue until the actual and natural rates of growth are equal, at which point we will once again have sustainable steady-state growth. This is illustrated in figure 5, which shows an initial growth equilibrium $y_B > y_p^*$ inducing anti-clockwise rotation of the y_p schedule (from y_{p_1} to y_{p_2}) until a final, sustainable equilibrium is reached at $y_B = y_p^{**}$.

Note that the result depicted in figure 5 can be termed "fully demand-determined growth," because sustainability of the long-run growth rate is now achieved by adjustments on the supply side, which accommodate the demand-determined actual (equilibrium) rate of growth described by the ordinary workings of Thirlwall's Law. The significance of this result is that Thirlwall's Law is once again seen to emerge as a satisfactory description of the long-run equilibrium growth rate – not only because it describes a growth rate that is sustainable (consistent with both the external *and* internal constraints on growth), but also because the resulting rate of growth is (per the original intent of Thirlwall's Law) unambiguously demand-led.

7. Conclusions

Thirlwall's Law provides a remarkably parsimonious description of the long-run equilibrium growth rate of an economy. Since its initial

Figure 5 – *Reconciliation of the actual and natural rates of growth, redux*



introduction over thirty years ago, it has been subject to many extensions designed to take account of issues as various as chronic trade deficits and multi-sector growth dynamics. It is important to note that these extensions constitute benign amendments to the underlying BPCG framework from which Thirlwall's Law is derived. In other words, there is no need to "defend" Thirlwall's Law against reformulations arising from the introduction of, for example, permanent net inflows of financial capital.[22] But it is nevertheless interesting to observe how, even as the BPCG framework is elaborated in this fashion, Thirlwall's Law in its "pure" form – describing the equilibrium rate of growth as the product of the rate of growth of exports and the ratio of the income elasticities of exports and imports – remains remarkably "close to the surface." It has been the purpose of this paper to demonstrate this fact explicitly, showing how the simplest statement of Thirlwall's Law "survives" the many extensions of BPCG theory that have been introduced over the past three decades. The hypothesis advanced is that it is precisely this robustness or durability that makes Thirlwall's Law so useful as a description of the long-run equilibrium growth rate, and that explains its widespread empirical success.

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[22] On the contrary, quite apart from the fact that these reformulations do no basic violence to the BPCG framework from which Thirlwall's Law is derived, they are often observed to marginally improve the empirical fit of the model.

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