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Financial Barriers to Structural Change in Developing Economies: A Theoretical Framework*

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ABSTRACT

Liabilities denominated in foreign currency have established a permanent role on emerging market firms' balance sheets, which implies that changes in both global liquidity conditions and in the value of the currency may have a long-lasting effect for them. In order to consider the financial conditions that may encourage (discourage) structural change in a small, open economy, we adopt the framework put forward by the "monetary theory of distribution" (MTD). More specifically, we follow the formulation adopted by Dvoskin and Feldman (2019), whereby the financial system is intended as a basic sector that promotes innovation (Schumpeter 1911). In accordance with this, financial conditions are binding only for the innovative entrepreneurs, whose methods of production are not dominant and hence they need to borrow from banks to kickstart their production. Through this device, our model offers an explanation of the technological lock-in experienced by a small, open economy that takes international prices as given.

KEYWORDS: Foreign Exchange Policy; Currency Mismatches; Structural Change

JEL CLASSIFICATIONS: F37; F31; E7

INTRODUCTION

The present work develops a theoretical framework for the role of the exchange rate for corporate, nonfinancial investment, expanding the work already put forward by Dvoskin, Feldman, and Ianni (2020), Dvoskin and Feldman (2020), and Nalin and Yajima (2021). Currency policies have been recommended as a tool for promoting structural change through a depreciated and stable real exchange rate that would lower salary costs, increase profit margins, and ultimately boost capital accumulation (Ros 2015; Ros and Skott 1998). We argue, however, that due to the continuous process of financial integration in conjunction with extraordinary monetary policies adopted since the global financial crisis (GFC), developing countries have the lost space for promoting such catching-up policies.

For instance, among the Latin American countries, the experience of economies such as Brazil, Colombia, Chile, and Mexico in the aftermath of currency depreciation after 2014—caused by the end of the commodity boom together with the announcement of the end of the expansionary monetary policy stance by the Federal Reserve—provides limited, if not null, evidence of the effectiveness of a real exchange rate (RER) to boost private investment and, thus, structural change. Despite the depreciating trajectory witnessed in the RER of their currencies since the end of the commodity boom in 2014, benefits to fixed gross capital formation failed to materialize. As argued in Nalin and Yajima (2021), two elements need to be included in the analysis.

From one side, currency fluctuations are nowadays mainly caused by short-term portfolio flows in search of yields. As a result, currencies are volatile and maintaining the so-much-invoked "depreciated and stable" exchange rate seems to be more a theoretical discussion rather than a real policy option, especially considering how the low placement of peripheral economies in international currency hierarchy (Kaltenbrunner and Painceira 2015) dissociates currency volatility from macroeconomic fundamentals and increases their link to liquidity premiums.

On the other hand, there has been an extraordinary issuance of foreign debt in the corporate nonfinancial sector that led to the (re)emergence of currency mismatches (Chui, Kuruc, and Turner 2018); that is, firms report higher foreign-exchange denominated liabilities than assets. For those

firms, depreciation would cause a balance sheet effect (Céspedes, Chang, and Velasco 2004; Gertler, Gilchrist, and Natalucci 2007). This may have important implications for their profitability.

A clarification needs to be made before proceeding. We are not advocating against RER depreciation as a tool for structural change. We understand this policy worked effectively in the past, especially if we take under consideration a larger sample of countries, as demonstrated in the empirical works of Rodrik (2008) and Razmi, Rapetti, and Skott (2012). We argue rather that, due to the new financial environment in which the RER is operating, its effect may have changed and, as a result, could be effective only under strict and specific conditions.

To clarify the importance of the RER financial channel on structural change, we adopt the framework put forward by the monetary theory of distribution (MTD). More specifically, we follow the formulation adopted by Dvoskin and Feldman (2019), whereby the financial system is intended as a basic sector that promotes innovation (Schumpeter, 1911). In accordance to this, financial conditions are binding only for innovative entrepreneurs, whose methods of production are not dominant and hence they need to borrow from banks to kickstart their production.

Unlike dominant sectors, innovation is assumed to be financed by borrowed capital and therefore the burden of the debt revaluation provoked by a currency depreciation may fall more heavily on these new (high-tech) sectors. In this sense, we simply argue that this increase in capital costs may be higher in some sectors than others, and therefore relative profitability may change with currency devaluation. When the latter occurs, it not only increases the selling price of tradable goods in domestic currency, but also affects the cost of capital in a greater proportion, by triggering some sort of elastic devaluation expectations and therefore preventing domestic firms from the possibility of innovating. This would explain, among other things, the technological lock-in experienced by a small, open economy that takes international prices as given.

The paper is organized as follows: section 2 reviews the literature on the limitation of RER devaluations for structural change, while section 3 presents some stylized facts on the foreign debt of nonfinancial corporations and risk premia in developing economies in the last decade. Section 4 introduces our analytical model, which is used to investigate four conditions that a small, open

economy that carries out currency policies may face in achieving structural change. Section 5 concludes.

LITERATURE REVIEW

In the literature of multisectoral models, at least three beneficial effects economics of having an undervalued RER are identified (Dvoskin, Feldman, and Ianni 2020; Frenkel and Rapetti 2011; Rodrik 2008), one acting in the short run while two act in the medium to long run:

(a) the employment or output effect
(b) the structural change effect
(c) the growth effect

In brief, (a) affirms that when the price of foreign currency increases, real wage as expressed in terms of the tradable goods falls, cheapening labor costs and inducing firms to adopt more labor-intensive methods of production, thereby raising the level of both employment and output (through the increase in aggregate demand). In turns, (b) implies that if devaluation persists, the price of tradables with respect nontradables will increase, making it more profitable to invest in the former sector and thus elevating its profitability. For the same reasons, new sectors that were not economically affordable will become competitive on international markets under the new level of the RER. Finally, since (a) and (b) postulate the existence of a positive relationship between the RER and the profit rate, firms will accumulate more capital and this causes (c) to take place.

Although it has been claimed that there is a consensus among development economists on these transmission mechanisms, some relevant differences are in plain sight. For instance, the central point in Rodrik's (2008) analysis—and the majority of all works that came after it—concerns the positive effect that the RER's undervaluation has on growth by compensating for the institutional backwardness that slows the expansion of tradables in developing countries. By having competitive tradable prices, companies will increase their demand. Also, competing with players abroad will optimize their production systems, thereby catching up with the technology adopted by players

abroad. This will require a greater level of private investment, and domestic industries' productivity will benefit, too.

However, limitations exist with respect to using the exchange rate to promote growth. Probably the most influential one is the Díaz-Alejandro effect (Díaz-Alejandro 1963), initially addressed in Alexander (1952) and successively by Krugman and Taylor (1978).[1] It argues that real depreciation leads to inflationary pressure, which implies a reduction in real wages. It therefore affects private consumption, producing a redistribution of income from workers in favor of entrepreneurs. If workers have a higher propensity to consume than entrepreneurs, redistribution increases the savings rate at the expense of consumption. Thus, for this channel to be fulfilled, the propensity of entrepreneurs to save should be greater than that of wage earners. This assumption finds two theoretical explanations: (i) that a part of corporate profits is normally kept as retained earnings, which are used for internal financing of the investment, while there is no corresponding "retention" of salary income (Blecker 1989; Kaldor 1957); and (ii) business owners (or shareholders) and other recipients of gross profits (e.g., bondholders receiving interest payments) tend to be wealthy, high-income individuals with greater marginal propensities to save than workers (Kalecki 1954). Whether this should cause a fall in income, both in the short and in the long run, depends on the behavior of investment, which could either rise (due to the increased retaining earnings) or fall (due to the reduction in the firm's revenues). In other words, it would depend on the demand regime in the economy, either exhilarationist (wage-led) or stagnationist (profit-led), as put forward by Bhaduri and Marglin (1990).

From a business decision perspective, the literature has also questioned the effect of depreciation on capital formation expenditures. The response of a company's investment to exchange rate movements depends on a variety of factors, such as dependence on imported inputs and the proportion of foreign sales to total sales. Bruno (1979) and Van Wijnbergen (1989) argue that in a semi-industrialized country where inputs for manufacturing are largely imported and cannot be easily produced domestically, the cost of firms' inputs will increase after depreciation. As a result, the negative impact of the higher cost of imported inputs may dominate the boost in production from the lower relative prices of tradable goods.

[1] They also add that devaluation has a negative effect for growth due two important factors: first, in the case that imports initially exceed exports and, second, if government revenues are increased by devaluation.

Another important remark on the effectiveness of exchange rate policy came from analyzing the structural condition under which a stimulus in trade could lead to an improvement in growth without undermining the external balances. In this sense, the analyses of the foreign trade multiplier, based on the seminal works of Harrod (1933), gave birth to a stream of contributions that later came to be known as the balance of payment constraint (BOP) growth rate theory, formally put forward by Dixon and Thirlwall (1975). According to the authors, the long-run determinants of growth in a context of trade openness depends ultimately upon both a demand and supply variable, the former being the rate of growth of the rest of the world and the latter being the income elasticity ratio (i.e., the ratio between the income elasticities of exports and imports). In other words, price competitiveness—captured by the RER and the price elasticities of imports and exports—should not influence the long-run rate of growth in a small, open economy. This rests upon the assumption that the RER itself is stable in the steady state, as any movement in the terms of trade are canceled out by corresponding movements in the nominal exchange rate (NER), implying the validity of the purchasing power theory. Thus, for a given pace of growth of foreign economic activity, the only way to improve the BOP rate is to raise the income elasticity ratio, which is meant to capture nonprice competitiveness and is given by technological factors.

Since Dixon and Thirlwall's (1975) seminal contribution of, the BOP approach has received a number of extensions, both aimed at including additional stylized facts within the same framework, such as capital flows (Moreno-Brid 1998; Thirlwall and Hussain 1982) and terms of trade differentials (Perez Caldentey and Moreno-Brid 2019), and reconciling it with other theories, such as the Kaleckian (Dutt 2002) and Neoschumpetereian (Cimoli and Dosi 1990). One of these appraisals came from the Brazilian neodevelopmental school (Bresser-Pereira 2008; Bresser-Pereira and Nakano 2003; Bresser-Pereira, Oreiro, and Marconi 2017; Gala 2007; Missio et al. 2015; Nassif, Feijo, and Araújo 2015; Oreiro and Feijo 2010). There are two key elements on which this line of thought focuses: the first is how maintaining an appreciated RER for long periods leads to deindustrialization of the economy by incentivizing companies to import capital goods from abroad. The second is the existence of a RER of industrial equilibrium capable of promoting import substitution, thus encouraging structural change. More formally, it is argued that when the RER equals the unit labor costs in the manufacturing sector, the income elasticity ratio improves, as more–technologically advanced sectors become more profitable (Marconi, Araujo, and Oreiro 2015).

This interpretation of the Thirlwall's law assumes that a negative relationship exists between real wages and the rate of growth consistent with a balance-of-payments equilibrium, through its effect on the income elasticity ratio. It could be interpreted as both a variant of (b) (i.e., the structural change effect) and an answer to the Diaz-Alejandro effect, as even assuming output has a negative reaction in the short-run due to the existence of a wage-led regime, the intermediate effect of a depreciated RER can trigger a process of structural diversification and thus long-run growth. However, the fact that the latter can be disconnected from any distributive implication is not a consensus in the BOP literature. For example, Lima and Porcile (2013) assume that for (c) (i.e., the growth effect) to take place, the firms' positive reaction to the higher exchange rate's incentive to invest should more than compensate for the redistribution toward more savings-oriented classes of income.[2] Furthermore, Ribeiro, McCombie, and Lima (2017) add to this condition that the price competitiveness incentive should more than offset the increase in the costs of imported intermediate inputs, otherwise the effect would be just the opposite of the one signaled by Bruno (1979) and Van Wijnbergen (1989).

Authors who consider RER as a substitute for industrial policy (Rodrik 2008) usually neglect the point mentioned above, arguing that a devaluation will provoke a process of import substitution, as capital goods produced abroad will become more expensive and a new local sector producing the same vintage of goods previously exported will emerge. This theoretical justification requires a mechanism that we have not discussed so far, that is the possibility of producing a commodity by combining any factor of production for a given level of technology. Although the possibility of perfect substitution between labor and capital has been one of the main points of contention in the history of economic thought, it has been relatively disregarded in the debate on the growth effect of the RER.

There is yet another assumption that seems controversial in adopting RER as substitute for industrial policy, which is the little attention paid to the level of technological capabilities within the country applying this kind of policy to stimulate growth and structural change. As a matter of fact, this seems to be another implicit concession to the neoclassical growth theory based on Solow

[2] Alternatively, even if the existence of both (b) and a profit-led economy in the short run is assumed, it is still possible to obtain wage-led growth as in Blecker (1989), thus also postulating a nonlinear relationship between the profit rate and the RER at variance with the (c) effect.

(1956), that the state-of-the-art technology is always available without any kind of restriction and can be promptly used by any firm, industry, or country willing to adopt it. This is something that has been harshly criticized by the neoschumpeterian school of thought (Cimoli 1988; Cimoli and Dosi 1990; Nelson 2009), which has been focusing instead on the behavior of spillovers in the process of growth and catching up. In particular, according to Verspagen (1992), a nonlinear relationship exists between the distance to the frontier of technology and local capabilities: when this distance surpasses a critical threshold, it is unlikely that local universities, laboratories, and research centers can incorporate the new methods of productions of foreign origins, especially when they are of a disruptive nature. From this standpoint, the need for coordinated policy appears even stronger, provided that currency policies can offer, at best, only indirect effects on the country's stock of knowledge.

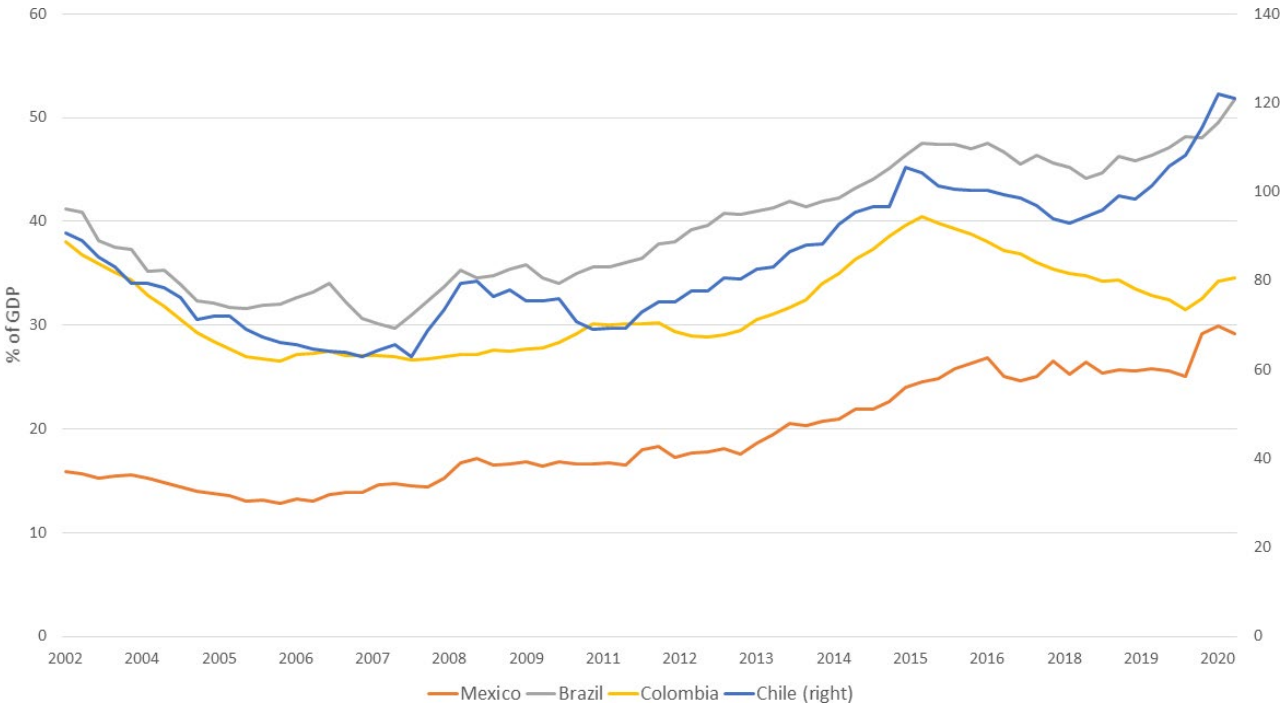
In this sense, the stream of research based on Steedman (1999) and Shaikh (2016), and more recently Dvoskin, Feldman, and Ianni (2020), fills the gap in the literature. The novelty of their work is an extensive analysis of the obstacles of using depreciation as a tool for promoting structural change and economic growth, namely, the presence of capital mobility, the importance of the economy's structure, the role of wage frictions, and the production of an agricultural good in presence of a differential land rent appropriated by landowners. The authors show formally that in order for a devaluation to bring about the effects mentioned above, there are a number of necessary conditions that should be, but are usually not, met. We argue that if we consider two additional stylized facts that is experienced by developing countries in general and in particular Latin American ones (i.e., the rise in nonfirnacial corporations, debt, and the linkages between the exchange rate and corporate risk premia), these conditions are even less likely to occur. The next section clarifies this point.

CURRENCY DEPRECIATION, FOREIGN DEBT, AND CORPORATE RISK PREMIUM: SOME STYLIZED FACTS

Since the GFC in 2007–8, the international macro financial landscape has drastically changed. At the first signs of GFC, the US Federal Reserve (Fed hereafter) started an expansionary monetary policy cycle and lowered the benchmark rate from 5 percentage points to 0.25 percentage points in

less than two years, beginning in mid-2007 through the end of 2008. To further inject liquidity and sustain market valuation, it started a bond repurchasing program that was soon replicated by other central banks in developed and developing countries. As a result, beginning in 2010, the world experienced a historically unprecedented level of international liquidity. The near-zero interest level set by the Fed remained unchanged for eight years, until December 2016. As the Bank for International Settlements (2020) has largely argued, the low-rate environment generated the incentive for nonfinancial firms in developing countries to finance their activities through external debt. This process particularly occurred in Latin America, as put forward by Pérez Caldentey, Favreau Negront, and Lobos (2019) and, in some cases, led these countries to suffer from currency mismatches (Chui, Kuruc, and Turner 2018).

Figure 1: Nonfinancial Sector External Debt for Selected Countries (GDP)

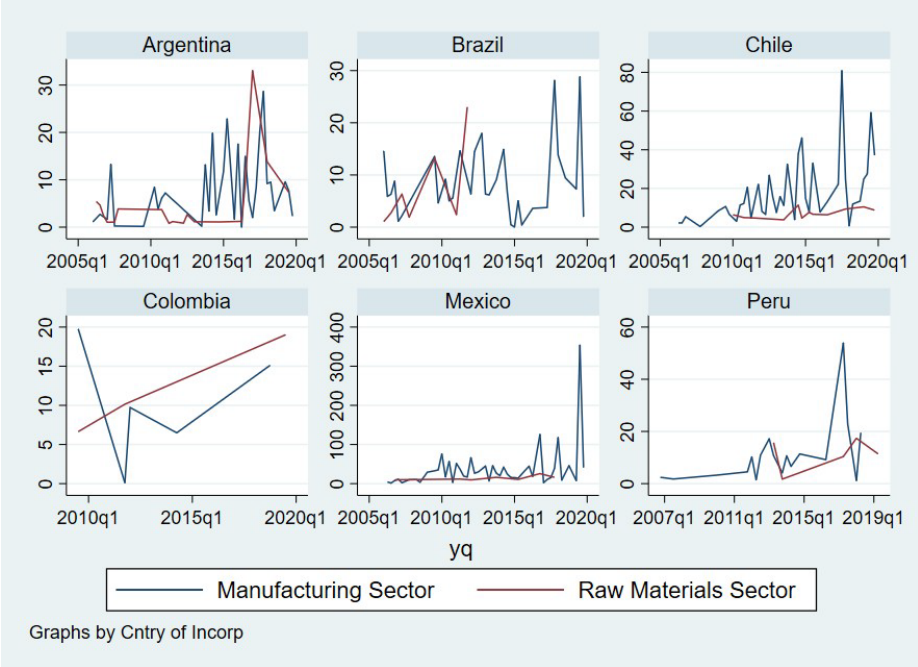


Source: Own elaboration with data from BIS (2021).

Figure 1 shows the rapid expansion in foreign leverage for Latin American nonfinancial corporations. In June 2007, just before the financial crisis took place, the nonfinancial sector's foreign leverage as a percent of of GDP in Brazil, Chile, Colombia, and Mexico were 30.7 percent, 62.8 percent, 27.07 percent, and 13.9 percent, respectively. During those years, in Chile, Colombia, and Brazil external debt was following a downward trajectory, while in Mexico the ratio was

steady. Yet, since 2010, coincident with the abundance of international liquidity, the slope of the debt curves rapidly increased and, by 2015, all countries recorded much higher stocks of foreign liabilities as share of their product: Brazil (47.5 percent), Colombia (39.8 percent), Chile (104 percent), and Mexico (25 percent).

Figure 2: Amount of Bills Issued in Selected Countries (billions USD)



Source: Own elaboration with data from Bloomberg (2021)

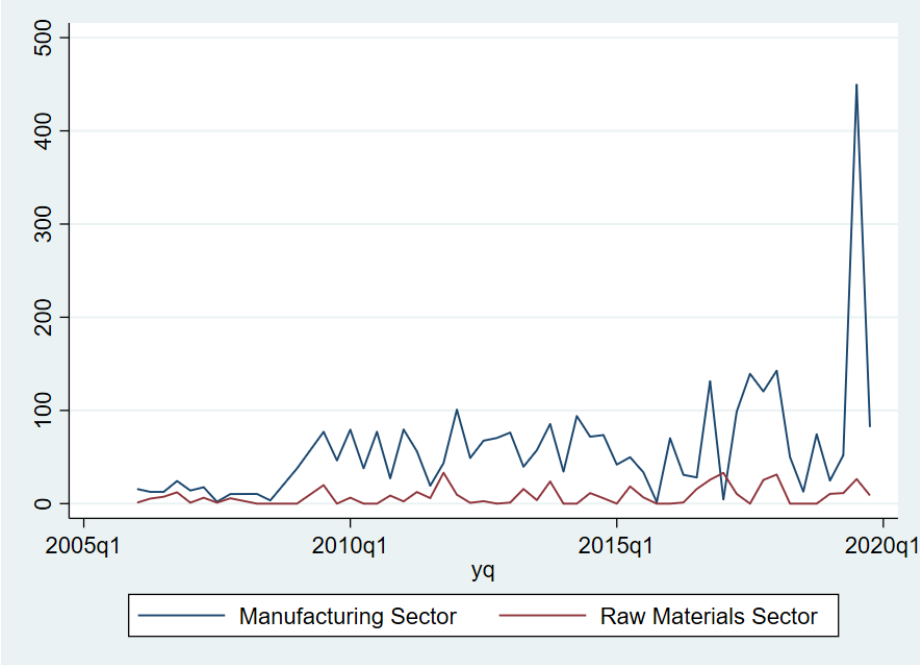
Corporate indebtedness appears to be higher and more volatile in the manufacturing sector, as shown in figure 3. This is due to the fact that firms in this sector are oriented toward internal markets and have to acquire foreign technology and intermediate goods in order to produce. However, in recent years sectors producing raw materials and commodities—whose revenues are usually denominated in foreign currency—have also been increasingly issuing foreign debt, in particular in Argentina and Colombia (figure2).

A further element that characterizes the evolution of the Latin American economies in recent years is the correlation of corporate risk (proxied by the CEMBI index, calculated by the investment bank J.P. Morgan) with real currency depreciations (figure 4). The four countries under analysis report positive and statistically significant correlations, indicating comovements between corporate risk

and currency depreciation. While correlation does not provide information about causality, it still allows us to establish a temporal relationship between the two variables.

High foreign debt coupled with volatile depreciation and increasing corporate risk raise concerns over the channel through which the exchange rate operates on corporate investment in the current financialized context (Nalin and Yajima 2021).

Figure 3: Amount of Bills Issued in Selected Countries, Aggregate (billions USD)



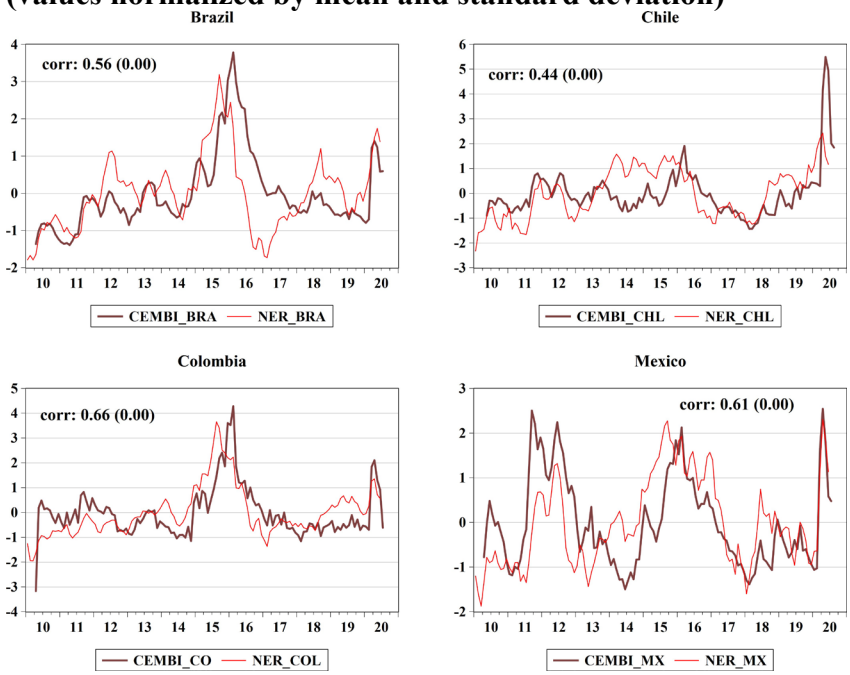
Source: Own elaboration with data from Bloomberg (2021)

During a period of currency depreciation, corporate risk premium is higher and corporations are required to pay higher interest/spreads on the borrowed money. To avoid this risk, they might ultimately hedge their leverage with derivatives contracts, generating an additional cost. Yet, risk premiums and derivates are additional costs that could harm expected profitability and discourage investment.

In this sense, the financial cost of depreciation could outweigh the positive effects generate by competitive exports and lower real salaries. In figure 5, we report the yearly percent growth of fixed capital formation and RER, lagged by one year to capture the possible lagged effect of the latter on the former. Visual inspection and correlation analysis point to a weak link between

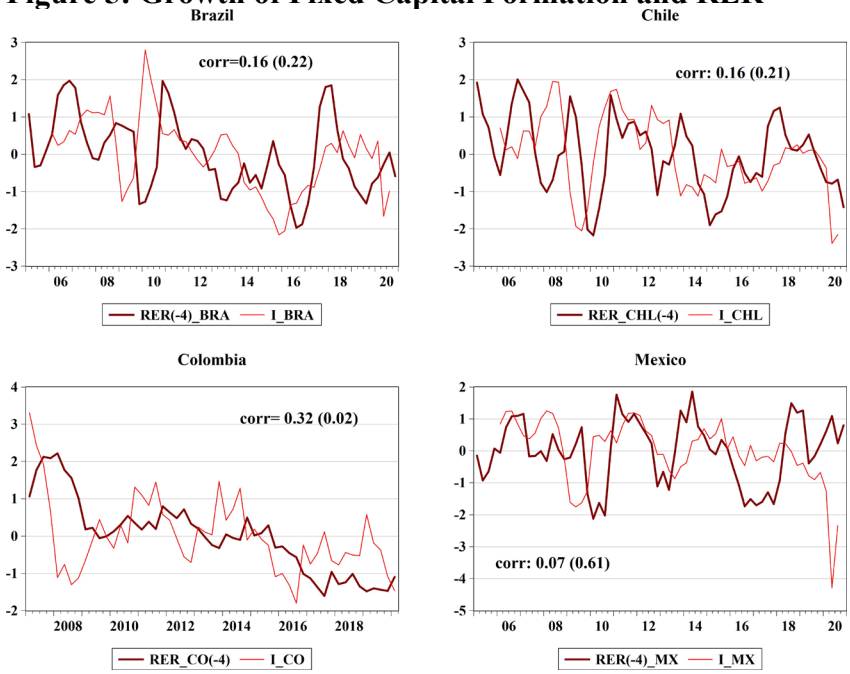
variables for the period 2004–19. Indeed, three out of four countries do not show statistically significant correlations. In Colombia, the only country in which the correlation reports a p-value lower than canonical rejection levels, the correlation is positive; that is, a more appreciated currency is correlated with higher growth in capital formation. All in all, it seems very unlikely that currency volatility *cum corporate risk premium* and foreign debt revaluation could promote a favorable investment environment over the last decade.

Figure 4: Corporate Risk Premium (CEMBI) versus Nominal Exchange Rate, 2009–20 (values normalized by mean and standard deviation)



Source: Bloomberg (2020)
Note: Graph takes inspiration by Esteban Perez Caldentey presentation at the Thirlwall Seminar organized by UNAM University.

Figure 5: Growth of Fixed Capital Formation and RER



Source: Own elaboration with data from BIS (2021)

THEORETICAL MODEL

We start from Dvoskin, Feldman, and Ianni (2020)—hereafter, we use the acronym DFI—as their work addresses the impact of exchange rate devaluations on a multisectorial economy. Their baseline model is introduced in case 1. Then, to consider the financial conditions that may favor (discourage) structural change, we adopt the framework put forward by the monetary theory of distribution (MTD) (Ciccarone 1998; Dvoskin and Feldman 2019, 2021; Franke 1988; Panico 1985, 1988; Pivetti 1988). More specifically, we follow the formulation adopted by Dvoskin and Feldman (2019), whereby the financial system is intended as a basic sector that promotes innovation (Schumpeter 1911). The implications for the achievement of structural change are discussed in cases 2, 3, and 4.

Case 1: Baseline Framework, DFI (2020)

Our small, open economy is composed of two tradable sectors, C and I, whose production requires both imported capital (thus weighted by the nominal exchange rate, Q) and domestic labor. Hence, these goods in the model stand for two types of exports with different production processes, represented by different values for the unitary input coefficients l_T , k_T . Sector I may thus be

interpreted as the more technologically advanced sector (such as manufacturing), whilst sector C, the laggard, as an agricultural-based (or commodity-based) sector. Under the assumption that wages are paid *ante factum*, pricing condition for these sectors are given by equation (1):

$$P_T^S = (wl_T + k_T Q)(1 + r_T), \qquad (T = C,I) \tag{1}$$

The market equilibrium condition is given by the equality between the demand and supply price for each sector, with the former representing the maximum amount of money that consumers are willing to pay for a certain commodity. Due to international competition, the domestic economy is a price taker, and then the demand price is originated internationally equation (2). To stay in the market, companies need to demand a price that is higher than the production costs found in equation(3):

$$P_T^D = QP^*_T, \quad (T = C,I) \tag{2}$$

$$P_T^D \geq P_T^S, \qquad (T = C,I) \tag{3}$$

After defining RER as $q = Q/w$ and assuming both the nominal wage rate and the international prices of tradable goods as given and equal to one, we can solve for the rate of return of each tradable sector in equation (4):

$$r_T = (1 / q_T + k_T q) - 1, \ (T = C,I) \tag{4}$$

Under the assumption that sector C (I) is more (less) labur intensive than capital intensive ($k_C < k_I, \ l_C > l_I$), it is possible to show that r_I crosses r_C only once, at q^*, which can be interpreted as an "industrial equilibrium exchange rate," a notion put forward by the New Developmentalists (Bresser-Pereira, Oreiro, and Marconi 2017).

$$q^* = (l_I - l_C)/(k_C - k_I) \tag{5}$$

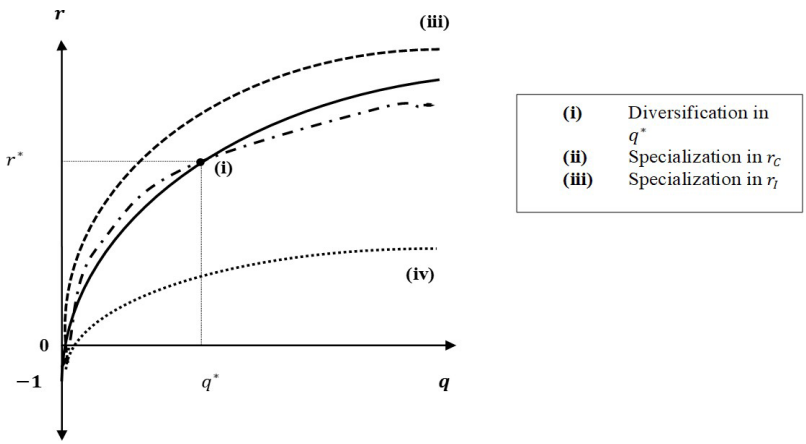
As in DFI, we can draw a chart illustrating the possible shapes of these curves for any given level of the q (hereafter, $q - r$ curve). The rate of profit for C (I) is represented by a bold (thick) line.

Figure 4 can be interpreted as the time path of the rate of profit for a policymaker committed to depreciating its RER at a constant rate. We can report three different situations, namely:

- **(i)** the one assumed by Frenkel and Ros (2006), in which a devaluation aimed at achieving the equilibrium level q^* accomplishes the policy objective of maintaining a diversified productive structure by avoiding a shift in relative prices that can endanger either C or I;
- case **(ii)** and **(iii)**, in which diversification is impossible, since sector C (I) would be always the most competitive one, and the country itself specializes in only one item.

In sum, this baseline framework depicts an economy that tries to achieve structural change via competitive devaluation policies by changing the relative profitability of the two sectors. In turn, these two tradable sectors do not have to rely on external finance to carry out their production. We will correct this assumption in the next case.

Figure 6: Baseline Framework, DFI (2020)



Source: Own elaboration

Case 2: The Role of the Financial System

We now introduce the financial system to our model in line with Dvoskin and Feldman's (2021, 2019) approach to MTD, who suggested that financial conditions are binding only for the innovative entrepreneurs, whose methods of production are not dominant and hence they need to borrow from banks to kickstart their production. Conversely, incumbent firms are assumed to require only retained earnings to finance themselves. This closure of the MTD emphasizes the twofold role of finance in the production process, i.e., to directly create credit to bridge the gap

between new products and means of production, and to indirectly create new market and, hence, allow the profitability of the entry firms. However, we depart from its treatment of the financial markets in order to incorporate the stylized facts outlined in section 3 for nonfinancial corporations, as we assumed that they issued debt in international markets. This is clearly an oversimplification of reality, as many developing countries, especially in Latin American, have deepened their financial sectors and nowadays have banking sectors that provide credit in domestic currency—which represents a departure from the idea of original sin from Eichengreen, Hausmann and Panizza (2002). Yet, it allows us to maintain the model's parsimoniousness and focus on the interaction between foreign debt and the exchange rate. Our goals is to emphasize the role of foreign currency financing; as such, the introduction of domestic credit would complicate our equation without providing additional useful information (i.e., we would have still focused on foreign capital assuming domestic credit as constant). To introduce foreign debt as a cost, in equation (6) we slightly modify the supply price of each sector from equation (1):

$$P_T^S = wl_T + A_I pQ(1 + \pi_T),\ (T = C,I) \qquad (6)$$

We hold that wages are paid *post factum*. The capital coefficient, k_I ,is replaced with $A_I p$, the matrix of unitary capital requirements at normal prices, $k_I + k_B = A_I p$, which contains both the owned capital per output and the credit raised by borrowing external funds, k_B. With this specification, the nominal exchange rate, Q, should be considered alongside the column vector of normal price, p. The extended version of equation (6) would read $P_I^S = wl_I + k_I(1 + r) + k_B(1 + i)$. Thus, it can be shown[3] that the profit rate, π_I, is compounded according to equation (7):

$$\pi_I = r(1 - \alpha) + i_d\alpha \qquad (7)$$

where i_d stands for the demand interest rate, i.e., the rate at which firms can carry out production at a profit, and α for firms' leverage ratio, $\alpha \equiv k_B/A_I p$. Without loss of generality, we can assume that for sector I (the entrant) $\alpha = 1$, since the new method should be financed from scratch, while for sector C (the incumbent) $\alpha = 0$. Hence, equation (4) should be slightly modified into equation (8):

[3] Using the definition of the leverage ratio and substituting it into the extended version of equation (6), one obtains $P_I^S = wl_I + A_I pQ + A_I pQ(r(1-\alpha)+i\alpha)$, from which the definition of π_I is easily obtained. The mathematics are developed in the appendix.

$$\pi_T = [q(1 - AIp) - lT]/ A_I pq \ , \ (T = C,I) \tag{8}$$

In accordance with Dvoskin and Feldman (2019), for the innovative entrepreneur to produce at a profit, their effective cost of production (represented by the supply interest rate, i the rate at which financial intermediaries are willing to lend funds) should be strictly smaller than π_I:

$$\rho_s = \pi_I - i \tag{9}$$

If this is true, sector I will become the dominant market player and the economy would adopt its method of production because it can benefit from extra profits, since $\rho_s > 0$. To the extent that the new method employs smaller labor and capital coefficients, the real wage rate, $\omega = w/p$, increases.[4]

Finally, we need to specify the equation for the interest rate, the main contribution to our specification. Here we depart from Dvoskin and Feldman (2019) and assume firms raise credit in international markets, since the local intermediaries charge higher interest rates on domestic credit. Foreign intermediaries determine the interest rate using a benchmark rate plus a spread proxying the lender's risk, which may reflect, for instance, the CEMBI index's basis points discussed in the stylized facts from section 2.

$$i = i_f + \sigma_q \tag{10}$$

Equations (6)–(10) allow us to consider two slightly different $e - r$ curves. Focusing on figure 5, curve **(5.ii)** and **(5.iii)** are one above the other. They are obtained by postulating that I is a more efficient method of production than the one employed in sector C as its unitary input requirements are strictly smaller ($k_C > k_B, l_C > l_I$). In other words, sector C (I) was supposed to be the most efficient one only for values higher (lower) than the industrial equilibrium exchange rate, $q*$, which in fact marked our reswitching point from a capital-intensive to a labor-intensive production method. In

[4] Notice that this increase in the real wage is obtained by assuming the constancy of w. Thus, in an open economy, nominal wages may be driven upward following a devaluation either because of wage resistance or increased workers' bargaining power, as pointed out in section 2. Due to space reasons, we will not analytically address these cases, as we will focus on the interaction between the productive structure and (foreign) finance.

this case, the absence of an intersection between the curves indicates that no reswitching from one technique to another—and thus no diversification of the production structure of the economy—is achievable via exchange rate devaluations. The (more efficient) technique, I, will be adopted only if the effective cost of production (i, the interest rate) permits so, otherwise the less-efficient technique, C, will remain dominant and the economy will be stuck in a technological lock-in. In this setting, there may be a case for using exchange rate policy to promote structural change—intended here as replacing *in toto* the dominant process with the innovative one instead of allowing the coexistence of two sectors (as in case 1). Consider, for instance, the situation in figure 5.i, in which the π_I curve intercepts the flat i curve for some level of q. Hence, all the locus above that point make the innovative entrepreneur's production profitable and technical change achievable through currency devaluation. We can interpret this case as a dual economy that relies on external finance (denominated in foreign currency) for its more-advanced productions. This conclusion, however, rests on the ad-hoc hypothesis of the two curves, in particular with respect the inelasticity of the interest rate to the level of the exchange rate. In the next section, we will remove this assumption.

Case 3: RER Depreciation and Interest Rate Adjustment

So far, we our simulation relies on the unrealistic hypothesis that the interest rate and currency are uncorrelated. We depart from the hypothesis of the interest rate's inelasticity to the RER by postulating that international lenders demand a higher interest rate if the exchange rate depreciates, which leads to equation (11):

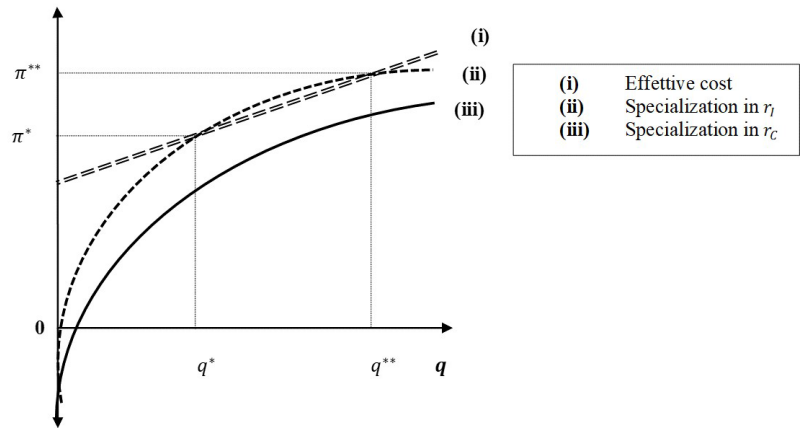
$$i = i_f + \sigma(q),\ \sigma'(q) > 0 \qquad (11)$$

whereby the spread $\sigma(q)$ is a function of the RER, whose first derivative is positive. Again, we can draw a figure (figure 8) representing the possible outcomes in the e - r space. The figure pretty much resembles figure 7, with the exception that the effective cost is endogenous to the nominal (and real) exchange rate. This allows for an interesting condition, in which the i curve intercept is twice the π curve. This translates into the possibility of success for a devaluation policy restricted only to the segment in which $\rho_s > 0$. In other words, if the central bank excessively increases the interest rate, it will cause an increase in the cost of funding that will eventually discourage innovation. In this case, the economy here represented more realistically matches the financial

constrains faced by developing countries when they pursue devaluation policies, as investors bet against them and tighten credit conditions.

A different outcome possibly would be obtained if investors believe in the ability of the domestic central bank to maintain a constant rate of devaluation over time. This would have two implications, namely: a) the forward exchange rate would be regarded as the future spot rate and it would be computed as such by investors in their pricing decision (Moosa 2004); and b) the uncovered interest parity (UIP) condition would hold by definition, as the domestic interest rate would be given by the foreign rates plus the difference between the spot and forward exchange rates (expressed in logarithmic terms), as predicted by neoclassical authors (Lavoie 2014). If the monetary authority would keep a constant rate of devaluation, the difference between the future and current spot rate would shrink over time as the *i* schedule would turn downward sloping and approach the limit of the value of i_f. We would be back to case 1, this time with i_f as a stable long-run attractor for the cost of funding, *i*. Notice, however, that the UIP should not be interpreted in this context as a natural law but as a simple markup rule, whose rationality is sound as long as investors believe it is—as in the case of equation (11). In this sense, we could also assume a nonlinear relationship between the RER and the domestic interest rate, with *i* converging toward (diverging to) the international benchmark interest rate for low (high) levels of *q*. Depending on which of these two factors would prevail in investors' considerations, we would obtain an *i* schedule that more resembles case 2 (case 3).

Figure 8: RER Depreciation and Interest Rate Adjustment



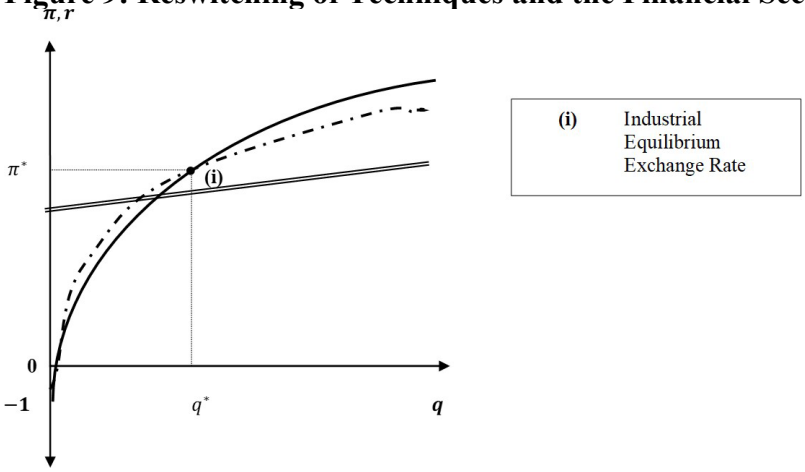
Source: Own elaboration

Case 4: Reswitching of Techniques and the Financial Sector

Finally, let us depart from the hypothesis that the method *I* is more efficient, and assume the following inequality between capital requirements: $k_C < k_B$. This implies the credit needed to finance the new sector is strictly greater than the stock of capital in the production function of sector *C*, a realistic hypothesis for firms that are introducing new methods of production. Hence, the behavior of the curves in the *e* - *r* space turns out the same as in case 1, and reswitching is again possible. This implies that the developing economy would again be able to foster structural change through the diversification of the productive structure but, in this case, the job of the monetary authority is more demanding, as it requires them to know precisely the level of the exchange rate that allows the coexistence of both sector *I* and *C*. If the policymaker wants to avoid the displacement of sector *C* while introducing *I*, it needs to consider the financial conditions that allow profitability to be positive, $\rho_s > 0$. This combination depicted, in figure 9, may happen only by a fluke, since: a) the effective cost of production may be higher than the level of the industrial equilibrium exchange rate—that is, the financial cost of the production curve lies above the intersection between r_c and r_i; and b) this industrial equilibrium exchange rate exists but for a negative profit rate in the equilibrium—because the unitary input requirements are too close to one. This case adds another layer of realism to our framework, as developing economies have access only to a limited set of production methods, the most innovative (and more efficient) ones being protected by patents.

In the cases so far presented, we focused exclusively on the role of stocks of foreign debt. However, flows may also exert a significant influence over an economy, as they may put upward (downward) pressure, i.e. appreciation (depreciation), on the value of *q* desired by the policymaker. If investors bet against the devaluation once a certain threshold level of *q* is surpassed and if the monetary authority is not able to revert this trend, the local currency will appreciate. Hence, if *q* lies on the right (left) of this threshold, structural change will be unattainable. Similar considerations apply (obviously in reverse order) if investors believe that devaluation will occur at a faster pace than the one planned by local authorities, with the exception of in case 2. This bet is more likely to succeed if the level of foreign reserves held by the domestic central bank is too low to resist excessive depreciations. Thus, necessary complements for any kind of currency policy for avoiding an overreliance on reserves may be represented by quantitative measures on foreign flows and stricter regulations, in particular on short-term speculative movements.

Figure 9: Reswitching of Techniques and the Financial Sector



Source: Own elaboration

Table 1: Summary of the Cases

Cases	**Case 1**	**Case 2**	**Case 3**	**Case 4**
Type of Technology	$k_C < k_I, l_C > l_I$	$k_C > k_B, l_C > l_I$	$k_C > k_B, l_C > l_I$	$k_C < k_B, l_C > l_I$
Type of Structural Change	Diversification (I and C coexists)	Innovation (I displaces C)	Innovation (I displaces C)	Diversification (I and C coexist)
Financial Sector	No	Yes (Exogenous)	Yes (Endogenous)	Yes (Endogenous)
Industrial Equilibrium Exchange Rate	$q^* = \frac{l_I - l_C}{-k_C} / k_B$	$\pi^* > i, q > q^*$	$\pi^* > i, q \in (q^*, q^{**})$	$q^* = k_B l_I - k_C l_C / k_B - k_C, \ \pi^* > i$

FINAL REMARKS

In this paper we analyzed the role of exchange rate policies in promoting structural change in a financially integrated environment. Stylized facts for the Latin American region for the period 2010–20 suggest the growing importance of foreign debt in nonfinancial corporations that couples with currency volatility and higher corporate risk premium. Within this context, promoting structural change via a stable and depreciated currency became a difficult task. On the contrary, countries seem to have lost an important tool for development, as for the period 2005–20 the data shows a negative correlation between private investment and exchange rate.

Based on stylized facts, we built a two-sector model inspired by Frenkel and Ros (2006) and Dvoskin, Feldman, and Ianni (2020). To depict the interactions between real and financial factors we followed closure employed by Panico (1985), Ciccarone (1998), Franke (1988), and, in particular, Dvoskin and Feldman (2019, 2021) in which the market interest rate is interpreted as an effective cost of production only for the innovative entrepreneurs, in line with Schumpeter (1911). We applied their framework to the analysis of small, open economies pursuing structural change through currency devaluation policies, but with limited control over their borrowing conditions.

We identified two types of strategy to achieve the goal of structural change, namely diversification and innovation. The former contemplates the possibility of coexistence of two tradable sectors with different technologies (case 1 and 4), while the latter foresee the substitution of the current process adopted by incumbent firms with an innovative one by newcomers (case 2 and 3). We assumed that external finance is required to kickstart the production of innovative entrepreneurs (entrepreneurs in sector 1) in cases 2 and 3 (case 4). In case 2, financial conditions are a given for each country, as innovative firms borrow in international markets, and thus are charged with the prevailing foreign interest rate plus an idiosyncratic risk premium. Conversely, cases 3 and 4 postulate an upward sloping i schedule in the e - r space, i.e., tightening effective costs of production with a more depreciated RER. The analytical conditions for a competitive exchange rate—intended as the level of RER that allows structural change—are explored for all the scenarios. In case 1, the solution is unique and it is represented by the intercept of r_C with r_I at q^*, r^*. The solution for cases 2 and 3 is represented instead by a locus along the r_I instead of a single point. In particular, in case 2 the pair q^*, r^* should be considered as a threshold above (below) which all q are competitive

(uncompetitive) exchange rates. In turn, in case 3 competitive values for q are those included in the segment q^{*}, q^{**}. Finally, case 4 is similar to case 1, although with the presence of the constraint represented by equation (9).

From a policy perspective, one can identify several challenges for a successful competitive devaluation; first, as already pointed out by Dvoskin and Feldman (2021), if the economy resembles case 1 and case 4, the monetary authority needs to not undershoot (overshooting) q^{*}, otherwise sector I (C) will prevail over C (I). Secondly, even if the central bank can precisely target q^{*} (namely because it is a threshold, as in case 2), it would still take into account the funding conditions, in the likely scenario that the new sector requires external resources to begin production. If these conditions deteriorate suddenly—because of a hike in the foreign rate or an increase in liquidity premia—currency policies become unable to modify relative prices along the direction desired by policymakers. Thirdly, a currency devaluation endogenously raises effective costs of production if foreign financial intermediaries incorporate devaluation expectations into their price equations. Depending on their risk aversion, innovative entrepreneurs may find credit conditions too tight to carry out production, even if their production function is more efficient with respect the one of the incumbents. In this sense, resorting to the domestic credit market may be a better option, even if higher interests are charged, since the profit rate, r_I, would be increasing in both its first and second derivative with respect q, as no balance sheet effects are involved for the innovative firms when currency depreciates. If domestic financing is not an option, say for instance because that new technology is precluded by patenting whose costs need to be paid in foreign currency, the financial cost of depreciation may be tamed by promoting multiple RERs (Guzman, Ocampo, and Stiglitz 2018). In our model, this would reflect the introduction of a multiplier $\beta > 0$ on k_B, improving r_I for all values of q. This, in turn, would imply an increase in the degree of control over foreign exchange transactions.

A final takeaway regards the role of the markup over the international rate, as in equation (11). As in case 2, this was assumed to be exogenously given to reflect lenders' risk; it could be put forward that policies aimed at enhancing a country's market credibility among international investors—such as liberalization reforms and structural adjustment programs—may help in easing financial constraints and implementing devaluations. Although this is analytically feasible, from a regulatory standpoint, it implies looser credit conditions, which may have perverse effects on foreign debt

accumulation. As documented by Gallagher and Prates (2014) and Abeles, Pérez Caldentey, and Valdecantos (2018), in the last decade financial and nonfinancial sectors in developing countries and especially Latin American ones have progressively taken on riskier behaviors and practices. One of these activities was borrowing foreign-denominated funds and lending them to domestic actors, speculating on the (positive) differential between the local and international base rate. Given also the stylized facts presented in section 3, it is likely to expect the buildup of foreign debt following, for instance, a general relaxation of local financial regulations, as long as a spread exists between the interest rate charged by the domestic central banks and international financial markets. Once the rally comes to an end, investors' beliefs rapidly deteriorate, and credit conditions may tighten even more than before the kickoff of the expansionary episode. Although within the model presented in case 2 this may not represent an issue (since the economy has already switched to the most efficient technology), in practice this transition may take an amount of time that is inconsistent with the fluctuations in exchange rates to which small, open economies are currently subject. To exploit a temporary price advantage, an institutional setting that stimulates innovation and learning by doing appears to be a necessary condition (Porcile, Spinola, and Yajima 2021). Hence, in contrast to Rodrik (2008), competitive currency devaluations should not be regarded as a (imperfect) substitute to industrial policies.

APPENDIX

Case 1: Baseline Framework, DFI (2020)

The market-clearing equations stated in equations (1), (2), and (3) implies:

$$Q = (wl_T + k_T Q)(1 + r_T), \qquad (T = C,I) \tag{12}$$

Case 2: The Role of the Financial System

Recall that the extended version of equation (8) can be expressed as follows:

$$P_T^S = wl_T + k_T Q(1 + r) + k_B Q(1 + i), \quad (T = C,I) \tag{13}$$

For sector C, given that credit is assumed not to be required in the production process, $\alpha \equiv kB/AIp = 0$. Hence, using equation (8), one obtains:

$$P_C^S = wl_C + k_C Q(1 + \pi_C) \tag{14}$$

Conversely, for sector I:

$$P_I^S = wl_I + k_I(1 + r) + k_B(1 + i) \tag{15}$$

Using the definition of α and AIp, the unitary capital requirements k_I may be rewritten as follows:

$$k_I = AIp - AIp\alpha \tag{16}$$

Substituting equation (16) into equation (15) and manipulating α one obtains:

$$P_I^S = wl_I + (AIp - AIp\alpha)Q(1 + r) + AIp\alpha Q(1 + i) \tag{17}$$

$$P_I^S = wl_I + AIpQ(1 - \alpha)(1 + r) + AIp\alpha Q(1 + i) \tag{18}$$

$$P_I^S = wl_I + AIpQ[(1 - \alpha)(1 + r) + \alpha(1 + i)] \tag{19}$$

$$P_I^S = wl_I + AIpQ[1 + r - \alpha - r\alpha + \alpha + i\alpha] \tag{20}$$

Then, recalling the definition of equation (8):

$$P_I^S = wl_I + AIpQ[1 + r(1 - \alpha) + i\alpha] \tag{21}$$

$$P_I^S = wl_I + AIpQ(1 + \pi_I) \tag{22}$$

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