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Patterns of Growth in Structuralist Models: The Role of Political Economy

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PATTERNS OF GROWTH IN STRUCTURALIST MODELS: THE ROLE OF POLITICAL ECONOMY

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This paper presents a set of growth and distribution models in developing countries which reflect distinct political economy regimes. These regimes give rise to different institutional frameworks that affect macroeconomic outcomes. We focus on three cases: (1) a pure developmentalist state, (2) conflicting claims between workers and the government, and (3) financialization under a neoliberal coalition. The equilibrium growth rate is defined, following the Keynesian tradition in open economy growth model, by the Balance-of-Payments constraint (Thirlwall, 1979). The paper relies on cumulative causation à la Kaldor in periods in which the depreciation of the real exchange rate raises temporarily the BOP-constrained equilibrium rate of growth. The transition between one equilibrium level of the RER to another allows (under certain conditions) for a process of learning that transforms the income elasticity of exports and hence the BOP-constrained rate of growth in the long run. The model produces a variety of outcomes that help explain the contradictory results reported in the empirical literature associated with different constellations of power and institutions.

Keywords: Structural Change, Growth models, Structuralist models, BOP-constrained growth.

JEL: O33, O40, O41

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1. Introduction

Structuralist models take into account the role that different institutional settings, power relations and productive structures play in shaping economic outcomes[4]. This paper presents a model in which the interactions between structures, power and institutions result in the emergence of different patterns of growth and income distribution in peripheral economies. The structural dimension is captured by the country's pattern of international specialization, expressed in the income elasticity of exports and imports. The institutional dimension is captured by what Nelson and Sampat (2001) call "social technologies" which represent (implicit or explicit) forms of coordination widely accepted by and incorporated to the behaviour of public and private socioeconomic actors. Our focus is on institutions governing technical change and the behaviour of the real exchange rate (RER)[5]. For simplicity, we will refer to them as "industrial policy"[6] and "exchange rate policy", although they involve more than policy decisions by governments, to encompass complex interactions among workers, capitalists and governments.

The key mechanism that relates policies to structures is learning by doing. Under certain conditions (discussed in the paper), the depreciation of the RER stimulates economic growth and investment, leading to the accumulation of knowledge, which in turn redefines the income elasticity of exports. The model thus entails a process of "deep path-dependence" as defined by Setterfield and Cornwall (2002), in the sense that its parameters change as the economy moves towards its long-run equilibrium, after a shock produced by the depreciation of the RER.

The modelling strategy combines a Neo-Kaleckian approach to investment and income distribution with a Balance-of-Payments (BOP) constraint on growth[7]. We assume a centre-periphery system, in which the centre is the technological leader and the periphery is specialized in sectors with lower income-elasticity of exports than the centre. The challenge of the periphery is to transform its pattern of specialization using the exchange rate and industrial policies. The paper presents three scenarios for the periphery that we consider representative of different combinations of these policies, which in turn reflect different power relations among three actors (government, capitalists and workers). Each scenario is a stylized representation of growth patterns effectively observed in different countries or even in the same country at different points in time.

The first scenario is the "developmentalist state" (presented in section 3) in which the government aims at a competitive exchange rate while implementing a strong industrial policy to foster learning and structural change. The policy focus is on international competitiveness, and

[4] See Taylor (2004, p.3).

[5] The RER is defined as $RER = (P^*E/P)$), where P^* are foreign prices, E the nominal exchange rate (defined as the price of the foreign currency in units of the domestic currency) and P represents domestic prices.

[6] It is important to mention that industrial policy is observed in terms of its institutional effects (Chang, 1994).

[7] The model is inspired by Dutt (2002), but suggests rather different closure equations.

there is in power an "industrialist coalition" whose objective is to maximize the investment rate and close the technology gap with the technological leaders.

The second is the "heterogeneous preferences" scenario (section 4) in which there are contending forces over the RER which reflect the different objectives of governments, capitalists and workers. The RER endogenously responds to political conflict among domestic actors, probably in association with the alternation of power between centre-right and centre-left political coalitions in democracy. Various potential outcomes from this scenario may arise, and their implications for growth and distribution analysed.

The last scenario (section 5) is called "financialization". The RER fluctuates out of the interaction between a government that uses monetary policy to control inflation, and international capital flows that arbitrate between the rates of return on assets denominated in different currencies. This scenario corresponds to a model in which there is a "neoliberal coalition" in power that focuses on curbing inflation while keeping the capital account fully open. The openness of the capital account implies that capitalists and workers have little direct influence over the RER, which is driven by shocks in international financial markets.

Two caveats are necessary. First, in all cases we assume that technical change affects both productivity growth (and hence price competitiveness) and the pattern of specialization (reflected in the income elasticity of exports). Both effects are contemplated, but the main focus is on changes in the income elasticity of exports. Second, the institutional and political conditions are given in the model, which allows us to concentrate on the macroeconomic outcomes of each scenario.

2. RER, structural change and growth: a brief summary of the literature

2.1. Conflicting results in theory and empirical testing

The role of the RER and industrial policy is central to the current debate on growth, structural change, and income distribution in developing economies[8]. Although the debate is far from new, it was revived by Rodrik (2008), who suggests for a panel of 184 countries between 1960 and 2004 that a depreciated RER stimulates changes in the composition of output towards activities which are more dynamic from a technological standpoint. Changes in the composition of output, in turn, give rise to a higher long-run rate of growth by enhancing increasing returns. Subsequent empirical studies tend to support this view. The literature is so vast that we will review a small sample of it, which we consider representative. Rapetti et al (2012) in a panel of 181 countries for the 1950–2004 period confirm the positive association between a depreciated RER and output growth. Currency devaluation raises revenues and profit margins in the tradable

[8] For a recent review of ongoing debate on this topic see Medeiros (2020).

sector, thus increasing investment and capital accumulation, especially in developing countries. Similar results are achieved also by Marconi et al. (2016) in a sample of 63 countries between 1990 to 2011, although the effect is stronger for middle income countries. Berg et al. (2012) report that a persistent overvaluation reduces the duration of growth episodes that took place between the 1970 and 2006 in a panel of 140 countries. Frenkel and Ros (2006) confirm this story for Latin America by finding a positive association between a higher RER and a higher rate of employment growth in a panel of 17 countries during 1990-2002. Gabriel et al. (2020) in a sample of 84 countries for 1990-2011 argue that the undervaluation of the RER works better in countries which are technologically backward, because a higher RER compensates for the lack of non-price competitiveness.

Although the different authors converge on the view that an undervalued RER helps structural change, they measure such change in different ways. For Mcmillan et al. (2014), in a panel of 38 countries from 1990 to 2005 structural change is the "structural" component of the increase in labor productivity stemming from the reallocation of labor from low-productivity sectors towards sectors with higher productivity. Freund and Pierola (2012), by identifying 92 episodes of export surges in 1980-2006, focus on the diversification of exports and on the increase of the extensive margin. Cimoli et al. (2013) for 111 countries in the period 1962–2008 emphasize changes in the technological intensity of exports. Bresser-Pereira et al (2016) suggest theoretically a positive effect of depreciation on the income elasticity ratio when the RER approaches the "industrial equilibrium" exchange rate[9], a hypothesis empirically tested by Missio et al (2015) for a sample of 103 countries from 1978 to 2007 and by Nassif et al (2015), with data for Brazil from 1980 to 2010.

However, there are several contributions that challenge the results showing a positive association between RER, structural change and growth, both at the theoretical and empirical level. From a theoretical standpoint, Diaz-Alejandro (1986) and Krugman and Taylor (1978) are pioneer works expressing RER pessimism. Blecker (1989) shows that the final effect of depreciation on aggregate demand depends on the factor that causes such depreciation. It is more likely that depreciation will be expansive when the origin is a reduction of the mark-up of the firms, while it is more likely to be recessive when it comes from a rise in wages or in the nominal exchange rate. A fall in the firms' mark-up improves at the same time international competitiveness and income distribution, and both effects are positive for aggregate demand. A rise in the wage share, on the other hand, improves income distribution but lowers international competitiveness. Ribeiro et al (2016, 2017) observe that an increase in RER triggers inflationary pressures by raising the prices of imported capital goods and reducing real wages, with a negative

[9] The industrial equilibrium RER, as defined by Bresser-Pereira (2014), is the one that allows industrial firms that are using state-of-the art technology to be competitive in the international market.

effect on consumption and investment. In the empirical works discussed above, the positive effects of RER depreciations prevail over the negative ones[10].

Nucci and Pozzolo (2001), using data from a panel of 1000 firms from Italy in the period 1995-1985, show that exchange rate depreciation has a positive effect on investment through higher expected revenues, but a negative effect through higher costs. They argue that the final effect would depend on the relevance of imported input in the firms' balance sheet, as well as the degree of monopoly they command. Caglayan and Demir (2019) in a sample of 172 countries during 1962–2012 find evidence that the RER affects positively the expansion of low- or medium-skill manufactures, while skill-intensive manufactures are less responsive. A similar conclusion is suggested by Agosin et al (2012) in a dataset of 79 countries covering the period 1962–2000, who find that export diversification does not improve following a RER depreciation. Ribeiro et al. (2020) in a panel of 54 developing economies for the period 1990–2010 find that, once functional income distribution and the relative level of technological capabilities are explicitly considered, the direct impact of RER misalignments on the growth performance of developing countries becomes statistically insignificant. Finally, Ibarra and Blecker (2016), in their estimate of the BOP-constrained rate of growth of Mexico for 1960–2012, conclude that the impact of the RER on exports is positive but weak due to the high share of imported intermediate inputs in the total cost of Mexican exporters[11].

In recent years, the dynamic of the RER in developing economies has been shaped by financial factors, mainly in form of currency volatility and rising external debt of the non-financial sector. Procyclical capital inflows are behind volatility, triggered by the boom in commodity prices and by rising interest rates. In turn, the increase in debt of non-financial firms reflects the move of local exporting firms to financial intermediation, to explore opportunities from carry trade returns and fiscal avoidance. RER volatility negatively affects both export volumes and diversification, as put forward by Agosin et al (2012) and by Vieira and MacDonald (2016) for a set of 106 countries for 2000-2011. Additionally, Vieira et al. (2013), using a sample of 82 countries ranging from 1970 to 2009, find a negative relationship with long-run run growth. There is also evidence that the relationship between some key variables linking the RER to growth is nonlinear — for instance, between profit margins and RER, as stressed by Marconi et al. (2020) for Brazil between 1996 and 2017.

In an appendix at the end of the paper we present a summary of the main findings of the literature we reviewed in this section, as well as of the transmission mechanisms through which

[10] The increase in internal funding and capital accumulation is the main mechanism linking RER and growth in heterodox models along Kaleckian lines. Other heterodox works focus of changes in the composition of output (see Araujo and Lima, 2007, Cimoli and Porcile, 2008, and Araujo 2013). More orthodox approaches suggest that currency devaluation corrects market and institutional failures and thus works as a second-best policy for promoting structural change.

[11] Similar results are reported for developed economies. Storm and Naastepad (2015) argue that the importance of non-price competitiveness is much higher than that of price competitiveness in explaining the German export success, contrary to the widely held perception that wage compression played a larger role.

the RER operates as stated in these works. The main takeaway is that a depreciated RER may play a role in encouraging growth and structural change, but this association is highly dependent on how it interacts with technical change. Additionally, the instability of the RER generated by financial factors appears to be a serious obstacle to growth. The next sections present a model that suggests an explanation for these apparently contradictory empirical results in terms of outcomes from different institutional scenarios.

2.2. RER and growth in the BOP-constrained growth model

We will assume that the reader is already familiarized with BOP-constrained growth model, a comprehensive review of which can be found in Blecker and Setterfield (2019, chapters 9-10). Formally, the BOP-constrained growth rate in equilibrium is given by the following equation:

$$y = \frac{\varepsilon}{\pi} y^* + \frac{\gamma}{\pi} \dot{q}$$

Where ε is the income elasticity of exports, π the income elasticity of imports, y^* is the exogenous rate of growth of the centre, $\gamma \equiv 1 - \mu_x + \mu_m > 0, \mu_x \equiv \partial \ln(X) / \partial q > 0$ is the price elasticity of exports, $\mu_m \equiv \partial \ln(M) / \partial q < 0$ is the price elasticity of imports, γ is assumed to be positive (the Marshall-Lerner condition holds) and q is the natural logarithm of the RER, $q = ln(P^* E / P)$), where P^* and P are foreign and domestic prices, respectively, and E is the nominal exchange rate, defined as units of the domestic currency per unit of foreign currency. The ratio of the income elasticity of demand of exports and imports, ε/π, is a function of the pattern of specialization: countries specialized in goods with higher technological intensity tend to show a higher income elasticity ratio.

From that equation, it is straightforward that the RER can only affect economic growth when it is changing (i.e., when $\dot{q} \neq 0$). However, in the long run the RER should be stable, and hence $\dot{q} = 0$. When his happens, economic growth will only depend on the income elasticity of exports, the income elasticity of imports, and the rate of growth of the rest of the world (Thirlwall, 1979). The RER only matters for growth in the transitional dynamics from one equilibrium position to another.

The previous review of the literature, however, suggests that the RER may affect the composition of production. By changing price competitiveness, the RER may change the pattern of specialization and hence the income elasticity ratio[12]. In the following sections we will explore a mechanism relating the RER to the income elasticity of exports. We will keep the original tenet of Thirlwall's Law in which, when the RER is in equilibrium, it cannot affect the long-run rate of economic growth. However, if the income elasticity of exports and / or imports changes during

[12] This is the mechanism suggested in Cimoli and Porcile (2014), Marconi et al. (2016), and Porcile and Spinola (2018). As it happens with the empirical results, there is no consensus in the theoretical literature about the relation between depreciation, growth and structural change. See Dvoskin et al. (2020) for a theoretical critique of the potential benefits of depreciation on structural change.

the transition from one equilibrium value of the RER to the other, then the BOP-constrained rate of growth will be a function of the previous trajectory of the RER. The new long-run BOP-constrained rate of growth will not be the same as it was before the transition[13].

What are the forces at work explaining the rise / fall of the income elasticity ratio during the transition? The most obvious suspect—well established in the literature[14]—is Kaldorian cumulative causation. While the RER is increasing (depreciating) there is an acceleration of growth because the external constraint is being eased (assuming the Marshall-Lerner condition holds). Faster growth leads to learning by doing —the accumulation of knowledge associated with experience in production[15]. Higher investments and increasing returns enhance the quality and technological intensity of the goods produced. A similar story is told by technology-gap models: learning by doing stemming from economic growth reduces the technology gap of the laggard economy with respect to the advanced economy, thereby changing the pattern of specialization and the income elasticity ratio (Verspagen, 1993; Porcile and Spinola, 2018).

Cumulative processes, however, are not manna from heaven. The intensity of learning depends on the firms' investments in technology and the institutional environment which boosts or hinders technical change. Evolutionary economists convincingly argue that policies and institutions for innovation and diffusion of technology (which we simply label here as "industrial policy") are extremely important for defining the rate of technical change in the economy[16]. *Paths of cumulative learning will vary across countries as a result of different industrial policies.* Depreciation will be growth-enhancing only when it goes hand in hand with industrial policy. The idea of a cumulative process at work in growth acceleration is consistent with the finding of Rodrik (2008, p.387), who shows evidence suggesting that "*the growth spurt takes place after a decade of steady increase in UNDERVAL* [the index of undervaluation of the domestic currency] *and immediately after the index reaches its peak value*".

The next sections present different models of path-dependency in technology and growth. We take on board the definition of the medium run by Ribeiro et al (2016) as a period in which there is equilibrium in the trade balance, but the RER changes due to different rates of growth in prices, wages, the monopoly power of firms (mark-up) and / or the exchange rate policy of the government. In the long run the RER attains its equilibrium value and remains stable. The central theme of the in analysis is (a) what forces drive the RER from one equilibrium to the other; (b) how industrial policy shape the intensity of technical change during the transition. We identify different patterns of transition based on different combinations of industrial and RER policies (different institutions shaped by different power coalitions), namely the developmentalist state, conflict claims and financialization.

[13] A similar type of model (result) is found in Setterfield & Ozcelik (2018).
[14] See Setterfield (2002) and Boggio and Barbieri (2017).
[15] Verdoorn (2002). See also Setterfield (2011).
[16] Cimoli et al (2010); Lee (2013); Lundvall (2016).

3. The developmentalist state

The first scenario to be addressed is one in which a developmentalist state in the periphery applies capital controls, sets a target for the RER based exclusively on objectives of international competitiveness, and deploys the arsenal of industrial policy to encourage structural transformation.

3.1. Basic equations

The economy produces a composite good that can be sold in the domestic market or exported. Firms have some degree of monopoly power and set prices in accordance with the following equation:

(1) $P = zaW$

In equation (1), $z > 1$ is the markup factor, a labor per unit of production (L/Y) and W are nominal wages. The profit share in GDP is $\sigma = 1 - WL/PY$. Using this equation in equation (1) gives:

(2) $\sigma = \frac{z-1}{z}$

Log-differentiating (1) with respect to time gives the inflation rate:

(3) $\hat{P} = \hat{z} + \hat{a} + \widehat{W}$

Recall that q is defined as:

(4) $q = ln\left(\frac{P^*E}{P}\right)$

Assume that prices are set in the foreign country (the centre) as in the home country (the periphery) following the mark-up rule, hence: $\widehat{P^*} = \widehat{z^*} + \widehat{a^*} + \widehat{W^*}$. It is straightforward forward that:

(5) $\dot{q} = \hat{E} + (\widehat{z^*} - \hat{z}) + (\widehat{a^*} - \hat{a}) + \left(\widehat{W^*} - \widehat{W}\right)$

The equilibrium growth rate is given in the medium-run by the BOP-constrained growth rate (in the long-run $\dot{q} = 0$):

(6) $y = \frac{\varepsilon}{\pi}\, y^* + \frac{\gamma}{\pi}\dot{q}$

Using equation (5) in (6) gives:

(7) $y = \frac{\varepsilon}{\pi} y^* + \frac{\gamma}{\pi}\left[\hat{E} + (\widehat{z^*} - \hat{z}) + (\widehat{a^*} - \hat{a}) + \left(\widehat{W^*} - \widehat{W}\right)\right]$

Assume now that the mark-up factor is constant both in centre and periphery and hence $\hat{z} = \widehat{z^*} = 0$. In addition, assume that $-\hat{a} = \widehat{W}$ and $-\widehat{a^*} = \widehat{W^*}$, i.e. wages, as in the time of the

developmentalist state (until the 1970's) succeed in catching up with labour productivity in centre and periphery. These assumptions imply:

(8) $\dot{q} = \hat{E}$

As mentioned, the government manages the nominal exchange rate, which implies that there are barriers to short-term capital flows in the home economy (i.e. the periphery imposes capital controls). The government is in the hands of a South Korean type of developmentalist state (see Rajan, 2010; see also Frieden 2015, chapter 7), in which there is target for the RER (q_D) whose main objective is to enhance international competitiveness. Formally:

(9) $\dot{q} = \vartheta(q_D - q)$

Using (9) in (6) gives the BOP-constrained growth rate as a function of the exchange rate policy:

(10) $$y = \frac{\varepsilon}{\pi} y^* + \frac{\gamma}{\pi} [\vartheta(q_D - q)]$$

In the medium run, the economy grows above its previous equilibrium growth rate as a result of gains in price competitiveness, stemming from the depreciation of the currency. The second term of the right-hand-side is the acceleration of growth. In the long run the government attains the desired RER and hence $q = q_D$, $y^D = (\varepsilon/\pi)y^*$ and the acceleration of growth is zero. However, as mentioned, the transition towards the new RER[17] changes ε. The increase in the rate of growth boosts learning by doing. Knowledge accumulates along with the stock of capital. The production structure is transformed as technical change raises non-price competitiveness[18]. The simplest assumption is that the rise in the income elasticity of exports is a positive linear function of the acceleration of growth during the transition from q to q_D:

(11) $$\dot{\varepsilon} = \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}\dot{q} = \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}\vartheta(q_D - q).$$

The parameter α translates the impact of knowledge accumulation on structural change, while the parameter β represents the inertial forces embedded in existing capabilities and production routines. From a policy perspective, industrial and technological policies should aim at enhancing α and reducing the friction (inertia) factor β[19].

[17] The evolution of the RER is given by $q(t) = (q_D - q_0)e^{-\vartheta t} + q_D$

[18] Learning occurs not only during the transition, but also when the RER is stable. We assume that in the long-run equilibrium the rate of learning in the foreign and home countries is the same and there is no change in the pattern of specialization. What changes the pattern of specialization is the acceleration of growth triggered by depreciation. Other economic or institutional shocks may change this pattern too, but we will keep the focus of the analysis only on shocks arising from changes in the RER.

[19] Since the two parameters are closely related, it could be argued that operationally the distinction between the two does not really matter. While this may be true in this context, this distinction would become important in section 5, when the Financialization scenario will be analyzed.

The economy traverses from an initial RER q_0 to the desired RER q_D. The income elasticity of exports is equal to ε_0 at the beginning of the transition. The increase in the income elasticity when the economy reaches its new equilibrium can be found by integrating both sides of equation (10) with respect to t. The new value of the income elasticity of exports will be $\int_{t_0}^{t_D} \dot{\varepsilon}\, dt = \varepsilon_D = \varepsilon_0 + \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}\vartheta \int_{q_0}^{q_D}(q_D - q)dq$. Therefore:

$$\varepsilon_D = \varepsilon_0 + \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}\vartheta \frac{(q_D - q_0)^2}{2} \quad (12)$$

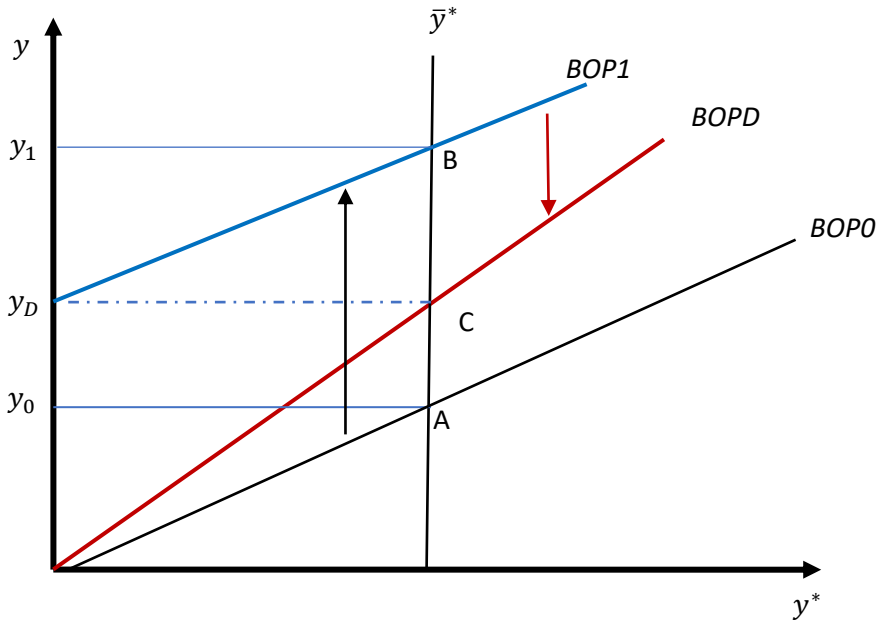
Equation (12) says that the new income elasticity of exports is a function of the distance between the two equilibrium values of the RER (q_0 and q_D), along with the technological efforts deployed by the country to take advantage of the surge in investments and increasing returns.

3.2. A graphic representation of structural change out of knowledge accumulation in the medium run

Figure 1 shows the adjustment process between two long-run equilibrium positions, always assuming that Marshall-Lerner holds. Initially the economy is at point A, which represents the BOP-constrained growth rate in equilibrium ($y_0 = (\varepsilon_0/\pi)y^*$) for a given income elasticity of exports ε_0. The RER is at its initial equilibrium value q_0. The rise in the real exchange rate (from q_0 to q_D) allows the economy to grow at a higher rate while the RER is depreciating (the BOP0 curve shifts to BOP1). The new BOP-constrained growth rate is $y_1 = \frac{1}{\pi}[(\varepsilon_0)y^* + \gamma\, \dot{q}]$ at point B. It is easy to see that the difference between BOP0 and BOP1 is that the BOP-constrained growth rate schedule no longer passes through the origin. The intercept of the B0P1 curve is $(\gamma/\pi)\dot{q} > 0$.

When the depreciation process ends, the growth-enhancing effect of depreciation would have ceased. However, the economy does not come back to BOP0 but to BOPD (the red line, new equilibrium in C). The reason is, as mentioned, that during the period of faster growth new investments and learning by doing allowed the economy to raise its income elasticity of exports. The new equilibrium features a higher RER, a higher income elasticity of exports ($\varepsilon_D > \varepsilon_0$), and a higher rate of growth in equilibrium ($y_D = (\varepsilon_D/\pi)y^* > y_0 = (\varepsilon_0/\pi)y^*$).

Figure 1. A temporary rise in economic growth with long run implications: depreciation, cumulative learning and the BOP-constrained growth rate



Key to the variables

BOP0: $y_0 = (\varepsilon_0/\pi)y^*$

BOP1: $y_1 = \frac{1}{\pi}[(\varepsilon_0)y^* + (\gamma/\pi)\dot{q}]$

BOPD: $y_D = (\varepsilon_D/\pi)y^* = \frac{1}{\pi}\left[\varepsilon_0 + \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}\vartheta\frac{(q_D - q_0)^2}{2}\right]y^*$

Figure 2a presents the phase diagram of $\dot{q}$ as a function of q and the stable equilibrium at q_D. Figure 2 b shows the evolution of ε in response to changes in q.

Figure 2. Evolution of the RER and income elasticity of exports in the developmentalist state

Figure 2a.

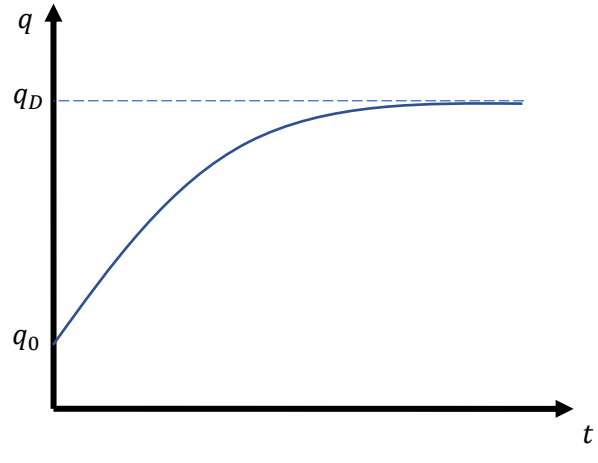
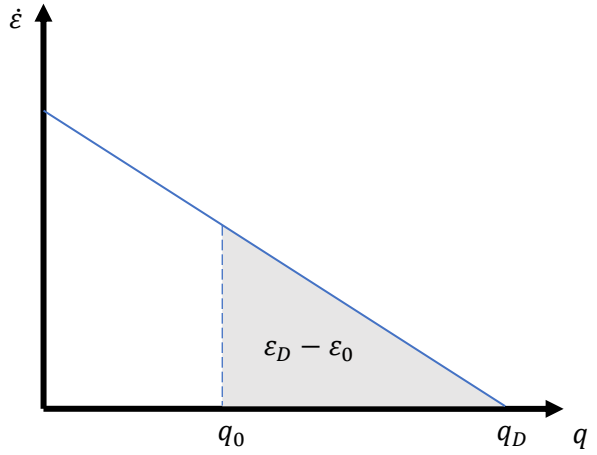


Figure 2b.



The previous analysis gives results that are consistent with the evidence reviewed in section 2. Countries that allow the RER to depreciate attain higher rates of growth and a more diversified export structures than countries that appreciate their RER. The crucial institutional condition for having this result is that the developmentalist states not only pursues a competitive RER, but also applies industrial policies to raise the parameter α and reduce β. In these economies, technical change sustains a process of catching up in income and productivity with the most advanced economies. However, the RER is a tool that has important downsides, as discussed in the next subsection.

3.3. Depreciation does not always help growth

Depreciations in certain cases can be harmful to both growth and learning. As mentioned, the RER has negative implications for income distribution and raises the price of imported capital goods. This can reduce economic growth and/or slow down technical progress. The empirical literature suggests a nonlinear relation between depreciation and growth: a moderate degree of undervaluation favours growth, but after a critical threshold undervaluation brings about the opposite result. This suggests that the accumulation of knowledge may be better described in the following terms:

$$\dot{\varepsilon} = \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}\vartheta[u(q_D - q) - v(q_D - q)^2] \quad (13)$$

Now the parameter u captures the positive effects on growth and learning produced by the depreciation; and v represents the negative effects coming from the higher cost of imported

capital goods and the worsening of income distribution. Hence, we have that $\int_{t_0}^{t_D} \dot{\varepsilon}\, dt = \varepsilon_D = \varepsilon_0 + \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}\vartheta \int_{q_0}^{q_D} \left[u\left(q_D - q\right) - v\left(q_D - q\right)^2\right] dq$. Therefore:

$$(14) \qquad \varepsilon_D = \varepsilon_0 + \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}\vartheta \left[u\frac{(q_D - q_0)^2}{2} - v\frac{(q_D - q_0)^3}{3}\right]$$

Equation (13) no longer implies that a higher q_D necessarily leads to a higher ε_D. This will happen under the additional condition (besides industrial policy) that the difference between the initial RER and the target RER should not be too high. Specifically, for having a positive impact on the income elasticity of exports, the distance between the two RERs must satisfy the following inequality: $q_D - q_0 < 3u/2v$. In economies whose production is destined mostly to the domestic market and which are highly dependent on imported capital goods, it is likely that v is high and u is low[20]. Hence, it is less likely that depreciation would help capital and knowledge accumulation. In such cases, the RER will be a rather inefficient instrument for economic development.

4. Conflicting claims and the RER

In the previous section it was assumed that the developmentalist state keeps a tight rein on the RER. This is a good approximation to the historical experience of a few Asian countries. However, in many developing economies there is resistance to depreciation. A higher RER means a lower wage share in GDP. Depreciation has redistributive consequences that elicit a response from workers' unions. In some Latin American countries (such as Argentina and Uruguay) there are strong labour unions that negotiate with the firms in a unified and structured way. This makes unviable for governments or firms to unilaterally set the RER they prefer based solely on the quest for international competitiveness. The following discussion is based on the analysis of RER dynamics when actors' preferences over the RER are heterogeneous, as set forth in Lima and Porcile (2013).

4.1. Basic equations

We consider now a model in which workers consume imported goods. The cost of the workers' consumption basket is $P^W = P^\tau (P^* E)^{1-\tau}$ where τ is the share of domestic goods. The real wage in this economy is $\omega = W/P^\tau (P^* E)^{1-\tau}$. Since $W = P/za$ and $q = ln(P^* E/P)$, then $\omega = 1/za(e^q)^{1-\tau}$. As $a = L/Y$, real workers' consumption in GDP is:

[20] this may also apply in a case where the production is export-oriented, but a) exports are highly intensive in imported intermediate goods and b) learning by doing effects are hindered by a particular institutional setting (such as Mexico's *maquila*).

(15) $(\omega L)/Y = 1/z(e^q)^{1-\tau}$.

It can be seen that there is a negative association between the real exchange rate and the workers' consumption share in GDP. If workers are organized, they will react to a real depreciation. Workers will demand higher nominal wages when the RER is high so as to sustain or increase real consumption. Formally, the increase in nominal wages will have two parts: a term that captures the increase in labour productivity ($-\hat{a}$); a term to offset the impact of the RER on the cost of the labor consumption basket:

(16) $\widehat{W} = -\hat{a} + \varsigma\left[ln\left(\frac{1}{z\left(e^{q^W}\right)^{1-\tau}}\right) - ln\left(\frac{1}{z(e^q)^{1-\tau}}\right)\right] \rightarrow \widehat{W} + \hat{a} = h(q - q^W)$, where $h \equiv \varsigma(1-\tau)$

In equation (63) q^W is the RER aimed at by the workers and ς the velocity of the adjustment to equilibrium in the labour market. Equation (16) can be rearranged as:

(17) $\widehat{W} + \hat{a} = h(q - q^W)$, where $h \equiv \varsigma(1-\tau)$

We will keep the assumption that wages in the centre grow at the same rate as productivity in the centre.

Workers are not the only actors in the game. The government uses the exchange rate policy to sustain competitiveness and avoid an external crisis. Frequently, governments are more responsive to the capitalists' demands than to workers' demands. If capitalists' actors demand a higher profit share in GDP and a higher RER to export and invest, their representatives in government and parliament will make pressure in this direction. Consider the case discussed in Lima and Porcile (2013) in which workers and the government have different preferences in terms of the RER: workers focus on the wage share, the government on competitiveness. The government will raise the rate of nominal devaluation when the RER falls below the level it considers necessary to sustain international competitiveness. Formally:

(18) $\hat{E} = j(q^G - q)$

Recall that the rate of change of the RER is $\dot{q} = \hat{E} + (\widehat{z^*} - \hat{z}) + (\widehat{a^*} - \hat{a}) + \left(\widehat{W^*} - \widehat{W}\right)$. If the mark-up is constant in centre and periphery and assuming $\left(\widehat{W^*} = -\widehat{a^*}\right)$, this expression becomes $\dot{q} = \hat{E} - \widehat{W} - \hat{a} = \hat{E} - h(q - q^W)$ (per equation 17)[21]. Using this result in (18), the rate of change of the RER will be given by:

[21] Since $P = Wza$, then the inflation rate (with a constant z) is $\hat{P} = \widehat{W} + \hat{a}$ (assuming $\hat{z} = 0$). It is straightforward that $\dot{q} = \widehat{P^*} + \hat{E} - \hat{P}$ and with $\widehat{P^*} = 0$, then $\dot{q} = \hat{E} - \widehat{W} - \hat{a}$, and using $\widehat{W} + \hat{a} = h(q - q^W)$ we obtain $\dot{q} = \hat{E} - h(q - q^W)$.

(19) $\dot{q} = j(q^G - q) - h(q - q^W)$

We will normalize $h + j = 1$. Then the differential equation (19) produces a stable equilibrium q_E when:

(20) $q_E = jq^G + (1 - j)q^W$

Note that the equilibrium in equation (20) implies that neither workers nor the government will ever be contented with the equilibrium value of the RER (unless in the very special case in which $q^G = q^W$, when there are no conflicting claims on income shares at all). It will be true that ($\hat{E} = \hat{W} + \hat{a}$) and this means that the RER is constant at q_E. Since $q^W < q^G$, the higher the bargaining power of workers (h), the lower the RER in equilibrium; the higher the concern of the government with competitiveness (j), the higher will be the RER. Indeed, it is easy to see that the developmentalist state is a special case of equation (19), in which $j = 1$ gives equation (9).

4.2. The learning path

In the conflicting claims scenario, the BOP-constrained rate of growth in equilibrium in the medium run will be:

(21) $y = \frac{\varepsilon}{\pi} y^* + \frac{\gamma}{\pi} [j(q^G - q) - (1 - j)(q - q^W)]$

As in the previous section, the rate of learning and the transformation of the production structure depend on the acceleration of growth multiplied by a factor given by the learning parameters of the economy, α and β:

(22) $\dot{\varepsilon} = \left(\frac{\alpha}{1+\beta}\right) \frac{\gamma}{\pi} \dot{q}$

Using (19) in (22) gives:

(23) $\dot{\varepsilon} = \left(\frac{\alpha}{1+\beta}\right) \frac{\gamma}{\pi} [j(q^G - q) - (1 - j)(q - q^W)]$

Integrating both sides of the equation between with respect to q allows for finding the new value of the income elasticity of exports when $q = q^E$:

(24) $\int_{t_0}^{t_E} \dot{\varepsilon} dt = \left(\frac{\alpha}{1+\beta}\right) \left(\frac{\gamma}{\pi}\right) \left[\frac{q_E^2}{2} + (j - 1)q^W q_E - jq^G q_E - \frac{q_0^2}{2} - (j - 1)q^W q_0 + jq^G q_0\right]$

If we make $j = 1$ and $q^G = q_D$, equation (24) gives the same result as equation (12).

Some interesting points emerge from equation (24). First, given α and β, the higher the value of the RER in equilibrium, the higher the new income elasticity of exports. If α and β are constant,

the road to diversification implies a fall in the wage share (even though real wages may be increasing as the economy grows at a higher rate in equilibrium).

Second, although the model does not capture the dynamics of wages and inflation behind the stable RER, these dynamics may affect investment and learning. If the equality $\hat{E} = \hat{W}$ is satisfied at very high levels of wages increases and rates of nominal devaluations, inflation will be rampant, the intensity of conflict more acute and investment will necessarily fall. Uncertainty and instability will hamper technological change and the transformation of the production structure.

Last but not least, an increase in α and a fall in β allows for having a higher wage share for any value of the long-run BOP-constrained rate of growth[22]. Industrial policy allows minor depreciations to become an effective mechanism for diversifying the export structure when the learning parameter α is high and the inertia parameter β is low. *This explains why industrial policy is so important for sustaining growth without compromising, or even improving, income distribution*.

Industrial policy is central to mollify the distributive conflict in a democratic society in which workers, capitalists and government have heterogeneous preferences over the RER. In the Latin American countries, industrial policies had been highly ineffective (or inexistent), which made it more difficult for them to arbitrate the contradiction between price competitiveness (represented by the RER) and income distribution (represented by the wage share). There was no rapid diffusion of technology (which would shift outward the external constraint on growth and employment) to reduce the intensity of the distributive conflict. On the other hand, in advanced democracies (such as those in Northern Europe, and especially in the Nordic countries), highly institutionalized negotiations over wage shares and prices are combined with incentives to innovation and diffusion of technology. As put by Andersen et al (2015):

"*In a sense it can be argued that competitiveness was enhanced by collective bargaining based on the relatively pragmatic positions of dominant trade unions and employers'*

[22] The wage share does not depend directly on α and β, as $\omega = 1/za(e^q)^{1-\tau}$. However, in the diversification equation (ε): $\dot{\varepsilon} = \left(\frac{\alpha}{1+\beta}\right)\frac{\gamma}{\pi}[j(q^G - q) - (1-j)(q - q^W)]$, a reduction in j (and rise in $1-j$) will only be consistent a fixed $\dot{\varepsilon}$ if α increases or β falls, for the same growth rate (y).

associations. It is not that conflicts and power struggles were absent, rather there (…) a basic willingness to try to develop the collective bargaining systems."

The combination of structured bargaining and industrial policy keeps international competitiveness (based on technological learning) and equality moving hand.

5. Financialization and the neoliberal coalition: slow growth and instability

The third scenario assumes that the game is between a state whose sole objective is to control inflation and an international capital market that arbitrates between assets denominated in domestic and foreign currencies. This is an economy with a fully open capital account in which the government allows the RER to fluctuate as a function of short-term capital flows and seeks to control inflation using a Taylor rule (Woodford, 2001; Taylor, 1993) for the interest rate. We call this a financialization scenario because the RER will be driven changes in the international financial markets and the government commitment to fight inflation.

5.1. Basic equations

Foreign capital will be attracted by the difference between the real interest rates in the periphery and that in the international markets. If real domestic interest rates are higher than foreign interest rates, capital inflows will appreciate the domestic currency, as expressed in the following equation (where r^f is the international real interest rate, φ an adjustment parameter and r the domestic real interest rate)[23]:

$$\dot{q} = \varphi(r^f - r) \tag{25}$$

The government of the peripheral country is mostly concerned with inflation and adopt an inflation target θ which it pursues using monetary policy. From equations (17), nominal wages will rise faster when the RER is higher than the RER aimed at by the workers. A rise in nominal wages, for a given rate of growth of productivity and a fixed mark-up, raises the inflation rate. The government will try to curb the surge in inflation by increasing r to reduce aggregate demand. The reaction curve of the policymaker can be expressed as a simple Taylor rule:

$$\dot{r} = \rho_0\left(\widehat{W} - \theta\right) - \rho_1 r = \rho_0[h(q - q^W) - \theta] - \rho_1 r \tag{26}$$

[23] We admit the relevance of considering the risk of a developing country. However, we assume risk as a constant, aiming to focus only on the effects of the nominal interest rate in attracting foreign capitals.

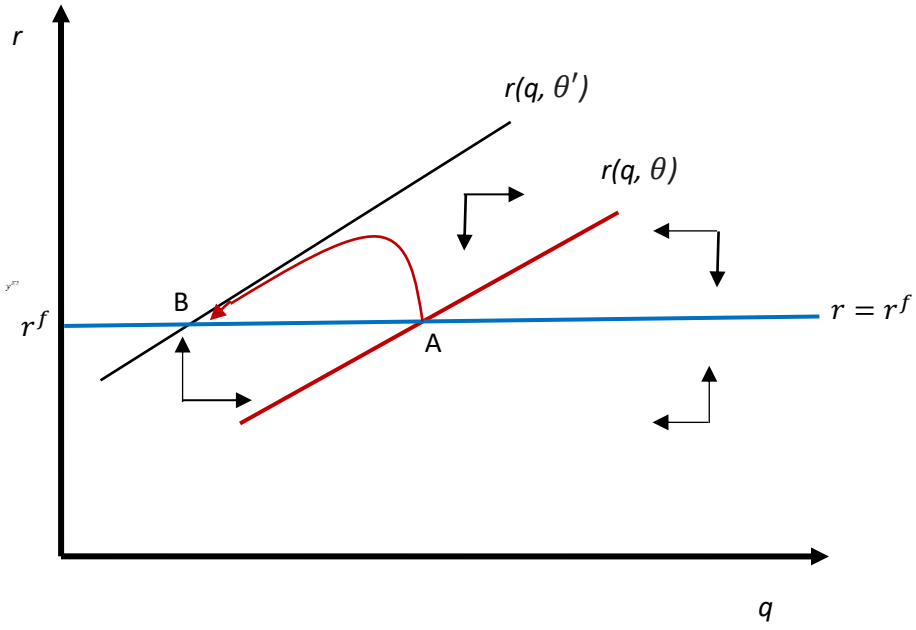
The increase of the real interest rate is a positive function of the RER (which boosts inflation) and a negative function of the real interest rate (which reduces aggregate demand with the elasticity ρ_1). The system is stable and the equilibrium values are:

(27) $$r^E = r^f$$

(28) $$q^E = \rho_0 h q^W + \rho_0 \theta + \rho_1 r / \frac{1}{\rho_0 \theta}$$

Figure 3 shows the phase diagram of the system of differential equations formed by equations (27) and (28). Assume that the economy is initially at point A, and that the government adopts a stricter target for the inflation rate ($\theta' < \theta$). The $\dot{r} = 0$ isocline shifts to the left. To attain θ', the government increases the real interest rate, which leads to inflow of foreign capital that appreciates the RER. Gradually, the appreciation of the RER helps control inflation and the interest rate becomes less necessary to attain the new inflation target. The adjustment process ends with the same real interest rate as before (which is the international interest rate) and a lower real exchange rate in equilibrium.

Figure 3. The dynamic system in the financialization scenario



Key to variables and parameters: r: real interest rate; q: real exchange rate; θ: initial inflation target; $\theta' < \theta$ new (lower) inflation target.

The Jacobian of the dynamic system formed by equations (25) and (26) is:

$$J = \begin{vmatrix} 0 & -\varphi \\ \rho_0 h & -\rho_1 \end{vmatrix} \quad (29)$$

It can be readily checked that the trace is negative and the determinant positive, and hence the system is always stable.

5.2. The learning path

Figure 3 shows how the decision of the government to pursue a lower inflation target leads to the appreciation of the RER[24]. Along the process of appreciation, there is a loss of accumulated knowledge and the new equilibrium entails a lower BOP-constrained growth rate. Relying on the RER as the anchor of prices compromises competitiveness and structural transformation.

Another scenario emerges if monetary policy fails to control aggregate demand. This scenario can be represented by a very low value of the parameter ρ_1. Assume the extreme case in which $\rho_1 = 0$. The trace of the Jacobian (29) becomes zero and the equilibrium solution in this case is a closed orbit. The RER and the real interest rate chase each other without never reaching their equilibrium values. It is then most likely that the negative effect of instability will overcome any potential positive effect of depreciation on growth. Such instability increases with the radio of the circle defined by the orbit of the variables r and q.

Given the initial position of the economy (the initial value of r and q), the economy is permanently moving in circles around the equilibrium point without never reaching it. What are the implications for structural transformation of this kind of dynamics?

If fluctuations are small and predictable, they play no relevant role in decision making. If these fluctuations are wide, even if they were predictable, they will compromise investment[25]. Assume that investment increases when the BOP-constraint is eased ($\dot{q} > 0$) and decreases when the BOP-constraint becomes more severe ($\dot{q} < 0$). In addition, assume that:

$$\dot{\varepsilon} = \left(\frac{\alpha}{1+\beta_1}\right)\frac{\gamma}{\pi}\dot{q}, \text{ if } \dot{q} > 0 \quad (30)$$

$$\dot{\varepsilon} = \left(\frac{\alpha}{1+\beta_2}\right)\frac{\gamma}{\pi}\dot{q}, \text{ if } \dot{q} < 0 \quad (31)$$

where $\beta_1 > \beta_2$[26]. This assumption implies that the inertial forces are stronger when the economy is recovering than when the economy is losing capabilities. The rationale for this assumption is that building capabilities is a difficult process (especially in a world in which technical change is

[24] Alternatively, a surge in inflation may happen as a result of a fall in the international real interest rate (a downward shift in the horizontal line r^f), which triggers capital inflows in the periphery and appreciates the RER.
[25] The effects of cycles and fluctuations in investment and structural change in a scenario of BOP-constraints are more thoroughly discussed in Spinola (2020, 2021).
[26] A similar assumption about different velocities of adjustment is suggested by Blecker and Setterfield (2019, p. 400-401).

extremely fast) that takes more time than the loss of capabilities. It is necessary to run to stay in the same place (the "Red Queen Effect"). Institutions are not easily reconstructed; the skills lost in one period will not be available in the next; firms, networks and externalities will no longer be at hand. This is a hysteresis scenario that hinders structural transformation and leads to regressive structural change after each appreciation / depreciation cycle of the RER.

Figures 4a and 4b represents the evolution of technological capabilities following the cyclical movement of the RER and over time, respectively. Initially there is an appreciation of the RER that makes ε falls, from point A to B (figure 4a). But when the RER returns to its original value, it follows a different path (from B to C) and reaches in equilibrium the same RER as before, but with a lower ε. Figure 4b shows the cyclical fluctuations of the income elasticity of exports and its declining trend over time[27].

Figures 4a. Hysteresis in the evolution of ε

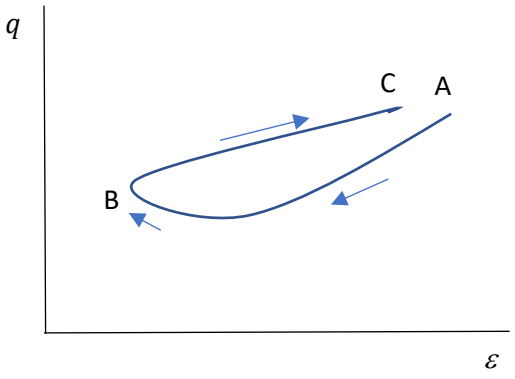
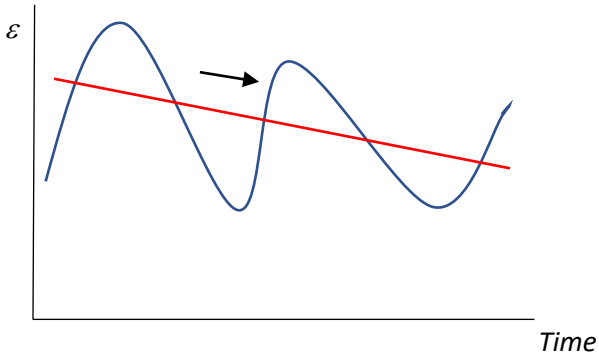


Figure 4b. Cycles and trend in ε over time



The trajectories described in figures 4a and 4b express the difficulties faced by an economy which fails to exercise control of the RER in times of financial globalization. An apparently positive feature of the international economy (high financial liquidity in the international markets and low international interest rates) may become a serious problem if it means a significant appreciation of the domestic currency of the periphery, which negative consequences for the BOP-constrained rate of growth.

[27] The reader may wonder if it is realistic that the income elasticity would be subject to such fluctuations. There exists inertia in industrial investment and production, and a country would not switch back-and-forth between exporting goods with high and low income elasticities so easily or frequently. Nonetheless, if we take an historical perspective at least since the Mid-nineteenth Century, the emergence of medium-run oscillations in the pattern of specialization coupled with a long-run downward trend is a well-established stylized fact at least for Latin America (Erten and Ocampo, 2013).

6. Concluding remarks

The empirical literature on the effects of the depreciation of the RER on economic growth offers conflicting results. We suggest a BOP-constrained growth model that can explain these results as a function of different combinations of two kinds of policies, the exchange rate policy and industrial policy. Such policies shape the institutional framework in which technological learning takes place and the RER evolves towards its long-run equilibrium. We identify three institutional frameworks that lead different outcomes regarding growth and income distribution: the developmentalist state, heterogeneous preferences on the RER, and financialization, as summarized in the table below.

In the BOP-constrained growth model, the depreciation of the RER leads to the acceleration of growth, which offer a window of opportunity for building new technological capabilities out of increasing returns—based on learning by doing and the ensuing accumulation of knowledge. Technical change brings about structural change, captured by the rise in the ratio between the income elasticity of exports and imports. However, the window of opportunity opened by economic growth is not automatic. It will be seized upon or not depending on the institutional framework that prevails (and its underlying power relations). Developmentalist states tend to maximize growth and learning, while financialization tends to generate appreciation and technological backwardness. The heterogeneous preferences regime offers a variety of results depending on the relative bargaining power of firms and workers, and especially on the ability of the government to implement industrial policy.

The model suggests some questions for future research. First, more empirical studies, especially case studies on political economy, are needed to understand the mechanisms linking the RER with technological learning and catching up. We focus on just one of them (a competitive RER favouring increasing returns), but this might be compensated by other forces (for instance, more expensive imported capital goods). Second, although the paper focused in developing economies, the modelling strategy is useful for studying developed countries as well. Spending in warfare or welfare entails different technological trajectories and have different implications for income distribution. Third, there is space to further elaborate on the hysteresis effects caused by economic cycles on the income elasticity of exports. Last but not least, institutions and the economic structure interact. For instance, a financialization model may reduce the share of manufacturing (which is tradable) and by doing so may reduce the political power of those seeking to promote industrial diversification and keep the RER competitive. Inversely, the developmentalist state may create an environment favourable to raise even more investments in science and technology. This kind of interactions are critically important, but they are beyond the scope of the paper.

Table 1. Summary: institutional patterns and outcomes

Case	**Developmentalist State**	**Heterogeneous preferences and conflicting claims**	**Financialization**
Political economy	Industrialist coalition	Equilibrium emerges from relative power of workers and capitalists	Neoliberal coalition
Policy focus	International competitiveness	Balancing international competitiveness with income distribution	Focus on the inflation rate
Capital account	Strong capital controls	Capital controls	Fully open
Agents' objectives	Maximize the investment rate and close the technology gap with the technological leaders.	Workers aims to raise real wages; firms aim to keep their mark-up; governments aim to avoid an external crisis	The government pursuit an inflation target; capitalists and workers try to expand their share in GDP.
Agents: behavioural rules	Government aims at a competitive RER. $\dot{q} = \vartheta(q_D - q)$ RER may have downsides: negative implications for income distribution and higher price of imported capital goods. $\dot{q} = \vartheta[u(q_D - q) - v(q_D - q)^2]$	Resistance to depreciation; negotiation between government and workers. $\dot{q} = j(q^G - q) - h(q - q^W)$	International capital market arbitrates between assets denominated in domestic and foreign currencies. Government commitment to fight inflation (Taylor rule). $\dot{q} = \varphi(r^f - r)$ $\dot{r} = -g + \rho q - \rho_1 r$ It is easier to lose capabilities than to build them (hysteresis).
Role of industrial policy	Foster learning and structural change.	Sustaining growth without compromising income distribution.	There is no industrial policy. RER is the price anchor, with negative implications for competitiveness and structural transformation.

The model implemented in .R can be found in the following GitHub repository: https://github.com/danilospin/Lipi-Model

Table 2. Summary of the different positions on the RER

Author(s)	**Effect on Structural Change**	**Effect on Growth**
Rodrick (2008) ‡, *Frenkel and Ros (2006)*‡	Positive	Positive
Rapetti et al (2012) †	Positive	Positive (stronger for developing countries)
Marconi et al. (2016) †	Positive	Positive (stronger for middle income countries)
Berg et al. (2012) †		Positive (growth duration)
Ibarra and Blecker (2016) ‡	Positive	Positive, but weak
Gabriel et al. (2020) †	Positive	Positive (stronger if the technological gap is greater)
McMillan et al. (2014) †	Positive (labour productivity)	Positive
Bresser-Pereira et al (2016), Missio et al (2015)* ‡, *Nassif et al (2015)* †	Positive (income elasticity ratio)	Positive
Freund and Pierola (2012) †	Positive (diversification of exported products)	
Cimoli et al. (2013) †	Positive (technological intensity of export)	
Caglayan and Demir (2019) †	Positive (only for low and high tech firms)	
Agosin et al (2012) †	No effects (diversification of exported products)	
Diaz-Alejandro (1986), Krugman and Taylor (1978)**		Negative (lower wages and higher cost for imported inputs)
*Blecker (1989)**		Ambiguous: Negative (lower wages)/ Positive (lower profits)
*Ribeiro et al. (2016; 2017)**		Unambiguously positive only if the economy is profit-led and devaluations enhance price competitiveness
Ribeiro et al. (2019) †	Positive (not statistically significant)	Slightly Negative (lower wages)
Nucci and Pozzolo (2001) †		Ambiguous: Positive (higher revenues) / Negative (higher costs for imported inputs)

(a) Source: own elaboration

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