

## The balance-of-payments–constrained growth model: a north–south approach

***Abstract:** This paper develops a general extended version of the balance-of-payments–constrained growth model that takes into account three often ignored aspects of contemporary growth in open economies—namely, trade imbalances and the importance of net financial flows in the long run, relative price changes caused by idiosyncratic rules of adjustment in prices, and trade and payments interdependence among asymmetric regions. We first present partial solutions for both a northern and a southern region under the key assumption of an exogenous world income growth. We show how, under specific assumptions, the solutions reduce to Thirlwall’s rule. After that, we lift the small economy assumption and allow full interdependence among regions and explore the implications, over the terms of trade and the rate of growth of both regions, of changes in the rate of growth of net financial transfers. Contingent on parameters values of each region, we found that an exogenous change in the rate of growth of financial transfers may generate either a mutually reinforcing growth regime or a conflicting growth regime.*

***Key words:** balance-of-payments constraint, north–south, Thirlwall’s law.*

“An engine of growth” is the famous phrase that Robertson (1938) used to describe the role of international trade in the expansion of the world economy from the mid-nineteenth century to World War I. But it was Harrod (1933) who put forward the view that the level of output of industrial countries is to be explained by the principle of the foreign

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trade multiplier. This principle captures the twin idea that, in the context of an open economy, exports are the main (or only) component of autonomous demand, and that, in the long run, economic activity is constrained by the balance-of-payments equilibrium on the current account.

Both Harrod and Robertson wrote during an age of considerable turbulence in world markets. In the face of the great depression, many countries had resolved the choice between internal and external balance by curtailing their trading links with the rest of the world. This path imposed extremely high costs on the world economy and contributed to the slow recovery for depression. The entire Bretton Woods system that was born in the mid-1940s was established to reify the idea of a desirable international economic system. In this new system, international trade was seen as a source of worldwide economic strength.

During the period from 1950 through the mid-1960s, there was considerable debate on trade and growth. The dynamic benefits of international trade for developing countries were extolled, and it was claimed that trade had been and could be an engine of growth. Lewis, for instance, was convinced that “historically the beginnings of economic development in every country are associated with increase foreign trade. Exports are the engine of the first stage of economic growth” (1967, p. 254). However, since the late 1950s, analytical constructs to understand the relationship between trade and growth have been dominated by neoclassical thinking. The focus of this analysis is on resource availability and the supply of inputs. Assuming, for instance, two regions that possess similar technology and preferences, and that there are no institutional barriers to the flow of both capital and labor across regional borders, the Solow–Swan neoclassical growth model would predict that regions would have similar levels of real per capita income in the long run. Across regions that share such a common long-run level of real per capita income, convergence of per capita income is driven by diminishing returns to capital. That is, each addition to the capital stock generates large increases in output when the regional stock of capital is small. If the only difference between regional economies lies in the level of their initial supply of inputs (say, the stock of capital), the neoclassical growth model predicts that poor regions will grow faster than rich ones. In other words, regions with lower starting values of the capital–labor ratio will have higher per capita income growth rates.

Prebisch (1950) was the first economist in the postwar era to seriously question the doctrine of mutual convergence of growth between developed and developing countries. Prebisch argued that in a world of center/periphery countries, production, trade, and technological asymmetries

matter and would produce uneven growth. Thus, successful leadership in product development would generate a trading deficit in the periphery vis-à-vis the center, and, for a balance of payments to be restored, the exchange rate (or the barter terms of trade) must decline. Prebisch has a more sophisticated approach, linking changes of productivity to the terms of trade and ultimately to adjustments in real income, but it was Kaldor (1975) who did much to revive Harrod's idea that it is variations in real income and employment, not relative prices and exchange rates, that provide the force tending to adjust imports to exports.

Interest in studying the relationships that link trade and payments and economic growth has recently undergone a revival within the framework of the most modern Post Keynesian proposals. In line with Thirlwall (1979), most of the studies seek to analyze how the trade account, acting as a demand constraint, might explain the growth dynamics of a single country. On the assumptions that the equilibrium is preserved on the trade account and that the terms of trade remain unchanged, the balance-of-payments-constrained growth rate is defined as the ratio of the rate of growth of export volume to the income elasticity of demand for imports. In this demand-oriented approach to growth, long-run output growth in the open economy is fundamentally determined by export growth in accordance with the workings of the dynamic Harrod trade multiplier.

Thirlwall's initial approach suggested that for most developed countries, capital flows were relatively unimportant in contributing to deviations of a country's growth rate from that consistent with trade equilibrium. However, recognizing that the contemporary growth experience of developing countries has been more diverse than that of developed countries, Ferreira and Canuto (2001), McCombie and Thirlwall (1999), Moreno-Brid (1998–99; 2003), and Thirlwall and Hussain (1982) extended the model to allow for the influence of foreign capital flows. The usual interpretation of this extended version of the balance-of-payments-constrained growth model is that, unconditionally, capital flows relax the constraint allowing a faster growth rate of income. Although this interpretation of the role played by capital flows may be true for most developed countries, it is not entirely satisfactory in the context of developing countries. The recent experience of the heavily indebted developing countries suggests that this interpretation underestimates the extent of the negative impact of foreign credit rationing, the buildup in debt that has been accompanied by increasing capital flight (the "revolving door" effect), and increases in the debt burden. Thus, independent of whether net capital inflows are positive or negative, for some

sufficiently long intervals of time, net financial transfers may be negative.<sup>1</sup> How important are these negative financial transfers to abroad for developing countries? Kregel (2004a) and the United Nations (1998), for instance, report negative net resources transfers in Latin America since the early 1980s until the small recovery of the early 1990s, and negative figures in every year since 1997. Kregel (2004b) even notes a series of reports and episodes that demonstrate that this pattern of high repayments and interest burden on loans had been present in the region since the late 1930s. Moreover, there is now evidence that the situation in many African countries is reaching similar trends. The total debt of sub-Saharan African countries reached a staggering \$209 billion in 2001. In that year, the subcontinent borrowed \$11.4 billion, but paid \$14.5 billion in debt service—\$9.8 billion as principal repayment and \$4.7 billion as interest. As a result, the region recorded a net transfer of −\$3.1 billion (Boyce and Ndikumana, 2002). This continued a trend of negative net transfers in the previous decade. With the above point in mind, it seems to us that the concept of net financial transfers may condition the analysis of the determinants of the output growth rate in balance-of-payments–constrained models.<sup>2</sup>

A second important aspect of the conventional balance-of-payments–constrained growth framework is that it usually assumes that relative price changes between countries measured in a common currency played no role in relaxing the balance-of-payments constraint on growth. Considerable space has been devoted to the discussion of this assumption. Rather than reviewing this large literature, we confine our attention to the fact that deviation from this assumption is likely to be important for developing countries, which arguably face persistent deterioration of the term of trade. Moreover, in a developed country framework where production is characterized by the predominance of the manufacturing industry, relative price changes may partly dictate the growth process. Consider, for instance, a Kaldorian export-led growth process of the type formalized by Dixon and Thirlwall (1975). In this framework, in-

<sup>1</sup> The concept of net financial transfers is used to account for the effect of both net capital inflows and net interest payments abroad. In the economic literature, the concept of net transfers became popular as a consequence of the debate on the German reparations and it reappeared in the context of the debt crisis (Bacha, 1992).

<sup>2</sup> Although most representations of Thirlwall's rule do not explicitly capture the influence of foreign interest payments, recent exceptions can be found in McCombie and Thirlwall (1999), Moreno-Brid (2003), and Richards Elliot and Rhodd (1999).

dustrial export prices are set up internally as a markup over unit cost, output growth is driven by the growth of exports, and a higher output growth induces a greater rate of growth of productivity, which, in turn, strengthens the country's competitive international position. This increasing competitiveness would lead to increasing exports, thus leading to a higher growth rate. It is clear that the cumulative nature of this process is possible thanks to the improvement in the country's competitiveness, which is measured in terms of relative price variations of the trading goods among trading partners. Therefore, there are some reasons why neither developing countries nor developed economies face constant terms of trade in the long run.

A third interesting aspect regarding most of the literature on the balance-of-payment-constrained growth is that many contributions have solely been interested in examining how Thirlwall's rule explains the growth rate of individual countries. In all these analyses, the country under scrutiny is defined to be small in the sense that it cannot affect the national income of its trading partners. World income is exogenous, and no trade or payments interlinkages are allowed. However, income growth rates of individual countries are not necessarily independent, and they are, in fact, interdependent among regions. Although exceptions to the rule can be found in Thirlwall (1983), McCombie (1993), and Dutt (2002), even those remarkable efforts to go beyond the small country assumption are plagued with limitations. Thirlwall (1983), for instance, presents a brief formalization of Seers's outlined center-periphery model, but asymmetries in Thirlwall's model are minimal. Moreover, income differences between the center and the periphery are presented in levels (not in growth rates), and the whole story rests on the arbitrary assumption of an exponential growth rate in the center. McCombie (1993) examines the implications of Thirlwall's analysis in a two-country setting; however, in McCombie's model, there are no structural differences between the countries (two advanced economies are assumed), and financial flows and changes in the long-run trend of the terms of trade are completely ruled out. The model put forward by Dutt (2002) undoubtedly allows for structural asymmetries between two regions (referring to developed countries as the North and developing countries as the South). He presents a description of the overall structure of each region that makes explicit the determinants of investment and savings. Following Taylor's pioneering model (1981), the North grows with excess capacity with firms practicing markup pricing (output is demand-determined), whereas the market for the Southern good is perfectly competitive (producers fully utilize capacity). He derives the export and import functions

of the two regions and allows the terms of trade to be determined endogenously. Dutt's analysis, however, assumes that productivity growth in the North is exogenous and does not allow for the Southern good to be a primary intermediate good.<sup>3</sup> Moreover, he implicitly assumes balanced trade so that net financial transfers or even capital flows are ignored.

Our aim in this paper is to develop a general extended version of the balance-of-payments-constrained growth theory that avoids some of the theoretical shortcomings previously mentioned. We start by noting that the extension of Thirlwall's model presented here takes into consideration three key aspects of contemporary growth in open economies, namely, trade imbalances and the role played by net financial transfers in the long-run, relative price changes due to idiosyncratic rules of adjustment in prices, and trade and payments interdependence among asymmetric regions.

We base the analysis on an incremental or step-by-step exposition. We first present a model designed to be far more close to the elements of a developed or Northern region (or country). The developed region specializes in the production of a manufactured good that is sold to the rest of the world. Northern imports consist of intermediate primary goods. Given some specifications for the export and import functions and keeping the assumption of no trade and payments interlinkages with the rest of the world, the model concludes that long-term economic growth in the North is constrained by the evolution of a complex array of factors that simplifies to Thirlwall's rule under some specific assumptions. The price of manufacturing goods is assumed to be determined endogenously, and a Kaldor-Verdoorn mechanism is allowed to work through an output-productivity growth relationship. The idea that endogenous labor productivity growth can be integrated in a balance-of-payments-constrained model goes back to Thirlwall and Dixon (1979). However, the implications of this integration have been hardly explored in the literature. A particular characteristic of the model partial solution is that the endogenous determination of the price of manufacturing goods will make the balance-of-payment constraint on growth more stringent.

In a second step, and as far as the South is concerned, this is described as supplying a primary good to the rest of the world. The primary good

<sup>3</sup> Dutt seems to be aware of the qualitative importance of this assumption. However, regarding this aspect, he says, "[i]f 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" (2002, p. 378).

is produced at a price in which the rate of change reflects supply and demand conditions in commodity markets. The South imports a manufactured good that is used for consumption purposes. Given standard export and import Keynesian demand (depending on income), a partial solution for balance-of-payments-constrained growth in the South is found.

As an ultimate step, the small economy assumption is lifted to allow full interdependence among regions. The conventional assumption on the exogeneity of world income does not apply in this framework, meaning that the growth rates in the two regions are not independent. Moreover, because each region specializes completely in the production of an absolutely differentiated good, and each sector or good shows a different price adjustment rule, there is no law of one price, and changes in the terms of trade become an additional transmission mechanism of trade and payments. In the financial counterpart, the North is a net creditor and the South is a highly indebted region. This means that the South is also constrained by extreme pressures on the financial payments. We will show a general equilibrium solution for the rate of output growth and rate of change of prices in each region, and we examine the stability of equilibrium growth in both regions. The model is rather simple but provides a new interesting insight regarding uneven development and the evolution of the terms of trade. It also provides a vehicle for examining the growth effects of an exogenous change in the rate of growth of net financial transfers. Contingent on parameters values of each region, it is shown that an exogenous change in the rate of growth of net financial transfers may generate either a *mutually reinforcing* growth regime or a *conflicting* growth regime.

### **The north**

We consider a highly stylized model in which the North is completely specialized in the production of a single manufactured good. The manufactured tradable good is produced using labor and intermediate goods. Intermediate goods are imported from the South. The pricing decision of producers in the North is a markup over average costs, which includes intermediate goods. Growth in productivity stems from the growth of output, which allows for a reduction of unit labor cost. The purpose of the model is to account jointly for the process of export-led growth (allowing for the fact that industrial export prices are set up internally, and that labor productivity growth responds to the growth of output) and the constraint imposed on the rate of output growth, in the long run, by the

balance-of-payment equilibrium. Financial transfers are allowed, meaning that trade is not balanced in the long run.

Without loss of generality, the model assumes that, in the long run, the balance of trade in goods, that is, nominal exports,  $EX$ , minus nominal imports,  $IM$ , equals the net financial transfers of the economy,  $F$ :

$$EX_1 + F_1 = IM_1. \quad (1)$$

Nominal exports come from the industrial sector, and the variables  $P_1$  and  $X_1$  stand for the price and the volume of exports, respectively, that is,

$$EX_1 = P_1 X_1. \quad (2)$$

Nominal imports, which are considered noncompetitive, consist of intermediate goods or raw materials and may be expressed as

$$IM_1 = EP_2^* A_1 Y_1, \quad (3)$$

where  $E$  stands for the nominal exchange rate (that is, the home price of foreign currency),  $P_2^*$  is the price level of imports in foreign currency,  $A_1$  is an input–output coefficient for intermediate imports, and  $Y_1$  is real national income of economy 1. Accordingly,  $EP_2^* A_1$  represents imports per unit of output, and  $A_1 Y_1$  equals real imports,  $M_1$ .

The financial counterpart to the net real resource transfer ( $EX_1 - IM_1$ ) is the difference between net capital inflows,  $CF_1$ , and net factor services to abroad,  $J_1$ .<sup>4</sup> Let  $D_1$  stand for the net external debt stock and  $i$  stand for the world interest rate. That is,

$$F_1 = CF_1 - J_1 = CF_1 - iD_1. \quad (4)$$

<sup>4</sup>  $CF$  is defined as the sum of net capital inflows to all residents, including the central bank. Hence, international reserves accumulation by the central bank enters the definition of  $CF$  with a negative sign. In addition, it is worth stressing that for the purpose of the exposition (and the workings of the model), the current account only contains two components—net exports and net interest payments. We do know that services comprise transportation, travel, insurance services, royalties, and license fees, as well as financial services, but we just want to highlight the importance of net financial transfers as emphasized by the United Nations Financing for Development Office for years (see Kregel, 2004b). Net financial transfers are roughly the difference between net capital inflows,  $CF_1$ , and net interest payments,  $J_1$ . Therefore, we have taken out net interest payments from the current account and added it to the net capital inflows. Thus, a hedge profile for a country would be one in which it has a sufficiently large surplus on goods to cover its debt service commitments.

In general, being a developed economy, we will expect that country 1 will exhibit a positive  $F$ . If positive, then it measures by how much the trade deficit allows domestic residents' spending to exceed domestically generated output  $Y_1$ .

The demand function for exports is given as

$$X_1 = \Phi_1 (Y_2)^\varepsilon, \quad \varepsilon > 0, \quad (5)$$

where  $X_1$  represents the volume of exports,  $\Phi_1$  is a constant,  $Y_2$  is the level of world income, and  $\varepsilon$  stands for the income elasticity of demand for exports. In Equation (5), it is implicitly assumed that the exported good is not produced abroad. Hence, price competitiveness makes no sense as a determinant of the demand for exports.

The demand function for imports reflects the fact that imports are non-competitive and that their levels increases nonlinearly with domestic income  $Y_1$ . This is defined as

$$M_1 = k_1 (Y_1)^\pi, \quad \pi > 0, \quad (6)$$

where  $k_1$  is constant, and  $p$  is the income elasticity for imports.

Using Equations (1), (2), (3), (5), and (6), we define the balance-of-payments equilibrium condition as

$$P_1 \Phi_1 (Y_2)^\varepsilon + F_1 = EP_2^* k_1 (Y_1)^\pi. \quad (7)$$

Taking natural logs, and then differentiating with respect to time, yields the following condition for imbalanced trade with net financial transfers:

$$\sigma_1 (p_1 + \varepsilon y_2) + (1 - \sigma_1) f_1 = e + p_2^* + \pi y_1, \quad (8)$$

where lowercase letters indicate the growth rates of the corresponding variables. The parameters  $\sigma_1$  and  $(1 - \sigma_1)$  stand for the share of exports and net financial transfers as a proportion of total receipts, respectively. By solving  $y_1$ , we obtain the rate of growth of domestic income consistent with the balance-of-payments equilibrium ( $y_1^0$ ):

$$y_1^0 = \frac{\sigma_1 (p_1 + \varepsilon y_2) + (1 - \sigma_1) f_1 - e - p_2^*}{\pi}. \quad (9)$$

Because we are now particularly interested in the effect on output that is caused by the feedback effect from a faster growth rate of productivity,

we first let the domestic price of exports be endogenous and finally let productivity growth be a function of the growth of output.

Export prices  $P_1$  can be based on a markup on unit labor costs and imported intermediates

$$P_1 = \tau \left[ (W/B) + EP_2^* A_1 \right], \text{ with } \tau > 1, \quad (10)$$

where  $\tau$  is the markup,  $W$  is the money wage label, and  $B$  stands for labor productivity.

Taking rates of change of the variables involved in Equation (10), we have

$$p_1 = \hat{\tau} + h(w - b) + (1 - h)(e + p_2^* + a_1), \quad (11)$$

where  $h$  and  $(1 - h)$  represent the share of labor unit cost and raw material unit cost as a proportion of total unit cost, respectively.

If we consider labor productivity growth,  $b$ , to be partly a function of the growth of domestic output (Kaldor–Verdoorn effect), we have

$$b = b_0 + \theta y_1, \quad (12)$$

where  $\theta$  is usually called the “Kaldor–Verdoorn coefficient” and  $b_0$  is the autonomous component of labor productivity growth.<sup>5</sup> It is this relation between output growth and labor productivity growth that will make this extension of the balance-of-payments–constrained growth of country 1 “circular and cumulative” (Dixon and Thirlwall, 1975).

Substituting Equation (12) into Equation (11), we have

$$p_1 = \hat{\tau} + h(w - b_0 - \theta y_1) + (1 - h)(e + p_2^* + a_1). \quad (13)$$

Assuming a constant markup ( $\hat{\tau} = 0$ ), negligible changes in the exogenous component of labor productivity ( $b_0 = 0$ ), and that there are no changes in nominal wages ( $w = 0$ ) and in intermediate imports unit cost ( $e + p_2^* + a_1 = 0$ ), Equation (13) becomes<sup>6</sup>

$$p_1 = -h\theta y_1. \quad (14)$$

<sup>5</sup> Obtaining a coefficient  $\theta$  equal to 0.5 for the United Kingdom led Kaldor (1966) to the conclusion that there were economies of scale in the manufacturing sector.

<sup>6</sup> Later we modify Equations (9) and (13) by assuming that the change in  $P_2^*$  is no longer constant.

Thus, in essence, the rate of change of export prices is inversely related to the world rate of output growth. Keeping  $(e + p_2^* + a_1) = 0$  and further assuming  $p_2^* = 0$ , we now substitute Equation (14) into Equation (9) and rearrange to obtain an augmented version of the rate of growth of income consistent with the balance-of-payments equilibrium:

$$y_1^0 = \frac{(1 - \sigma_1)f_1 + \sigma_1 \varepsilon y_2}{\pi + \sigma_1 h \theta}. \quad (15)$$

It can easily be seen that Equation (15) corresponds to an augmented version of Thirlwall's rule where both the net financial transfers effect and the Kaldor-Verdoorn effect are allowed. In general, we will expect that real gross domestic product (GDP) growth in the North may increase with an exogenous expansion in  $f_1$  or  $y_2$ . Note that when  $f_1 = 0$  and  $\theta = 0$ , Equation (15) reduces to

$$y_1^0 = \frac{\varepsilon y_2}{\pi}, \quad (16)$$

which is analogous to Thirlwall's rule (1979), in which growth depends only on external income growth multiplied by the ratio between export and import income elasticities in the long run.

Let us now turn to a basic question. This refers to the effects of an expansion in world income on the domestic rate of growth of output. In particular, it is a simple matter to show, using Equations (15) and (16), that

$$\left. \frac{dy_1^0}{dy_2} \right|_{\theta \neq 0} = \frac{\varepsilon}{\pi + \sigma_1 h \theta} > 0 \quad (17)$$

$$\left. \frac{dy_1^0}{dy_2} \right|_{\theta=0} = \frac{\varepsilon}{\pi} > 0. \quad (18)$$

Certainly, both the Thirlwall's rule equation and the augmented version imply a certain degree of complementarity between the domestic and the world economy, because the prosperity of the trading partners tends to spill over through an expansion of exports and growth. However, and paradoxically, comparisons of expressions (17) and (18) ipso facto indicate that the mere presence of macro-increasing returns will

diminish the spillover effects of exports and growth. The reason is straightforward. Because a world expansion increases productivity growth and induces a fall in export prices, then exports receipts decrease and domestic income has to adjust to balance the external account.<sup>7</sup>

### The south

Primary products constitute the sole output of the developing region that is exported to the rest of the world. Developing country firms operate in a competitive international environment where the price of their products is demand-determined.<sup>8</sup> The developing country is a specialized economy that imports manufacturing goods from the rest of the world only for consumption purposes. As in the previous section, net financial transfers are allowed. However, we will assume now that the developing economy is highly indebted, meaning that its net financial transfers are negative. This is the case of a country where interest payments are high and the accumulation of external debt has occurred to such an extent that the financial markets and creditors cut new loans and are not willing to lend anymore. If net financial transfers are negative, however, the workings of the previous model indicate that the output growth rate will tend to be lower than the trade balanced rate of growth.

As before, we assume that the balance of payments in region (country) 2 is in initial trade account disequilibrium, which is expressed as

<sup>7</sup> Alternatively, we may conceive the case in which faster growth is caused by the feedback effect from faster growth of productivity through the resulting improved price competitiveness. Consider, for instance, following Thirlwall (1979), that the demand function for exports in the North is given in constant multiplicative form as  $X_1 = \Phi_1(EP_1^*/P_1)^n(Y_2)^\varepsilon$ , with  $\varepsilon > 0$  and  $n > 0$ . Now, the positive influence of competitiveness on this account is captured by the first term in parentheses. The reader should note that unless the North and the rest of the world produce the same good, a risk of bad specification will undermine the logical structure of the model. It is also possible to assume a third region (or country) competing against the North for sales in the same market. To establish this case, we can rewrite the balance-of-payments equilibrium condition as  $P_1\Phi_1(EP_1^*/P_1)^n(Y_2)^\varepsilon + F_1 = EP_2^*k_1(Y_1)^\pi$ . Substituting expression (14) into this latter expression and solving for  $y_1$ , we get  $y_1^0 = ((1 - \sigma_1)f_1 + \sigma_1\varepsilon y_2)/[\pi - \sigma_1 h\theta(n - 1)]$ . Given the multiplicative nature of the right-hand side of this inequality, we will expect  $\pi > \sigma_1 h\theta(n - 1)$ . Accordingly, for values of  $n$  greater than one ( $n > 1$ ) and as far as  $\pi > \sigma_1 h\theta(n - 1)$ , the Kaldor-Verdoorn coefficient ( $\theta$ ) serves to increase the rate of growth of domestic output. Thus, to bring about higher output growth in the augmented version (when world income is expanded), a high sensitivity of exports to relative price changes is required.

<sup>8</sup> The existence of a third region is ancillary to our model so that we can model competition among periphery regions in a common third center market.

$$EX_2 - F_2 = IM_2. \quad (19)$$

By definition, nominal exports and imports in region 2 are given by

$$EX_2 = P_2 X_2 \quad (20)$$

$$IM_2 = (1/E) P_1^* M_2. \quad (21)$$

Note, now, that imports are noncompetitive for region 2 and will not enter into the production process. Export and import demand functions with constant elasticities are given by

$$X_2 = \Phi_2 (Y_1)^\beta, \quad \beta > 0 \quad (22)$$

$$M_2 = k_2 (Y_2)^\mu, \quad \mu > 0, \quad (23)$$

where  $\Phi_2$  and  $k_2$  are constants,  $\beta$  is the income elasticity for exports, and  $\mu$  stands for the income elasticity for imports.<sup>9</sup> Substituting Equations (20) and (21) into Equation (19), taking into account Equations (22) and (23), and taking rates of change of the variables, we have the following balance-of-payments equilibrium condition for region 2:

$$\sigma_2 (p_2 + \beta y_1) - (1 - \sigma_2) f_2 = p_1^* - e + \mu y_2. \quad (24)$$

Rearranging Equation (24), we obtain the region's balance-of-payments equilibrium growth rate:

$$y_2^0 = \frac{\sigma_2 (p_2 + \beta y_1) - (1 - \sigma_2) f_2 + e - p_1^*}{\mu}. \quad (25)$$

Now, rather than taking the price of primary exports as exogenously given, we postulate that it reflects supply and demand conditions in commodity markets. To avoid undue mathematical complications, a constant elasticity excess demand function is considered. This can be written as

<sup>9</sup> We should remember that the export elasticity of the South is the import elasticity of the North ( $\beta = \pi$ ), and the export elasticity of the North is the import elasticity of the South ( $\varepsilon = \mu$ ).

$$p_2^* = \gamma(y_1 - y_2), \text{ with } \gamma > 0, \quad (26)$$

where  $\gamma$  represents the sensitivity of primary export prices with respect to deviations between the growth rates of the regions. The differential Equation (26) shows that the rate of growth of primary goods prices will increase when the rate of growth of output in the North is higher than in the South. Assuming that the exchange rate is fixed, we can rewrite Equation (26) as

$$p_2 = p_2^* = \gamma(y_1 - y_2). \quad (27)$$

If we further assume that the price of manufacturing imports in foreign currency is given ( $p_1^* = 0$ ) and substitute Equation (27) into Equation (25) and solve for  $y_2$ , we get

$$y_2^0 = \frac{\sigma_2(\gamma + \beta)y_1 - (1 - \sigma_2)f_2}{(\mu + \sigma_2\gamma)}, \quad (28)$$

which states that the growth rate of output of region 2 depends on world income ( $y_1$ ), the share of exports as a proportion of total receipts ( $\sigma_2$ ), the sensitivity of primary export prices to deviations between the growth rates of the regions ( $\gamma$ ), and the income elasticities of exports and import demand ( $\beta$  and  $\mu$ ). With no net financial transfers and a constant price level of foreign exports,  $f_2 = 0$ ,  $\sigma_2 = 1$ , and  $\gamma = 0$ , and Equation (28) yields the old Thirlwall's result:

$$y_2^0 = \frac{\beta y_1}{\mu}. \quad (29)$$

We can formally verify the effect of a change in world income upon the developing region. Differentiating Equations (28) and (29) with respect to  $y_1$ , we have

$$\left. \frac{dy_2^0}{dy_1} \right|_{\gamma \neq 0} = \frac{\sigma_2\beta + \sigma_2\gamma}{\mu + \sigma_2\gamma} > 0 \quad (30)$$

$$\left. \frac{dy_2^0}{dy_1} \right|_{\gamma=0} = \frac{\beta}{\mu} > 0. \quad (31)$$

Let us call again these two cases the “augmented” version and Thirlwall’s rule, respectively. Two features of Equations (30) and (31) are worth noting. First, in Equation (30), we can see that  $\sigma_2\beta > \mu$  implies  $dy_2^0/dy_1 > 1$ . Thus, to the extent that the joint effect of the income elasticity for exports and the share of exports in total receipts is greater than the income elasticity for imports, an exogenous expansion in the rate of growth of world income ultimately leads to a higher rate of growth in the developing region. When we look at Equation (31) (Thirlwall’s rule case), we can reach a similar conclusion. As long as  $\beta > \mu$ , the expansion in world income generates a higher expansion domestically. Of course, the identification of the South with the production of commodities with high income elasticities of exports and the North with the production of income-inelastic goods is not straightforward (despite the changing composition of exports in both regions).<sup>10</sup> In contrast, South’s relative impoverishment becomes a possibility as soon as these counterintuitive assumptions are reversed.<sup>11</sup> Second, assuming again that  $\sigma_2\beta > \mu$ , then the induced expansion of the growth rate of output in the South (caused by an increase in the rate of growth of world income) will be lower in the case of the augmented version than in the case in which Thirlwall’s rule is invoked. The reader may wonder, why? The mechanism in the pure Thirlwall’s version operates in the following way. An increase in the

<sup>10</sup> Indeed, since Prebisch (1950), many development economists have attributed the phenomenon of regional disparities to the relative low income elasticity of demand for primary commodities that developing countries produce and export, compared to the higher income elasticity of demand for manufactures that developed nations produce and export. Thirlwall (1983) argues that uneven regional growth of the type that lies in the disparity between income elasticity of demand for imports and at the “center” and at the “periphery” can be derived from his balance-of-payments-constrained growth model. Recently, the uneven pattern of per capita growth that derives from the disparity between income elasticities has been brought to the fore by Davidson (1990–91). Although much of the empirical work following Houthakker and Magee’s (1969) classic paper on export and import elasticities for developed countries seems to suggest that the elasticity of imports is high and the elasticity of exports is low, this does not invalidate the uneven growth implications of Thirlwall’s rule. As Dutt (2002) has correctly pointed out, what ultimately matters is the elasticity of exports and imports between regions (North and South) controlling for intra-North and intra-South trade. Moreover, structuralist economists following Prebisch would argue that the root of the problem (with respect to regional disparities) lies in the disparity between the income elasticities of demand for primary goods at the “center” and industrial goods at the “periphery.”

<sup>11</sup> Engel’s curves also suggest that the developed world will have a low income elasticity of demand for basic goods.

rate of growth of world income,  $y_1$ , raises the growth rate of the South,  $y_2$ , by a proportion  $\beta/\mu > 1$ . In the augmented version, however, an increase in  $y_1$  raises the growth rate of the South,  $y_2$ , by a proportion  $\beta/\mu > 1$ , but because Southern growth is greater than Northern growth, primary commodities prices will go down and the rate of growth of the South, in turn, will decrease by a proportion  $\sigma_2$ .

### A two-country setting: north and south

Let us take a brief look at any of the models developed so far. Each consists of two equations, one for the rate of growth of real GDP and another one for the evolution of price changes. However, in that framework, both prices and output of the trading partner are given. In contrast, in the present context, the growth rate of each region will also be affected by changes in output and prices of the trading partner. Therefore, in essence, the model will now present a general equilibrium structure.

Again, each region specializes completely in production of its own good—a tropical primary good in the South and manufactures in the North. The Northern manufactured good is consumed in the South. The Southern good is used in the North as an intermediate good or raw material. With macro-increasing returns in manufacturing, the Kaldor–Verdoorn effect applies,  $\theta > 0$ , and given a constant markup, domestic prices in the North will react endogenously. Similarly, the price of primary goods depends on the relative rates of growth of the two regions. Thus, there are no fundamental changes in the formulation of nominal exports and imports, and conditions coincide with those assumed in earlier sections.

Similar to Dutt (2002), we deal with two aspects of international trade that the vast literature on Thirlwall's Law has ignored: those that make explicit allowance of trade interlinkages and concern the determinants and the evolution of the terms of trade, and those that tell us what determines the growth process in the two regions. Unlike the model of Dutt (*ibid.*), we do not deal with underlying assumptions about saving, consumption, and investment. In this respect, we are closer to Harrod's, Kaldor's, and Thirlwall's original ideas in thinking about exports as the most important or only true component of demand. In addition, we assume that there is an intermediate good in the model and that regions face significant capital movements and debt servicing (trade is not balanced).

By leaving the price of primary goods imported by region 1 to be endogenous, the Northern pricing equation in discrete rate of change becomes

$$p_1 = [(1-h)\gamma - h\theta]y_1 - (1-h)\gamma y_2. \quad (32)$$

The novel aspect of this expression is that it suggests mechanisms through which the actual process of export-led growth in the North can be translated into an improvement of labor productivity but also into an increase in the average cost of intermediate goods. Notice that the relationship between output and the rate of change of prices of manufactured goods is now ambiguous. When output growth, for instance, increases in region 1, manufactured prices will change positively or negatively depending on the gap between  $(1 - h)\gamma$  and  $h\theta$ . Moreover, to the extent that output growth in the South increases,  $p_1$  changes in a proportion  $-(1 - h)\gamma$ , but it may also change indirectly by the induced change in  $y_1$ .

If the exchange rate,  $E$ , is assumed constant, so that  $e = 0$ , Equation (9) reduces to

$$y_1 = \frac{\sigma_1(p_1 + \varepsilon y_2) + (1 - \sigma_1)f_1 - p_2^*}{\pi}. \quad (33)$$

We now substitute Equations (27) and (32) into Equation (33) and get

$$y_1 = \frac{\sigma_1[(1 - h)\gamma - h\theta]y_1 + \sigma_1\varepsilon y_2 + (1 - \sigma_1)f_1 - \gamma(y_1 - y_2)}{\pi}, \quad (34)$$

which may be rearranged to obtain

$$y_1 = \frac{(1 - \sigma_1)f_1}{\pi + \gamma - \sigma_1[(1 - h)\gamma - h\theta]} + \frac{[\sigma_1\varepsilon + \gamma]y_2}{\pi + \gamma - \sigma_1[(1 - h)\gamma - h\theta]} \quad (35)$$

or

$$y_1 = \phi_1 f_1 + \phi_2 y_2, \quad (35a)$$

where

$$\phi_1 = \frac{(1 - \sigma_1)}{\pi + \gamma - \sigma_1[(1 - h)\gamma - h\theta]} > 0$$

if  $\pi + \gamma > \sigma_1[(1 - h)\gamma - h\theta]$

$$\phi_2 = \frac{[\sigma_1\varepsilon + \gamma]}{\pi + \gamma - \sigma_1[(1 - h)\gamma - h\theta]}$$

if  $\pi + \gamma > \sigma_1[(1 - h)\gamma - h\theta]$ .

Equation (35) is not yet an equilibrium solution for the balance-of-payments equilibrium growth rate in the North because  $y_2$  is now endogenous and depends (partly) on movements in  $y_1$ . However, it can be seen as a two-region setting extension of Thirlwall's rule (as seen from the North), where positive net financial flows are allowed in the long run; the Kaldor–Verdoorn works through a mechanism of export-led growth, and the time variation of price of imports is endogenous and different from zero. This two-country setting augmented version generates, as a special case, the augmented version when  $\gamma = 0$ , and the more parsimonious Thirlwall's rule when we further assume  $f_1 = 0$  and  $\theta = 0$ . Moreover, our earlier contention regarding the degree of the positive relationship between the rate of growth of world output (in this case, Southern output) and domestic rate of growth of output is not disturbed so long as  $\pi + \gamma - \sigma_1[(1-h)\gamma - h\theta] > 0$ .

In the South, we lift the assumption used in the earlier section of an exogenous rate of growth of manufactured prices. If we go back to Equation (25) and combine it with Equation (32), we have

$$y_2 = \frac{\sigma_2[\gamma(y_1 - y_2) + \beta y_1] - (1 - \sigma_2)f_2 - [(1-h)\gamma - h\theta]y_1 + (1-h)\gamma y_2}{\mu} \quad (36)$$

Rearranging Equation (36), we get

$$y_2 = \frac{-(1 - \sigma_2)f_2}{\mu + [\sigma_2 - (1-h)]\gamma} + \frac{[\sigma_2(\gamma + \beta) + h\theta - (1-h)\gamma]y_1}{\mu + [\sigma_2 - (1-h)]\gamma} \quad (37)$$

or

$$y_2 = -\phi_3 f_2 + \phi_4 y_1, \quad (37a)$$

where

$$\phi_3 = \frac{(1 - \sigma_2)}{\mu + [\sigma_2 - (1-h)]\gamma} > 0$$

if  $\mu + \sigma_2\gamma > (1-h)\gamma$

$$\phi_4 = \frac{[\sigma_2(\gamma + \beta) + h\theta - (1-h)\gamma]}{\mu + [\sigma_2 - (1-h)]\gamma} > 0$$

if  $\mu + \sigma_2\gamma > (1 - h)\gamma$  and if  $\sigma_2(\gamma + \beta) + h\theta > (1 - h)\gamma$ .

The first term on the right-hand side of Equation (37) has a negative sign. The developing region, in this case, is far from being a net creditor, and the rate of growth of net financial transfers is inversely related to the output growth rate in the South. Once again, we should note that Equation (37) yields the augmented version as soon as  $y_1$  is assumed to be exogenous, and Thirlwall's rule when we further assume that  $p_2$  is exogenous as well.

The mutual feedback between  $y_1$  and  $y_2$  is captured by Equations (35) and (37) and similarly by Equations (35a) and (37a). A graphical analysis of either of these pair of equations clearly demonstrates the stability condition of the system—namely, the condition that needs to be satisfied for mutual feedback between Northern growth and Southern growth to gradually converge over time. This is illustrated in Figure 1, which plots Equations (35a) and (37a) as a pair of straight lines showing the two-sided relation between  $y_1$  and  $y_2$ .

Consider, for instance, an arbitrary initial level of  $y_1$ . Through Equation (35a), this is related to  $y_2$  at point "a" on line A (see Figure 1). However, level  $y_2$  has its feedback on  $y_1$  through relation (37a), which is shown by line B. Thus, growth in the South leads to higher growth in the North at point "b" on line B; that higher income growth in the North causes higher income growth in the South again through a multiplier relation at point "c," and so on, until the sequences of rising  $y_1$  and  $y_2$  converge at their respective equilibrium values  $y_1^0$  and  $y_2^0$ , represented by point "d." Such a convergence is possible only if the slope of line A exceeds the slope of line B.

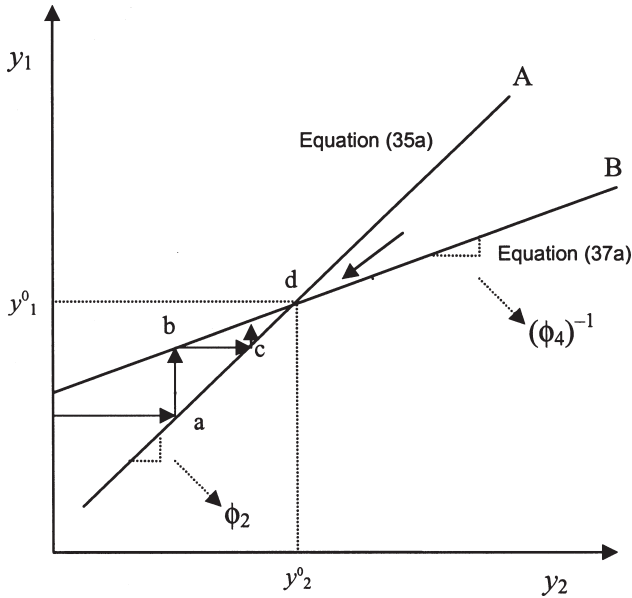
Algebraically, the condition for stability is

$$\frac{[\sigma_1\varepsilon + \gamma]}{\pi + \gamma - \sigma_1[(1 - h)\gamma - h\theta]} > \frac{[\sigma_2(\gamma + \beta) + h\theta - (1 - h)\gamma]}{\mu + [\sigma_2 - (1 - h)]\gamma} \quad (38)$$

or

$$\phi_2 > (\phi_4)^{-1}.$$

Presumably, the income elasticity of Southern demand for Northern goods ( $\varepsilon$ ) should be greater than the income elasticity of Northern demand for Southern goods ( $\pi$ ). The idea is that the combination of input-saving technologies and an extended interpretation of Engel's Law cause imports of primary products by the North to expand at a lower rate than

**Figure 1** The stable solution: convergence

real income (Floto, 1989). In contrast, the demonstration effect of the North on the consumption patterns of high-income groups in the South and the innovative character of Northern goods yields high-income elasticity of demand for imports in the South. Assuming further that the sensitivity of primary export prices with respect to deviations between the growth rates of the regions,  $\gamma$ , and the share of raw material unit cost as a proportion of total unit cost,  $(1 - h)$ , are not too high, then the stability condition (38) is highly plausible.

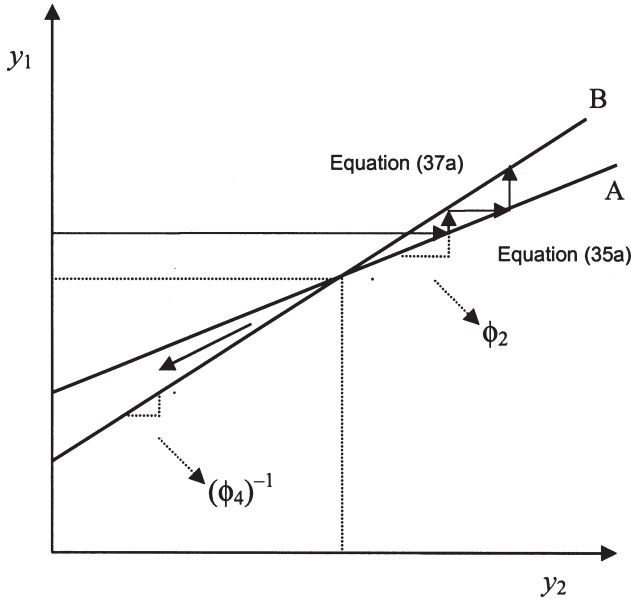
However, the above case could be reversed by making the slope of line B steeper than the slope of line A as shown in Figure 2. The consequence is that both rates of growth diverge from the equilibrium solution.

By inserting the value of  $y_2$  from Equation (37a) into Equation (35a), we obtain, on simplification, the equilibrium value  $y_1^0$ :

$$y_1^0 = \frac{\phi_1 f_1 - \phi_2 \phi_3 f_2}{(1 - \phi_2 \phi_4)}. \quad (39)$$

Similarly, inserting the value of  $y_1$  from Equation (35a) into Equation (37a) and simplifying,

**Figure 2** The unstable solution: divergence



$$y_2^0 = \frac{\phi_4 \phi_1 f_1 - \phi_3 f_2}{(1 - \phi_2 \phi_4)}. \quad (40)$$

Once we have solved for  $y_1^0$  and  $y_2^0$ , it is a simple matter to solve for the equilibrium values of  $p_1$  and  $p_2$ . In particular, the equilibrium for  $p_1$  (the rate of change of price of manufactured goods) can be found by substituting the equilibrium values  $y_1$  and  $y_2$  into Equation (32), which yields

$$p_1^0 = \frac{[(1-h)\gamma - h\theta](\phi_1 f_1 - \phi_2 \phi_3 f_2) - (1-h)\gamma(\phi_4 \phi_1 f_1 - \phi_3 f_2)}{(1 - \phi_2 \phi_4)}. \quad (41)$$

Similarly, substituting Equations (39) and (40) into Equation (27), we found the equilibrium value for  $p_2$  to be

$$p_2^0 = p_2^{*0} = \frac{\gamma(\phi_1 f_1 - \phi_2 \phi_3 f_2) - \gamma(\phi_4 \phi_1 f_1 - \phi_3 f_2)}{(1 - \phi_2 \phi_4)}. \quad (42)$$

Equations (39), (40), (41), and (42) comprise a system of general equilibrium solutions. Given some parametric values, the system allows us

to determine the equilibrium values of the rate of change of output and prices. It should be noted that such a system would deal with the two issues of the “widening gap” between the real incomes of the North and the South, and their effects on the evolution of price changes. However, these four equilibrium equations appear to be rather complicated, and definite conclusions would be difficult to draw from them. Even so, we find necessary conditions to produce a situation where the South will have a lower rate of growth than the North—that is,  $y_2^0 < y_1^0$ . For this case of uneven development (or growth), the comparison between the numerators in Equations (39) and (40) requires  $(\phi_1 f_1 - \phi_2 \phi_3 f_2) > (\phi_4 \phi_1 f_1 - \phi_3 f_2)$ , and note that this is what one would normally expect if  $\phi_4$  and  $\phi_2$  are fractions lower than one. These requirements will be easier met the higher the income elasticity for imports in both regions. Imposing these conditions in the model endows it with a specific solution for the evolution of the terms of trade ( $p_1^0/p_2^0$ ) as well. Note, in this case, that the key difference between expressions (41) and (42) is the term  $-h\theta(\phi_1 f_1 - \phi_2 \phi_3 f_2)$ . The existence of dynamic returns to scale in the North implies that  $p_2^0 > p_1^0$ . Thus, the terms of trade can move against the North, but the South can still be impoverished. This contrasts with the normal interpretations drawn from the Prebisch–Singer analysis. On the same logic, when the Kaldor–Verdoorn coefficient is equal to zero, the equilibrium solution will exhibit stable terms of trade ( $p_2^0 = p_1^0$ ).

To capture the interaction between both regions, we return to Equations (35a) and (37a). Because we have argued that the existence of net financial transfers may be an important factor in determining the maximum growth rate that the regions are able to achieve, the growth Equations (35a) and (37a) are of considerable economic interest. Let us turn to analyzing, for instance, an autonomous increase in the rate of change of net financial transfers (which now plays an instrumental role in the model). If the autonomous increase is reported in the South (where net financial flows are negative), the value of the shift parameter  $f_2$  increases by  $|\Delta f_2|$ . Because the export of region 1 is nothing but the import of region 2 and vice versa, this implies that the rate of change of net financial flows in the North also shifts upward by  $\Delta f_2$ . The changes in the rate of growth of the two regions resulting from this autonomous shift in  $f_2$  of region 2 can be computed from Equations (35a) and (37a), respectively, as

$$\Delta y_1 = \phi_1 \Delta f_1 + \phi_2 \Delta y_2 \quad (43)$$

$$\Delta y_2 = -\phi_3 \Delta f_2 + \phi_4 \Delta y_1. \quad (44)$$

The first term on the right-hand side of Equations (43) and (44) algebraically displays the conflictive aspect of international payments relations. In contrast, the second term on the right-hand side of the same equations depicts the complementary aspect of growth. Depending on parameter values, three different growth regimes may emerge from system (43) and (44): a *mutually reinforcing contractionary growth regime*, a *mutually reinforcing expansionary growth regime*, and a *conflicting growth regime*. The essential formalism is simple.

The increase in the magnitude of  $f_2$  would mean a decrease in the rate of growth of the South by a proportion  $\phi_3$ . On the other hand, region 1, experiencing an equivalent positive net financial transfer ( $\Delta f_1$ ), undergoes a negative or positive change in its growth rate, as shown by the second term of the right-hand side of Equation (43). If the induced fall in  $\Delta y_2$  times  $\phi_2$  is greater than the factor  $\phi_1 \Delta f_1$  (capturing the increase in net financial transfers in the North), then  $\Delta y_1$  will fall as well and will induce a further fall in  $\Delta y_2$  through the second term in the right-hand side of Equation (44).

Consequently, if  $\phi_1 \Delta f_1 < \phi_2 \Delta y_2$  and  $|\phi_3 \Delta f_2| > \phi_4 \Delta y_1$ , we find a mutually reinforcing contractionary growth regime—that is, a regime where both the North and the South will experience lower rates of output growth as a consequence of an increase in negative financial transfers from the South.

In a second case, in contrast, the combined effect of  $-\phi_3 \Delta f_2$  and  $\phi_4 \Delta y_1$  increases the rate of growth of output in the South. Given that  $\phi_1 \Delta f_1$  is positive, the North will be growing as well in a mutually reinforcing expansionary growth regime. In essence,  $\Delta y_2$  and  $\Delta y_1$  will be positive if  $|\phi_3 \Delta f_2| < \phi_4 \Delta y_1$ .

A conflicting growth regime will prevail if an increase in negative financial transfers from the South induces a higher growth rate of domestic output in the North and reduces growth in the South. Here, again, the increase in the magnitude of  $f_2$  means a decrease in the rate of growth of the South if  $|\phi_3 \Delta f_2| > \phi_4 \Delta y_1$ , which, in turn, induces a fall in the factor  $\Delta y_2$  times  $\phi_2$ . However, because the increasing factor  $\phi_1 \Delta f_1$  in Equation (43) dominates, then  $\Delta y_1$  will increase. Formally, the conflicting growth regime arises when  $\phi_1 \Delta f_1 > \phi_2 \Delta y_2$  and  $|\phi_3 \Delta f_2| > \phi_4 \Delta y_1$ .

## Conclusions

Balance-of-payments-constrained growth models have proved to be a versatile tool for improving our analytical understanding of the macroeconomic transmission mechanism at work in open economies. Throughout

this paper, we have presented a general version of the balance-of-payments–constrained growth model that explicitly takes into account net financial transfers and relative price changes between interdependent asymmetric regions. The approach corresponds to the Post Keynesian view of a demand-constrained global economy. We have employed a North–South framework, because we believe essential asymmetries help explain why the international development is, in fact, an uneven playing field. These asymmetries refer to the differentiated nature of the goods traded, the pricing rules, the type of returns to scale, and the net foreign assets position of each region. Thus, similar to Dutt (2002), our effort can be seen as a further step in understanding how Thirlwall’s analysis can be incorporated into North–South models.

We have presented partial analytical solutions for both the Northern and the Southern regions and derived, under specific assumptions, the more parsimonious Thirlwall’s rule. The general equilibrium solution encompasses all these cases and allows us to evaluate certain conditions under which the South’s real output will grow at a lower rate than the North. The conditions are not sufficient, but they provide a rough benchmark for an evaluation of the equilibrium solution. Contrary to the popular idea in which the terms of trade will move against the South when the whole international block comes to an equilibrium that favors growth at the North, we found an impoverished South dynamics even in a situation of better terms of trade for the South. This contrasts with the normal interpretations drawn from the Prebisch–Singer analysis in which the structure of production has been overshadowed by the differences in import demand elasticities.

The model can also capture the interaction between both regions. Consider the case in which the North is a net creditor and the South is a highly indebted region. The analysis suggests that an autonomous increase in the rate of change of net financial transfers from the South may generate, depending on parameter values, three different growth regimes—namely, a mutually reinforcing contractionary growth regime, a mutually reinforcing expansionary growth regime, and a conflicting growth regime.

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