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REAL EXCHANGE RATE POLICIES FOR ECONOMIC DEVELOPMENT

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### **ABSTRACT**

This paper analyzes the role of real exchange rate (RER) policies in promoting economic development. Markets provide a suboptimal amount of investment in sectors characterized by learning spillovers. We show that a stable and competitive RER policy may correct for this externality and other related market failures. The resulting development of these sectors leads to overall faster economic growth. A system of effectively multiple exchange rates is required when spillovers across different tradable sectors differ. The impact of RER policies is increased when they are complemented by traditional industrial policies that increase the elasticity of the aggregate supply to the RER. Among the instruments required to implement a stable and competitive RER are interventions in the foreign exchange market and regulation of capital flows. We also discuss the trade-offs associated with alternative stable and competitive RER policies.

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## 1. Introduction

The role of exchange rate policies for economic development is still largely debated. There are two central and interconnected issues regarding exchange rate policies in the macroeconomic literature on emerging economies in recent decades that relate to the links between the balance of payments and macro stability and growth: (i) the role that the exchange rate plays in facilitating or hindering economic diversification; and (ii) the extent to which the exchange rate regime and capital account management help manage cyclical swings in external financing and terms of trade fluctuations in commodity-exporting countries, and open or limit the space for counter-cyclical macroeconomic policies. Both of these issues highlight the importance of exchange rate policies in open economies, alongside monetary and fiscal policies, and also the specific and somewhat contradictory links between exchange rate and monetary policies in emerging economies subject to strong boom-bust cycles in external financing.

The first of these issues underscores the central role that economic diversification plays in the long-term growth of emerging and developing countries (Ocampo, Rada and Taylor, 2009; Rodrik, 2007 and 2013; Stiglitz and Greenwald, 2014). In this view, scaling up toward activities with higher technological contents is the key to dynamic growth. These new activities can be found in natural resources, but are most commonly associated with the development of higher-tech manufacturing and modern services. The East Asian experiences, first of the Newly Industrializing Countries and most recently of China, are underscored as success stories of such diversification (Rodrik, 1994; Lin, 2017). This contrasts with the difficulty faced by a large number of natural-resource dependent economies in diversifying their production and export structures, and even the “premature de-industrialization” that several of them have faced (Rodrik, 2016).<sup>2</sup>

The second issue—the management of cyclical swings in capital flows—emphasizes the importance of counter-cyclical macroeconomic policies for long-term growth. The essential problem in this regard is that capital flows, like finance in general, are pro-cyclical. In

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<sup>2</sup> Note that changes in technology and the structure of the global economy mean that the pattern of growth for countries going forward may have to be markedly different from those that were successful in the past. Global employment in manufacturing is on the decrease, and those countries seeking to increase industrial employment will face increasing competition for a diminishing number of jobs. Moreover, there is likely to be some onshoring, with robotization. See Stiglitz and Greenwald (2014).

commodity-exporting economies, this means, moreover, that capital flows reinforce rather than mitigate the commodity price cycle. There is overwhelming evidence that capital flows to emerging and developing countries are pro-cyclical and have become one of the major determinants—and in many cases *the* major determinant—of business cycles in emerging economies.<sup>3</sup>

The goal of this paper is twofold. First, we analyze what role real exchange rate policies can play for fostering economic development. The paper surveys and discusses recent literature and clarifies how optimal real exchange rate policies are dependent on the conditions under which they are implemented – including the available policy instruments at the time of their implementation. Even though the real exchange rate is an endogenous variable and not a direct policy instrument, we still speak of *real exchange rate policies*, understanding that these policies rely on the management of a set of *actual* policy instruments. Second, we review the instruments that can be used for implementing optimal real exchange rate policies, and review the evidence on their effectiveness.

We argue that in conditions that are common to developing economies, optimality entails competitive, stable, and *effectively* multiple real exchange rate policies<sup>4</sup>. These conditions include learning spillovers in at least some tradable sectors and the impossibility of subsidizing these sectors. Any policy that has the potential for reallocating the economy's factors of production towards the sector with learning spillovers could be welfare improving. In particular, if the government could identify the learning spillovers associated with each type of activity and if it could use subsidies and lump-sum taxes to finance the subsidies, then there would be a set of subsidies and transfers that would constitute the first best policy response. These policies would entail an appreciation of the real exchange rate (see Itskhoki and Moll, 2014, and see the appendix for the analytical development of this proposition). But if the implementation of these

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<sup>3</sup> This was well known before the global financial crisis (see, for example, Prasad *et al.*, 2003; and Ocampo, Spiegel and Stiglitz, 2008), but has been reinforced by the effects of the September 2008 Lehman shock, the effects of developed countries' expansionary monetary policies on capital flows toward emerging economies, and the more recent swings associated with the gradual dismantling of U.S. expansionary monetary policy, the commodity price collapse and the turbulence in Chinese stock markets.

<sup>4</sup> By this last term we recognize the need to introduce other policy instruments that effectively lead to a less competitive exchange rate for sectors with negative spillovers, while maintaining the commitment of members of the International Monetary Fund to avoid multiple exchange rates.

policies is not possible (either because there are severe political economy problems or risks of rent seeking that impede an efficient allocation of subsidies, or there are international regulations that impede the implementation of subsidies in the first place), then there is a key role for real exchange rate policies as second-best policies.

Under those circumstances, a competitive exchange rate will increase the profitability of tradable sectors (including new sectors as “infant sectors”, including new export activities). Implicitly, the competitive real exchange rate acts as a subsidy to the tradable sectors.<sup>5</sup> However, there may be multiple tradable sectors, including some that do not feature learning spillovers. Therefore, as a means to correct relative prices, optimality will require that the sectors with no learning spillovers that receive the implicit subsidy implied by the competitive real exchange rate are taxed, while sectors characterized by learning spillovers retain the implicit subsidy. The resulting system of effective multiple real exchange rates will help those sectors that must go through a learning process in order to be competitive. This implies that the exchange rate operates as a type of industrial policy, or in a broader sense, as a type of production sector policy<sup>6</sup>.

This consideration of real exchange rate policies as a means for fostering the development of sectors that are associated with larger technological progress is backed up now by a growing literature that shows that long-term growth in developing countries is positively associated with the capacity to guarantee a competitive exchange rate (Rodrik, 2008; Rapetti, Skott and Razmi, 2012; Razmi, Rapetti and Skott, 2012; Rapetti, 2013; and for a review of the literature, Frenkel and Rapetti, 2014; Damill, Frenkel, and Rapetti, 2014; Missio, Jaime, Brito, and Oreiro, 2015).

The conclusion of our analysis of the empirical evidence on the effectiveness of different policy instruments is that there are in fact certain interventions, as foreign exchange interventions

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<sup>5</sup> The intervention that makes the real exchange rate more competitive will be associated with static and dynamic losses but will also bring dynamic gains. In the margin, the dynamic gain will dominate (Korinek and Serven, 2016).

<sup>6</sup> It should be emphasized that modern industrial policy is not just concerned with expanding the industrial sector. Instead, it entails any policy directed at affecting the sector composition of the economy or the choice of technology. Modern industrial policies can be directed not only at promoting growth, but increasing employment, reducing inequality, promoting the environment, or any other societal objective. See Greenwald and Stiglitz (2014a, 2014b).

and capital account regulations, which are effective for maintaining competitive exchange rates and for dampening the effects of financial shocks on the exchange rate.

The rest of the paper is organized as follows. Section 2 analyzes the usefulness of competitive, stable, and effectively multiple real exchange rate (RER) policies as a vehicle for economic development in economies with low diversification. It also stresses how those policies must be complemented by other interventions that increase the elasticity of the aggregate supply to the real exchange rate policies, and discusses the trade-offs for the society in terms of present versus future consumption associated with their implementation. Sections 3 and 4 describe the alternative instruments that can be used for achieving a competitive and stable RER, emphasizing the advantages and disadvantages of each of them; section 3 focuses on capital account regulations and section 4 on complementary policy interventions in foreign exchange markets. Section 5 analyzes the challenges that competitive, stable, and effectively multiple RER policies face; it focuses on the need of coordination of different macroeconomic policies, and on the challenges that identification of economic trends poses for implementing stable and competitive real exchange rate (SCRER) policies that can be sustained over time. Section 6 provides conclusions. Finally, the appendix provides analytical clarifications on the circumstances under which optimality entails the implementation of competitive real exchange rate policies.

## **2. Real Exchange Rate policies for Economic Development**

Many of the developing economies, especially in Africa and South America, are highly dependent on agricultural as well as non-renewable natural resource exports (fuels and minerals). The abundance of natural resources, instead of increasing standards of living, has led to noncompetitive exchange rates that strangled the development of the tradable non-natural resource sectors, leading to structures of production with low diversification. The lack of diversification, in turn, has aggravated the problems of dependence on the terms of trade, leading

to high macroeconomic volatility and vulnerability. This overall failure is known as the resource curse.<sup>7</sup>

There are policies that could effectively attack the macroeconomic problems implied by the macroeconomic volatility associated with those structures of production, such as stabilization funds and the counter-cyclical macroeconomic policies supported by active interventions in foreign capital markets and capital account management to which we refer below (Ocampo, 2008). Nevertheless, those policies are not sufficient to attack two more fundamental problems: the low labor requirements of those structures of production (particularly fuels and minerals), and the limited learning spillovers associated with those economic activities (Stiglitz and Greenwald, 2014).<sup>8</sup>

The combination of exchange rate policies with other types of industrial policies may transform the comparative advantage of economies, with positive effects on economic development. Properly designed interventions may allow for the development of the sectors that are more conducive to learning –and hence lead societies to create more and better “social resources” and to use them more efficiently in the long-term.

This section describes the role of exchange rate policies for achieving those goals. It analyzes the characteristics that those policies must contain, and investigates how in specific structures of production those policies must be complemented by other active interventions (i.e. other types of industrial policies) that increase the elasticity of the aggregate supply to the real exchange rate. It also analyzes the trade-offs that the society faces with their implementation, as

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<sup>7</sup> There are other dimensions of the resource curse, e.g. related to rent-seeking (for a thorough analysis of factors that have historically prevented economies rich in resources to make a proper use of them for fostering development, see Venables, 2016). Some of the excess volatility observed in resource dependent countries is related to the highly pro-cyclical nature of capital flows, noted earlier (see Humphreys, Sachs, and Stiglitz, 2007). This curse or “disease” can also be thought as the existence of a wedge between the market exchange rate equilibrium and another (or others) that makes the emergence of non-resource tradable sectors viable (Bresser Pereira, 2008; Gerchunoff and Rapetti, 2016). The variety of mechanisms through which the abundance of natural resources can affect the economic performance is analyzed by Van der Ploeg (2011). The literature has provided rationale for using a number of policy instruments to deal with the type of resource curse known as Dutch disease (see for instance Corden (2012) for an analysis of policy options for dealing with Dutch diseases in Australia). While those instruments are not necessarily mutually exclusive, this paper focuses on understanding how policies that affect the real exchange rate can play a positive role for the development of sectors that would have a suboptimal (too small) size from the perspective of the social optimum in a free market solution.

<sup>8</sup> It must be emphasized that while, historically, linkages between natural resource sectors and the rest of the economy have often been limited, this is at least partly the result of not implementing adequate industrial policies. See, Greenwald and Stiglitz (2014a, b) and Jourdan (2014).

they may entail the sacrifice of present consumption in exchange for larger levels of future consumption.

## 2.1. Competitive real exchange rates

A competitive real exchange rate makes investment in the tradable sector more profitable. It may allow “infant sectors” to emerge and settle. In the absence of interventions, the size of sectors with large learning spillovers would be suboptimal, as the market would not internalize the positive effects of those sectors on the rest of the economy. Besides, when there are credit constraints, the *within*-sector<sup>9</sup> learning spillovers—i.e., the benefits that a learning process would imply for the same sector in the future—will also be underexploited. Interventions that give these sectors an advantage over the conditions that the free market solution would provide constitute a (at least partial) correction of externalities and other market failures.

These types of benefits are important for all economies, as these pervasive externalities and market failures are always present no matter the stage of development; but they are particularly important for developing economies, where there is more to learn and where credit constraints may be more binding.<sup>10</sup> Then, exchange rate policies would be a type of industrial or more generally production sector policies that would especially benefit economies with more infant sectors characterized by learning spillovers.<sup>11</sup>

At least four caveats must be made in relation to these propositions. The first one refers to the potential need for complementing real exchange rate policies with other traditional industrial policies. The second one relates to the challenge of channeling the benefits of exchange rate policies to the right sectors – i.e. those with larger positive externalities. The third one refers to the trade-offs that the implementation of these policies imposes on societies. The rest of this subsection analyzes these issues.

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<sup>9</sup> Or, for that matter, within-firm learning potentials.

<sup>10</sup> This is especially so because of the predominance of SMEs in such economies.

<sup>11</sup> Greenwald and Stiglitz (2006) refer to policies promoting development in such economies as *infant economy* policies (as opposed to *infant industry* policies).

A final caveat, not analyzed in detail here, relates to the international implications of these policies. Adopting an active exchange rate policy may have negative externalities on other countries, especially if the country adopting such a policy is a large player in world trade. Also, if many emerging and developing countries adopted these policies, the joint effect would be more limited than if fewer economies did so, and there could be fallacy of composition effects that contribute to the generation of global imbalances.

### **2.1.1. The complementarity between the exchange rate and industrial policies**

A competitive exchange rate can be viewed as a type of industrial policy that can partially substitute for other traditional industrial policies<sup>12</sup>; however, under some circumstances, it must also be complemented by the implementation of those other policies.

Given the complex political economy that may be associated with appropriate management of active industrial policies, and the rent seeking that has sometimes characterized these policies in the past, many analysts see competitive exchange rates as the right approach for industrial or production sector policies, as opposed to the approach that consists in what has come to be called “picking winners”. In this sense, production sector policies must be viewed as an exercise in correcting market failures, in order to create social capabilities and exploit them optimally over time—i.e., in “creating” rather than “picking” winners.

Indeed, competitive exchange rates would not constitute a sufficient policy for correcting those failures if other conditions that are also necessary for expanding the sectors with larger learning spillovers were not present. If the non-natural resources tradable sectors that these policies intend to expand do not have the other necessary conditions to emerge (for instance, access to technology and credit), the elasticity of aggregate supply to the real exchange rate will be low.

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<sup>12</sup> But, of course, it is far more than an industrial policy.

It is then crucial to create those conditions. Other, more traditional industrial policies may be the right vehicles for creating them. One of those traditional policies is the provision of credit. Many countries have built up successful development banks to correct a myriad of market failures: inadequate long-term finance (including for infrastructure), promoting innovative sectors (“infant sectors” in the terminology of this paper) on and others with positive externalities (those associated with environmental protection, including combating climate change), guaranteeing access to finance for SMEs and poor households, and counteracting the procyclical behavior of private finance (Griffith-Jones, Ocampo and Barros de Castro, 2017). This is true of major developed countries (notably Germany and Japan) but also several emerging and developing countries. Even countries that lack national development banks develop several interventions to guarantee access to finance or regulatory policies that affect the allocation of credit – the US Small Business Administration and the US Community Reinvestment Act, for example. The success of development banks is related to the development of institutional capabilities of the country. The process of building-up development banks involves learning itself.<sup>13</sup> Indeed, successful learning in the development of these institutions tend to transform them into essential instruments of production sector policies, as well as of the provision of public goods and socio-economic inclusion.

Non-convexities – as for instance those associated with sunk costs – may also prevent the emergence of tradable sectors associated with learning spillovers in the presence of credit-constraints. A competitive real exchange rate policy also plays a role for the development of those sectors, through two channels: a reallocation of the domestic demand towards locally produced goods, and an increase in the foreign demand for the local goods. Thus, the competitive real exchange rate can give rise to Kaldor-Verdoorn effects in sectors where scale effects are relevant.<sup>14</sup> Under those conditions, a sufficiently large increase in demand will increase the scale of production to a point where it pays off to meet the sunk costs – within the macroeconomic constraints to the adoption of expansionary aggregate demand policies.<sup>15</sup>

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<sup>13</sup> See for instance Shimada (2016) for an analysis of the role of development banks in Japan and their evolution.

<sup>14</sup> Verdoorn (1949), Kaldor (1966); see also Setterfield (1997) on the mechanisms of cumulative causation.

<sup>15</sup> Of course, the proposition that there can always be consistent demand-led growth cannot be general. If increases in the aggregate demand always translated in equivalent increases in the aggregate supply, then there would be a trivial policy prescription for fostering economic development: aggregate demand should be increased to infinity,

Investments in infrastructure, education and R&D to enhance the competitiveness of the learning sectors are other traditional policies that could complement real exchange rate policies. Investments in human capital are especially profitable when the skills composition of the labor force is not well tuned for developing the infant sectors. In those situations, re-training the labor force must be an essential element of the integral development plan.

### **2.1.2. Channeling the benefits of competitive RER to the “right” sectors: the need for effectively multiple real exchange rates**

Economies with strong competitive advantages in natural resources face particularly difficult challenges in following the recommendation of adopting competitive exchange rate policies. This is truer if traditional export sectors benefit from high commodity prices, such as those experienced during the super-cycle of commodity prices that recently came to an end. Furthermore, although competitive and stable exchange rate policies can help to overcome the uncertainties and fixed costs that characterize the creation of new sectors of production and associated learning processes, they also benefit traditional export sectors, including natural resource-intensive sectors, and generate additional incentives to invest in them<sup>16</sup>. This is another reason why exchange rate policy *alone* may fail to encourage diversification.

In the absence of interventions, the benefits of commodity booms would be concentrated on the resource tradable sector, with limited benefits to non-resource sector exports and import competing sectors (indeed, when commodity booms lead to exchange rate appreciation, these sectors may be disadvantaged). Besides, pursuing a policy of competitive real exchange rate implies an “implicit” subsidy to all the tradable sectors, including those that do not feature learning externalities.

This is why raising taxes on traditional commodity production (including through export taxes) to capture part of the commodity price windfall and to channel the benefits of the

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and aggregate supply would respond by increasing to infinity as well. This is clearly an absurd proposition, because it would imply the non-existence of resource constraints.

<sup>16</sup> It is not just that the more competitive exchange rate increases the marginal return to investments in these sectors. In the presence of imperfect capital markets, the additional revenues may not flow easily to other sectors.

interventions to the right sectors should be part of the policy package under these circumstances. These interventions would generate the capacity for distributing the benefits of the boom to the rest of the economy, and would align relative prices with the marginal social returns; this policy approach creates *de facto* a system of *effectively multiple exchange rates* that could make exports in the non-resource sector competitive.

The proposition is general: sectors with negative externalities and with smaller learning spillovers should be more heavily taxed. This tax policy, besides creating the incentives for expanding the “desirable” sectors, would at the same time contribute to generating the revenues for running active industrial or production sector policies that increase the elasticity of output to the real exchange rate policy.

The strong static comparative advantage of the commodity sector also implies that industrial policies must particularly aim at exploiting the upstream, downstream, and horizontal linkages, including the linkages that might be associated with processing and resource extraction itself – i.e., exploiting the sideways externalities. For this type of an economy, the exploration and development of linkages with activities that have larger learning spillovers can be the basis of an effective industrial policy, one that enhances the capabilities of both individuals and firms.<sup>17</sup>

### **2.1.3. The associated trade-offs**

A more “undervalued” RER means higher prices of tradable goods and services in terms of the domestic currency. Therefore, following a policy of competitive RER is associated with lower real wages in the present, with the objective of achieving higher real wages in the future. The magnitude of these effects depends on the composition of the consumption basket, and would tend to be stronger the larger the share of tradables in that basket (a basket that is endogenous). These trade-offs are also associated with distributive effects: not all the sectors of the society pay the same “price” in the present for achieving larger economic growth in steady state—and it may

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<sup>17</sup> For further elaboration, see the various chapters in Stiglitz, Lin, and Patel (2014), especially Jordan (2014) and Greenwald and Stiglitz (2014b).

not be clear for the different sectors of the society who will benefit from the increases in economic growth at the time they are achieved.

Therefore, the implementation of competitive RER policies requires social coordination that in many occasions is difficult to achieve—especially so when the sectors that would lose purchasing power in the present believe that they will not share the potentially larger purchasing power of the aggregate economy in the future.

The implementation of competitive real exchange rate policies may be associated with another trade-off: a more depreciated exchange rate means higher costs of imported inputs.<sup>18</sup> But as long as the domestic production of tradable goods also has domestic contents, the profitability of the tradable sector will increase. But the development of sectors that eventually become internationally tradable may take time, i.e. it may take time until firms learn enough as to become competitive in international markets. If learning requires imported inputs, the cost of learning will increase with a more depreciated real exchange rate.

## 2.2. Stable real exchange rates

Under the assumption that firms are risk-averse and in the presence of non-convexities, optimal policies entail a *stable* real exchange rate. The reason is that the real exchange rate instability is a major source of uncertainty for the production of tradable (export and import-competing) goods and services, and therefore discourages investment in these sectors. If firms are risk averse and face non-convexities as those associated with bankruptcy costs, they will care not just about the average exchange rate, but also about its volatility.<sup>19</sup> Furthermore, exchange rate instability increases the volatility of cash flows for firms in these sectors, the main source of funding for small and medium firms in imperfect capital markets, further deterring investments.<sup>20</sup>

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<sup>18</sup> Indeed, import shares may even increase with a devaluation (see Blaum, 2017).

<sup>19</sup> Rothschild and Stiglitz (1971) provide the analytical foundations of this mechanism.

<sup>20</sup> It is now well established that SMEs are especially cash constrained, and that cash flows are the major source of funding for their investments. This is true even in advanced countries with well-developed capital markets.

An additional adverse effect of exchange rate instability is associated with the hysteresis accompanying dynamic economies of scale (e.g., if productivity tomorrow depends on production today). Under these circumstances, exchange rate appreciation during booms can generate permanent losses in the production structure, and therefore, adverse effects on long-term growth—an effect neatly captured in a classic paper by Krugman (1987).

Short run movements in the exchange rate today are largely related to changes in capital flows.<sup>21</sup> While we focus in this section on the exchange rate effects, we need to recognize that these changes in capital flows have far more reaching effects than just the change in exchange rates; for (in the absence of fully countervailing measures by monetary authorities) they affect the flows of funds to different sectors of the economy, and thus, affect the structure of the economy.<sup>22</sup>

The cyclical behavior that characterizes capital flows goes beyond volatility of short-term flows, which in turn contribute to volatility in exchange rates. The large and growing literature on macro-economic externalities (Jeanne and Korinek (2010), Korinek (2010, 2011)) emphasizes that because of these externalities, there is *no* presumption that market determined exchange rates have optimality properties. They provide a theoretical rationale for the capital account management interventions described in this paper.<sup>23</sup>

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<sup>21</sup> Recent shocks in global financial markets have once again demonstrated that the cyclical supply of finance toward emerging economies is largely driven by monetary policy and portfolio decisions in industrial countries, related in turn to the response of banks and portfolio investors to incentives created by monetary and financial events generated in developed countries and, particularly in the U.S. These responses are called the “search for yield” and the “flight to safety”, typical of different phases of financial cycles. In emerging economies, the domestic financial risks are made more complex by the currency mismatches that they generate in domestic economic agents borrowing abroad (especially in the absence of adequate regulation), as well as the pro-cyclical response to exchange rate and interest rate movements by portfolio foreign investors in the domestic currency bond and equity markets of emerging economies, including through carry trade.

<sup>22</sup> Surges in capital flows are thus often associated with real estate bubbles.

<sup>23</sup> Even more challenging in policy terms are the *medium-term* cycles in the availability and costs of financing. Since the mid-1970s, emerging economies have experienced three full medium-term cycles of external financing of emerging economies—mid-1970s to late-1980s, 1990 to 2002, and 2003 to 2009—and may be coming to the end of a fourth one, which started in late 2009 and has been followed by several episodes of capital outflows since the initial announcements of U.S. monetary tapering in May 2013, which became more severe since the collapse of commodity prices in 2014 and the turbulence of Chinese stock markets since mid-2015. The major problem with these medium-term swings is their strong effect on *all* major macroeconomic variables: exchange rates, interest rates, domestic credit, asset prices and, through all of them, on the balance of payment and economic activity.

A major source of concern of the recent literature and policy debates are the macroeconomic and financial stability risks generated by swings in both the balance of payment and domestic finance that are associated with these cycles. Since we are concerned here with the exchange rate and the capital account, we will concentrate on the balance of payments effects—although these risks have other implications of major concern for societies, such as perverse distributive effects.

The increase in external liabilities associated with capital account booms are sometimes offset by an increase in foreign assets. Even in these cases, the currency mismatch between the assets and liabilities generates risks. However, the major problem is when capital account booms are “absorbed” by growing current account deficits, thus generating a deterioration of external balance sheets. Large current account deficits are a major source of financial risks when external financial conditions deteriorate (see, for example, Calvo, 1998). This enhances the probability and potential costs of balance of payments crises. Furthermore, the associated exchange rate correction that then takes place generates massive wealth losses associated with currency mismatches in domestic portfolios, which may lead to a domestic financial crisis. This is reinforced by the possible bust of the domestic credit and asset price bubbles generated during the external financing boom.<sup>24</sup>

Finally, pro-cyclical capital flows limit the space for counter-cyclical macroeconomic policies and, more generally, exacerbate major policy trade-offs. For example, exchange rate flexibility does generate some degree of monetary policy autonomy. However, by attracting additional capital flows, the use of counter-cyclical monetary policies would only exacerbate appreciation pressures during booms—in a sense just displacing the effects of pro-cyclical capital flows to the exchange rate. Besides, as monetary policy itself has sectorial impacts, the reliance on monetary policy for managing volatility in capital flows disadvantages sectors that are particularly sensitive to the exchange rate and interest rate. Even then, monetary policy may be relatively ineffective in countervailing the inflationary impact of capital surges: the decrease in activity in the interest rate and exchange rate-sensitive sectors can be more than offset by the stimulus generated by the additional capital inflows induced by the higher interest rates.

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<sup>24</sup> Some of these adverse effects might be mitigated by the capital account management techniques described below, which are part of appropriately designed macroprudential regulations.

An alternative to reducing the expansionary pressures generated by capital inflows is to adopt a contractionary fiscal policy. But this makes fiscal policy hostage to capital account volatility.

There is, therefore a strong rationale for intervening directly in the source of the cyclical swings (i.e., on capital flows) or in the exchange rate market, through counter-cyclical accumulation of foreign exchange reserves. These are the issues to which we now turn.

### **3. Complementary macroeconomic policy instruments: capital account regulations**

The implementation of competitive and stable real exchange rate policies requires an identification of effective policy instruments. This section analyzes the role that can be played by that capital account regulations (CARs).

CARs play indeed a multiple role: they serve as a *macroeconomic* policy tool, as a *financial stability* tool (Ocampo, 2015) and, following our analysis above, as an instrument for maintaining a competitive real exchange rate – a role that we could define as a *development* tool. As a macroeconomic policy tool, they provide larger room for counter-cyclical monetary policies. During booms, they increase the space to undertake contractionary monetary policy while avoiding the exchange rate appreciation pressures that such monetary policy can generate. By mitigating exchange rate appreciation, they also reduce the risks that rising current account deficits will generate a future balance of payments crisis. In turn, during crises, they can create some room for expansionary monetary policies while containing capital flight and excessive exchange rate depreciation, and the effects of the latter on domestic inflation. The increase in capacity for counter-cyclical monetary policies reduces the burden on fiscal policies throughout the business cycle.

On the other hand, viewed as a financial stability tool, CARs recognize the fact that the reversibility of capital flows varies significantly according to the nature of capital flows: foreign direct investment is more stable than portfolio and debt flows and, among the latter, short-term

debt flows are particularly volatile.<sup>25</sup> So, as a financial stability tool, CARs aim at moderating the build-up of debts, and particularly short-term debts, during booms as well as reversible portfolio flows. These interventions reduce the intensity of the capital account cycle.

CARs can also be justified as a way of avoiding the negative externalities of volatile capital flows on recipient countries. These externalities result from the fact that individual investors and borrowers do not take into account or ignore the effects of their financial decisions on the level of financial stability in a particular nation, including on the exchange rate and other macro-economic variables. Such market failures call for a Pigouvian tax—here, taxes on cross-border financial activities and other regulations (Korinek, 2011).

Finally, as demonstrated by Jeanne (2012), capital account policies – including all the policies that affect the private sector’s access to foreign capital – can have persistent effects on the real exchange rate.<sup>26</sup> The evidence is aligned with this theoretical prediction.<sup>27</sup> The experience of China illustrates the mechanisms at play. Between 2002 and 2008, the Chinese tradable sector experienced grew rapidly; in absence of policy interventions should have led to an appreciation of the renminbi (due to the Balassa-Samuelson effect). But the appreciatory pressures were resisted though capital account policies. During the period, there was a large accumulation of foreign reserves. Instead of an appreciation of the real exchange rate, the country had a large accumulation of foreign reserves and large trade surpluses.

CARs can be either administrative (quantitative) or price-based, but there are more complex typologies (see, for example, IMF 2011). They have also been called “capital flow management measures” (IMF, 2011) and “capital management techniques” (Epstein *et al.*, 2003). Administrative regulations include ceilings or prohibitions or ceilings on certain transactions, minimum stay periods, restrictions on foreign investors taking positions in domestic

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<sup>25</sup> The classic treatment of the riskiness of short-term capital is Rodrik and Velasco (2000).

<sup>26</sup> A concern with the implementation of policies that control the capital account is that they could be circumvented. However, if evasion is costly, the controls will still bind. The evidence shows that contrary to the common perception that capital controls can be evaded, they indeed affect the cross-market premium (Levy Yeyati, Schmukler, and Van Horen, 2008). Relatedly, Bengui and Bianchi (2014) find that leakages do not necessarily make CARs as macroprudential policies less desirable, and that stabilization gains still outweigh the costs of leakages.

<sup>27</sup> See Blanchard, Adler, and de Carvalho Filho (2015), Levy Yeyati and Sturzegger (2007), Levy Yeyati, Sturzenegger, and Gluzmann (2013), and Montecino (2015). Relatedly, Libman (2017) shows that pegs are associated with more overvaluation.

securities or rules that only allow certain agents (residents and corporates) to undertake certain transactions. In turn, price-based regulations include unremunerated reserve requirements on capital inflows (URRs) or tax provisions applying to foreign-currency liabilities (see, on the latter, Stiglitz and Bhattacharya 2000).

All of them belong to the family of what have come to be called “macroprudential regulations”. This concept was proposed before the global financial crisis,<sup>28</sup> but has only received widespread acceptance in recent years, including in the IMF’s “institutional view” of capital account management. In fact, CARs should be seen as part of a continuum, which goes from regulation on financial transactions of domestic residents in the domestic currency (traditional prudential regulation), to those of domestic residents transacting in foreign currency, to those involving domestic agents’ transactions with foreign residents.

As components of the broader family of macroprudential regulations, those that focus directly on the capital account can be partly substituted by domestic prudential regulations. For example, a good fairly generalized regulatory practice is managing the net foreign exchange exposure of domestic financial institutions. This may entail forbidding banks and other domestic financial intermediaries from holding net liability positions in foreign currency, or using differential reserve requirements for liabilities of the domestic banks in domestic vs. foreign currencies. These regulations can be combined with oversight of the currency exposure of the firms to which the banks lend. One disadvantage of replacing purely domestic regulations for those that directly affect capital flows is that they do not encompass direct borrowing abroad by non-financial agents. A specific advantage of CARs is that they aim at the direct source of financial volatility.

Most of the literature on the effectiveness of CARs comes from the analysis of individual countries or comparative experiences of countries that apply them.<sup>29</sup> This has been complemented by an increasing number of multi-country studies.

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<sup>28</sup> See, for example, the concept of “counter-cyclical prudential regulations” in Ocampo (2003), as well as the work of the Bank for International Settlements on what they already termed the “macroprudential perspective”.

<sup>29</sup> See, among others, several papers by the IMF (2011) and IMF experts (Ariyoshi *et al.* 2000; Ostry *et al.* 2010, 2011 and 2012; the literature reviews of Magud and Reinhart (2007), Magud, Reinhart and Rogoff (2011), Ocampo (2008) and Ocampo and Erten (2014); and the broad review of the debates on CARs in Gallagher (2014).

The strongest consensus in the literature relates to the improvement in the quality of capital inflows generated by CARs, by lengthening the maturity of external debt obligations. There is also a fairly broad agreement in the capacity of regulations to increase monetary policy independence by partly delinking the interest and exchange rate effects of capital flows, thus allowing countries greater scope to increase domestic interest rates during booms and avoid raising them during crises while partly avoiding the exchange rate effects of such policies.

In contrast, there is no agreement on whether CARs can be used to affect overall capital inflows and exchange rates. Exchange rate effects are generally found to be statistically insignificant or at least temporary. The same is true of overall capital flows, implying that these regulations are “speed bumps”<sup>30</sup> rather than permanent restrictions<sup>31</sup>. This implies that it may be necessary to modify regulations to respond to ways private agents learn to circumvent regulations. However, speed bumps do make direct contributions to financial stability. Historically, financial crises have been associated with manias, typically including the rapid expansion of credit that in turn led to the rapid growth of prices of some type of assets (Kindleberger and Aliber, 2011).<sup>32</sup> Speed bumps may effectively discourage the creation of bubbles.

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<sup>30</sup> This is the term used by Bhattacharya (1997), Stiglitz (1999) and Ocampo and Palma (2008), among others.

<sup>31</sup> Some CARs do, however, affect the relative attractiveness to, say, foreign exchange exposures, and thus should be expected to have a long run effect.

<sup>32</sup> Prolonged manias in presumably stable environments have also been associated with more severe crises (Gluzmann, Guzman, and Howitt, 2014; Guzman and Howitt, 2015).

These effects may depend on the nature and strength of the regulations.<sup>33</sup> Using two instruments simultaneously may also enhance their effectiveness, as shown in the analysis by Rincón and Toro (2010) which illustrates the stronger effects of central bank interventions in foreign exchange markets and URRs on exchange rates when these interventions were adopted simultaneously.

CARs also have real effects. According to IMF research, countries that had CARs in place before the global financial crisis were able to mitigate the contraction of GDP during the crisis (Ostry et al., 2012). This was confirmed by Erten and Ocampo (2017), who found that CARs not only helped countries avoid a strong impact of the crisis but also overheating during the recovery, indicating that they are, overall, an effective counter-cyclical policy instrument.

The literature has also discussed the advantages and disadvantages of several forms of regulations: regulating inflows versus outflows, administrative vs. price-based, and temporary versus permanent interventions. On the first of these issues, there is a preference for regulating inflows. However, the empirical evidence, including in past IMF research, indicate that regulations of outflows are more effective than those on inflows.<sup>34</sup>

There is also a preference for price-based over administrative regulations, as they are more market friendly and less susceptible to political economy failures (rent seeking and corruption). But again, the evidence in the literature, including past IMF research, is that administrative regulations may be more effective. Theory shows that in general, when information is imperfect and contracts are incomplete, it is optimal to use a set of controls that contain both price regulations to affect incentives and quantity regulation to affect constraints (Weitzman, 1974; Dasgupta and Stiglitz, 1977).

In relation to temporary versus permanent regulation, the crucial issue is whether countries have the institutions in place when they needed, rather than having to improvise them, risking their ineffectiveness. This is closely related to the associated learning process as to how

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<sup>33</sup> See, for example, the comparative study of the effects of CARs on inflows in Chile, Colombia and Malaysia in the 1990s (Ocampo and Palma, 2008), which concluded that the harsher 1994 Malaysian regulations had the strongest effect and, in turn, those of Colombia were more effective than those of Chile because the tax equivalent of the unremunerated reserve requirement (URR) was larger. Similarly, the strong tax on outflows introduced by Malaysia in 1998 is generally considered to have been very effective (Kaplan and Rodrik, 2002).

<sup>34</sup> See the older research by the IMF (Ariyoshi *et al.* 2000) and Erten and Ocampo (2017).

to use them, and the capacity to design rules that incorporate the most important adjustments required through the business cycle. In both regards, having permanent regulatory systems in place that can be used in a counter-cyclical way—including temporarily phasing out the regulations when there are no balance of payments pressures—is better than improvising institutions to manage either booms or crises.<sup>35</sup>

#### **4. Complementary policy interventions in foreign exchange markets**

It can be argued that the basic disadvantage of capital market regulations is that they *segment* domestic from international markets. It can be argued, however, that this recognizes the reality that markets are already segmented. In fact, the basic flaw of capital account liberalization is that it does not recognize the implications of this fact. In any case, the most common rationale for opening the capital account is that countries positively value being integrated into global financial markets. This preference, plus the generally negative view on regulating capital flows that prevailed before the global financial crisis, is why countries generally prefer to intervene in foreign exchange markets.

Such interventions have indeed become a major rule in many emerging and developing countries, particularly after the emerging countries' crisis that started in East Asia in 1997. A major result of this is that, in contrast to the mainstream view that prevailed in the 1990s, according to which only polar regimes were stable—hard pegs or freely floating exchange rates—the dominant exchange rate regime in emerging and developing countries has become intermediate regimes, in particular *managed* exchange rate flexibility (see Ilzetzki, Reinhart, and Rogoff, 2017). In fact, and in contrast to the mainstream views a decade ago, IMF research now shows that managed floats are significantly less prone to crises (Ghosh, Ostry and Qureshi, 2014). This indicates that the pragmatic choice of many emerging and developing countries has been a correct one.

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<sup>35</sup> Klein (2012) finds that temporary controls are less effective than permanent controls, and that this is likely due to the fact that countries with long-standing controls have a larger probability of having incurred the sunk costs that building a system of surveillance requires, thus enforcement of controls works better in the latter economies.

Interventions in foreign exchange market among countries differ, however, in terms of the magnitude and symmetry of their interventions through the business cycle. For example, among the five major Latin American countries with managed floats, Peru is the country that most massively intervenes in foreign exchange markets, followed by Chile (if we include the copper stabilization funds as a complement to foreign exchange reserves); Brazil falls in an intermediate position, and Colombia and Mexico have the most moderate levels of intervention (though Mexico has intervened more heavily since the global financial crisis). The unsurprising result is that Peru has had the most stable real exchange rate over the past decade (Ocampo and Malagón, 2015). Obviously, the magnitude of the necessary interventions depends on the capital account regime as well as the global conditions that determine the size and volatility of capital flows.

Managing fluctuations in foreign exchange earnings associated with commodity export price cycles also aim to smooth real exchange rates, and in this sense are complementary with those that try to avoid real exchange fluctuations associated with capital account volatility. In this sense, stabilization funds, such as those used by Chile to accumulate funds during copper price booms, play a complementary role to foreign exchange reserves.

A cursory look at trends in foreign exchange reserves in emerging economies shows also that interventions in foreign exchange markets tend to be asymmetrical. In particular, the massive accumulation of reserves prior to the global financial crisis was followed by a rather moderate use of such reserves during the peak of the crisis—the year or so after the collapse of Lehman Brothers. One rationale is that there is an inherent asymmetry in the fact that emerging countries' central banks issue domestic currency but not dollars (or euros). Since the demand for the domestic currency increases during booms, reserve accumulation is one way of supplying the additional money; beyond the point that central banks view it as appropriate to issue domestic currency, they can also sterilize the reserve accumulation. In contrast, the degrees of freedom that they have when foreign reserves dwindle are more limited, and the reduction in reserves may itself generate strong adverse speculative pressures, rising risk premiums and capital flight. So, given the asymmetries that emerging and developing countries face, the asymmetrical management of foreign exchange reserves is a rational response of authorities.

In any case, central bank preferences differ significantly in this regard. Analyzing five large Asian economies over the past decade, Sengupta and Sen Gupta (2014) find that all countries accumulated reserves during capital account surges but they allowed them to fall during episodes of sudden stop in external financing in a very diverse way. India and Korea reduced their reserves during such episodes but Indonesia and Thailand did not, while Malaysia's response depended on the specific episode. This reveals, according to the authors' analysis, the stronger relative preference by Indonesia and Thailand for exchange rate stability as a policy objective relative to monetary independence.

If the basic problem of CARs is that they segment capital markets, the major disadvantage of reserve accumulation is that it is costly. As it is well known, the basic problem in this regard is that reserves are invested in very low-yield safe assets; so, if reserves are accumulated to avoid the appreciation of the exchange rate in the face of booming and higher yield private capital flows, the cost can be sizable. If reserve accumulation is sterilized, there are also domestic costs associated with such sterilization. As reserves have become sizable in most countries, these costs have increased (see, for example, the estimates of Gallagher and Shrestha, 2012).

However, there are circumstances in which sterilization costs can be compensated by the returns on accumulated foreign exchange reserves. This was the case of Argentina during 2003-2008, a period in which that country followed a policy of stable and competitive real exchange rate (and also of multiple effective exchange rates, determined by a structure of differential taxes on exports). To reach the real exchange rate "targets", the Central Bank followed a managed floating regime within a monetary framework of targeting a monetary aggregate. To achieve the monetary targets, the Central Bank had to sterilize part of the increase in liquidity generated by its intervention in foreign exchange markets through the issuing of short and medium term securities. As the interest payments on short and medium term securities were not greater than the yields obtained from international reserves, sterilized foreign interventions were not costly in net terms.

Furthermore, while countries have traditionally held low yielding assets in their reserves, they have increasingly recycled some of the reserves into higher yielding asset purchases,

generating significant returns. In general, however, when for one reason or another, a country is unable to manage its reserves to yield significant return, a more active use of CARs may be seen as a less costly way of intervention.

Overall, what this analysis indicates is that best practice in open emerging economies subject to boom-bust cycles in external financing is the complementary use of traditional macroeconomic policies with interventions in foreign exchange markets and capital account regulations.<sup>36</sup> These interventions have proven effective. While the studies of the 1980s had largely rejected the effectiveness of interventions in foreign exchange markets, subsequent studies have contested those earlier results, and have shown that interventions are indeed effective.<sup>37</sup>

## **5. Additional policy coordination challenges with the implementation of SCRER policies**

The effectiveness of SCRER policies depends on the capacity of being maintained at least until the infant sectors become competitive and the learning externalities that those policies aim to foster are built up.

One of the challenges for using a SCRER as industrial policy is to avoid a large pass-through from nominal exchange rate depreciation to prices. There is evidence that countries with more volatile nominal exchange rates have higher pass-through elasticities (Campa and

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<sup>36</sup> These interventions must be seen as a complement and not a substitute for counter-cyclical macroeconomic policies, and of industrial policy. They should also not be seen as a sort of “interventions of last resort” once other macroeconomic policies have been exhausted, but rather as part of the normal counter-cyclical policy package.

<sup>37</sup> See for instance Sarno and Taylor (2001) for a comparative review of the empirical literature of the 1980s and 1990s; the study concludes that the studies of the 1990s, that are supportive of the effectiveness of intervention, should be given more weight than the studies of the 1980s, that had two major handicaps: the lack of data on intervention and the lack of survey data on exchange rate expectations. More recently, Adler and Tovar (2011) studied the effects of sterilized foreign exchange interventions from 2004 to 2010 for a panel of 15 economies (most of them Latin American). They found that interventions are effective for maintaining the real exchange rate persistently undervalued, but this effect is stronger when the capital account is more closed.

Goldberg, 2005).<sup>38</sup> A corollary from this relationship is that a policy that targets nominal exchange rate stability would also decrease the pass-through to prices, making the SCRER policy more sustainable.

Generally, pass-through elasticities will depend on the characteristics of the market structure. Under the law of one price, in highly competitive markets there would be a perfect pass-through from movements in the exchange rate to domestic prices of tradable goods.<sup>39</sup> But a less than infinity elasticity of substitution between domestic and foreign goods would decrease the pass-through elasticity. Consistently, empirical studies show that pass-through elasticities are larger when the economy is more open. The elasticities also depend on macroeconomic conditions: they are smaller in recessions than in booms (Goldfjan and da Costa Werlang, 2000).

The sustainability of SCRER requires coordination with fiscal and monetary policies, and importantly, it requires a proper identification of productivity trends. Macro policies should in this sense generate an essential enabling environment for industrial policies to be effective. Policies that encourage significant increases in consumption based on the expectation of future increases in productivity—perhaps as a consequence of the real exchange and other industrial policies—may fail dramatically if those expectations are not subsequently realized. If macro policies turn out to be over-expansionary ex-post, they may result in inflationary pressures that will severely damage the capacity for pursuing competitive *real* exchange rates. The recent case of Argentina is an indication of these risks: When the country followed a SCRER policy (2003-2008), the macroeconomic performance was successful. When that strategy stopped being followed (since 2010), economic performance was mediocre (Damill, Frenkel, and Rapetti, 2015).

Ultimately, the success of SCRER policies will depend on the capacity of being sustained at least until the infant sectors grow, and this capacity will in turn depend on the possibility of

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<sup>38</sup> The quoted study provides evidence only for OECD countries. This empirical finding is consistent with Devereux and Engel (2001) theory, in which a higher volatility of the exchange rate makes the choice of foreign currencies for transaction invoices more likely. Then, variations in the exchange rate would have a larger effect on prices.

<sup>39</sup> Matters are somewhat more complicated than this discussion suggests. For instance, if the country purchases mostly machine goods from abroad, then a change in the exchange rate might not affect the short run marginal costs of production. If the country imports mostly food, the impact on manufactured goods will depend on the structure of the labor market and wage bargaining processes.

financing the complementary traditional industrial policies and of ensuring an economic structure associated with a low pass-through. Avoiding boom-go-bust situations is central for achieving those conditions.

## 6. Conclusions

There are a variety of historical experiences that support the claim that stable and competitive real exchange rate (SCRER) policies are good for economic development, as demonstrated by a number of Asian economies (Rodrik, 2008; Razmi et al., 2012), and more recently by Argentina during 2003-2008 (Damill, Frenkel, and Rapetti, 2015).

This paper has described the theoretical foundations for those policies. We note that the main argument *against* such interventions—that they represent interference in the free functioning of markets, which, in the absence of such intervention would ensure efficiency—has been undermined by research over the past decades. In the absence of government intervention, markets are not in general either efficient or stable. Today, in fact, every government intervenes in the market, at the very least through the setting of interest rates (monetary policy). There is no such thing as a “pure” market equilibrium. Indeed, the market equilibrium is affected by virtually every regulation that affects the macro-economic equilibrium, including those that affect domestic savings and investment.

We argued that a SCRER sets (some of) the necessary conditions for increases in diversification of the tradable sector. But in order to incentivize the sectors with larger learning spillovers, other complementary conditions must be established. Particularly, the sectors with smaller learning spillovers must be taxed more heavily, in order to create a structure of shadow prices that reflects the true social benefits and costs. The revenues from that tax structure may serve the function of funding other traditional industrial policies that would increase the elasticity of the aggregate supply to real exchange rate policies, such as the provision of credit to the infant sectors, investments in infrastructure and R&D, and investments in education that allow for a reconversion of the composition of the labor force to one that is complementary of the pursued structure of production.

A variety of capital account regulations and foreign exchange market interventions can be used for achieving the goal of a SCRER. Those instruments may play a key role for achieving macroeconomic and financial stability. We argue that the question should not be *which* instrument to utilize. Rather, there should be a portfolio of instruments; direct interventions combined with capital account management techniques, and in the latter case, price as well as administrative interventions. We have argued that pursuing a *stable, competitive, and effectively multiple* exchange rate can promote economic development, and given the instability of global financial markets, this requires *flexible and sustained interventions*. And these interventions and instruments need to be used in combination with, and in coordination with, a range of other monetary, macro-economic and micro-instruments, including, most notably, industrial policies. Exchange rate management is thus both an instrument of industrial policy, and a policy that can enhance the power of other instruments.

## Appendix

This appendix sketches a simple two-period model for a small open economy with learning spillovers in the production of a tradable good, in order to clarify the conditions under which the implementation of competitive (and effectively multiple) real exchange rate policies is optimal.

### *Case 1. Two goods: a tradable and a non-tradable*

Suppose the economy produces two goods, a tradable good  $T$  and a non-tradable good  $N$ . There is a set of identical consumers-workers of measure  $L$  that has preferences defined by

$$U = u(c_1^T) + u(c_2^T) + v(c_1^N) + v(c_2^N)$$

where  $u_T > 0$ ,  $u_{TT} < 0$ ,  $u_N > 0$ ,  $u_{NN} < 0$ , with  $u_T = \frac{\partial u}{\partial c^T}$ ,  $u_{TT} = \frac{\partial^2 u}{\partial c^{T^2}}$ ,  $v_N = \frac{\partial v}{\partial c^N}$ ,  $v_{NN} = \frac{\partial^2 v}{\partial c^{N^2}}$  and  $c_t^x$  is the consumption of good  $x$  in period  $t$ ,  $x = T, N$ . For simplicity we assume the representative consumer has no impatience, and inelastically supplies her unit of time in each period as labor at the market wage  $w$ . Labor is perfectly mobile across sectors.

Each sector  $T$  and  $N$  is composed by identical firms, indexed by  $i$ . There is free entry in both sectors. Production in each sector requires labor as the only input. The production functions are described by

$$y_t^{N,i} = a_N L_t^{N,i} \quad (1)$$

$$y_t^{T,i} = a_T(y_{t-1}^T) L_t^{T,i} \quad (2)$$

where  $y_t^{N,i}$  and  $y_t^{T,i}$  denote the production of the non-tradable and the tradable good by an individual firm, with  $a_N > 0$ ,  $a_T(y_{t-1}^T) > 0$ , and  $a'_T(y_{t-1}^T) \equiv \frac{\partial a_T(y_{t-1}^T)}{\partial y^T} > 0$ . The latter assumption corresponds to the existence of learning spillovers in the tradable sector, as productivity of an individual firm in the tradable sector is increasing in the aggregate production of tradable goods. For simplicity, we assume that in the decentralized solution  $a_T(y_{t-1}^T) = a_T$  in equilibrium (this

assumes that the learning gain is compensated by an equivalent destruction of capabilities in the first period).

The consumer has perfect access to international credit markets. There is no default, and we assume the international interest rate is zero. The budget constraints of the consumer are

$$p_1^N c_1^N + p_1^T c_1^T = w + d_1$$

and

$$p_2^N c_2^N + p_2^T c_2^T = w - d_1$$

where  $p_f^x$  is the price of good  $x$  and  $d_1$  denotes net savings in the first period. Equilibrium in labor markets must satisfy the clearing condition  $\int_{i \in N} L_t^{N,i} + \int_{i \in T} L_t^{T,i} = L \forall t$ . The economy's constraints are

$$y_1^T + y_2^T \equiv \sum_{t=1,2} \left( \int_{i \in T} y_t^{T,i} \right) = (c_1^T + c_2^T) L$$

$$y_t^N = \int_{i \in N} y_t^{N,i} \quad \forall t$$

*The real exchange rate in the decentralized solution*

From the utility maximization problem and the profit maximization problems, we obtain

$$\frac{u_{T,1}}{v_{N,1}} = \frac{u_{T,2}}{v_{N,2}} = \frac{a_N}{a_T} = \frac{p_1^T}{p_1^N} = \frac{p_2^T}{p_2^N}$$

Thus, the evolution of the real exchange rate in the decentralized equilibrium,  $\{e_1^D, e_2^D\}$ , is given by

$$e_1^D = e_2^D = \frac{a_N}{a_T}$$

### *The real exchange rate in the planner's solution*

The planner resolves the utility maximization problem subject to the resource constraints and the technological constraints. The difference with respect to decentralized solution is that the planner internalizes (2), the learning-by-doing externality.

The real exchange rate in the planner's first best solution,  $e_1^P$ , is given by

$$e_1^P = \frac{a_N}{a_T(1 + a_T')} < e_1^D$$

Thus, in the first best equilibrium the real exchange rate *appreciates*. The reason is that the planner is moving labor from the non-tradable sector to the tradable sector; then, the non-tradable good becomes more scarce, and its relative price increases.

A subsidy per unit of production of the non-tradable good that is equal to the learning externality would take the economy to the first best. In the first best, consumers experience a decrease in the relative price of the tradable good (that is the real exchange rate appreciation) and producers experience an increase in the relative profitability of the tradable good.

### *Real exchange rate policies for economic development*

If somehow it is not possible to provide a subsidy to the sector with the learning externality, the government can still resort to policies that affect the real exchange rate as a second best. Capital account policies as described in Jeanne (2012) or Korinek and Serven (2016) can be used for that purpose.

Suppose the government controls the capital account, purchases tradable goods in  $t = 1$  -- a purchase that is funded with a lump sum tax -- saves them in the form of foreign reserves, and gives them back to the consumer in  $t = 2$  also in the form of a lump-sum. Then, the real exchange rate under the intervention will be more depreciated than in the decentralized solution

in the first period:  $e_1^I > e_1^D$ . The depreciation reverts in the second period. *This intervention is optimal in the margin, because the net gain is the learning externality.* Going beyond the margin, the intervention creates both a static and dynamic distortion (the dynamic distortion, corresponding to the intertemporal misallocation of consumption, would not exist in an infinite horizon model as the one from Korinek and Serven, 2016), as well as a dynamic gain. The optimal magnitude of the depreciation will be determined by the equalization of the distortion costs and the dynamic gain.

**Case 2. Two goods: a tradable and a non-tradable**

Suppose next that there are two tradable sectors, a resource sector  $R$  where learning does not occur, and a non-resource sector  $T$  where learning occurs, and one non-tradable sector.

The production function for the resource sector is

$$y_t^{R,i} = a_R L_t^{R,i}$$

with  $a_R > 0$ .

The preferences of the representative consumer in this extended economy are described by

$$U = u(c_1^T) + u(c_2^T) + v(c_1^N) + v(c_2^N) + h(c_1^R) + h(c_2^R)$$

and the consumer's budget constraints are now

$$p_1^N c_1^N + p_1^T c_1^T + p_1^R c_1^R = w + d_1$$

and

$$p_2^N c_2^N + p_2^T c_2^T + p_1^R c_1^R = w - d_1$$

Optimality now requires

$$\frac{h_{R,1}}{v_{N,1}} = \frac{a_N}{a_R}$$

$$\frac{u_{T,1}}{v_{N,1}} = \frac{a_N}{a_T(1 + a'_T)}$$

$$\frac{u_{T,1}}{h_{R,1}} = \frac{a_R}{a_T(1 + a'_T)}$$

A policy that makes the real exchange rate more competitive will now face a targeting problem. It will increase the relative price of both the non-resource tradable good that has the learning externality and the resource tradable that does not have it. The competitive real exchange rate policy is providing an implicit subsidy to the two tradable sectors, but there is no gain from subsidizing the resource sector. The solution to this targeting problem will then involve a tax to the resource sector that eliminates the advantage that the initial foreign exchange intervention creates, that is, a tax  $\tau^R$  such that

$$e_1^R = e_1^I(1 - \tau^R) = \frac{a_N}{a_R}$$

The tax revenues can be used for purchasing the non-resource tradable goods in the first period that the intervention requires.

Thus, in the environment with multiple tradable goods with different learning spillovers and in the absence of instruments to implement the first best, a policy of *competitive and effectively multiple real exchange rates* will be a second-best – it will be a policy that will promote economic development.

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