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Global growth and international cooperation: a structuralist perspective

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This paper revisits the structuralist ideas on trade and growth and suggests (based on the Prebisch's principle of implicit reciprocity) that policies for promoting structural change in the periphery may lead to higher global growth and a better income distribution across countries. The paper discusses the inter-relations and complementarities that exist between autonomous expenditure and industrial and technology policies in the long run. With this objective, we develop a structuralist growth model in which the technology gap and the growth rate of the domestic autonomous expenditure are endogenously determined in a two-country (centre and periphery) international economy.

Key words: Structural change and Development, Economic Growth in Latin America, North-South trade
JEL classifications: F43, F51, O54

1. Introduction

The current international economic crisis has produced a broad consensus suggesting that the recovery of growth requires new, more advanced forms of international cooperation, involving not only the developed countries but also some key developing countries. So far the focus has been placed chiefly on fiscal and monetary policies and on the need for devising new rules for the international financial system, which is probably the most urgent challenge to be addressed in the next years (see Kregel, 2009). But the trade side of the global growth equation cannot be ignored, particularly in the long run. In the new international system that would emerge from the crisis, the development issues that have remained unsolved (such as the stubborn persistence of large income and technology gaps between developed and several developing areas) should be considered. In this paper we suggest that the structuralist perspective on international trade and development could be a useful starting point for discussing a new set of policies in which concerns with global growth and distribution are paramount. Our main argument is that in an interdependent international economy with significant technological and productive asymmetries,

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sustainable long-run growth requires traditional Keynesian policies to be supported by policies aimed at changing the pattern of specialisation of the periphery.

The paper is organised in two sections, in addition to this introduction and the concluding remarks. In Section 1 we revisit structuralist ideas and discuss Prebich's principle of implicit reciprocity. This principle states that the periphery is balance-of-payments constrained and, as a result, it tends to convert all its exports into imports from the centre with a view to fostering growth. Prebisch (1950) and the Economic Commission for Latin America and the Caribbean (ECLAC, 1955) stressed the existence of large asymmetries between developed and developing economies as regards the intensity of technical change, the pattern of specialisation and the distribution of productivity gains.[1] Technological asymmetries imply that peripheral exports will be concentrated in few commodities with low income-elasticity of the demand, compromising its ability to increase exports (and hence imports from the centre).[2] Therefore, these asymmetries are not inconsequential for global growth: redefining the pattern of specialisation of the periphery (based on technological catching-up) may lead to a higher rate of growth of international effective demand.

Section 2 discusses in a formal way the inter-relations that exist in the long run between the pattern of specialisation and the international coordination of fiscal policies between centre and periphery. With this objective we develop a structuralist model, which extends the two-country model suggested by McCombie and Thirlwall (1994) by including the technological dimension, drawing from the literature on technological catching up and competitiveness (cf Dosi *et al.*, 1990; Patel and Pavitt, 1998; Araujo and Lima, 2007; Cimoli and Porcile, 2009). We argue in favour of a combination of policies stimulating structural change along with traditional Keynesian macroeconomic policies. A policy that solely focuses on technological learning and efficiency may lead to higher unemployment if it is not complemented by a parallel rise in effective demand. Although part of the increase in demand would come out of exports and from the workings of the foreign trade multiplier, an active fiscal policy is necessary to keep aggregate demand in line with the growth potential. Inversely, if fiscal policy is used as the only instrument to sustain demand without diversifying exports and improving international competitiveness, then growth will be hampered by external disequilibrium. To be sustainable, a Keynesian policy requires a Schumpeterian companion.

2. Trade and growth in the centre-periphery system

2.1 Technology and the formation of the centre-periphery system

Structuralist ideas on trade and development have been frequently misread. They have been considered unfavourable or even hostile to international trade, a perspective that is not supported by a first-hand reading of ECLAC and Prebisch works.[3] The main concern of these authors is with the implications for growth of the technology gap and of different

[1] See also Prebisch (1955, 1963, 1976, 1981). For a detailed appraisal of the structuralist view, see Rodríguez (1980, 2007). For a discussion of these topics in the light of the present crisis see ECLAC (2010).

[2] See Dosi *et al.* (1990) and Cimoli and Porcile (2010). Prebisch also observed that this kind of specialisation would prevent the periphery from taking full advantage of technical change in the exporting sector, as the terms of trade would gradually deteriorate. A reappraisal of the terms of trade debate can be found in Ocampo and Parra (2003).

[3] As achnowledeged by Rodrik (1997), 'Anyone who has read Prebisch more closely—and I am now happy to include myself in this company—would object that the usual characterization of Prebisch as an advocate of protection ignores a lot of subtleties. Prebisch did not favor indiscriminate protection. He anticipated his later critics by recognizing that trade protection on its own would not lead to increased productivity in manufactures, and might even result in the opposite.'

economic structures in the two poles of the international system, centre and periphery. Structuralists argued that the correction of these asymmetries would lead to more trade, not less, and that changing the pattern of specialisation should be actively pursued by policy-makers. They agree that trade is the handmaiden of growth, as suggested by Kravis (1970), but at the same time point out that it could not rely solely on market forces. This section briefly summarises some of the key points raised by structuralist authors.

The analysis begins with an undifferentiated international economy, where technological capabilities and productivity levels are fairly similar across regions. At a certain point in time technical change accelerates in one of the regions (which will become the centre), gradually transforming its productive structure, which becomes diversified and homogeneous. The emerging centre economy is diversified because it comprises a large number of sectors and activities, and homogeneous because labour productivity is fairly similar across them. At the same time, technology diffuses at a very slow rate at the international level and penetrates in a highly localised form in other regions (chiefly in a few exporting activities). In these regions, which form the periphery, the economic structure is specialised and heterogeneous: there are less sectors and activities, and they exhibit major differences in labour productivity, as technical change leaves untouched large traits of the production system.[4] These differences explain why the periphery is perceived as a dual economy, with a significant share of employment allocated in archaic and subsistence sectors.

In Figure 1 we suggest a stylised description of the evolution of the centre-periphery system. Each box represents one of the two economies, centre and periphery. In both boxes labour productivity (π, left vertical axis) in the modern sector is plotted against the number of modern sectors (N, abscise axis), ordered as a monotonically decreasing function of labour productivity, represented by the dotted line. Sector $N = 1$ is the one with the highest labour productivity, while the last sector N^j has the lowest labour productivity ($j = C,P$, centre and periphery). At the same time, in both boxes the accumulated share in total employment ($0 < E \leq 1$, right vertical axis) is plotted against the number of sectors of the economy (continuous line).[5] As this number increases, so does accumulated total employment.

Thus, Figure 1 plots two variables, labour productivity (left vertical axis) and accumulated total employment (right vertical axis), as a function of the number of modern sectors in the economy. Two features in Figure 1 are particularly interesting. First, productivity in the centre declines very gradually along with the number of sectors, in such a way that the difference in productivity between sectors 1 and N^C (the last sector in the centre economy) is small. On the other hand, productivity declines rapidly in the periphery because technical progress is highly localised in the export activities and it does not permeate the rest of the economic structure. As a result workers employed in the 'last' modern sector of the periphery ($N^P < N^C$) have productivity levels that are much lower than those employed in the export sectors.

In addition, looking at the evolution of accumulated employment, it can be seen that the centre is able to employ all its labour supply in modern activities, since when $N = N^C$ then $E_{NC} = 1$ (all the labour force is employed). But in the periphery there still remains a substantial part of the workforce unemployed when $N = N^P$. In other words, not all the workforce will find a job in the modern sector in the periphery and therefore part of it $(1 - E_{NP})$ is bound to be allocated in subsistence activities. Therefore there are two sources of

[4] For a discussion of the concept of structural heterogeneity see Pinto (1970, 1976), Prebisch (1976), Sunkel (1978) and Cimoli *et al.* (2005). For evidence on the Latin American case, see ECLAC (2010, chapter 3).

[5] Note that $E_i = \sum_{i=1}^{i=N} e_i$, where e_i is the share of sector i in total employment.

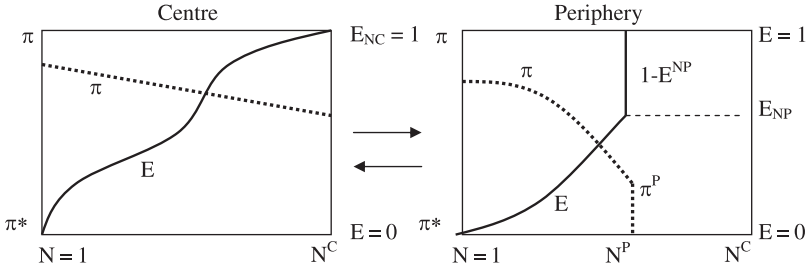

Fig. 1. *The centre and periphery economic structures. Variables: π, labour productivity (pointed line); E, accumulated participation in total employment (continuous line); N, number of sectors ranked as a monotonically decreasing function of labour productivity; N^C, total number of sectors in the centre; N^P, total number of sectors in the periphery; E_{NP}, total employment in the modern sector of the periphery (the residual, $1–E_{NP}$, is allocated in the subsistence sector); E_{NC}, total employment in the modern sector of the centre, which equals 1 (there is no subsistence sector in the centre); $\pi^\star$, labour productivity in the subsistence sector of the periphery; π^P, labour productivity in the sector number N^P in the periphery.*

heterogeneity in the periphery. First, there are large differences in productivity between the people employed in the modern sector, from the export sector to the last modern sector (N^P). Second, a significant share of the peripheral workforce remains allocated in the subsistence sector, urban or rural, formal or informal. This contributes to explain why heterogeneity and income inequality are so pervasive in the periphery as compared to the centre.

The previous analysis poses another question. Which are the forces leading to either a fall or an increase in the technology gap? This problem is addressed in the following subsection.

2.2 Technological asymmetries and implicit reciprocity

Structuralists identify strong inertial forces in the pattern of specialisation and argue that market forces alone would be unable to curb technological asymmetries. When Prebisch and ECLAC presented the centre-periphery theory, in the late 1940s and early 1950s, there were no solid microeconomic foundations for the analysis of technological learning that could be used to rigorously support their claims about barriers to the transformation of the periphery productive structure (Cimoli and Porcile, 2009). These foundations would only be developed from the late 1970s, particularly by the evolutionary school, based on the microeconomic theories of inflexibility, information asymmetries, and leads and lags in innovation and diffusion (see Rosenberg, 1982; Dosi, 1988; Freeman, 1995; Cimoli and Dosi, 1995). To a large extent the new growth, trade and economic geography theories that have flourished in the past 20 years are based on the avenues opened up by the microeconomics of increasing returns and path-dependency.[6]

The persistence of the technology gap implies that the periphery specialises in goods that are less intensive in technology and, in general (except for some periods of good luck in the commodity lottery), with low income-elasticity of the demand for exports. At the same time the periphery displays a high income-elasticity of the demand for imports. These differences between the income-elasticity of exports and imports have, as a consequence, growth that will be constrained by the availability of foreign exchange. The periphery needs to accumulate technological capabilities and grow at very high rates to be able to transfer the labour force underemployed in low-productivity sectors towards higher-productivity sectors. This is the only form of overcoming heterogeneity in labour productivity. But

[6] The literature on this is extensive; see, for example, Arthur (1989, 1994).

external disequilibrium sets a limit to growth, and consequently a substantial share of labour is forced to remain in the subsistence sector.

The need to speed up growth and absorb the underemployed gives rise to another key tenet of the structuralist school, the idea that the periphery offers automatic or implicit reciprocity to the centre. In effect, each additional unit of foreign exchange the periphery obtains from international trade will be transformed into additional imports of capital and high-tech goods from the centre. These imports are indispensable for attaining higher rates of investment and growth. Automatic reciprocity implies that the periphery will not accumulate reserves, but convert all its foreign exchange into growth with a view to reducing the size of the subsistence sector. Moreover, a corollary of the principle of implicit reciprocity is that the participation of the periphery in international trade is to a large extent a function of its own capacity to export. Limits to trade largely stem from the fact that the periphery lacks the technological capabilities required to participate more actively in the process of increasing division of labour at a world level, based on intra-industry trade.

The idea that Prebisch and ECLAC opposed trade arises mainly from the identification of structuralism with import-substituting industrialisation. But Prebisch, at different times, made it clear that import-substitution was a second-best avenue for industrialisation, which should be embraced solely when for some reason it would not be possible to diversify exports. In his own words:

> Trade is an essential condition for development since it provides the necessary goods that a periphery country cannot produce because of lack of natural resources or lack of technological and economic capabilities. It has to export to be able to buy these goods (...) Yet primary production is normally insufficient to play this role (...) Therefore exports of manufactures become a necessity. But in this point emerges a serious barrier, since the centers are generally unwilling to take peripheral manufactures at the rate required by development (...) There are two forms of correcting the disparity of elasticities [between peripheral exports and imports]: one is exporting new goods along with those traditionally exported (...); the other is to encourage the expansion of domestic production. The first alternative is to be preferred. But if this option is not available, then the second one should be adopted to foster development. (Prebisch, 1981, pp. 184–5)

Thus, industrialisation is seen as the form of redefining the income elasticities of the demand for exports and imports. But for advancing in this direction active policies (at both the domestic and international levels) are required. Prebisch himself devoted considerable efforts, from the mid-1960s, as Director of UNCTAD, to encourage new rules favourable to peripheral exports. Although he had little success in this, the key problems of institution building for international cooperation gradually received more attention from both policy-makers and theorists.[7] Our previous analysis suggests that these rules should take into account the heterogeneity that characterises the international system. A purely market-led approach to international relations will fail to explore all the potential for trade. More trade and laissez-faire policies may move in opposite directions when there are structural barriers to diversification.[8]

[7] In a pioneering work, Kindleberger (1986) suggested that governance in international relations is a public good produced at a sub-optimal level. Keohane (1984) argued that institutions for global cooperation are crucial to raise the supply of international public goods, particularly when there is no single hegemonic power (see also Ocampo, 2005A).

[8] Kindleberger (1978, 2000, ch. 7), for instance, gives support to this view in his historical account of the origins of free trade in England. Katzenstein (1985) found convincing evidence from his studies of the small open European economies that openness required strong policy intervention in the labour market to avoid rising inequality. In Asia, the more intense transformation of the export structure towards high-tech sectors allowed the Asian region to increase its share in world trade, while the opposite occurred in Latin America, which remained, by and large, as an exporter of commodities and low-tech industrial goods (Fransman, 1986; Lall, 1997; Rodrik, 1997; Palma, 2005; UNCTAD, 2005; ECLAC, 2007; Cimoli *et al.*, 2010).

In the next section we use a structuralist model to analyse how implicit reciprocity, structural change in the periphery and global growth are related. Under certain conditions, international coordination may give rise to an equilibrium position with higher rates of growth and lower technology and income gaps between centre and periphery. The model builds upon the Keynesian tradition and includes the technology gap as a new endogenous variable.

3. Fiscal policy, structural change and automatic reciprocity

3.1 A two-country dynamic Keynesian system: the MT model

Our starting point is the two-country balance of payments (BOP)-constrained growth model suggested by McCombie and Thirlwall (1994, pp. 437–56), which we will call the MT model.[9] It begins with the classical Keynesian equations, where country 1 is the periphery and country 2 is the centre:

$$Y_1 = C_1(Y_1) + I_1(Y_1) + Z_1(Y_1) + X_1 - M_1(EP_2/P_1) \quad (1)$$

$$Y_2 = C_2(Y_2) + I_2(Y_2) + Z_2(Y_2) + X_2 - M_2(P_1/EP_2) \quad (2)$$

Consumption (C), investment (I) and government spending (Z) have two components, one of which is autonomous and the other is a function of income (see the mathematical appendix for details). In turn the quantity of exports (X) depends on the real exchange rate and on the other country's gross domestic product (GDP). In country 1 the demand for exports will be given by:

$$X_1 = \left(\frac{P_2 E}{P_1}\right)^{\phi_1} (Y_2)^{\pi_2} \quad (3)$$

In equation (3) φ_1 is the price elasticity of the demand for exports of country 1 and π_2 the income elasticity of the demand for imports of country 2 (clearly, exports from country 2 respond to a symmetric equation). E is the nominal exchange rate (units of currency of country 1 per unit currency of country 2), while P_1 and P_2 denote domestic and foreign price levels. It should be recalled that in a two-country model, exports from one country are imports from the other ($X_1 = M_2$), and hence the income elasticity of the demand for imports in country 1 (π_1) corresponds to the income elasticity of the demand for exports of country 1.

The condition for current account equilibrium in both countries is given by:

$$P_1 X_1 = P_2 E M_2 \quad (4)$$

The model does not consider capital flows. Taking logs in equations (1), (2) and (3), differentiating with respect to time, and assuming that the dynamic version of purchasing power parity holds (and hence the real exchange rate is about constant in the long run), then we have:[10]

$$y_1 = \alpha_1 a_1 + \beta_1 \pi_2 y_2 \quad (5)$$

$$y_2 = \alpha_2 a_2 + \beta_2 \pi_1 y_1 \quad (6)$$

Small letters represent proportional rates of growth (for instance, $p=(dP/dt)(1/P)$ is domestic inflation). In equations (5) and (6), y_1 is the rate of growth of the periphery, π_2 is the income elasticity of the demand for imports in country 2, π_1 is the income elasticity of

[9] For a thorough discussion of demand-led growth see Setterfield (2002).
[10] Cf. the mathematical appendix.

the demand for imports in country 1, and y_2 is the rate of growth of country 2. The coefficients α and β are related to the share in total GDP of the different components of effective demand (see the mathematical appendix). Thus, equation (5) gives the rate of growth of the periphery as a function of the rate of growth of its autonomous expenditure and that in the centre. Symmetrically, equation (6) provides the rate of growth of the centre as a function of the growth rate of its own autonomous expenditures and exports. By log-differentiating equation (3) we get:

$$x_1 = \phi_1(p_1 - e - p_2) + \pi_2 y_2 \tag{7}$$

In equilibrium, with a constant real exchange rate ($p_1 - e - p_2 = 0$), the rate of growth of exports of 1 should equal the rate of growth of its imports:

$$x_1 = \pi_2 y_2^\star = \pi_1 y_1^\star \tag{8}$$

By rearranging terms we have the rates of growth of countries 1 and 2 in equilibrium as:

$$y_1^\star = \frac{\pi_2}{\pi_1} y_2^\star \tag{9}$$

Figure 2 uses the diagram set forth in the MT model to illustrate how international coordination may affect the equilibrium rates of growth in the two-country model. Initially both economies are in equilibrium at point *s*. In effect, in *s* the effective rate of growth of country 1 (curve AA1, which corresponds to equation 5) cuts the effective rate of growth of country 2 (curve BB1, which corresponds to equation 6) and the condition for equilibrium in current account (curve CC1, which corresponds to equation 9). The effective rates of growth in the two countries coincide with that compatible with current account equilibrium. Country 1 is the periphery and hence the declivity of curve CC (the elasticity ratio π_2/π_1) is less than the unity: country 1 grows less than country 2 in equilibrium (Rodriguez, 1977; Thirlwall, 1979; Dutt, 2002).

Now assume that country 1 increases the rate of growth of its autonomous expenditures. Then the curve AA1 moves to AA2 and the system will no longer be in equilibrium (country 1 has a deficit). But if the expansion is coordinated and country 2 increases its autonomous expenditure too, a new equilibrium will be achieved in *q*, in which both countries grow at higher rates. Coordination makes the more active fiscal of the periphery sustainable. Otherwise country 1 would have been obliged to cut its expenditure and return to point *s*, where both countries grow at lower rates.

Still, if country 1 encourages structural change[11] and redefines its pattern of specialisation, the curve CC1 will shift to CC2 (as π_2/π_1 increases). For simplicity, in Figure 2 we assume that π_1 falls while π_2 remains constant. This implies that the declivity of the curve BB changes (from BB1 to BB3) along with π_1, while the declivity of AA does not change. In this case, structural change makes fiscal expansion in the periphery viable. At the end of the day, the combination of a new pattern of specialisation plus higher autonomous expenditure lead to higher growth in country 1 with the same rate of growth in country 2, as represented by point *z* in Figure 2.[12]

[11] The transformation of the pattern of specialisation of the periphery requires a combination of investments in human capital, science and technology infrastructure, research and development (R&D) incentives and industrial policy. In the paper we label this combination of policies simply as industrial policy, but it should be borne in mind that this term represents a broader effort at accumulating technological and productive capabilities. For a discussion of the relations between macroeconomics and productive structure see Ocampo (2005B).

[12] This will be formally demonstrated below.

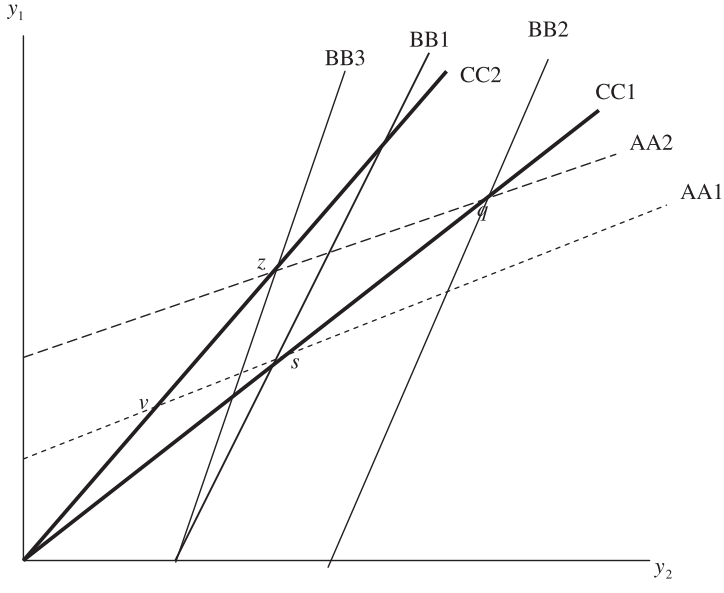

Fig. 2. *Growth, fiscal policy and structural change. CC, current account equilibrium locus; AA, effective rate of growth of country 1 as function of growth in country 2; BB, effective rate of growth of country 2 as a function of growth in country 1. If country 1 increases the rate of growth of autonomous expenditure (from AA1 to AA2) and country 2 follows suit (from BB1 to BB2), equilibrium will occur at point q. If country 2 does not increase the growth of autonomous expenditure, there will be a deficit in country 1, which could only be corrected by structural change (shifting the CC curve from CC1 to CC2). The combination of expansionist fiscal policy plus structural change (point z) implies higher growth in the periphery and the same rate of growth in the centre.*

Of course, if the periphery follows a mercantilist approach, focusing solely in raising its competitiveness without any concern with domestic effective demand, the result will be different. A mercantilist approach implies increasing competitiveness (higher elasticity ratio, moving CC1 to CC2) without a parallel rise in autonomous expenditure (the intercept of the curve AA does not shift). In this case a deficit will be imposed on country 2. If, as a consequence, country 2 adopts a recessive fiscal policy to restore external equilibrium, reducing the growth of its autonomous expenditure, BB will shift to the left (not represented in the figure) and the system will move towards point v, where both countries grow at lower rates than in the original situation. A mercantilist approach is thus one in which the periphery improves its competitiveness but does not give automatic reciprocity (keeping its autonomous expenditure constant), thereby generating a current account deficit in the centre.

In sum, both a purely pro-competitiveness policy and a purely activist fiscal policy will be, at the end of the day, self-defeated. Changing the pattern of specialisation and the management of effective demand should go together in order to sustain global growth. A 'pure' structural change approach may produce a mercantilist drive in trade policy, while a 'pure' fiscal policy approach will meet the barrier of the external constraint. We will now extend this macroeconomic system by including the technological dynamics, which is the subject of the following sub-section.

3.2. The MT model with technological learning and structural change

In this section we extend the MT two-country model to analyse the co-evolution of the technology gap and the pattern of specialisation, and its relation with long run trends in fiscal policy. Two are the key assumptions of the extended MT model, drawn from the structuralist tradition presented above. First, income elasticities are a function of the technology gap: the higher the technology gap, the higher will be the income elasticity of the demand for imports and the lower the income elasticity of the demand for exports of the periphery. This relation is based on the role played by technological asymmetries in leads and lags in innovation and learning—and therefore in international competitiveness. The technology gap defines the ability of the country to enter the most dynamic markets and rapidly respond to changes in the competitive environment. The second assumption is that automatic reciprocity holds. In other words, the periphery will not adopt mercantilist policies, but use all its foreign exchange to buy imports from the centre. As mentioned, the rationale for automatic reciprocity is that the periphery needs to grow at very high rates to reduce heterogeneity, i.e. to reduce the presence of a large share of its labour force in the subsistence sector.

The two previous assumptions can be formalised as follows:

$$\pi_1 = \gamma G \tag{10}$$

$$\dot{a} = \zeta\left(y_1^{\star} - y_1\right) \tag{11}$$

Equation (10) states that the income elasticity of the demand for imports of the periphery increases linearly with the technology gap, defined as the ratio between technological capabilities in the centre and the periphery, $G=(T_2/T_1)$. To keep the model simple, we assumed that the gap only affects π_1, while π_2 is exogenously given. Equation (11) embodies the principle of automatic reciprocity: when effective growth is lower than the rate of growth consistent with current account equilibrium, then autonomous expenditure in the periphery will be raised.[13] Various forces contribute to such an outcome. The availability of foreign exchange may stimulate the animal spirits of investors and raise the confidence of consumers. This increase in the animal spirit and confidence may be related to favourable expectations in which external crises are not on the horizon and the economy is on a stable path. Investment will be encouraged as concerns with possible speculative attacks on the domestic currency or with bottlenecks in the supply of complementary imported capital goods are set aside by a situation of external equilibrium. In addition, the alleviation of the external constraint will stimulate the government to pursue a more active fiscal policy aimed at reducing unemployment and underemployment. Note, in addition, that the policy rule implied by equation (11) is not 'populist' (in the sense of being unsustainable), since government expenditures just complement the opportunities for growth consistent with the external equilibrium.

We also need an equation for the evolution of the technology gap, which drives competitiveness. The simplest one is the linear catching up model proposed by Fagerberg (1988, 1994). In this model, the higher the technology gap, the higher the rate at which the periphery will catch up. The rationale for this is that the technological distance between two countries is a measure of the existing opportunities for imitation by the laggard

[13] Note that equation (11) is a long run relationship: it produces the rate of growth of autonomous expenditure that adjusts to a changing productive structure, as opposed to short term fluctuations around a constant productive structure.

country. As catching up proceeds and the technology gap is closed, then learning opportunities recede and the accumulation of capabilities in the periphery loses momentum.[14] Formally:

$$\hat{G} = u - vG \tag{12}$$

Where $\hat{G}$ is the rate of growth of the technology gap G, u is the exogenous rate of technical change in country 2 (centre) and v is the learning parameter of the periphery, which depends on its efforts for adapting and improving foreign technology.

It is easy to see that equations (11) and (12) form a dynamic system in which the technology gap and the growth of autonomous expenditure are endogenously determined. To solve the system we have to rewrite equation (11) as a function of G and a_1. Using equation (6) in (5):

$$y_1 = \alpha_1 a_1 + \beta_1 \pi_2 (\alpha_2 a_2 + \beta_2 \pi_1 y_1) \tag{13}$$

And using equation (10) in (13), after some algebraic manipulation, we get:

$$y_1 = \frac{\alpha_1 a_1 + \beta_1 \pi_2 \alpha_2 a_2}{1 - \beta_1 \beta_2 \gamma G \pi_2} \tag{14}$$

This is the effective rate of growth of country 1. But it has to be compatible with equilibrium in current account. The latter can be found using equations (6) and (10) in (9):

$$y_1^\star = \left(\frac{\pi_2}{\gamma G}\right)(\alpha_2 a_2 + \beta_2 \gamma G y_1^\star) = \left(\frac{\pi_2}{\gamma G}\right)\left(\frac{\alpha_2 a_2}{1 - \pi_2 \beta_2}\right) \tag{15}$$

Finally, using equations (14) and (15) we can rewrite the differential equation (11) as follows:

$$\dot{a}_1 = \zeta \left[\left(\frac{\pi_2}{\gamma G}\right)\left(\frac{\alpha_2 a_2}{1 - \pi_2 \beta_2}\right) - \frac{\alpha_1 a_1 + \beta_1 \pi_2 \alpha_2 a_2}{1 - \beta_1 \beta_2 \gamma G \pi_2} \right] \tag{16}$$

Figure 3 presents the phase diagram of the system of differential equations formed by equations (12) and (16). It can be seen that the system is stable (see the mathematical appendix).

As an exercise in comparative dynamics, we study the effects of an increase in the periphery effort for catching up with the centre, represented by a rise in the learning parameter v from v_1 to v_2. For simplicity we will assume that this increase does not depend on autonomous expenditure, or that it requires a negligible rise in this expenditure (and hence a_1 can be considered constant at the initial moment). Such an increase reduces the gap from $G1$ to $G2$, taking the economy away from its initial equilibrium in A. The fall in the gap fosters international competitiveness, which in turn opens more room for the growth of autonomous expenditure in the periphery (a higher a_1), leading to a new equilibrium in B. Since now both exports and autonomous expenditure grow at higher

[14] For more detailed discussion see Narula (2004). Verspagen (1993) and León-Ledesma (2002) discuss this topic within BOP-constrained growth models, while Pugno (1996) considers the influence on technological innovation of changes in real wages. Verspagen and Narula convincingly argue that the relationship between the rate of growth of the technology gap and its level is non-linear. Still, we keep the linear specification for simplicity, as it does not compromise the main results of the model and allows us to focus on the link between growth, aggregate demand and specialisation.

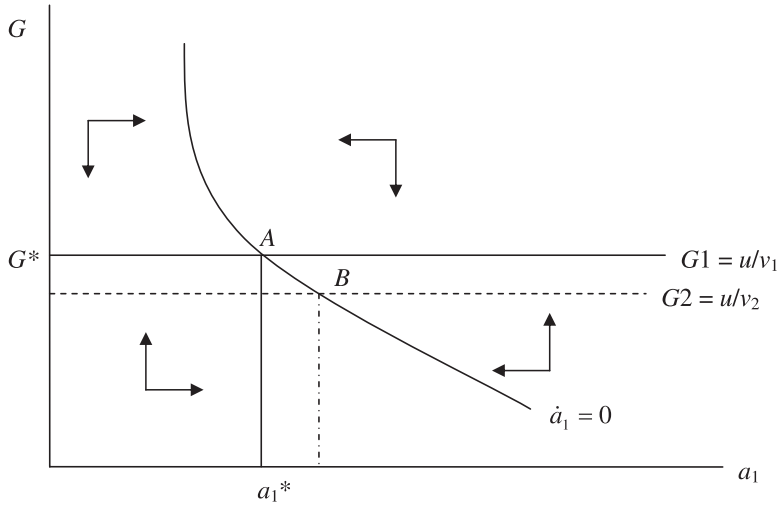

Fig. 3. *Industrial policy in the periphery.*

rates in point B, there will be a higher rate of growth in the periphery as well. The inverse relationship that exists between the gap and fiscal policy can be understood in terms of new opportunities to expand domestic absorption when the external constraint has been shifted away by higher technological competitiveness.[15]

In equilibrium $\hat{G}=\dot{a}_1=0$ and hence:

$$G^{\star} = \left(\frac{u}{v}\right) \tag{17}$$

$$a_1^{\star} = \frac{\pi_2\alpha_2 a_2[1-\beta_1\gamma(u/v)]}{\alpha_1\gamma(u/v)(1-\beta_2\pi_2)} \tag{18}$$

With the equilibrium values of G and a_1 we can find the rates of growth of country 1 and country 2. We first use the result $G^{\star}=(u/v)$ in equation (17) to obtain $y^{\star}_1$:

$$y_1^{\star} = \frac{\pi_2\alpha_2 a_2}{\gamma(u/v)(1-\beta_2\pi_2)} \tag{19}$$

To find the equilibrium growth rate of country 2 we use equation (19) in equation (9):

$$y_2^{\star} = \frac{\alpha_2 a_2}{1-\beta_2\pi_2} \tag{20}$$

There are key results that emerge from equations (19) and (20), which are worthwhile stressing.

First, the rate of growth of the periphery depends on the growth of autonomous expenditure of the centre and on its own efforts for technological catching up as compared with the innovation rate of the centre. These equilibrium values are based on the

[15] In Figure 3 we have not considered the possibility of a feedback from a higher autonomous expenditure towards the learning rate of the periphery. This possibility is discussed in section A3 of the mathematical appendix.

assumption that fiscal policy in the periphery always adjusts so as to make the BOP-constrained rate of growth binding. In the model, a_1 is an endogenous variable that always fills in the gap between effective growth and potential growth. This is what prevents an export-led policy from becoming mercantilist or a mere substitute of the expansion of domestic demand. In our model, the role of exports (and structural change) is to open up space for a steady rise in domestic demand. They are complementary in the sense that the competitiveness and expenditure policies should go hand in hand and their positive effect on global growth would only occur when they are combined.

Second, the rate of growth of the centre solely depends on its own autonomous expenditure. This is a crucial asymmetry between the two poles of the system. To the extent that the periphery offers automatic reciprocity, the centre will not suffer from the BOP constraint. If the centre grows at higher rates and imports more from the periphery, the latter will guarantee an equivalent demand for centre exports that inhibits the appearance of external disequilibrium. In this specific sense, the centre can choose its rate of growth according to its domestic objectives—for instance, full employment or a certain inflation target—while the periphery depends on the rate of growth of the centre.[16] The centre is policy-constrained or supply side-constrained (if it has already reached a situation of full employment), while the periphery is BOP-constrained (growth depends on the evolution of its capacity to import). At variance with the centre, autonomous expenditure in the periphery must lie within the boundaries defined by technology and competitiveness. Therefore, industrial policy and conventional macroeconomic policies should be regarded in the periphery as two-sides of the same equation, none of which could work in isolation.

Third, a reduction of the technology gap produces higher growth in the periphery without affecting growth in the centre. This means that active industrial policies in the periphery may contribute both to increase global growth and improve income distribution across countries. In effect, the relative rate of growth of the periphery in equilibrium is given by:

$$\frac{y^{\star}_1}{y^{\star}_2} = \frac{\pi_2}{\gamma(u/v)} \tag{21}$$

It is easy to see that a lower technology gap increases the periphery relative growth rate and reduces unequal growth.[17] At the same time, equation (20) shows that this result is attained by increasing $y^{\star}_1$, while $y^{\star}_2$ remains constant.

Last but not least, it is not an automatic result of the model that a lower technology gap will lead to a reduction in labour heterogeneity and underemployment in the periphery. This would only be true if the increase in the rate of growth of the demand for labour (brought about by the increase in the rate of economic growth) exceeds that of labour supply. The latter will equal the rate of growth of population plus labour productivity. In equilibrium, both rates are exogenous, since labour productivity will grow at the same rate as technological progress in the centre. Only when labour demand exceeds supply will there be a contraction of the subsistence sector through time and the reallocation of workers from low-productivity sectors towards those with higher productivity.[18]

[16] This is consistent with Prebisch's suggestion that growth in the periphery is a reflection of growth in the centre.

[17] To overcome unequal growth it would be necessary that $\gamma u/v \leq \pi_2$. Still, since in a centre-periphery system the technology gap (u/v) is higher than one, it is unlikely that this condition could be attained.

[18] Formally, it is necessary that in equilibrium $y^{\star}_1 > l + x$ (where l is the rate of population growth and x the rate of technical progress in the centre) for having a reduction of the subsistence sector in equilibrium.

The international political economy that emerges from the two-country model does comply with structuralist views as regards the possibility of a positive-sum game in the international economy. The centre should stimulate the periphery exports, as this would not compromise its own growth objectives. And the periphery, in turn, should combine fiscal and industrial policies in order to keep the rule of automatic reciprocity working. However, there are major barriers that make a move in this direction a very complex and difficult process.

On the one hand, centre and periphery are not homogeneous blocks. Some centre countries will be BOP-constrained, even if this constraint is not binding for the aggregate, and they will tend to adopt restrictive policies to check imbalances. In the periphery, in turn, some countries will be supply-side or policy-constrained and fail to speed up growth, even if the growth rate of exports allows them to do so. The case of the oil-exporting countries after the 1973 oil shock is an example of this. These countries accumulated large trade surpluses that fed international lending and financial speculation rather than growth in the second half of the 1970s. The accumulated disequilibria were at the basis of the subsequent debt crisis of the periphery in the 1980s. In recent years, China has accumulated large surpluses in current account in spite of its very high rates of economic growth. Such surpluses have been a source of tension with other regions, particularly with the USA. Last, but not least, automatic reciprocity implies a focus on growth, which is not always the case in developing countries. In Latin America policy-makers have emphasised the control of inflation and the accumulation of reserves to manage inflationary expectations, which in many cases have run against automatic reciprocity. Moreover, concerns with industrialisation and industrial policy receded in this region after the 1990s, while a focus on static comparative advantages prevailed (French-Davis, 1999; Stalling and Peres, 2000)

On the other hand, in an interdependent global economy, structural change in the periphery means structural change by force in the centre. This implies that some sectors in the centre should grow while others lose ground, with very different impacts across sectors, regions and the labour market. Although the political costs of specialising along intra-industry lines are in general lower than the costs of inter-industry specialisation, tensions and conflict are inevitable in the adjustment process. There are several examples of protectionist policies in the centre whose rationale has to do with the impact of competition upon certain industries and regions. This reinforces the importance of a point discussed above, namely the inter-relations that exist between international negotiations to foster trade and active domestic policies that facilitate structural adjustment.

Finally, integration to international trade will be critically affected by the financial architecture that will be defined in the coming years. The stability and evolution of the real exchange rate and the external debt respond to changing financial patterns. Distortions stemming from international cycles of financial liquidity and lending, manias and crashes impress major fluctuations on the BOP constraint in ways fairly independent of technology and trade. Our model assumes a constant real exchange rate in the long run, but short run and medium run oscillations in this variable impact on competitiveness, growth and unemployment, placing more pressure and uncertainty on international trade.

4. Concluding remarks

The challenge of development is to transform a specialised, heterogeneous economic structure into a diversified, homogeneous one by reducing technological asymmetries

both with respect to the centre and within the periphery structure itself. This requires diffusing technological progress so as to incorporate new sectors and reduce intersectoral disparities, raising productivity levels and changing the pattern of specialisation. As the external constraint is overcome, faster growth will allow for a decline in unemployment and underemployment in the subsistence sector. Based on technological learning, openness and growth will be related to an improving income distribution.

Trade can be a valuable handmaiden in the process of structural change. This handmaiden will be 'in distress' in a world of rising protectionism. But it will also be in distress in a world in which the asymmetries between centre and periphery are not taken into consideration. There exists a kind of paradox, in which a too specialised productive structure reduces the potential for trade. To understand why, it is necessary to recall that intra-industry specialisation requires countries with similar, advanced technological capabilities. A high specialisation along inter-industry lines with little accumulation of knowledge hampers the ability of the country to specialise along intra-industry lines, while the diversification of the productive structure towards more technology-intensive goods enhances it.

As the Keynesian literature correctly points out, the many variables affecting growth should be studied through their effects on effective demand. Structural change only brings about growth if it boosts effective demand. In the model developed in this paper, implicit reciprocity ensures that fiscal policy in the periphery is managed with a view to filling in any gap between actual growth and the BOP-constrained growth.

From this perspective, there is no contradiction between export growth and the expansion of the domestic market. A sustained increase in domestic autonomous expenditure could not be achieved unless higher competitiveness eased the external constraint. And, in turn, demand management prevents industrial policy from becoming just a mercantilist, beggar-your-neighbour strategy. The role of industrial policy is to reduce the technology gap, increase international competitiveness and allow for an expansion of exports from the periphery in global markets, thereby alleviating the external constraint on growth.

The model suggests that a Keynes plus Schumpeter policy mix contains the ingredients required for both catching up and a positive-sum game in the international system. This approach sharply contrasts with the combination of orthodox monetary and fiscal policies plus a static Ricardian approach to trade, which has been so frequent in Latin America since the 1990s.

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Mathematical appendix

A1 The MT model

The model is suggested by McCombie and Thirlwall (1994, ch. 7). The basic initial equation for country 1 (where $i = 1,2$) is:

$$Y_i = C_i + I_i + Z_i - X_i + M_i\left(EP_j/P_i\right) \tag{A1}$$

Each expenditure item has an autonomous and an induced component:

$$C_i = \bar{C}_i + \delta(Y_i - T_i) \tag{A2}$$

$$T_i = \tau Y_i \tag{A3}$$

$$I_i = \bar{I}_i + \theta Y_i \tag{A4}$$

$$Z_i = \bar{Z}_i + \zeta Y_i \tag{A5}$$

Collecting terms:

$$A_i = \bar{C}_i + \bar{I}_i + \bar{Z} \tag{A6}$$

$$B_i = (\delta(1 - \tau) + \theta + \zeta) Y_i \tag{A7}$$

Using (A2)–(A5) in (A1) and then log-differentiating the result with respect to time:

$$y_i = \omega_{Ai} a_i + \omega_{Bi} b_i + \omega_{Xi} x - \omega_{Mi} m_i \tag{A8}$$

Small letters are proportional rates of growth and Greek letters represent the share in total expenditure of each component of demand (vg, ω_{Ai} is the share of autonomous demand in total expenditure). We assumed that purchasing power parity and hence $((p_j - e - p_i = 0)) = 0$. Recalling that the rate of growth of induced expenditure equals the rate of growth of GDP, then $a_i = y_i$:

$$y_i = \alpha_i a_i + \beta_i \pi_j y_j \tag{A9}$$

In equation (A9) we have $\alpha_i = \frac{\omega_{Ai}}{(1 - \omega_{Bi} + \omega_{Mi}\pi_i)}$ and $\beta_i = \frac{\omega_{Xi}}{(1 - \omega_{Bi} + \omega_{Mi}\pi_i)}$.

A2 Equilibrium and stability in the model with technical change

The system of differential equations is the following:

$$\hat{G} = u - vG \tag{A10}$$

$$\dot{a}_1 = \zeta \left[\left(\frac{\pi_2}{\gamma G} \right) \left(\frac{\alpha_2 a_2}{1 - \pi_2 \beta_2} \right) - \frac{\alpha_1 a_1 + \beta_1 \pi_2 \alpha_2 a_2}{1 - \beta_1 \beta_2 \gamma G \pi_2} \right] \tag{A11}$$

The Jacobian matrix is:

$$\mathrm{J} = \begin{bmatrix} -v & 0 \\ \frac{\zeta \partial(\dot{a}_1)}{\partial G} & -\zeta \frac{\alpha_1}{1 - \beta_1 \beta_2 \pi_2 \gamma G} \end{bmatrix} \tag{A12}$$

Since the trace of the Jacobian (A12) is negative ($-v - \zeta \frac{\alpha_1}{1 - \beta_1 \beta_2 \pi_2 \gamma G} < 0$) and the determinant is positive ($v\zeta \frac{\alpha_1}{1 - \beta_1 \beta_2 \pi_2 \gamma G} > 0$), it is straightforward that the system is stable.

A3 The case of autonomous investment in R&D

So far we have assumed that there is no impact of autonomous expenditure (a_1) on the rate of learning. Still, it is reasonable to consider that at least fraction of this expenditure goes to strengthen learning activities and institutions—such as R&D, education, technological infrastructure and scientific centres. Therefore, a higher rate of growth of autonomous expenditure in the periphery should be associated with a faster diffusion of technology and a reduction of the technology gap. Formally:

$$\hat{G} = g(G, a_1),\ g_G < 0, g_a < 0 \tag{A13}$$

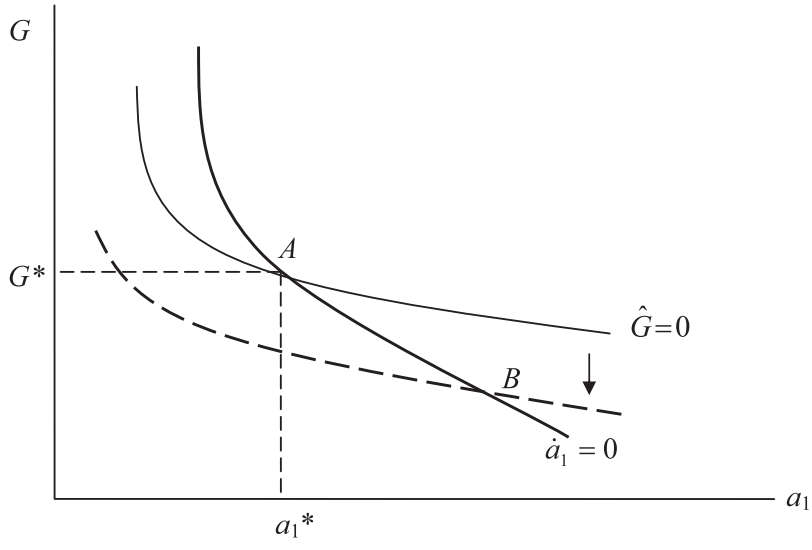

Fig. A1. *The case of a higher share of investment in learning in total autonomous investment.*

Equations (A11) and (A13) form a system of differential equations whose Jacobian is given by:

$$\begin{bmatrix} g_G & g_a \\ \frac{\zeta\partial(\dot{a}_1)}{\partial G} & -\zeta\frac{\alpha_1}{1-\beta_1\beta_2\pi_2\gamma G} \end{bmatrix} \tag{A14}$$

Where the trace is $g_G - \zeta\frac{\alpha_1}{1-\beta_1\beta_2\pi_2\gamma G} < 0$ and the determinant is $-g_G\zeta\frac{\alpha_1}{1-\beta_1\beta_2\pi_2\gamma G} - \frac{\zeta\partial(\dot{a}_1)}{\partial G}g_a$. Since g_G, g_a, $g_G, g_a, \frac{\zeta\partial(\dot{a}_1)}{\partial G}$ are all negative, for having a locally stable equilibrium it is necessary that:

$$-g_G\zeta\frac{\alpha_1}{1-\beta_1\beta_2\pi_2\gamma G} > \frac{\zeta\partial(\dot{a}_1)}{\partial G}g_a. \tag{A15}$$

It should be observed that g_a can be affected by the government, for instance, by raising the share of investment in education in total autonomous fiscal expenditure. This is represented in Figure A1. The iscocline $\hat{G}=0$ will shift to the right producing a new equilibrium with a lower technology gap and higher rates of growth (from point A to point B; we assume that the stability condition in A15 is satisfied). In other words, the government may reduce the gap and foster growth by changing the use of its autonomous expenditure. On the other hand, if spending in education and R&D becomes too dependent on changes in a_1, there will be a higher potential for instability (as emerges from A15). This suggests that a policy setting a high and stable fixed amount of investment in learning activities would be preferable to a policy that solely allocates this investment in terms of a constant fraction of total autonomous expenditure.