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# Thirlwall's Law and uneven development

***Abstract:*** *Thirlwall's analysis of balance-of-payments–constrained growth, and what has come to be called Thirlwall's Law, have usually been used to understand the determinants of growth for individual countries. This paper argues that another important use of Thirlwall's Law is to understand the mechanics of uneven development between rich and poor countries. To contribute to such an analysis the paper incorporates Thirlwall's analysis into a model of North–South trade to show how it explains uneven development. The paper also points to the need for empirical work necessary for relating Thirlwall's Law to uneven development, which is different from the work related to the law that has proliferated in recent years.*

***Keywords:*** *balance-of-payments constraint, global inequality, growth, import elasticity, North-South trade, Thirlwall's Law, terms of trade, uneven development.*

Thirlwall's analysis of the balanced-of-payments–constrained growth, and what has come to be called "Thirlwall's Law," emerged in the late 1970s when Thirlwall (1979) showed that under certain conditions the rate of growth of an economy is determined by the ratio of its growth of exports to its income elasticity of demand for imports.[1] Judged by the voluminous literature that it has spawned, Thirlwall's Law has emerged as one the most influential contributions to Post Keynesian economics.

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[1] McCombie and Thirlwall (1997a) have traced the roots of this approach much further back, to the Mercantilists, and Harrod's (1933) discussion of the foreign trade multiplier and to a newspaper letter by Kaldor reviving Harrod's analysis in the late 1970s. Some elements of the analysis are also to be found in Dixon and Thirlwall (1975), which develops an export-led growth model of the Kaldorian type incorporating Verdoorn's law.



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Davidson (1990–1991) has hailed the law was "one of the more important contributions [to Post Keynesian economics], if not one of the most noticed." The *Journal of Post Keynesian Economics* has also featured a minisymposium on Thirlwall's Law (see Davidson, 1997), containing five papers, including one by Thirlwall (1997) himself.

Thirlwall's analysis has been applied mainly to the study of the determinants of growth in individual countries. This analysis has been interpreted as an alternative to the neoclassical theory of economic growth, which views economic growth, in its earlier versions, as determined by labor supply growth and (usually) exogenous technological change and, in its later new growth theory avatar, "endogenously" by saving and investment behavior, research and development activity, human capital formation, and the like. Thirlwall's model, in contrast, has been interpreted as viewing growth as constrained by demand, which cannot be increased because of the balance-of-payments constraints faced by countries imposed by their export growth and income elasticity of demand for imports. A large literature has examined the empirical validity of this approach in order to test how well Thirlwall's Law explains economic growth for individual countries.

This paper starts from the premise that the vast literature on Thirlwall's Law has ignored another aspect of Thirlwall's analysis, one that has not only been stressed by Thirlwall, but that has an important bearing on recent theoretical and empirical controversies in the literature on economic growth: that concerning the relative rates of growth of rich and poor countries.

As is well-known, a large empirical literature suggests that the disparity between rich and poor countries is growing. Sala-i-Martin (1996), using purchasing power parity-adjusted data from the Penn World Tables from 1960 to 1990, finds that the dispersion of the gross domestic product (GDP) per capita, measured by the standard deviation of the log of per capita income levels of countries, increased steadily from 0.89 in 1960 to 1.12 in 1990, implying what has come to be called $\sigma$-convergence. Stocker (1994) finds that the Lorenz curve for international income distribution for countries has shifted outward between 1960 and 1990 and that the Theil index increased from 0.46 in 1960 to 0.51 in 1990. Sala-i-Martin (1996) shows that the equation regressing the growth rate of per capita income on initial per capita income (1960) has a positive slope, implying what is called $\beta$-divergence. Baumol et al. (1989) run quadratic equations regressing growth rates of per capita income on the initial level of per capita income and its square to find an inverse U-shaped relationship, suggesting a positive relationship between start-

ing income level and per capita growth for most of the sample, and a negative one for a small group of high-income countries. Quah (1993) estimates a $5 \times 5$ Markov chain transition matrix of frequencies of individual country per capita income relative to the world average to show that the matrices imply distributions with a thinning middle and an accumulation at both low and high tails, or what has come to be called the twin-peakedness of world income distribution. Some countries do seem to be converging at the top, but others are converging to a different, low income level.

Some analysts argue that these inequalizing trends are very likely to be reversed in the future so that there will be convergence across countries, rich and poor. Jones (1997) uses Quah's method of transitional matrices and calculates the long-run distribution of world incomes to find evidence of convergence. Whereas Jones's analysis is empirical, Lucas (2000) develops a simulation model using stark theoretical assumptions and obtains more striking results. He assumes an initial state (at 1800) when all countries stagnate at a constant per capita income. The first country to grow does so at 2 percent per annum, followed by other countries, the probability of growth for which is a positive function of the average per capita world income. Countries that then begin to grow do so at the rate of the leader plus a fraction of the difference of its income level with that of the leader. With plausible parameter values, Lucas argues that the model predicts that "sooner or later everyone will join the industrial revolution, that economies will grow at the rate common to the wealthiest economies, and that percentage differences in income levels will disappear" (Lucas, 2000, p. 166). This will happen despite the fact that the model implies that initially inequality increases, as has happened in the real world.

Lucas's analysis, however, relies only on the mechanism of international learning for convergence: poor countries are simply assumed to learn from the experiences of rich countries and to catch up to them if they are poorer than the rich countries. This method of analysis is tantamount to assuming the result: eventual convergence results from the fact that poor countries must eventually catch up. This analysis actually overlooks two important issues. First, it does not address whether—even ignoring other mechanisms of interaction—given what is known about the international diffusion of technology, can poor countries be expected to catch up to rich countries? Instead of assuming the result, an examination of the recent literature on technology transfers suggests that convergence is not a foregone conclusion, and that it is much more likely that convergence is likely to take place within rich countries, with

many of the poorer countries left out of the process (see Dutt, 2000; Vespargen, 1991). Second, it does not examine whether mechanisms other than international learning lead to convergence or divergence. Once it is found that international learning does not automatically result in convergence, the importance of these alternative mechanisms becomes obvious. Mechanisms that have been examined in the literature of North–South interaction include international trade, international capital movements, and international labor migration, among others (see, for instance, Dutt, 1990; Myrdal, 1957).

Thirlwall's analysis allows us to examine certain aspects of the interaction between rich and poor countries due to international trade, those concerning the income elasticities of imports and exports, which in turn arguably depend on the pattern of trade specialization by the North and the South. The objective of this paper is to examine how Thirlwall's analysis can be used to conduct such an examination.

## Thirlwall's Law

Following Thirlwall, let the import function of a country be given by

$$M = \Theta_M (1/P)^{-\mu} Y^{\varepsilon}, \tag{1}$$

where $\Theta_M > 0$ is a constant, $Y$ is domestic output or income, $\varepsilon > 0$ is the income elasticity of demand for imports, $\mu > 0$ is the absolute value of the price elasticity of demand for imports in the country, and $P = P_d/EP_f$, where $P_d$ is the price of the domestic good in terms of its own currency, $P_f$ is the price of the foreign good in terms of foreign currency, and $E$ is the foreign exchange rate. For simplicity, we set $E$ equal to unity. The function shows that the country's level of imports increases with domestic production, and falls with the relative price of the imported good, $1/P$, with constant elasticities. Similarly, let the export demand function of the country be given by

$$X = \Theta_X P^{-\nu} Y_f^{\delta}, \tag{2}$$

where $\Theta_X > 0$ is a constant, $Y_f$ is foreign income, $\delta > 0$ is the foreign income elasticity of demand for exports, and $\nu > 0$ is the absolute value of the (foreign) price elasticity of demand for exports. The function shows that the country's level of exports increases with foreign income and falls with the relative price of the good, with constant elasticities. The country's balance-of-payments equation in terms of foreign goods,

$$P X + F = M, \tag{3}$$

where $F$ is the net flow of foreign capital into the country, can be written in growth rate form as

$$\left[1-\left(F/M\right)\right]\left[p+x\right]+\left(F/M\right)f=m, \tag{4}$$

where lowercase symbols denote the rates of growth of the variable denoted by the uppercase symbol. Log-differentiating Equations (1) and (2) and substituting into Equation (4) yields

$$y=\left(1/\varepsilon\right)\left\{\left(1-\mu-\nu\right)p+\left[1-\left(F/M\right)\right]\delta\, y_f+\left(F/X_N\right)\left[f-\left(1-\nu\right)p\right]\right\}. \tag{5}$$

In the special case in which trade is balanced—so that $F = 0$ and $f = 0$, *and* the terms of trade do not change—so that $p = 0$, this reduces to

$$y=\left(1/\varepsilon\right)\delta\, y_f, \tag{6}$$

or, using Equation (2) and the assumption that $p = 0$, to

$$y=\left(1/\varepsilon\right)x\ , \tag{6'}$$

establishing Thirlwall's Law, which states that the growth rate of a country's output depends on its income elasticity of import demand, its foreign-income elasticity of exports, and the growth of foreign countries, or alternatively, on its income elasticity of import demand and the growth rate of its exports. We will use the term Thirlwall's Law in a narrow fashion to refer to these two equations, and the term Thirlwall's analysis more broadly to refer to analysis involving the use of isoelastic import and export functions and balance-of-payments constraints to determine growth rates, without necessarily imposing constant terms of trade and balanced trade.

Thirlwall (1979) used data from a number of developed countries over the post-war period and found that the growth rate of most of these countries approximates this simple rule. However, when Thirlwall and Hussain (1982) performed the same exercise with developing countries for which income elasticities of import are available, their predictions were not too accurate. They found that terms of trade variations and capital inflows do explain some of the variation in growth rates (factors that are ignored in Equations (6) and (6') by assumption), and that the mean absolute error of the actual growth rate, $y_i$, from the predicted growth rate given by $x_i/\varepsilon_i$, is 2.01, which they acknowledge may be regarded as high.

This early empirical work has been followed by many contributions that have examined the extent to which Thirlwall's Law explains actual growth in both developed and developing countries. Since surveys of this large literature can be found in McCombie (1997) and McCombie and Thirlwall (1997a), rather than reviewing it here, we confine our attention to a few relevant comments on it, emphasizing some contributions that have appeared after the publication of these surveys.

First, the literature has solely been interested in examining how Thirlwall's Law explains the growth rate of individual countries. Even when several countries are considered, the aim is to examine how variations in the actual rate of growth across countries is explained by variations in the growth rate predicted by Thirlwall's Law. In particular, the contributions do not systematically examine the issue of relative rates of growth of rich and poor countries.[2] One possible exception is the work of Bairam (1997), which explores how elasticities of export and imports vary over levels of development, a contribution to which we will return later.

Second, a variety of methods have been used to test Thirlwall's Law. One approach examines the cross-country correlation between the actual growth rate and that predicted by Thirlwall's equation. A second examines the average deviation of the actual rate of growth from the one predicted by Thirlwall's Law, ignoring sign. A third regresses actual growth rates across countries on the growth rate predicted by Thirlwall's Law and tests whether the regression coefficient differs significantly from unity. A fourth approach takes countries individually, estimates the income elasticity of demand for imports, which makes the growth rate equal to the one predicted by Thirlwall's Law, and compares it to the actual estimate of that elasticity from a time series regression for the country. Initially using ordinary least squares methods in estimating the elasticities, the contributions have kept up with developments in time series econometrics, testing for stationarity and using cointegration analysis where necessary. A final approach, developed by Alonso and

[2] This comment is about the empirical literature. There is one theoretical paper by McCombie (1993) that examines the implications of Thirlwall's analysis in a two-country setting in which one country faces a balance-of-payments constraint (that is, the constraint that trade is balanced) and the other country faces either resources constraints or is constrained by policy to grow at an exogenously specified rate. However, both countries are assumed to be advanced countries, so that the model is not meant to capture the interaction between rich and poor countries.

Garcimartin (1998–1999) takes an entirely different approach by estimating systems of equations for individual countries to examine whether deviations from balanced trade (reflecting the balance-of-payments constraint) result in variations in growth (as predicted by the Thirlwall approach) or in relative price changes (as predicted by their interpretation of the neoclassical approach), allowing for terms of trade changes, Thirlwall's import and export functions, and the slow adjustment of import and export growth to the rates predicted by the functions. This approach can be interpreted as a test of Thirlwall's analysis rather than of Thirlwall's Law.

Third, the law has held up quite well empirically (see the results summarized in McCombie and Thirlwall [1997a] and McCombie [1997]), especially for developed countries, and especially if one considers long periods of time. McCombie and Thirlwall (1997a), in reacting to Anderson's (1993) conclusion that Thirlwall's Law merely holds in the very long run, point out that the model is "meant to be a predictor of long-run growth performance, not short-run year to year fluctuations." It should be noted, however, that the distinction between short and long run made in the literature relates to how long a time span one considers, and not a theoretical one based on an explicit analysis of whether and how precisely the short-run growth rate converges to the long-run one. Thirlwall's analysis has also held up well for developed countries as shown by Alonso and Garcimartin (1998–1999).

Finally, the law does not hold everywhere, especially for less developed countries for which real exchange rates or real terms of trade have shown a tendency to change, and which have experienced large capital inflows or outflows. This should come as no surprise at all, since as we have seen, Thirlwall's Law is derived under the assumption that the terms of trade is constant and that trade is balanced, and deviations from these assumptions are likely to be important for developing countries, which arguably face significant and persistent fluctuations in terms of trade changes and capital inflows. Indeed, as noted above, Thirlwall and Hussain (1982) found such results for developing countries early on. In the subsequent literature, McCombie and Thirlwall (1997a) cite studies on developing countries, including those by Perraton (1990) and Hussain (1995), where the law does not hold exactly, and where terms of trade and capital flow effects have a non-negligible effect. Recent studies confirm this as well. Ansari et al. (2000) use data for the 1970 to 1996 period for the Southeast Asian economies of Indonesia, Malaysia, the Philippines, and Thailand and employ stationarity tests and cointegration analysis when necessary to compute import elasticities of demand for

these countries. They find that Thirlwall's Law cannot be rejected for Indonesia, Malaysia, and the Philippines, whereas it is rejected for Thailand due to large changes in its trade deficit and its exchange rate. Lopez and Cruz (2000) use cointegration techniques to examine Thirlwall's Law for the four Latin American economies of Argentina, Brazil, Colombia, and Mexico. Although their results are broadly sympathetic to Thirlwall's Law in the sense that export growth drives output growth in these countries, they question the applicability of the assumption of a constant real exchange rate. In particular, they find that over the period 1965 to 1996 the real exchange of these countries was subject to wide fluctuations and to an upward trend; there is no evidence of an equilibrium exchange rate. Consequently, changes in the real exchange rate affected the rate of growth of the economies, *pace* the constant terms of trade assumption of Thirlwall's Law.

Thirlwall's Law has also been subjected to a number of criticisms. Whereas several of these have been reviewed and adequately rebutted by McCombie and Thirlwall (1997a), it is useful for our purpose to briefly mention two. McGregor and Swales (1986, 1991) have argued, among other things, that if the price elasticities of imports and exports are infinite and relative prices are constant, the Thirlwall model becomes identical to the standard neoclassical supply oriented model. Krugman (1989) has pointed out—surprisingly without actually referring to Thirlwall's contributions—that the empirical relation between growth rates and income elasticities of imports should be interpreted as implying causality from growth to elasticities, rather than from elasticities to growth (as implied in Thirlwall's Law). For Krugman, long-run differences in growth across nations are determined by technological change, and he makes his case with a model in which full employment of labor explicitly assumed, and in which the elasticities are endogenous, depending on the number of goods produced by countries. Two comments about these criticisms are relevant for present purposes. First, the McGregor-Swales comment about infinite elasticities can only be relevant—if at all—for individual countries that can be thought of as small countries in the trade-theoretic sense, not groups of countries. Second, both criticisms take a supply constrained neoclassical view, in which factor supplies and technological change drive growth, contrary to Thirlwall's own balance-of-payments–constrained view. It is possible that these alternative interpretations have resulted from the fact that Thirlwall's Law has usually been derived merely from the trade balance equation without a clear description of the overall structure of the economy that makes explicit how saving, investment, and hence growth are determined.

## Thirlwall's Law and North–South uneven development

The connection between Thirlwall's Law and uneven development in a global economy has been noted in the past. Thirlwall (1983) argued that the balance-of-payments–constrained growth model provides a useful way of relating the main features of a number of so-called center-periphery models of uneven development, including those of Harrod (1933), Prebisch (1950), Seers (1962), Kaldor (1970), and Dixon and Thirlwall (1975). Davidson (1990–1991, p. 301) points out that the dreadful implication of Thirlwall's Law is that "the LDCs are condemned to relative poverty, and the global inequality of income will become larger over time."

This implication can be seen as follows. Divide the world into two regions—rich countries called the North and poor countries called the South—and interpret Equation (1) to represent the import function for the South and hence the export function of the North and Equation (2) to be the export function of the South or the import function of the North. Then Equation (6) can be expressed as

$$y_S/y_N = \varepsilon_N/\varepsilon_S, \tag{7}$$

where $y_i$ is the rate of growth of output, $Y_i$, of region $i$, and $\varepsilon_i$ is the income elasticity of demand for imports in region $i$, with $N$ and $S$ denoting North and South.

The presumption is that $\varepsilon_N$ is low—that is, the North's demand for Southern products is income-inelastic—and $\varepsilon_S$ is high—that is, the South's demand for Northern products is income-elastic, we have $\varepsilon_N < \varepsilon_S$. This can be explained in terms of the observation that "less developed nations . . . concentrate on the export of raw materials, and other basic commodities for which Engel's curves suggest that the developed world will have a low income elasticity of demand, while the LDCs have a high income elasticity for the manufactured products of the developed world" (Davidson, 1990–1991, p. 301). In this case, Equation (7) implies that $y_S/y_N < 1$, so that the South will have a lower rate of growth of total product than the North. Combined with the stylized fact that the South has a higher rate of growth of population than the North, the implication is that the South will have a lower rate of growth of per capita product than the North.

Although this is a promising route toward an explanation of global uneven development, it suffers from several shortcomings. As we have already seen, Equation (7) is derived on the basis of a number of stringent assumptions, of which two are: that the terms of trade are constant

and that trade is balanced. Both these assumptions are troubling in the present context. Regarding the first, variations in the terms of trade between rich and poor countries have played an important role in the examination of economic relations between the North and the South (see, for example, Prebisch, 1950; Reinhart and Wickham, 1994; Singer, 1950, 1987). Regarding the second, international capital flows have also been a major issue in the analysis of the relation between rich and poor countries. It has often been argued that foreign direct investment by transnational corporations creates development problems for the South and exacerbates North–South uneven development, and "surplus transfers" from the South to the North resulting from payments of interest on Southern debt have also had analogous effects. Others have argued that international capital flows provide an important means by which the South can grow more rapidly than is possible from domestic saving and thereby catch up with the North. Whereas it is possible to argue that issues related to capital flows raise issues that are unrelated to differences in import and export elasticities between rich and poor countries and should therefore be addressed separately, the same cannot be said of the terms of trade since some of the discussion related to the deterioration of the Southern terms of trade is related precisely to the inelastic demand for Southern goods.

What is needed to overcome this problem is a model that simultaneously determines the rate of growth of the North and the South and the evolution of the North–South terms of trade, rather than one that arbitrarily takes the terms of trade as exogenously given. Such a general equilibrium model of North–South trade also offers the possibility of explicitly taking into account North–South flows of capital. Such a model, moreover, has the potential to overcome some of the problems concerning Thirlwall's Law discussed in the previous section. First, by allowing the terms of trade to be variable (and trade not necessarily balanced), it does not require the assumptions of a constant terms of trade and balanced trade, which were implicit in the derivation of Thirlwall's Law. Second, by applying the law to groups of countries, it makes it harder to invoke the infinite price elasticity of exports assumption against the law. Finally, a complete model of North–South trade requires the explicit characterization of growth processes in the North and the South. Equation (7) at best provides an explanation of why Northern growth is faster than Southern growth, but does not tell us what determines the growth process in the two regions. Thus, it allows critics to provide neoclassical supply-side interpretations of the law. An explicit North–South model overcomes this problem and offers the possibility of demonstrating that

an internally consistent alternative to the neoclassical view exists, and one that corresponds more to a Post Keynesian view of a demand-constrained global economy.

## A model of North–South trade

A model that simultaneously determines growth rates and the evolution of the terms of trade can be developed using the structuralist assumptions made by Taylor (1981, 1983) in his pioneering model of North–South trade. Following Taylor, we assume that the North grows with excess capacity with firms practicing markup pricing and with output determined by demand. In other words, we assume a Kalecki-Keynes North rooted in the Post Keynesian tradition. Whereas the Northern good is produced under oligopolistic conditions, the market for the Southern good is perfectly competitive, so that the price of the good is flexible and Southern producers fully utilize their capacity. However, the South has a fixed real wage and unemployed labor, so that it has a Marx-Lewis structure.[3] We also assume that there are no interregional capital flows.[4]

Two comments on this model are in order. First, this particular model is not the only one that we could use for determining growth rates and the terms of trade in a North–South framework. In the literature on North–South models, the North and the South have been modeled in a number of different ways. For instance, Findlay (1980) assumes a neoclassical Solovian structure with full employment growth and Molana and Vines (1989) assuming a Marx-Lewis structure with a given real wage for the North, both assuming a Marx-Lewis structure for the South. These and other ways of modeling the structures of the North and the South are discussed and compared in Dutt (1990), where they are treated

[3] Taylor's assumptions have also been used by Sarkar (1998) in a model with Thirlwall-type export and import functions, and in that sense Sarkar's model is similar to the one presented here. However, Sarkar does not provide an explicit analysis of the expenditure assumptions that result in these export and import functions. Moreover, Sarkar uses the model to explain terms of trade movements and not differences in growth between North and South, whereas the model of this section determines both terms of trade and growth rates. Thirlwall's assumptions about export and import functions are also made in a two-region model by McCombie (1993). As noted earlier, this model is developed explicitly for analyzing the interaction between two advanced economies. In fact, it is a standard Keynesian model of two countries (although written in terms of growth rates rather than income levels) with balanced trade where there are no structural differences between the countries. Moreover, the model does not analyze the determination of the terms of trade and the dynamics of capital accumulation like the model of this section.

[4] Comments on relaxing this assumption will be made later, however.

as alternative closures to a general framework for examining North–South interaction. We model the South in a Marx-Lewis manner since that is the popular way to model them, and the North in the Kalecki-Keynes manner since it allows us to introduce effective demand considerations in the model. However, it should be pointed out that the qualitative properties of our model would be valid for many of the other closures as well, including those that allow effective demand issues to be important for the South as well. Second, it can be questioned whether the diversity within the North and the South can be captured in simple models that assume given structures within the North and the South. In particular, one may object to treating semi-industrialized (and even newly industrialized countries) on the same footing as primary producing poor countries. We treat the two regions as homogeneous to simplify the analysis. If the framework is found useful it can be extended to examine, for instance, a three-region model with two kinds of Southern regions, allowing for structural differences between them. Moreover, the Southern good that we consider in our model can be thought of either as a primary product or as a manufactured good, or as some composite of the two, without affecting the model. Thus, the difference in the types of commodities exported by primary producing countries and semi-industrialized countries does not affect our results.

Returning to the model itself, for both regions we assume that goods are produced with fixed coefficients of production using labor and capital as inputs.[5] In the North, firms set the product price according to the markup equation given by

$$P_N = (1+z)W_N b_N, \tag{8}$$

where $z$ is the exogenously given markup that represents the degree of monopoly in the market for the Northern good, $W_N$ is the fixed money wage in the North, and $b_N$ is the fixed unit labor requirement for the Northern good. Northern producers determine output according to demand in the manner specified below. In the South, firms produce at full capacity, so that we have

$$Y_S = K_S/a_S, \tag{9}$$

[5] We assume that there are no intermediate goods in the model. In particular, this implies that we do not allow for the Southern good to be a primary intermediate good. If we allowed the Southern good to be an intermediate good, the interaction between the two regions would become more complicated and become more difficult to model. However, the model could still imply uneven development due to raw material saving technological change along the lines examined in Dutt (1996).

where $a_S$ is the fixed capital-output ratio in the South, and $K_S$ is the Southern stock of capital.

There are two income groups in each region, workers who receive wage income and capitalists who receive profit income. In the North, Equation (8) implies that capitalists receive a share $z/(1 + z)$ of the value of Northern output, and workers receive $1/(1 + z)$. In the South, workers receive a wage that is fixed in terms of the price of the Southern good (which, as we will assume below, is the only good they consume), so that

$$W_S/P_S = V_S, \tag{10}$$

where $V_S$, the Southern real wage, is exogenously fixed. Consequently, capitalist income is $(1 - b_S V_S)P_S Y_S$ in terms of the Southern good.

In the North, capitalists save a fraction $s_N$ of their income, whereas workers consume all their income. Northern capitalists and workers spend a fraction $\alpha$ of their consumption expenditure on the Southern good and the rest on the Northern good. This fraction is determined according to

$$\alpha = \alpha_0 Y_N^{\varepsilon_N - 1} P^{1-\mu_N}, \tag{11}$$

where $P = P_S/P_N$, and where, as earlier, the nominal exchange rate has been assumed to be fixed at unity. This formulation is compatible with a variety of assumptions of price and income elasticities of the demands for the two goods.[6] In the South, workers spend their entire income consuming the Southern good, whereas capitalists save a fraction $s_S$ and consume the rest, devoting a fraction $\beta$ on the Northern good and the rest on the Southern good. Analogously, with Northern consumers, we assume that

$$\beta = \beta_0 (\sigma_S Y_S)^{\varepsilon_S - 1} P^{1-\mu_S}, \tag{12}$$

where instead of total income as in the North we use the profit share of income, $\sigma_S Y_S$, where $\sigma_S = (1 - b_S V_S)$, since the income of workers, who spend their entire income on the Southern good, is not available for allocation between the two goods.

[6] If $\varepsilon_N = \mu_N = 1$, the shares of consumption expenditure spent on the two goods are constant. If $\varepsilon_N < 1$, increases in Northern income will result in a lower proportion of consumption expenditure being spent on the Southern good, implying that the Southern good is income inelastic. If $\mu_N < 1$, the share of Northern consumption expenditure on the Southern good rises when $P$ rises, despite the increase in $P$, implying price inelastic demand for the Southern good, and conversely if $\mu_N > 1$.

Northern firms have an investment function given by

$$I_N / K_N = \gamma_0 + \gamma_1 (Y_N / K_N), \tag{13}$$

where $K_N$ is the capital stock in the North, and $\gamma_i$ are positive constants, which shows that the Northern investment rate depends on the rate of capacity utilization measured by $Y_N/K_N$, because higher capacity utilization implies more buoyant markets and higher profits. Only the Northern good is used as an investment good in the North. In the South, capitalist firms invest their entire saving.[7] We assume that both the Northern and Southern good can be an investment good in the South, and for simplicity assume that a fraction $\beta$ of total investment is spent on the Northern good and the rest on the Southern good. The stock of capital in neither region depreciates.

Our assumptions imply that the value of Northern imports from the South—that is, of Southern exports—is given by

$$P_S X_S = \alpha \left\{ \left[ 1 + (1 + s_N) z \right] / (1 + z) \right\} P_N Y_N,$$

which, using Equation (11), can be written as

$$X_S = \theta_S P^{-\mu_N} Y_N^{\varepsilon_N}, \tag{14}$$

where $\theta_S = \alpha_0 [1 + (1 - s_N)z]/(1 + z)$. The value of Southern imports from the North—that is, of Northern exports—noting that the same fraction of consumption and investment demand is spent by Southern capitalists on the Northern good, is given by

$$P_N X_N = \beta \, \sigma_S \, P_S Y_S.$$

This equation, using Equation (12), can be written as

$$X_N = \theta_N (1/P)^{-\mu_S} Y_S^{\varepsilon_S}, \tag{15}$$

where $\theta_N = \beta_0 \sigma_S^{\varepsilon_S}$. Thus, our assumptions imply the export functions for the North and the South, which were assumed in earlier sections.

[7] The assumption that all saving in the South is automatically invested in the South implies the absence of effective demand problems for the South. The assumption that Southern investment does not exceed savings follows from our assumption that there are no interregional capital flows. We may assume that the Southern government ensures that Southern investment is always at the maximum consistent with the condition of no capital inflows, which implies that all domestic saving is invested in the South.

We now examine the workings of the model, distinguishing between the short run and the long run. In the short run the stocks of capital in the two regions, $K_i$, are given, and the markets for the two goods clear through fluctuations in Northern output and the Southern relative price. We assume that a positive excess demand for the Southern good results in an increase in the relative price of the Southern good, $P$.[8] The excess demand for the good is given by

$$ED_S = C_{SS} + I_{SS} + X_S - Y_S, \tag{16}$$

where $C_{ij}$ denotes the consumption demand for good $i$ in region $j$, and $I_{ij}$ denotes the investment demand for good $i$ in region $j$, measured in terms of units of good $i$. Since Southern income can be spent on buying domestic goods or imports (since all Southern saving is invested), so that $Y_S = C_{SS} + I_{SS} + M_S$, where $M_i$ is imports of region $i$ in units of good $i$, and since $M_S = X_N/P$, we can rewrite Equation (16) as

$$ED_S = X_S - (1/P)X_N. \tag{16'}$$

We also assume that a positive excess demand for the Northern good results in an increase in $u = Y_N/K_N$, the rate of capacity utilization in the North. The excess demand for the Northern good is given by

$$ED_N = C_{NN} + I_N + X_N - Y_N. \tag{17}$$

Since Northern income can be used for consuming the Northern good—on imports, and on saving—we have $Y_N = C_{NN} + M_N + S_N$, where $S_N$ is Northern saving in terms of the Northern good, and since $M_N = PX_S$, we can rewrite Equation (17) as

$$ED_N = I_N - S_N + X_N - PX_S. \tag{17'}$$

Short-run equilibrium, in which $u$ and $P$ do not change, given $K_i$ requires $ED_i = 0$. Imposing this condition into Equations (16') and (17'), and using Equations (9), (14), and (15), we can solve for the short-run equilibrium values of the terms of trade and the Northern rate of capacity utilizations, which are given by

$$P = \left[ (\theta_S/\theta_N)(uK_N)^{\varepsilon_S} (K_S/a_S)^{\varepsilon_N} \right]^{1/(\mu_N + \mu_S - 1)} \tag{18}$$

[8] Since we have assumed that the nominal exchange rate is fixed, the adjustment is due to variations in the nominal price of the Southern good. If the exchange rate is not fixed, the changes in the terms of trade could reflect changes in the exchange rate as well.

and

$$u = \gamma_0 / [s_N \sigma_N - \gamma_1], \tag{19}$$

where $\sigma_N = z/(1+z)$, the profit share in the North and where the equilibrium value of the terms of trade can be solved by substituting Equation (19) in Equation (18).

Equation (19) is obtained from the saving-investment balance condition for the North, which must hold under balanced trade, as required by the equilibrium condition for the $S$ good as shown by setting excess demand for the good equal to zero in Equation (16'). It shows that to obtain an economically meaningful equilibrium value of $u$ we require $s_N \sigma_N > \gamma_1$, which is the standard condition in quantity adjustment models requiring that the responsiveness of saving to changes in output exceeds the responsiveness of investment for stability of output adjustment. The (local) stability of short-run equilibrium also requires that $\partial(ED_S)/\partial P < 0$ in the neighborhood of the short-run equilibrium. This is satisfied if $\mu_N + \mu_S > 1$, which is the well-known Marshall-Lerner condition.[9]

In the long run, capital stocks in the North and South grow according to the rates of capital accumulation in the two regions, given by $g_i = I_i/K_i$, whereas the short-run equilibrium conditions are always satisfied. Northern accumulation is given, from Equations (13) and (19), by

$$g_N = \gamma_0 + \gamma_0 \gamma_1 / [s_N \sigma_N - \gamma_1]. \tag{20}$$

For the South, we have

$$S_S = s_S \sigma_S K_S / a_S,$$

where $S_S$ is Southern saving in terms of the Southern good. Since investment is made in the form of both Northern and Southern goods, we assume that investment is given by the equation

$$I_S = P^{\xi} S_S,$$

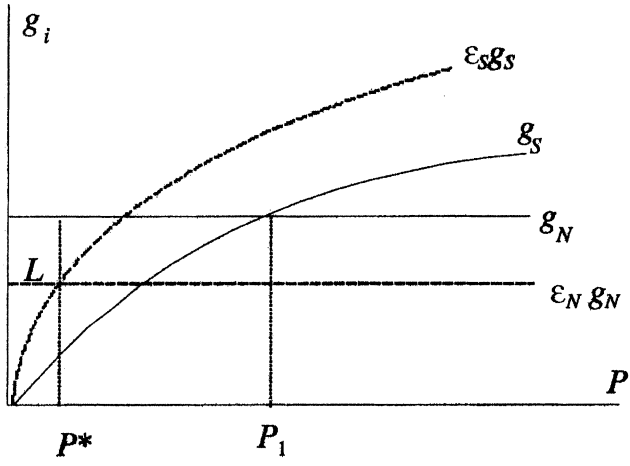
where $\xi < 1$. Combining these two equations implies that

$$g_S = s_S P^{\xi} \sigma_S / a_S. \tag{21}$$

The long-run dynamics of growth and the terms of trade are shown in Figure 1. The $g_N$ curve depicts Equation (20), which shows that $g_N$ is

[9] This can be shown by differentiating Equation (16') with respect to $P$ and using Equations (9), (14), and (15).

**Figure 1** Long-run dynamics




independent of $P$,[10] and the $g_S$ curve depicts Equation (21). Equation (18) implies, noting that $u$ and $a_S$ are independent of $K_i$, the rate of change in $P$, is given by

$$p = \left[1/\left(\mu_N + \mu_S - 1\right)\right]\left(\varepsilon_N g_N - \varepsilon_S g_S\right), \tag{22}$$

which shows that $P$ rises or falls depending on the gap between $\varepsilon_N g_N$ and $\varepsilon_S g_S$. We consider the case in which $\varepsilon_S > 1 > \varepsilon_N$, although the results will be valid whenever $\varepsilon_S > \varepsilon_N$. The curve for $\varepsilon_S g_S$ will lie above the curve $g_S$ and the curve $\varepsilon_N g_N$ will lie below the curve $g_N$, as shown in Figure 1. Given initial values of $K_i$, Equation (18) shows how the equilibrium terms of trade are determined in the short run. The curves $\varepsilon_S g_S$ and $\varepsilon_N g_N$ in Figure 1, with Equation (22), then show how $P$ moves over time: for any $P > P^*$, where $P^*$ is the relative price at which the $\varepsilon_S g_S$ and $\varepsilon_N g_N$ intersect, we have $\varepsilon_S g_S > \varepsilon_N g_N$, so that $P$ falls over time according to Equation (22), whereas for $P < P^*$, $P$ rises over time. Now suppose that the initial $K_i$ are such that we start with $P$ satisfying $P_1 > P > P^*$. It follows, then, that we must have $g_N > g_S$, and that $p < 0$. Thus, the global economy will experience declining $P$ and declining $g_S$, but have a constant $g_N$, until it reaches the point $L$, with the terms of trade $P^*$, at which

[10] This property will not hold in general if the Southern good is treated as an intermediate good in Northern production, as shown in a related model in Dutt (1996), which was referred to earlier.

$p = 0$. This is a long-run equilibrium for the system in the sense that $P$, $g_N$, and $g_S$ become stationary, as do $y_N$ and $y_S$. However, we have $g_S < g_N$ at this equilibrium, so that we have continuous, uneven development.[11] Note that if initially $P > P_1$, there will first be a phase in which $g_S > g_N$, but the deterioration of the Southern terms of trade will reduce $g_S$ over time until we have uneven development and enter the region in which $P_1 > P > P^*$. If we initially have $P < P^*$, the terms of trade for the South will improve over time until we achieve long-run equilibrium at $P^*$.

We conclude our discussion of the model with four comments. First, the model implies that in long-run equilibrium we have uneven development in the sense that Northern capital and output grow at a faster rate than Southern capital and output. What drives this result is the crucial assumption that $\varepsilon_N < \varepsilon_S$. Note that in the short run, the South can grow faster than the North even when this condition is satisfied; the outcome is therefore a long-run outcome. Note also that the short-run/long-run distinction used here is a theoretical one based on an explicit analysis of how the economy converges to the long-run equilibrium by traversing through a sequence of short-run equilibria, contrary to the distinction found in the empirical literature on Thirlwall's Law discussed in the second section.

Second, the model implies that the long-run growth of the world economy is determined by demand in the North, consistent with a Post Keynesian vision of growth. Suppose that Northern demand was autonomously increased by expansionary policies in the North, which increase $\gamma_0$. Then, as Equation (20) shows, the $g_N$ will move up, as will the $\varepsilon_N g_N$ curve. The Southern terms of trade would be higher in long-run equilibrium and Southern growth would also be higher. However, Equation (18) shows that the relative income of the North to the South would be higher.

Third, the model has assumed that there are no North–South capital flows. As argued earlier, this assumption can be justified on the grounds that North–South capital flows raises issues concerning the unevenness of global development, which are arguably independent of the issues about elasticities of exports and imports with which the present analysis

[11] It should be noted that this is a different conception of long-run equilibrium than the one adopted in Dutt (1990), where, given the general framework for North–South interaction used in the analysis, at long-run equilibrium the ratio of stocks of capital, $K_N/K_S$, becomes stationary. In contrast, in the formulation adopted here, $K_N/K_S$ increases in long-run equilibrium. In both formulations, however, the variables that change in the long run to change short-run equilibrium positions, become constant in long-run equilibrium.

is concerned. However, it can be shown that if North–South capital flows are introduced into this model with plausible credit constraints for the South, the qualitative results of the model would continue to hold.[12]

Finally, although the model has been developed mainly for showing how Thirlwall's analysis can be used to examine the dynamics of the terms of trade and growth in the global economy and to explain global uneven development, it also makes a contribution to the literature on the application of Thirlwall's analysis for individual countries or regions.[13] As noted earlier, most presentations derive Thirlwall's Law from the balance-of-trade or payments equation involving exogenously specified isoelastic export and import functions without specifying the structure of the economy and clarifying how the domestic economy adjusts to the balance-of-payments–constrained growth rate, and this may have led to some misunderstandings of the nature of Thirlwall's analysis. The model developed here derives the export and import functions of the two regions from underlying assumptions about saving, consumption, and investment, and also examines how macroeconomic adjustment takes place within each region when the economies adjust to the balanced trade (or, if we allow for international capital flows, balance-of-payments) condition.

## Conclusion

Thirlwall's Law, which examines how growth is determined in balance-of-payments–constrained economies, has been hailed as one of the major contributions to Post Keynesian economics. Almost all of the literature on Thirlwall's Law has used it to examine the growth of individual countries. Countless empirical studies have been performed to see how well it explains actual rates of growth in these countries. This literature has found that the law does quite well in explaining individual country growth rates, but not in all cases, especially for countries that have experienced

[12] See Dutt (forthcoming). See Moreno-Brid (1998–1999) for an analysis of the incorporation of capital flows into Thirlwall's analysis as applied to the growth rate of an individual country. However, Moreno-Brid's model neglects to take into account interest payments. It also appends the out-of-equilibrium dynamics of output and import change into the model in an ad hoc fashion after examining the equilibrium levels of these variables without introducing dynamics from the start, as the approach of the model developed here does. See also McCombie and Thirlwall (1997b) for a discussion of how Thirlwall's Law (for an individual country) is modified by introducing international borrowing and interest payments.

[13] I am grateful to an anonymous referee for pointing out this feature of the analysis.

fluctuations in real terms of trade and balance-of-payments positions, factors that have been assumed away in the derivation of Thirlwall's Law. Moreover, these applications of the law have been subjected to some criticisms.

This paper has examined a different application of Thirlwall's Law, one that addresses the issue of uneven development between rich and poor countries, a phenomenon that has been widely documented in recent years. Although this application of Thirlwall's Law was emphasized by Thirlwall and others, such as Davidson, it has been neglected in theoretical and empirical work on Thirlwall's Law.

This paper has developed a theoretical model of North–South trade, which shows how Thirlwall's analysis can be incorporated into North–South models to explain uneven development in which, in long-run equilibrium, the rich North grows faster than the poor South. This model overcomes some of the objections to the existing applications of Thirlwall's analysis, since it does not assume that the terms of trade are fixed, but rather allows them to vary and become constant in long-run equilibrium and because it makes explicit the internal structures of regions and hence the determinants of growth in rich and poor countries. The model shows that if the income elasticity of imports for the South is higher than that of the North, the world economy will eventually come to an equilibrium in which the South will grow less rapidly than the North, so that the gap between the North and the South will grow indefinitely.[14]

The analysis of this paper calls for empirical work that is different from that available in the literature on Thirlwall's Law. This literature examines whether the growth rate of an individual country is explained by the growth rate of its exports (or the elasticity of demand for its exports in the rest of the world and the growth of income in the rest of the world) and the income elasticity of its imports. The analysis of this paper calls for comparisons of the income elasticity of imports in rich and poor countries. It should be noted that if Thirlwall's Law is found to be valid for individual countries, it says nothing about the uneven development issue, since it is possible that poor countries may not have higher income elasticities of imports than rich countries. Also, if Thirlwall's

[14] This is not to imply, however, that individual Southern countries will necessarily be unable to break out of this impasse. For instance, individual countries may be able to grow rapidly for a while (with or without access to foreign capital), change their production structure, reduce their dependence on imports from rich countries, and eventually join the ranks of the North. But it does imply that the Southern countries as a group face considerable difficulties in achieving this.

Law is found invalid for particular countries (for instance, because it experiences terms of trade fluctuations), it may still be true that the income elasticity of imports is higher for the South than of the North, so that Thirlwall's analysis will predict long-run uneven development.

The analysis also calls for empirical work on import and export elasticities that is different from those that are usually found in the elasticities literature. This literature, following Houthakker and Magee (1969), mostly derives import and export equations for individual countries vis-à-vis the rest of the world. Focusing on these elasticities for understanding the processes of uneven development are likely to give misleading results. For instance, Bairam (1997) reports that the (foreign) elasticity of exports falls with the level of per capita income while income elasticities of imports are independent of income, so that the elasticity of exports is higher than the elasticity of imports for poor countries whereas the opposite is true for rich countries. Bairam's result appears to imply that Thirlwall's Law does *not* imply uneven development. Thirlwall (1997), recognizing this implication, criticizes Bairam's result for drawing inferences from a small and selective group of poor countries, which contains many newly industrializing countries and very few extremely poor countries. What one should examine, however, are not import and export elasticities of individual countries, but elasticities of exports and imports between the North and South, ignoring intra-North and intra-South trade. This requires a more detailed examination of trade flows of countries (emphasizing bilateral trade relations) than is presently available for most less-developed countries (Marquez, 1990, is an exception).

Some preliminary results that I have obtained with a colleague that estimates export and import elasticities of the South as a whole in relation to the North as a whole, seems to suggest that the income elasticity of imports of the South exceeds the Northern income elasticity of Southern exports.[15] Moreover, there appears to be no increase in the export elasticity over time despite much-heralded changes in the structure of Southern exports, which have reduced the importance of primary products and increased that of manufactured goods, whereas the import elasticity has

[15] Some results of this ongoing work, with Kajal Mukhopadhyay, are reported in Dutt (forthcoming). This work estimates standard Houthakker-Magee (1969) import and export functions for the South using alternative econometric techniques, using relative prices and purchasing power parity (PPP)-adjusted income variables. We have used two definitions of the North and the South in our work. For one we identified OECD countries with the North and non-OECD countries with the South. Then, using data from the Penn World Tables for the 1968 to 1990 period, we found that the

increased over time, arguably due to import liberalization as a part of the globalization process. Whereas these results are suggestive, on the empirical front this paper can claim to have done no more than point to the need for more empirical work along these lines to examine whether in fact balance-of-payments–constrained growth leads to uneven development between rich and poor countries.

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ordinary least squares (OLS) estimates of the Southern export elasticity with respect to Northern income is 1.02, which is smaller than the Southern import elasticity with respect to Southern income, 1.16, confirming the uneven development hypothesis. Other estimates using instrumental variables and cointegration techniques gave qualitatively similar results, although the elasticity magnitudes were higher. An alternative definition of the North and the South, which follows the World Bank's groupings of industrial and developing countries (leaving out other countries) and uses World Table data for 1964–1995, yields similar results: the OLS estimate for the Northern income elasticity of Southern exports was found to be 1.28, and the Southern import elasticity of Southern imports was estimated at 1.67.

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