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Thoughts on balance-of-payments-constrained growth after 40 years

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This paper considers how Thirlwall's balance-of-payments-constrained growth model has fared over the preceding 40 years. Issues dealt with include how the model fits into Harrod's closed-economy dynamic model; whether the model is a tautology; the role of the exchange rate and terms of trade in influencing the long-run growth rate, and whether capital inflows make any difference to the long-run predictions of the model. The conclusion is that it is mainly the structure of production and trade that determines the long-run growth rate of countries, within a balance-of-payments equilibrium framework, as determinants of the income elasticities of demand for exports and imports.

Keywords: *open-economy macroeconomics, balance-of-payments-constrained growth, the Harrod trade multiplier, Thirlwall's law*

JEL codes: *F41, F43*

1 INTRODUCTION

Recently I received a letter from a student in India, who wrote:

> I was absolutely thrilled when my professor worked through the math to arrive at Thirlwall's Law, especially when the entire complex looking equation collapsed to just three variables. It was one of the few moments during my economics education when everything just came together and started to make sense. Seeing the Marshall–Lerner condition, and the Law of One Price all come together in one equation was a great feeling.[1]

Naturally I was delighted to receive the letter, not least because it endorses my Occam's Razor approach to economics which is 'the simpler the better', and that 'to get a lot out of a little' is the essence of good economics!

When I wrote my 1979 paper, I never imagined it would still be discussed 40 years on; and I would like to thank the editors of *ROKE* for organising this anniversary symposium, as well as all the contributors for their thoughtful contributions. To put the paper into context, I had always been unhappy with orthodox Neoclassical growth theory (*à la* Solow 1956), particularly for understanding the *actual* growth experience of countries which, for the most part, are open economies in which not only domestic demand but also foreign demand (exports) matter for long-run economic performance.

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1. Letter dated 19 May 2019 from Advait Moharir, Azim Premji University, Bengaluru, India.

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I was also unhappy with the underlying assumptions of the orthodox model that the supplies of labour and capital, and technical progress, are exogenously determined when we know that labour supply is very elastic to demand, and that investment and productivity growth, to a large extent, depend on the growth of output itself.

To make progress, there was no point in tinkering with the orthodox model; a completely new approach was required which recognised the importance of demand, and that in the real world, national economies are open to trade. I had in the back of my mind the United Kingdom (UK) economy, and I had been concerned with the fragility of the UK's balance of payments (BoP) long before 1979 (see Thirlwall 1970; 1974). Every time the UK economy had attempted to grow faster, the BoP deteriorated, and the currency came under attack.

The initial stimulus to the formulation of the 1979 model came from Kaldor's 1970 regional export-led growth model (Kaldor 1970) in which growth is demand-driven by export growth, initiating a virtuous circle of growth sustained by the induced impact of output growth on productivity growth known as Verdoorn's law (Verdoorn 1949). Dixon and I (1975) formalised the model, but it contained no BoP constraint because regions using a common currency don't suffer BoP problems in the usual sense of having an exchange rate to defend.[2] It occurred to me, however, that if the same model was applied to countries, the growth rate determined by the variables and parameters of the model may generate a faster growth of imports than exports which may be unsustainable because of a limit to the current-account deficit to GDP, or export, ratio beyond which financial markets get nervous and borrowing becomes impossible. It was a short step from that insight to realising that the Kaldor model could be augmented by an import growth function and, since import growth is partly a function of output growth, it would be possible, setting import growth equal to export growth, to solve for the growth of output consistent with BoP equilibrium on current account. Given long-run current-account equilibrium, and no change in the real exchange rate (or real terms of trade), the predicted long-run growth rate is $g = \varepsilon w/\pi = x/\pi$, where x is export growth determined by world income growth (w) and the income elasticity of demand for exports (ε), and π is the income elasticity of demand for imports. This result turns out to be the dynamic analogue of Harrod's static foreign-trade multiplier (Harrod 1933) – see below.

Given how well the BoP-constrained growth rate fits the experience of many countries (see Thirlwall 2011 for a dated survey), my thinking now is the following sequence: the BoP-constrained growth rate determines the long-run actual growth rate, and the actual growth rate determines the long-run potential growth rate (or the natural rate of growth as Harrod 1939 originally called it) because the determinants of the natural rate – labour force growth and labour productivity growth – are endogenous to demand.[3] The most convincing research to show this, at least for a selection of OECD countries, is Lanzafame (2014). The model could be replicated for other groups of countries.

2. This does not mean, of course, that regions don't suffer balance-of-payments problems in other ways such as slow growth and high unemployment, as in some of the eurozone countries today (see Thirlwall 1980).

3. There are now many empirical studies of the endogeneity of the natural rate of growth, for example, Leon-Ledesma and Thirlwall (2002) for OECD countries; Perrotini and Tlatelpa (2003) for NAFTA countries; Libanio (2009) and Vogel (2009) for Latin American countries; Dray and Thirlwall (2011) for a selection of Asian countries; and Lanzafame (2010) for Italian regions.

The basic model (and its many extensions) raises several issues which contributors highlight in this symposium, some of which I discuss below. The model also has many policy implications, but in my view the most important one concerns a country's structure of production and trade because different goods have different production and demand characteristics. This obvious point is totally missing from the one-good aggregate closed-economy models of mainstream growth theory so prevalent in textbooks. Countries growing slowly need to examine carefully the types of goods they produce and export. 'What you export matters' is the evocative title of the paper by Hausmann et al. (2007), in which they show the clear association across countries between the technological sophistication of goods and export growth, determined by the income elasticity of demand for exports, and GDP growth. Pacheco-Lopez and Thirlwall (2014) also show the close association across countries between the growth of manufacturing output, export growth and GDP growth, which is an alternative (open-economy) interpretation of Kaldor's first growth law of manufacturing industry as the 'engine' of growth (Kaldor 1967). In many ways, the BoP-constrained growth model is an export-led growth model based on the crucial role of manufacturing and exports in the development process (Mathews 2019).

2 HARROD'S TRADE MULTIPLIER AND DYNAMIC ANALYSIS

The main result that the long-run growth of countries is likely to be approximated by the growth of exports relative to the income elasticity of demand for imports ($g_b = x/\pi$) turned out to be the dynamic analogue of Harrod's (1933) static foreign-trade multiplier result, $Y = X/m$, derived on the same assumptions as the dynamic result (where Y is the level of output, X is the level of exports and m is the marginal propensity to import), although I didn't realise it at the time. I had never read Harrod's 1933 book, *International Economics*, in which the foreign-trade multiplier, $1/m$, appears, but when I showed my result to my colleague at the University of Kent, Charles Kennedy (a former Oxford friend of Harrod), he immediately recognised the correspondence of the static and dynamic result. McCombie (1985) has also shown how the dynamic Harrod trade multiplier result can be interpreted as the Hicks supermultiplier because only exports can pay for the import content of other components of demand such as consumption, investment and government expenditure, which therefore allows them to grow faster in tune with export growth without a country running into a BoP constraint. Exports are a unique component of aggregate demand in this respect, which is often forgotten because, by relating imports to income in conventional income multiplier analysis, the import content of expenditure is missing. The correct approach to the foreign-trade multiplier in macro-analysis is to relate imports to expenditure, not income, allowing the import content of different items of expenditure to differ (Kennedy and Thirlwall 1979).

It will remain a mystery why Harrod himself did not realise that his static foreign-trade multiplier had a dynamic equivalent. If he had realised, he could have added the BoP equilibrium growth rate (g_b) to his dynamic analysis of the relation between the actual growth rate (g_a), the warranted growth rate (g_w) and the natural growth rate (g_n) (Harrod 1939). Despite Harrod's later promises to consider 'whether the problem of external balance gives rise to further conflicts [between g_w and g_n]' (Harrod 1973, p. 123), he failed to recognise the dynamic analogue of his static foreign-trade multiplier, and its implications. Whether the BoP position helps or hinders growth equilibrium depends on the

precise initial configuration of g_b, g_w and g_n (Thirlwall 2001). There are four interesting scenarios to consider:

1. $g_w > g_n > g_b$. A country in this case would be in a dire situation with excess saving and a tendency to BoP deficits before the capacity growth rate is reached. Capital inflows would worsen the inequality between g_w and g_n. The challenge would be to convert excess saving into exports.
2. $g_w > g_n < g_b$ and $g_w > g_b > g_n$. In this scenario there is no BoP constraint, and capital outflows would reduce g_w to g_n. On the other hand, $g_b > g_n$ could pull up g_n through the endogeneity of the natural rate of growth, thereby worsening the inequality between g_w and g_n.
3. $g_w < g_n > g_b$ and $g_w < g_b < g_n$. This situation could characterise many developing countries where $g_n > g_w$, causing structural unemployment and inflationary pressure because planned investment is greater than planned saving. The country would likely have a BoP problem, and capital inflows would raise g_w towards g_n. The growth of the country would be constrained by its BoP, despite surplus labour. The challenge is to convert excess domestic resources into tradable goods.
4. $g_w < g_n < g_b$. In this case, the BoP equilibrium growth rate exceeds the capacity to grow. Surpluses on the BoP will arise, and capital outflows will reduce g_w further below g_n. This situation describes many oil-producing countries. The solution lies in raising domestic saving and importing more.

It is an interesting question where individual countries lie within this framework and whether disequilibrium between g_b and g_n is self-correcting or self-aggravating. This is the issue that Perrotini-Hernández and Vázquez-Muñoz (2019) attempt to address in their innovative contribution to this symposium, for the countries of Argentina, Brazil, Chile and Mexico. They calculate g_b and g_n for each country and then estimate the elasticity of the two growth rates to the degree of capacity utilisation in the economies. Two scenarios are postulated: (i) where g_b is more elastic than g_n to capacity utilisation, in which case initial disequilibrium is reduced; and (ii) where g_n is more elastic than g_b, in which case initial disequilibrium is aggravated. In all four countries, the relationship between g_b, g_n and capacity utilisation is positive and generally g_b is more elastic than g_n, but not always. Over quite a long interval of time, sometimes the disequilibrium is self-correcting, but sometimes it is aggravated. There is more interesting work to be done on this topic for other samples of countries.[4]

3 IS THE HARROD TRADE MULTIPLIER AN IDENTITY?

One misconception that needs to be buried for good is that the dynamic Harrod trade multiplier result that $g_b = x/\pi$ is based on an identity, or is a tautology, because in the long run the growth of exports is bound to equal the growth of imports. This canard

4. Palley (2003) and Setterfield (2006) have previously addressed this issue in a different way. If $g_b \neq g_n$, does g_b adjust to g_n or g_n to g_b to avoid ever-increasing over- or under-capacity utilisation? For Palley, g_b adjusts to g_n through variations in the income elasticity of demand for imports (π), so long-run growth approaches g_n – the supply side rules. For Setterfield, g_n adjusts to g_b through variations in the Verdoorn coefficient (linking productivity growth to output growth), so long-run growth approaches g_b – the demand side rules. In practice, both effects are likely to operate.

was originally raised by McCombie (1981), but he soon changed his mind as a result of my response to him (Thirlwall 1981). The misconception has had an unfortunate reincarnation in the works of Blecker (2016) and Razmi (2016), among others. The result would reflect an identity if the income elasticity of demand for imports (π) is measured as m/g, where m is the growth of imports and g is actual output growth, but it is *not*. The income elasticity of demand for imports in all the empirical work I know (including the original estimates of π that I used in the 1979 paper, taken from Houthakker and Magee 1969) is estimated econometrically, controlling for changes in the real exchange rate, or the real terms of trade. It is perfectly possible, therefore, that π is not significantly different from zero, and the hypothesis that $g = x/\pi$ is refutable. McCombie shows this brilliantly in his paper in this symposium, in which he runs five simulations, all of which assume $x = m$ over the long run, but where sometimes the rule $g = x/\pi$ is accepted and at other times it is not. As McCombie (2019, p. 441) writes,

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

4 THE EXCHANGE RATE AND LONG-RUN GROWTH

The basic BoP-constrained growth rate prediction of $g = x/\pi$ has been criticised many times for neglecting the role of the exchange rate in determining the economic performance of nations. For the exchange rate to matter, the *real* exchange rate would have to change significantly over time, and the Marshall–Lerner condition would also have to be satisfied; that is, the sum of the price elasticities of demand for exports and imports would have to sum to greater than unity in absolute value. A property of the original 1979 model was that the export and import demand functions were specified as multiplicative (or log-linear), with constant price and income elasticity parameters. This implied that if the exchange rate was to affect the *growth* of exports and imports permanently, it would have to change continuously. A one-shot devaluation, for example, could not affect the *growth* of exports and imports permanently (and therefore output growth), only the *level* of exports and imports at the time the devaluation takes place. I then argued that a long-run change in the *real* exchange rate is unlikely for a number of different reasons depending on a country's economic circumstances. Firstly, a nominal devaluation could pass through into rising domestic prices; secondly, competitors may 'price to market'; thirdly, the law of one price may hold; and, fourthly, even without devaluation, relative domestic prices may be sticky because competition, at least among industrial producers, takes the form of non-price competition. In the end, this is an empirical question whether price adjustment is an efficient BoP adjustment mechanism. Alonso and Garcimartin (1998) find that it is not, at least for a group of ten OECD countries. From the evidence we have, it clearly cannot be an efficient adjustment mechanism for any country if the hypothesis that $g = x/\pi$ holds in the long run. It is income growth that adjusts to preserve long-run BoP equilibrium, not relative price changes.

Recently, however, there has been a different line of attack on the model relating to the multiplicative, constant elasticity, specification of the export and import demand functions. It has been argued that the *level* of the exchange rate is important for export performance, and that an undervalued exchange rate can initiate a virtuous circle of

growth relating to investment and structural change. In the extreme (Razmi 2016), exports are perfectly elastic at the 'correct' exchange rate, and the growth of world trade and the income elasticity of demand for exports plays no part in determining a country's export performance. This is diametrically opposed to the demand-oriented explanation of growth at the heart of the BoP-constrained growth model.[5]

The first point to make in response is that making the *growth* of exports a function of the *level* of the exchange rate implies a very peculiar demand function for exports. It would certainly not be a constant elasticity function. The price elasticity would vary according to the changing ratio of the growth of exports to the price level. This is not satisfactory theoretically. The second important point to make is that while a currency devaluation may initiate a growth acceleration, it is unlikely to sustain it.[6] The impetus of the initial depreciation is likely to peter out. This is where it is crucial to stress that the BoP-constrained growth model is meant to be applied to the long run; it is unsuitable for predicting growth over a short span of years not only because exchange-rate changes may only have temporary effects, but also because there can be nominal terms-of-trade shocks and volatile capital flows in and out of countries in response to, for example, interest-rate differentials between countries. These shocks can cause large deviations of actual growth from that predicted from the simple BoP-constrained model, but these shocks cannot, and do not, last forever, in which case the long-run growth rate will be determined by the structural characteristics of a country, reflected in the income elasticities of demand for exports and imports. This distinction between the short run and the long run shows up very nicely in the paper by Mhlongo and Nell in this symposium on growth transitions in South Africa. What the authors show is that it is misleading to evaluate the simple growth law, $g = x/\pi$, across a single regime because it provides no information on the sustainability of growth transitions.

Three growth regimes are identified: 1960–1976, when the annual average growth of GDP was 4.63 per cent; 1977–2003 with average growth of 1.74 per cent, and 2004–2017 with average growth of 3.01 per cent. Over the whole period 1960–2017, the simple growth law is rejected, but once regime changes are controlled for, the growth law provides valuable information on the sustainability of South Africa's different growth accelerations. In the period 1977–2003, the current-account-to-GDP ratio was virtually in balance and the rate of change of the real terms of trade was virtually zero. The growth acceleration in the period prior to that was related to FDI inflows (which did not last); and the growth acceleration afterwards proved unsustainable because of the short-term nature of the inflows. In the post-1973 period the economy has been converging to the rate predicted by the simple growth rule. Razmi (2016) and Blecker (2016) have used the empirical evidence of the literature on growth transitions to argue that the *level* of the real exchange rate matters for long-run growth. Mhlongo and Nell (2019) point out that the authors who have contributed to this literature (for example, Rodrik 2018) themselves acknowledge that an undervalued exchange rate cannot sustain growth transitions indefinitely. Ultimately growth reverts to the simple law.

Another way of coping with the understanding of growth fluctuations and transitions is not to work with a single import elasticity (π) estimated over a long period,

5. For a full critique of the Razmi (supply-side) model, see the papers by McCombie and by Mhlongo and Nell in this symposium.

6. Equally, a devaluation could ossify a production structure by making countries more competitive in goods that caused BoP problems in the first place. There are more direct and efficient ways of inducing structural change.

as in Mhlongo and Nell (2019), but to estimate a time-varying import elasticity (and export elasticity as well), and attempt to analyse why the elasticities might have changed. This is what Felipe, Lanzafame and Estrada (2019) do in their interesting paper in this symposium, which applies the BoP-constrained growth model to Indonesia, whose economic fortunes have fluctuated considerably over time. Over the long period 1982–2017, the actual growth rate and the BoP-constrained growth rate virtually coincide, but within the period there is wide variation in growth performance. In the 1980s, GDP growth averaged 5.8 per cent per annum. From 1990 to 1997, it averaged 7.2 per cent, and in the period 2000–2017 it fell to 5.3 per cent. The authors use a Kalman filter to make time-varying estimates of the income elasticities of demand for exports and imports, and hence time-varying estimates of g_b. What they show is that the deceleration of growth since 2000 has been the result of a dramatic fall in the ratio of the income elasticity of demand for exports to imports largely associated with the poor performance of the manufacturing sector in world trade. McCombie and Tharnpanich (2013) found the same for Thailand.

5 TERMS OF TRADE

The full BoP-constrained growth model contains an expression for the terms of trade; and both the direct and indirect effect of terms-of-trade changes on BoP-constrained growth can be estimated with knowledge of the price elasticities of demand for exports and imports, or as a residual after the effect of world income growth and capital flows (see later) have been calculated. Nureldin Hussain (1999) took this second approach for a sample of 29 African and 11 East Asian countries during the 1980s and 1990s and found terms-of-trade effects small for the vast majority of countries relative to the effect of differences in the income elasticities of demand for exports and the effect of capital flows. Africa grew more slowly than Asia because of its specialisation in primary commodities with a low income elasticity of demand.

It is true, however, that short-term terms-of-trade movements can cause large temporary deviations of actual growth from the long-run predicted growth rate from the BoP-constrained model. Africa in the 2000s is the most recent example where the commodity price boom caused the continent to be the fastest-growing on the planet for a short period of time (see Bagnai et al. 2016). Many studies have documented cyclical fluctuations in commodity prices and the terms of trade. Cashin and McDermott (2002) and Cashin et al. (2002) go as far back as 1862 and show fluctuations against a background of a declining long-run trend in the terms of trade of primary commodities (the Prebisch–Singer thesis). They conclude that such fluctuations 'have serious consequences [for] commodity-dependent countries and have profound implications for the achievement of macroeconomic stabilisation'. Erten and Ocampo (2013) identify four super-cycles of real commodity prices over the period 1865 to 2010 ranging between 30 and 40 years. The mean of each super-cycle of non-oil commodity prices is generally lower than the previous cycle, supporting the Prebisch–Singer hypothesis.[7]

Apart from commodity price changes causing temporary fluctuations in the actual growth performance of countries, Pérez Caldentey and Moreno-Brid in their paper in this symposium are right that the long-term consequences have not been fully explored.

7. Blattman et al. (2007) have looked historically at the relation between terms-of-trade volatility and GDP growth taking 35 countries over the period 1870–1939 and find a negative relation caused mainly by the deterrent to foreign direct investment (FDI).

As they say, 'the [balance-of-payments-constrained] growth literature has not yet explicitly considered the influence of the terms of trade given its potentially strong interrelations with the foreign-capital movements, the real exchange rate, the productive structure and its non-price competitiveness, and, thus, the long-term growth potential of an economy' (Pérez Caldentey and Moreno-Brid 2019, p. 478). The authors attempt to rectify this theoretically, but don't give evidence of its quantitative significance. In the period 2000–2012, the price of commodities rose significantly relative to manufactured goods, but what was the impact on the real exchange rate of countries and capital flows? It is well known that improvements in the terms of trade may lead to an appreciation of the real exchange rate – the Dutch Disease – leading to adverse consequences for the tradable goods sector and the premature 'deindustrialisation' of countries. Resources shift into commodity production where the linkages with other sectors of the economy are weak, undermining a country's growth potential. The impact on capital flows is uncertain. Pérez Caldentey and Moreno-Brid consider the case where an improvement in the terms of trade allows a higher current-account-deficit-to-GDP ratio to be financed by capital inflows, but I doubt in practice whether this is likely over the long term. Financial markets will still be nervous about the size of debt and whether the terms-of-trade improvement is permanent or not. If history is a guide, the evidence suggests that improvements are transitory and not the basis for sustained borrowing. The experience of Latin America, and the debt crisis of the 1980s, offers a salutary warning that countries and creditors can find themselves in deep trouble, borrowing and lending on the back of a commodity boom.

6 CAPITAL FLOWS

While writing the 1979 paper, I realised that the simple model might not fit very well many developing countries that often run large balance-of-payments deficits for a considerable period of time financed by a variety of short- and long-term capital inflows. In 1982, Nureldin Hussain and I extended the basic current-account model to include capital flows. This essentially meant working within the framework of an identity because the sum of the current account and capital account must equal zero. We showed that it is possible to disaggregate any country's growth rate into four component parts: (i) a pure terms of trade effect; (ii) the effect of real exchange-rate changes on the volume of exports and imports; (iii) the effect of world income growth determined by the income elasticity of demand for exports; and (iv) the impact of real capital flows – all deflated by the income elasticity of demand for imports. A major weakness of the extension to the basic model, however, was that no limit was imposed on the size of the current-account deficit that could be financed by capital inflows; nor were interest payments on debt considered, except implicitly as a negative component of capital inflows. It was not until much later that these important weaknesses were rectified by, among others, McCombie and Thirlwall (1997), Moreno-Brid (1998; 2003) and Barbosa-Filho (2001). Without considering interest payments, and assuming no change in the terms of trade, the growth rate consistent with a sustainable debt-to-GDP ratio is $g_D = (\Theta x)/[\pi - (1 - \Theta)]$, where Θ is the share of the import bill financed by exports, and $(1 - \Theta)$ is the share of the import bill financed by capital inflows. With no deficit, $\Theta = 1$, and the growth rate gives the simple rule $g = x/\pi$. The remarkable fact about this result, however, is that even if exports cover only 90 per cent of the import bill and 10 per cent is financed by capital inflows, the predicted growth rate hardly changes. For $x = 10$ per cent and $\pi = 2$, the simple rule yields

5 per cent growth, while the modified model with $\Theta = 0.9$ gives $g_D = 4.73$ per cent. Export growth reigns! With interest payments on debt considered, the debt-constrained growth rate becomes: $g_{Di} = (\Theta x - \Theta_i)/[\pi - (1 - \Theta - \Theta_i$], where i is the growth of real net interest payments abroad, and Θ_i is the share of foreign exchange devoted to interest payments. Now the growth rate is more significantly affected. If $i = 5$ per cent and Θ_i is 0.3, with $x = 10$ per cent, $\pi = 2$ and $\Theta = 0.1$, the predicted growth rate is 3.4 per cent compared to 5 per cent from the simple model.[8]

Bhering, Serrano and Freitas (2019), in their important paper in this symposium, criticise me and others, and rightly so, for measuring debt sustainability by the current-account-deficit-to-GDP ratio and not the debt-to-export ratio, because the latter is the true measure of the capacity to pay off external liabilities – otherwise there is a currency mismatch. The authors remind me that in a paper in 1983 (Thirlwall 1983), I argued that to get my simple growth rule ($g = x/\pi$) 'the only assumptions needed to produce this result are that in the long run trade must be balanced on current account (or that there is a *constant ratio of capital flows to export earnings*) and that the real terms of trade … remain constant' (ibid., p. 250, emphasis added). Regrettably, McCombie and I (1997) did not adopt the constant ratio of capital flows to export earnings. But the interesting result that Bhering et al. derive is that while sustainable long-run capital inflows can positively affect the long-run *level* of output, they do not alter the *growth* rate consistent with BoP equilibrium because ultimately there has to be a balance between exports and imports. The first necessary condition for debt sustainability in this improved model is that the interest rate should be less than export growth. The second necessary condition is that the ratio between imports and exports should not grow, otherwise the trade deficit will grow faster than exports – although this is not a sufficient condition because there will be a debt maximum beyond which the financial system will no longer finance external deficits. It would have been interesting if the authors had given some numerical simulations showing by how much the level of output could be affected by different ratios of debt-to-export earnings.

7 CONCLUDING REMARKS: THE NEED FOR STRUCTURAL CHANGE

If terms-of-trade changes and capital flows can only have transitory, or short-term, effects, the only component left from the full 1979 BoP-constrained growth model determining the long-run growth of countries is how well the world economy is performing (w), and the structure of a country's production and trade which determines the income elasticity of demand for exports (ε) and imports (π); that is, growth will tend towards $g = \varepsilon w/\pi$. The growth-of-world-income variable facing an individual country will be a weighted average of the growth rates of all the countries that a country exports to; ε will be a weighted average of the income elasticity of demand of all the goods that a country exports; and π will be a weighted average of the income elasticity of demand for all the goods a country imports. This leads to two important extensions of the basic model.

The first is a 'generalised' model originally developed by Nell (2003), which disaggregates the world income growth variable and takes into account the different income elasticities of demand for exports and imports to and from each trading partner.

8. McCombie and Roberts (2002) have shown in a different model that an increase in the sustainable debt-to-GDP ratio will raise the sustainable current-account-deficit-to-GDP ratio, allowing a transitional, but not a *permanent,* effect on growth.

Nell estimates the disaggregated model for South Africa, the rest of the Southern Africa Development Community (RSADC) and the OECD. Bagnai et al. (2016) have applied the model to 20 sub-Saharan African (SSA) countries trading with the rest of SSA, some Asian countries and the rest of the world. They are able to disaggregate how the BoP constraint on African countries has been affected by different factors from different sources. The policy message is plain that a country should orient its exports as far as possible to fast-growing markets and target import substitution from countries where the income elasticity of imports is high.

The second extension is a multi-sectoral model first developed by Araujo and Lima (2007) in which different exports and imports have different income elasticities. What this model highlights is that even if sectoral elasticities are constant and there is no change in world income growth, a country can grow faster by shifting resources to sectors with higher income elasticities of demand for exports and away from sectors with a high income elasticity of demand for imports. This is what export promotion and import substitution are supposed to achieve. Equally it shows that if there is an increase in world income, a country will benefit more the higher its sectoral income elasticities of demand for exports and the lower its sectoral income elasticities of demand for imports. From a policy point of view, this multi-sectoral specification of the model allows for the identification of key, strategic, growth-promoting tradable goods sectors of the economy.

This is where the supply side of an economy becomes extremely important because there is a growing body of evidence showing how the income elasticity of products is a positive function of the level of technology and the skill embodied in them. Gouvea and Lima (2010) test this multi-sectoral model for four Latin American and four Asian countries, distinguishing six sectors: primary products; resource-based manufacturing; low-technology manufactures; medium-technology manufactures; high-technology manufactures; and others. In general, technology-intensive sectors have a higher income elasticity of demand for exports, but for imports there is not much difference between sectors. Gouvea and Lima (2013) have also estimated sectoral export demand functions for a sample of 90 countries, and find that machinery has the highest income elasticity and primary products the lowest. Romero and McCombie (2016) estimate export-growth functions for different technological sectors in 14 OECD countries separately. Medium- and high-tech industries show higher income elasticities of exports than low-tech and primary commodities. Romero and McCombie (2018) use cross-product panel data to estimate export and import demand functions for four-digit product categories across 14 OECD countries. Income elasticities are always higher for high-tech sectors. Bottega de Lima and Romero (2019) estimate export demand functions for 15 countries on three continents measuring technology using patent data, and dividing the sample by technological groups. The income elasticity of demand for high-tech groups ranges from 1.1 to 2.0, while the income elasticity for low-tech groups ranges from 0.2 to 0.8. The evidence is overwhelming that the structure of production and trade matters for export growth and the growth of output in a BoP-constrained framework. Cimoli and Porcile (2014) and Gabriel et al. (2016) address the issue of the technological gap between poor and rich countries, and how it might be bridged. Porcile and Yajima in this symposium highlight the strong links between Structural, Keynesian and Schumpeterian approaches to development, with emphasis on the link between the structure of production and trade, and the external constraint on growth, based on the technical sophistication of goods and the diversity of production. They write: '[B]uilding technological capabilities and transforming the pattern of specialization is crucial for long-run growth. Otherwise, the efforts for

boosting aggregate demand by means of traditional macroeconomic tools (for instance, an expansive fiscal policy) will be frustrated by the emergence of external disequilibria and an unsustainable debt' (Porcile and Yajima 2019, pp. 529–530).

Structural change almost certainly requires a country to design an industrial policy embracing a national innovation system to facilitate the flow of technological knowledge across all sectors of the economy. The market mechanism itself is unlikely to bring about the required structural changes needed. I am attracted to the concepts of growth diagnostics (Hausmann et al. 2008) and self-discovery (Hausmann and Rodrik 2003). Growth diagnostics involves locating the binding constraints on a country's economic performance and to target these directly, giving the most favourable outcome from the resources available compared to the 'spray gun' approach to economic policy-making which may not hit hard enough the binding constraints on growth that really matter. In the case of the BoP, it would involve targeting exports with growth potential, and identifying imports where there is import substitution potential. Government expenditure on R&D to enhance export quality could reap high returns. Self-discovery involves seeking out new areas of comparative advantage and then implementing the most appropriate policies to foster them. Hausmann and Rodrik point out that there is much randomness in the process of a country discovering what it is best at producing, and a lack of protection reduces the incentive to invest in discovering what goods and services they are. Governments need to encourage entrepreneurship and invest in new activities, but the first best policy is not by the traditional means of tariffs and quotas, but public sector credit and guarantees which reward the innovator (and not the copy-cats), and can be withdrawn if firms do not perform well after a certain period of time.

It will be interesting to see whether the BoP-constrained growth model will still be discussed in the next 40 years, but in my view there is really no substitute for structural change to improve the trade balance if countries are to improve their long-run growth performance consistent with current-account BoP equilibrium.

REFERENCES

Alonso, J.A. and C. Garcimartin (1998), 'A new approach to balance of payments constraint: some empirical evidence', *Journal of Post Keynesian Economics*, 21(2), 259–282.

Araujo, R.A. and G. Lima (2007), 'A structural economic dynamic approach to balance of payments constrained growth', *Cambridge Journal of Economics*, 31, 775–774.

Bagnai, A., A. Reiber and T. Tran (2016), 'Sub-Saharan Africa's growth, South–South trade and the generalised balance of payments constraint', *Cambridge Journal of Economics*, 40(3), 797–820.

Barbosa-Filho, N. (2001), 'The balance of payments constraint: from balanced trade to sustainable debt', *Banca Nazionale del Lavoro Quarterly Review*, 54, 381–400.

Bhering, G., F. Serrano and F. Freitas (2019), 'Thirlwall's law, external debt sustainability, and the balance-of-payments-constrained level and growth rates of output', *Review of Keynesian Economics*, 7(4), 486–497.

Blattman, C., J. Hwang and J.G. Williamson (2007), 'Winners and losers in the commodity lottery: the impact of terms of trade growth and volatility in the periphery 1870–1939', *Journal of Development Economics*, 82(1), 156–179.

Blecker, R. (2016), 'The debate over "Thirlwall's Law": balance of payments constrained growth reconsidered', *European Journal of Economics and Economic Policies: Intervention*, 13(3), 275–290.

Bottega de Lima, A. and J. Romero (2019), 'Innovation and export performance in different groups of sectors and countries', Unpublished Paper.

Cashin, P. and C.J. McDermott (2002), 'The long-run behaviour of commodity prices: small trends and big volatility', *IMF Staff Papers*, 49(2), 175–199.
Cashin, P., C.J. McDermott and A. Scott (2002), 'Booms and slumps in world commodity prices', *Journal of Development Economics*, 69(1), 277–296.
Cimoli, M. and G. Porcile (2014), 'Technology, structural change and BoP-constrained growth: a structuralist toolbox', *Cambridge Journal of Economics*, 38, 215–237.
Dixon, R.J. and A.P. Thirlwall (1975), 'A model of regional growth rate differences on Kaldorian lines', *Oxford Economic Papers*, 27(2), 2001–2014.
Dray, M. and A.P. Thirlwall (2011), 'The endogeneity of the natural rate of growth for a selection of Asian countries', *Journal of Post Keynesian Economics*, 33(3), 451–468.
Erten, B. and J.A. Ocampo (2013), 'Super cycles of commodity prices since the mid-nineteenth century', *World Development*, 44, 14–30.
Felipe, J., M. Lanzafame and G. Estrada (2019), 'Is Indonesia's growth rate balance-of-payments-constrained? A time-varying estimation approach', *Review of Keynesian Economics*, 7(4), 537–553.
Gabriel, L.F., F.G. Jayme and J. Oreiro (2016), 'A North–South model of economic growth, technological gap, structural change and real exchange rate', *Structural Change and Economic Dynamics*, 38, 83–94.
Gouvea, R. and G. Lima (2010), 'Structural change and balance of payments constraint and economic growth: evidence from the multi-sectoral Thirlwall's Law', *Journal of Post Keynesian Economics*, 33(1), 169–204.
Gouvea, R. and G. Lima (2013), 'Balance of payments constrained growth in a multi-sector framework: a panel data investigation', *Journal of Economic Studies*, 40(2), 240–254.
Harrod, R. (1933), *International Economics*, London: Macmillan.
Harrod, R. (1939), 'An essay in dynamic theory', *Economic Journal*, 49(1), 14–33.
Harrod, R. (1973), *Economic Dynamics*, London: Macmillan.
Hausmann, R. and D. Rodrik (2003), 'Economic development as self discovery', *Journal of Development Economics*, 72(2), 603–633.
Hausmann, R., D. Rodrik and J. Hwang (2007), 'What you export matters', *Journal of Economic Growth*, 12(1), 1–25.
Hausmann, R., D. Rodrik and A. Velasco (2008), 'Growth diagnostics', in J. Stiglitz and N. Serra (eds), *The Washington Consensus Reconsidered: Towards a New Global Governance*, New York: Oxford University Press, pp. 324–355.
Houthakker, H. and S.P. Magee (1969), 'Income and price elasticities in world trade', *Review of Economics and Statistics*, 51(2), 111–125.
Kaldor, N. (1967), *Strategic Factors in Economic Development*, Ithaca: Cornell University Press.
Kaldor, N. (1970), 'The case for regional policies', *Scottish Journal of Political Economy*, 17(4), 336–348.
Kennedy, C. and A.P. Thirlwall (1979), 'The input–output approach to the foreign trade multiplier', *Australian Economic Papers*, 18(1), 173–180.
Lanzafame, M. (2010), 'The endogeneity of the natural rate of growth in the regions of Italy', *International Review of Applied Economics*, 24(5), 533–552.
Lanzafame, M. (2014), 'The balance of payments constrained growth rate and the natural rate of growth: new evidence', *Cambridge Journal of Economics*, 38(4), 817–838.
Leon-Ledesma, M. and A.P. Thirlwall (2002), 'The endogeneity of the natural rate of growth', *Cambridge Journal of Economics*, 26(4), 441–459.
Libanio, G. (2009), 'Aggregate demand and the endogeneity of the natural rate of growth: evidence from Latin American countries', *Cambridge Journal of Economics*, 33(5), 967–984.
Mathews, J.A. (2019), 'Latecomer industrialisation', in E.S. Reinhert, J. Ghosh and R. Kattel (eds), *Handbook of Alternative Theories of Economic Development*, Cheltenham, UK and Northampton, MA: Edward Elgar Publishing, pp. 613–636.
McCombie, J.S.L. (1981), 'Are international growth rates constrained by the balance of payments? A comment on Professor Thirlwall', *Banca Nazionale del Lavoro Quarterly Review*, 34(139), 455–458.

McCombie, J.S.L. (1985 [2004]), 'Economic growth, the Harrod trade multiplier and the Hicks super-multiplier', in J.S.L. McCombie and A.P. Thirlwall (eds), *Essays on Balance of Payments Constrained Growth*, London: Routledge, pp. 41–57.
McCombie, J.S.L. (2019), 'Why Thirlwall's law is not a tautology: more on the debate over the law', *Review of Keynesian Economics*, 7(4), 429–443.
McCombie, J.S.L. and M. Roberts (2002), 'The role of the balance of payments in economic growth', in M. Setterfield (ed.), *The Economics of Demand-Led Growth*, Cheltenham, UK and Northampton, MA: Edward Elgar Publishing.
McCombie, J.S.L. and N. Tharnpanich (2013), 'Balance of payments constrained growth, structural change and the Thai economy', *Journal of Post Keynesian Economics*, 35(4), 569–595.
McCombie, J.S.L. and A.P. Thirlwall (1997), 'Economic growth and the balance of payments constraint revisited', in P. Arestis, G. Palma and M. Sawyer (eds), *Markets, Unemployment and Economic Policy*, Cheltenham, UK and Northampton, MA: Edward Elgar Publishing, pp. 498–511.
Mhlongo, E. and K.S. Nell (2019), 'Growth transitions and the balance-of-payments constraint', *Review of Keynesian Economics*, 7(4), 498–516.
Moreno-Brid, J. (1998), 'On capital flows and balance of payments constrained growth models', *Journal of Post Keynesian Economics*, 21(2), 283–298.
Moreno-Brid, J. (2003), 'Capital flows, interest payments and the balance of payments constrained growth model: a theoretical and empirical analysis', *Metroeconomica*, 54(2–3), 346–365.
Nell, K. (2003), 'A generalised version of the balance of payments growth model: an application to neighbouring regions', *International Review of Applied Economics*, 17(3), 249–267.
Nureldin Hussain, M. (1999), 'The balance of payments constraint and growth rate differences amongst African and East Asian countries', *African Development Review*, 11(1), 103–137.
Nureldin Hussain M. and A.P. Thirlwall (1982), 'The balance of payments constraint, capital flows and growth rate differences between developing countries', *Oxford Economic Papers*, 34(3), 498–510.
Pacheco-Lopez, P. and A.P. Thirlwall (2014), 'A new interpretation of Kaldor's first law of growth for an open developing economy', *Review of Keynesian Economics*, 3, 384–398.
Palley, T. (2003), 'Pitfalls in the theory of growth: an application to the balance of payments constrained growth model', *Review of Political Economy*, 15(1), 75–84.
Pérez Caldentey, E. and J.C. Moreno-Brid (2019), 'Thirlwall's law and the terms of trade: a parsimonious extension of the balance-of-payments-constrained growth model', *Review of Keynesian Economics*, 7(4), 463–485.
Perrotini, I. and D. Tlatelpa (2003), 'Crecimiento Endogeno y Demanda en las Economias de America del Norte', *Momento Economico*, 128, 10–15.
Perrotini-Hernández, I. and J.A. Vázquez-Muñoz (2019), 'Endogenous growth, capital accumulation and Thirlwall's dynamics: the case of Latin America', *Review of Keynesian Economics*, 7(4), 444–462.
Porcile, G. and G.T. Yajima (2019), 'New Structuralism and the balance-of-payments constraint', *Review of Keynesian Economics*, 7(4), 517–536.
Razmi, A. (2016), 'Correctly analysing the balance of payments constraint on growth', *Cambridge Journal of Economics*, 40(6), 1581–1608.
Rodrik, D. (2018), 'An African growth miracle', *Journal of African Economies*, 27(1), 10–27.
Romero, J. and J.S.L. McCombie (2016), 'The multi-sectoral Thirlwall's law: evidence from 14 developed European countries using product level data', *International Review of Applied Economics*, 30(3), 301–325.
Romero, J. and J.S.L. McCombie (2018), 'Thirlwall's law and the specification of export and import demand functions', *Metroeconomica*, 69, 366–395.
Setterfield, M. (2006), 'Thirlwall's law and Palley's pitfalls: a reconsideration', in P. Arestis, J.S.L. McCombie and R. Vickerman (eds), *Growth and Economic Development: Essays in Honour of A.P. Thirlwall*, Cheltenham, UK and Northampton, MA: Edward Elgar Publishing, pp. 47–59.

Solow, R.M. (1956), 'A contribution to the theory of economic growth', *Quarterly Journal of Economics*, 70(1), 65–94.
Thirlwall, A.P. (1970), 'Another autopsy on Britain's balance of payments 1958–1967', *Banca Nazionale del Lavoro Quarterly Review*, 23(94), 308–325.
Thirlwall, A.P. (1974), 'The panacea of the floating pound', *National Westminister Bank Quarterly Review*, August, 16–28.
Thirlwall, A.P. (1980), 'Regional problems are balance of payments problems', *Regional Studies*, 14(5), 419–425.
Thirlwall, A.P. (1981), 'A reply to Mr McCombie', *Banca Nazionale del Lavoro Quarterly Review*, 34(139), 458–459.
Thirlwall, A.P. (1983), 'Foreign trade elasticities in centre–periphery models of growth and development', *Banca Nazionale del Lavoro Quarterly Review*, 36(146), 249–261.
Thirlwall, A.P. (2001), 'The relationship between the warranted rate of growth, the natural rate and the balance of payments equilibrium growth rate', *Journal of Post Keynesian Economics*, 24(1), 81–88.
Thirlwall, A.P. (2011), 'Balance of payments constrained growth models: history and overview', *PSL Quarterly Review*, 64(259), 307–351.
Verdoorn, P.J. (1949), 'Fattori che Regolano lo Sviluppo della Produttivita del Lavoro', *L'Industria*, 1, 3–10.
Vogel, L. (2009), 'The endogeneity of the natural rate of growth: an empirical study for Latin American economies', *International Review of Applied Economics*, 23(1), 41–53.