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1 March 2011

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Abstract

This paper discusses the effects of the real exchange rate (RER) on the structure of exports. Based on a North-South Ricardian model, two hypotheses are suggested and tested. The first one is that a higher RER allows for a higher diversification of exports. The second hypothesis is that this diversification raises the technological intensity of exports. We find favorable evidence for the two hypotheses from a panel data study including 111 counties in the period 1965-2005. From these results it is argued that a competitive RER should be considered a relevant variable in the process of economic development as it encourages the transformation of the pattern of specialization.

Introduction

The idea that the economic structure plays a crucial role in development is certainly not new, at least not in the heterodox tradition in economics. Schumpeter (1911) placed qualitative change at the centre of his theory of economic development. The works of Nelson and Winter (1982) and Freeman (1995), among other evolutionary economists, significantly advanced the Schumpeterian view of technical change and "creative destruction" as the main drivers of growth. On the other hand, in the neoclassical tradition structural change was for a long time confined to a marginal position, almost a footnote in aggregate growth models. But in the early 1990s the topic was rediscovered and has received increasing attention[2].

In open economies structural change is closely related to the pattern of specialization. The economic structure is shaped by what the economy can competitively produce for both domestic and external markets. This has been a long-standing point in ECLAC's structuralist school, which regards different patterns of specialization in centre and periphery as crucial for explaining why the periphery fails to develop[3]. It has been present as well in models based on structuralist ideas[4] and in new versions of mainstream models in which growth depends on the

[1] The ideas and opinions expressed in this paper are the sole responsibility of the authors, and do not necessarily represent those of their respective institutions.

[2] See for instance Acemoglu (2009), pp. 783-805.

[3] The seminal contribution is Prebisch (1949).

[4] Vera (2006), Botta (2009) and Cimoli and Porcile (2011).

diversification and composition of exports[5]. Moreover, the historical evidence points out that all successful processes of catching up in the international economy relied on building technological capabilities and the diversification of the export structure[6].

In conventional trade theory the pattern of specialization depends on endowments, which define the relative cost of producing goods with different factor intensity. But this theory is at the very least insufficient, as has been repeatedly argued in the literature. Technology leads and lags play the dominant role in trade of goods with medium and high technological intensity[7]. Moreover, the very concept of endowments changes when technological change allows countries to discover and/or exploit natural resources not used before. In the same vein, natural resources that are highly valuable within a certain technological regime may be made redundant by technical change. Even an infinite supply of labor means very little if there is no technology-driven process of structural change creating new jobs in emerging industries.

While technology and endowments contribute to define competitive advantages in international trade, policy variables play a role too. The real exchange rate (RER) is a significant policy variable affecting trade that may give rise to hysteresis effects[8]. Since the RER allows countries to compensate for asymmetries in technological capabilities or endowments, its appreciation or depreciation redefines the pattern of specialization[9]. In aggregate models, a change in RER leads to the reallocation of resources across sectors. Such a reallocation, however, means more than just producing different quantities of the same goods produced before. It frequently implies beginning new activities and/or closing those that cease to be competitive. Behind reallocation there is a story of structural change that may either strengthen or dampen sectors intensive in technology and knowledge. As a result, managing the RER may have significant implications for the subsequent trajectory of technological learning.

In effect, if periods of appreciation of the RER reduce the share of technology-intensive sectors in exports, path-dependence phenomena will compromise the recovery of these sectors in the future. Patterns of specialization presents a high degree of path-dependence, defined as a "dynamic process whose evolution is governed by its own history"[10]. Path-dependence is more likely to occur in medium and high-tech activities because the intensity of learning by doing

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[5] Hausmann et al (2007) and Agosin (2009).

[6] Katz, (1987), Reinert (1995), Chang (2001) and Bell (2006).

[7] Dosi et al (1990).

[8] Baldwin (1988), Baldwin and Krugman (1989) and Cimoli (1992). For a discussion of the RER as an instrument in development policy see Rapetti (2011).

[9] This point is presented more formally in section 1. Naturally, the whole arsenal of trade policies (tariffs, non-tariff protection, preferential trade agreements, export subsidies, export and import financing) may also change the export structure. Still, the focus of this paper lies on the RER because its appreciation has been a recurrent problem in some regions as Latinamerican countries since the late seventies, and is related to the major external crises that occurred in Latin America in the past forty years (Bresser, 2008; Nassif et al, 2010; Frenkel and Rapetti, 2011; Ocampo, 2011).

[10] David (2007) and Setterfield (2009b).

(cumulative) mechanisms is higher, externalities and complementarities across sectors stronger and technology changes faster[11]. This tends to reinforce the prevailing technological and growth trajectories and change the long run equilibrium in the process. Short term shocks that change the pattern of specialization may then have persistent effects on growth.

The paper is organized in four sections besides the introduction and the concluding remarks. Section I presents the Ricardian trade model with a continuum of goods, in which the role played by the RER in changing the pattern of specialization is discussed. The main result of the model is to show that a higher RER favors the diversification of the export structure towards sectors with higher technological intensity. Section 2 tests the relationship between export diversification and RER, while section 3 tests how the RER affects the technological intensity of exports. Finally, brief concluding remarks are presented.

1. RER and the pattern of specialization

1.1. The pattern of specialization

The Ricardian model with a continuum of goods offers a simple framework in which the effects of the RER, technology and specialization can be put together[12]. The focus is on North-South trade based on the following assumptions:

a) The international economy produces a large number of goods using two factors of production, labor and technology;
b) Goods differ in terms of technological intensity and can be continuously ranked from the good with the lowest technological intensity ($z = 0$) to the good with the highest technological intensity ($z = 1$).
c) There is a technology gap (G) between the advanced North and the laggard South, defined as the ratio between the aggregate stock of technology in the North and the same stock in the South ($G = T_N / T_S$);
d) For a given technology gap, the difference between labor productivity in the North and labor productivity in the South is higher for goods that are more technology intensive. In other words, the comparative advantage of the country on the technological frontier is in goods which are more technology intensive.

Point (b) implies that ranking the goods in terms of increasing North-South productivity gap ($\pi_z = \pi^N / \pi^S$, where S is South, N is North, z denotes the good, π is productivity and π_z is the productivity gap) is the same as ranking them in terms of increasing technology intensity. This gives rise to an upward sloping curve of Northern comparative advantage in which the

[11] If there is cumulativeness in learning, a rapidly moving international technological frontier implies that even a short period of contraction of investments in physical capital, human capital and R&D may lead to a large gap in technological capabilities, which would be difficult to overcome thereafter. Baldwin (1988) stresses sunk costs in entering new markets as a source of hysteresis in international trade (more on this later).

[12] See Dornbush et al (1977).

productivity gap is a function of z, ($\pi_z = \pi(z)$), where z is an index of technological intensity (see figure 1; see also Krugman, 1979).

A good z is produced in the South if:

$$1) \qquad \frac{W^S}{W^N e} < \frac{\pi_z^S}{\pi_z^N}$$

In equation (1) W are nominal wages and e is the nominal exchange rate (units of foreign currency per unit of domestic currency) The left-hand-side of inequality 1) is the inverse of the wage-based real exchange rate defined as $q = \frac{W^N e}{W^S}$ [13]. It is clear from (1) that z will be produced in the South if:

$$2) \quad q \geq \pi_z$$

The pattern of specialization defined by equation (2) is depicted in Figure 1, which shows that the South will produce the goods between 0 and z_1.

[Figure 1 about here]

If there is a change in the RER (after a change in macro policies, for instance), and the RER increases from q_1 to q_2, the Southern economy diversifies from z_1 to z_2.

The Ricardian model provides a simple form of directly linking RER and technology to the production structure and renders simple empirical predictions. First, a higher RER favors the diversification of exports (increase in z). If there is a change in the RER, and the RER increases from q_1 to q_2, the Southern economy diversifies from z_1 to z_2. Secondly, a rise in RER is not neutral across sectors. The move from z_1 to z_2 implies moving towards activities that are more technology-intensive than before (an increase in z implies an increase in the technological intensity of the goods produced in the South).

1.2. Specialization, learning and growth

The adjustment process does not end in point z_2. New exports will shift the position of the productivity gap curve to the right, out of cumulativeness in learning and productivity growth

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[13] There are alternative definitions of the RER, being the most frequent $RER = \frac{P^* e}{P}$. If prices are indexed to nominal wages and hence the ratio $W^N e / W^S$ moves hand by hand with P^*e/P, then the wage-based real exchange rate q will move *pari passu* with the *RER*, or at least both rates will not move too markedly apart.

(the mechanisms of the Kaldor-Verdoorn Law). The learning process that accompanies structural change prompts further diversification in the South until the good denoted by z_3. The economy emerges from the adjustment process with new technological capabilities and skills. The intensity of this shift (and hence the new equilibrium z_3) depends in turn on to forces. One of them is path dependence, the fact that learning occurs around the initial technological basis, and this force will tend to keep the economy moving along the previous learning trajectory. The second force are industrial and technological policies (ITP) that shape the intensity of the Kaldor-Verdoorn effects and the institutions that provide incentives to innovation and coordinate decisions, particularly when these decisions imply moving away from the dominant pattern of industrialization[14].

It is important to recall the importance of changes in the pattern of specialization for economic growth and development. From a pure supply-side perspective, adopted in most neoclassical models, potential growth is driven by the accumulation of human and physical capital and the rate of technical change. Effective demand adjusts in the long run to conform to the growth of potential output (Setterfield, 2009a). How does specialization affect potential growth? Sectors are different: some of them boost externalities, complementarities, innovation and technological innovation and diffusion, while others do not. Countries in which high tech sectors have a higher share in exports and production will therefore show higher rates of technical change and productivity growth.

The existence of technological asymmetries between sectors is as well a key concern of heterodox theory. Innovation and diffusion occur unevenly across sectors: this is why heterogeneity is the inevitable result of Schumpeterian competition[15]. The centre–periphery system emerges precisely because the most dynamic activities of the continuum of (heterogeneous) activities concentrate in a few areas, while lower-end activities prevail in the rest of the world. In addition, the heterodox tradition brings into the analysis the demand side of the equation, particularly the effects of the pattern of specialization in the income elasticity of the demand for exports and imports (Thirlwall, 2011). The empirical evidence suggests that demand for high-tech goods tends to grow faster in the international economy[16]. There is a clear association between technological capabilities and the ability to compete in sectors whose demand grows faster[17].

1.3. A brief overview of the literature

The effect of the RER on exports is not free of controversy in the empirical literature. Differences in methodology, models, the measurement of the RER, the concepts of over and

[14] See Metcalf (2001), Nelson (1993) and Narula (2002)

[15] Saviotti and Pyka (2004) and Dosi et al (2010).

[16] ECLAC (2007, 2010) and UNCTAD (2010).

[17] See Dosi et al (1990), Reinert (2005), Chang (2001), ECLAC (2007), Gouvea and Lima (2010), Cimoli *et al* (2010).

undervaluation, the countries included in the sample and the periods considered, among other factors, make it difficult to compare different results. However, it general terms, the empirical literature supports the idea that a stable and slightly depreciated RER favors export diversification and the upgrading of the export structure, while appreciation and a high RER volatility give rise to the opposite outcomes.

Thus, for instance, Freund and Pierola (2008a and 2008b) highlight the key role of a depreciated (and stable) RER in opening new lines of (and new destinations for) exports from developing economies. These authors found that devaluations were important for explaining export surges, which in turn contributed to accelerate growth. Their view is compatible with the finding of Berg et al (2006), who emphasize that openness is associated with higher growth only if at the same time the RER is competitive[18]. Chit et al (2008) underline the negative role of RER volatility on export diversification in Asian emerging economies.

Moreover, the findings of Freund and Pierola do not support the "export pessimism" view regarding the price-elasticity of exports from developing economies (see also Sekkat and Varoudaki, 2000). Eichengreen (2008) concludes that the RER can "*help to jump-start growth by encouraging the redeployment of resources into manufacturing and reaping immediate productivity gains*". Similar results are set forth by Rodrik (2008), Berg and Miao (2010) and McMillan and Rodrik (2011) and Rapetti et al (2009). Saviotti and Frenken (2008) show that export diversification towards related goods enhances growth in the short run, while export diversification towards unrelated goods does so in the long run. However, not all the literature shares this perspective. Fang et al (2006) report very low price-elasticities for exports from Asian developing economies, while Agosin et al (2011) report no significant effect of the RER in export diversification in a broad panel of countries for the period 1962-2000.

Bilateral trade models based on the gravity equation point out that the effects of the RER are asymmetric across sectors and conditioned by institutional and geographical variables that shape competitiveness and the costs of trade. Colacelli (2008), for instance, shows the RER has a stronger effect on exports of differentiated goods than on exports of homogeneous goods, while Berthou (2008), working with trade between the OECD and different regions in 1989-2004, observes that the price elasticity of OECD exports to countries with weak institutions (developing economies) tend to be lower. This author also offers evidence of the presence of hysteresis phenomena due to sunk entry costs into the export market à la Baldwin-Krugman, a finding confirmed by Freund and Pierola (2008b).

In the next sections we test the two hypotheses derived from the Ricardian framework presented in this section. The hypothesis that the RER affects the level of export diversification is tested in section (2); the relationship between RER and the technological intensity of exports is tested in section (3); and finally section (4) tests the relationship between specialization and growth.

2. RER and export diversification

[18] See also Bernard and Jensen (2004)

The model presented in section 1 highlights two explanatory variables of the pattern of specialization, RER and technology, which contribute to define relative unitary costs. In addition the model emphasizes the role of path dependency in technological learning and specialization. To discuss the effects of these variables on export diversification we run a panel data regression for a large sample of countries (111) in the period 1965-2005. Three alternative indicators of export concentration are used as the endogenous variable: the Gini Index (IG), the Herfindahl Index (IH) and the Theil Index (IT). The RER is obtained from the Penn Tables. As a proxy of technological capabilities, we use the country's GDP per capita[19]. In order to take into account the dynamic forces of path dependence, and at the same time control for the possible endogeneity of the explanatory variables (for instance, there may exist an association between levels of productivity and the RER), we used the standard Arellano Bond (1991) procedure for dynamic panel data estimation as shown in equation (1). The importance of the lagged value of the dependent variable in the theoretical model gives rise to autocorrelation in the estimation for which Arellano-Bond (1991) accounts for. Additionally, it is possible to think that some variables of the model can cause one to each other. The use of instruments in this technique allows to avoid the endogeneity bias that the possible bi-directional causality in the variables. Given the expected existence of heteroscedasticity in the data the robust standard errors will be reported. In order to get good estimations the tests of validity of instruments in presence of heteroskedasticity (Hansen, 1982) of the instruments and the test of autocorrelation Arrellano-Bond (1991) were instrumented.[20].

$$y_{it} = \beta y_{it-1} + X_{it}\gamma + Z_{it}\delta + \eta_i + \varepsilon_{it} \qquad (1)$$

where $y_{i,t}$ represents the variable of interest (Gini Index (IG), the Herfindahl Index (IH) or the Theil Index (IT)), $y_{i,t-1}$ the lagged value of this variable, *X* represents the matrix with RER and GDP per capita), Z represents a set of control variables (detailed below), η_i an unobserved country specific effect and $\varepsilon_{i,t}$ the random term.

According with the model, we expect that higher RER and GDP per capita, and a lower level of concentration in the previous period, should reduce concentration in the export structure. To assess the robustness of that relationships, a set of control variables are included in different specifications of the model. Differences in factor endowments are captured by proxies of human capital, physical capital and the stock of natural resources (land, minerals and energy sources). Human capital may be seen (from a Schumpeterian perspective) as another proxy for technological capabilities and learning potential. In addition, openness and the volatility of the RER are taken into account. The degree of openness is relevant because high barriers to trade would affect the pattern of exports. This variable also helps to control for the size of the country, recalling that large countries tend to have lower openness coefficients. As regards the volatility

[19] The GDP per cápita of the countries in relation with the GDP of the United States were used later as a proxy of technological gaps, but as we will see the results of the paper remains equal.

[20] More details about sources and definitions of the variables of the model can be found in the statistical appendix at the end of the paper.

of the RER, there are several mechanisms by which this variable may affect diversification. Volatility heightens uncertainty about future profits and market shares in tradable goods, and thereby makes less attractive investing in tradables beyond the traditional export activities.

A caveat is necessary. Many studies on RER and exports uses a misalignment measure respecting an equilibrium RER and estimate such misalignment through the Balssa-Samuelson correction. The latter, in turn, is based on a fixed effect regression of the RER on productivity per capita for the sample of countries included in the study. The difference between the actual RER and the RER estimated through this regression gives the degree of misalignment. Still, in the model presented above the level of the RER plays a role on its own on exports, along with a technological variable which is captured by GDP per capita. For this reason, we have chosen to include RER and productivity as separate independent variables on the right hand side of the model. This allows us to interpret the results in a form compatible with the theoretical model. It is likely that what other studies identify as misalignment, from the perspective of the Ricardian model, combine effects stemming from both the management of the RER and the dynamics of technology.

The results of the regressions analysis are shown in Table 1, 2 and 3.

Some of the conclusions that can be drawn from the result of the estimations presented in Table 1, 2 and 3 are the following (Table 2 and 3 are shown in the appendix:

[Table 1 about here]

a) Export diversification responds positively to a higher RER[21]. This is a robust result, verified with all the different specifications of the model and for the three different indicators of the degree of concentration (IG, IH and IT).
b) The variable GDP per capita reduces the degree of concentration. This result is less robust than that of the RER, as the coefficient is insignificant in some of the specifications of the model[22].

[21] Our results are compatible with the literature that relates RER, exports and growth in developing economies. However, they do not validate the findings of Agosin et al (2011). The divergence between results may be due to the use of different methodologies of estimation (dynamic GMM instead of GMM) and different control variables. For instance, these authors included in the model the terms of trade but not physical capital. We decided not to include the terms of trade as an explanatory variable since the degree of overlapping of this variable with the RER is too high in our sample. Indeed, it should be expected that under a regime of fluctuating exchange rates, positive (negative) shocks will be associated with the appreciation (depreciation) of the RER (see Broda, 2002). Such a response, however, varies with the international conditions of capital markets and the behavior of macro-policies and inflation.

[22] In another exercise, not reported in the paper, we used as an indicator of technological capabilities the ratio between the GDP per capita of the country and that of the USA. When this proxy was used, then the technological variable is no longer significant. However, the RER remains significant and with similar coefficients regardless of the proxy used for the technological variable.

c) The coefficient of the lagged endogenous variable is positive and significant (lower than the unity, as required for stability in the system). The higher the export concentration in a certain period, the higher this concentration will be in the next period. Path-dependence is at work in the evolution of the pattern of specialization, as argued before.

As regards the control variables, some of them work according with what is predicted in trade models. The availability of human capital and physical capital favors diversification. From a Schumpeterian perspective, this is related to the accumulation of technological capabilities that fosters both the moving towards new sectors and the ensuing upgrading of the production structure. In particular, the indicator of human capital is suggestive of the existence of institutions and policies that support learning and innovation. From a more conventional perspective, this may be seen as the result of the accumulation of factors of production which in turn redefines comparative advantages though time. Independently of how one interprets the control variables, the results confirm the importance of the RER and technology as explanatory variables.

The volatility of the RER is not significant in most of the specifications of the model. Openness, on the other hand, is positively associated with export concentration. This fact points out to the effect of the specialization once the economies are open to world economy. In general, the higher the abundance of natural resources, the higher export concentration. However, in the case of the abundance of land, in the more general specification (when human capital and physical capital are included), the coefficient is no longer significant. We will come back to this point later, when we discuss the effects of natural resources on the technological content of exports.

In sum, a higher RER is consistently related to a more diversified export structure (measured by three indicators of export concentration, namely Gini, Herfindahl and Thail indexes), even after controlling for the variables stressed by conventional trade theory (endowments of natural resources, physical and human capital). Technology levels play a positive role in diversification, although its effects are less robust. Path dependence is significant and robust and reveals the importance of inertia in production and specialization. The accumulation of physical and human capital enhances export diversification, while the endowment of natural resources tends to lower such diversification.

3. RER and the Technological Intensity of Exports

A higher RER not only increases export diversification but that it does so by encompassing new exports which are more technology-intensive than previous exports. The reason is that a rise in the RER makes competitive the production of goods whose productivity gap is higher. Under the assumptions of the simple model of section 1, goods with a higher productivity gap are at the same time more technology-intensive.

The test for the technological content of exports is devised in a similar fashion as the test for export diversification. RER and technology are included as explanatory variables along with a set of control variables on the right-hand side. The dependent variable, in this case, is an indicator of the technological intensity of exports, defined as the share in total exports (in percentage) of medium and high technological exports (MHTE). These sectors are defined according with Lall's classification (cf. Lall, 2000). As in the previous exercise, we made estimations using the Arellano-Bond technique, including the lagged dependent variable among the explanatory variables in order to capture path-dependence. We expect positive signs for the lagged endogenous variable, the RER and GDP per capita.

The control variables are the same as in the previous exercise. There are no straightforward predictions regarding the sign effect of the availability of natural resources on the technological intensity of exports. The key question in this case is how the rents from natural resources are used. If rents are used to foster the consumption of imported goods or diverted from investment in any way, then the availability of natural resources will favor exports with lower technological content. Inversely, if natural resources are used as a competitive basis for further leaning, upgrading and diversification, then the effect of MHTE will be positive.

The same ambiguity exists for the variable openness. More openness implies stronger competitive pressure that would strengthen the efforts of local firms for catching up with the leaders. On the other hand, such a pressure may eliminate local producers before they have time to learn. The timing of both processes – catching up versus competitive advantages of the leaders –, and the existence of policies to speed up technological diffusion, will define the emerging pattern of specialization and market shares in the international economy[23].

[Table 4 about here]

The results of the econometric test are presented in Table 4. They can be summarized as follows.

a) The RER has a significant influence on the technological intensity of exports and the effect is robust to various specifications of the model.

b) The coefficient of the GDP per capita is positive and consistently associated with a higher technological content of exports. The result conforms to what we expected, considering this variable as a proxy for the technological level of the economy.

c) The laggard endogenous variable is significant, which supports the idea that specialization in MHTE is subject to path-dependence. The reasons are the same as in the case of export diversification, namely sunk costs and increasing returns. Sunk costs are higher in goods with higher technological content, as more specialized assets (human and physical capital) and production bases are required to compete in MHTE. At the same time, cumulativeness in productivity and innovation also tends to be higher in high tech sectors, where both technological opportunities are and the possibility of furthering the division of labor are higher.

Although the control variables are not the main focus of the analysis, some of the results are worth commenting. Natural resources are negatively associated with HMTE except when we include human and physical capital in the model. In the latter specification, arable land per capita

[23] In other words, production and market shares will be more concentrated in Northern firms if the velocity with which innovative firms drive out of business the laggards is higher than the velocity with which the laggards are able to learn and catch up with the best technology.

changes signs and minerals per capita looses significance. Only the indicator for energy resources (oil, natural gas, and coal) is consistently related to lower HMTE, probably reflecting the influence of large oil exporters with very little diversification in Asia and Latin America. This suggests that the effect of natural resources on the technological content of exports may be associated with the accumulation of human capital and the ITPs for technological innovation and diffusion. When this variable is controlled, then the initial competitive advantage based on natural resources does not compromise HMTE, at least in the case of the land and minerals endowments.

In sum, the RER is associated with a higher technological intensity of the exported goods. The variable GDP per capita (a proxy for technological capabilities) has a similar effect, as well as human capital. Both results are in conformity with the hypotheses set forth in section (1). In addition, "endowments are not fate"[24]: having natural resources does not necessarily lead to a lower technological intensity of exports if we control for human capital (understood as a proxy for a broad set of institutions that foster learning).

Concluding remarks

The paper discussed the role of the RER on the transformation of the pattern of specialization – a key issue in economic development and long run growth. Several developing economies have gone through periods of currency appreciation with subsequent external crises, particularly in Latin America, either as a result of cyclical improvements in the terms of trade or (more frequently) cycles of high liquidity in the international financial markets. Appreciation discouraged the production of tradable goods, particularly those of medium and high technological content. The outcome of appreciation, in the absence of ITP, has been slowing down structural change and growth.

Path-dependence is an important concept linking short run shocks with long run outcomes. The econometric evidence confirms the existence of path dependence. This sends a clear message to policy-makers: there are significant endogenous factors that reproduce the dominant pattern of specialization. To overcome a slow-growth trap (or sustain the momentum of growth) it is necessary to use active policies in order to alter the parameters governing structural change. Only strong policy measures can compensate for the endogenous forces that perpetuate structural constraints on growth. A depreciated RER may serve as a starter for a surge in exports that – via increasing returns – gives rise to the upgrading of the export structure. But for this upgrading to occur, a competitive RER should be combined with active ITP boosting both, the learning coefficients of the Kaldor-Verdoorn Law and the implantation of new sectors not related to current comparative advantages.

The cases of catching up and convergence (in technology and income with rising equality) in the post-war years have included high RER and an active ITP in the policy mix. The experience of the most successful Asian economies (from Korea in the sixties to China nowadays) points out in the same direction. RER and ITP should be seen as complementary -- two mutually reinforcing instruments – rather than as substitutes in spurring structural change.

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[24] Nugent and Robinson (2010).

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Figures and Tables

Figure 1, RER and Specialization

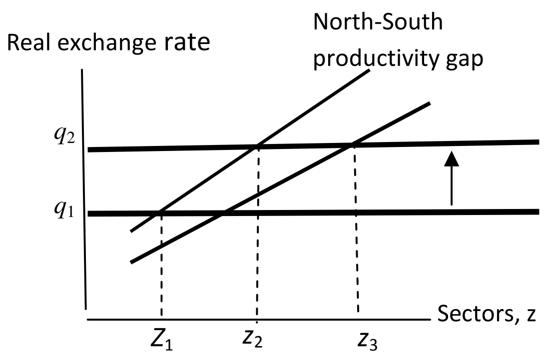

Table 1: Dependent Variable: Gini Index

	Dependent: GINI					
L.GINI	0.214***	0.241***	0.316***	0.183***	0.266***	0.184***
	(6.60)	(7.43)	(10.02)	(5.67)	(8.13)	(5.62)
RER	-0.549***	-0.453***	-0.479***	-0.389***	-0.504***	-0.450***
	(-9.88)	(-8.41)	(-9.29)	(-7.97)	(-10.08)	(-9.43)
GDP	-0.352***	-0.283***	-0.504***	-0.0946	-0.464***	-0.0676
	(-5.49)	(-4.48)	(-7.69)	(-0.97)	(-6.76)	(-0.72)
Volatility		-0.431***	-0.129	-0.0957	-0.230*	-0.163
		(-3.29)	(-0.99)	(-0.80)	(-1.87)	(-1.40)
OPEN			0.667***	0.726***	0.511***	0.628***
			(9.51)	(12.09)	(7.69)	(10.54)
HumanK				-0.448***		-0.373***
				(-7.30)		(-5.87)
PhisicalK				-0.179*		-0.309***
				(-1.74)		(-3.15)
AGRIPC					59.98***	-9.065
					(3.82)	(-0.59)
ENERGY					0.0150***	0.0139***
					(6.24)	(6.13)
MINERY					0.0336***	0.0255***
					(3.34)	(2.72)
Obs.	724	724	724	724	678	678
Countries	111	111	111	111	106	106
AB(2)	0.488	0.637	0.574	0.558	0.559	0.43

Note: All the equations are estimated by Arellano Bond (1991) and differ only in the control variables used in model. The first model includes only the lag of the dependent variable and the RER, while the others include different combinations of the set of control variables. The estimation is based on five-year panels for the period 1965-2005. The autocorrelation of residuals (Arellano Bond test) was used to confirm the presence of the dynamic variable and the Hansen contrast to test the validity of the instruments.

Table 2: Dependent Variable: Herfindhal Index

	Dependent: HERF					
L.HERF	0.0429	0.0722**	0.115***	0.211***	0.135***	0.216***
	(1.29)	(2.19)	(3.53)	(6.51)	(4.07)	(6.58)
RER	-0.494***	-0.451***	-0.420***	-0.297***	-0.416***	-0.364***
	(-7.86)	(-7.61)	(-7.20)	(-4.77)	(-7.07)	(-5.96)
GDP	-0.0261	-0.0266	-0.0999	-0.710***	-0.114	-0.609***
	(-0.37)	(-0.37)	(-1.26)	(-5.49)	(-1.34)	(-4.89)
Volatility		-0.165	-0.0449	0.253	-0.0241	0.187
		(-1.10)	(-0.29)	(1.64)	(-0.16)	(1.24)
OPEN			0.113	0.243***	0.0280	0.147*
			(1.39)	(3.20)	(0.35)	(1.94)
HumanK				-0.185**		0.0139
				(-2.54)		(0.18)
PhisicalK				0.517***		0.297**
				(3.83)		(2.31)
AGRIPC					61.80***	61.29***
					(3.13)	(3.03)
ENERGY					0.0142***	0.0146***
					(4.87)	(4.99)
MINERY					0.0250**	0.0210*
					(2.07)	(1.75)
Obs.	724	724	724	724	678	678
Countries	111	111	111	111	106	106
AB(2)	0.0869	0.175	0.222	0.27	0.227	0.265

Note: All the equations are estimated by Arellano Bond (1991) and differ only in the control variables used in model. The first model includes only the lag of the dependent variable and the RER, while the others include different combinations of the set of control variables. The estimation is based on five-year panels for the period 1965-2005. The autocorrelation of residuals (Arellano Bond test) was used to confirm the presence of the dynamic variable and the Hansen contrast to test the validity of the instruments.

Table 3: Dependent Variable: Theil Index

	Dependent: THEIL					
L. THEIL	0.222***	0.259***	0.330***	0.219***	0.268***	0.218***
	(6.94)	(8.17)	(10.67)	(6.91)	(8.31)	(6.75)
RER	-0.533***	-0.429***	-0.456***	-0.363***	-0.482***	-0.417***
	(-9.71)	(-8.12)	(-9.00)	(-7.46)	(-9.91)	(-8.87)
GDP	-0.382***	-0.213***	-0.532***	-0.187*	-0.466***	-0.137
	(-5.99)	(-4.05)	(-8.12)	(-1.92)	(-6.87)	(-1.48)
Volatility		-0.407***	-0.0645	-0.0364	-0.162	-0.0971
		(-3.15)	(-0.50)	(-0.30)	(-1.35)	(-0.84)
OPEN			0.666***	0.701***	0.484***	0.594***
			(9.58)	(11.68)	(7.41)	(10.07)
HumanK				-0.413***		-0.318***
				(-6.72)		(-5.07)
PhisicalK				-0.119		-0.266***
				(-1.16)		(-2.72)
AGRIPC					65.73***	2.815
					(4.24)	(0.18)
ENERGY					0.0149***	0.0140***
					(6.33)	(6.22)
MINERY					0.0373***	0.0284***
					(3.78)	(3.06)
Obs.	724	724	724	724	678	678
Countries	111	111	111	111	106	106
AB(2)	0.349	0.557	0.976	0.999	0.936	0.925

Note: All the equations are estimated by Arellano Bond (1991) and differ only in the control variables used in model. The first model includes only the lag of the dependent variable and the RER, while the others include different combinations of the set of control variables. The estimation is based on five-year panels for the period 1965-2005. The autocorrelation of residuals (Arellano Bond test) was used to confirm the presence of the dynamic variable and the Hansen contrast to test the validity of the instruments.

Table 4: Dependent Variable: Medium and High Technology Export Share

Dependent: HIGH AND MEDIUM TECH EXPORTS						
L. HMTE	0.0430	0.0707**	0.109***	0.145***	0.141***	0.132***
	(1.31)	(2.16)	(3.31)	(4.39)	(4.16)	(3.81)
RER	0.472***	0.393***	0.331***	0.154*	0.287***	0.200**
	(5.43)	(4.61)	(3.89)	(1.75)	(3.22)	(2.17)
GDP	1.095***	0.957***	0.762***	0.653***	0.548***	0.555***
	(9.12)	(8.21)	(6.31)	(3.51)	(4.27)	(2.91)
Volatility		0.167	0.284	0.151	0.361	0.219
		(0.75)	(1.26)	(0.68)	(1.59)	(0.96)
OPEN			0.204*	-0.118	0.198	-0.0360
			(1.65)	(-1.01)	(1.60)	(-0.29)
HumanK				0.412***		0.451***
				(3.78)		(3.78)
PhisicalK				-0.0449		0.118
				(-0.22)		(0.57)
AGRIPC					-59.24*	81.28***
					(-1.89)	(2.79)
ENERGY					-0.0140***	-0.0131***
					(-3.15)	(-2.95)
MINERY					-0.0261	-0.00292
					(-1.43)	(-0.14)
Obs.	701	701	701	701	661	661
Countries	110	110	110	110	105	105
AB(2)	0.185	0.235	0.281	0.534	0.625	0.6

Note: All the equations are estimated by Arellano Bond (1991) and differ only in the control variables used in model. The first model includes only the lag of the dependent variable and the RER, while the others include different combinations of the set of control variables. The estimation is based on five-year panels for the period 1965-2005. The autocorrelation of residuals (Arellano Bond test) was used to confirm the presence of the dynamic variable and the Hansen contrast to test the validity of the instruments.

Appendix I: Variables and Sources

Real GDP per capita, *rgdpc:* Penn World Tables, in PPP adjusted to 2005.

Stock of physical capital per capita, *capital*: estimated using the method of permanent inventory, based on the series of investment (*ki*) of the Penn World Tables.

Real exchange rate in PPP, *pRER*: it is estimated by dividing the exchange rate (XRAT in the PWT) by the conversion factors of the PPP (variable P in Pen World Tables). This is the same indicator used by Rodrik (2008).

Volatility of the RER, *volpRER*: Variance of the RER within 5-year periods.

Human capital, *humancapital*: measured by educational attainment of the population above 14 years-old, as reported in Barro & Lee, http://www.barrolee.com.

Adaptability Index, *IA*: Ratio between the share of sectors whose demand grows above the average and the share of sectors whose demand grows below average. Data was obtained from the data bank of Feenstra et al (1962-2000) and WITS (2000-2008) at a 3-digit level.

Index of Theil, Gini and Herfindahl: Data obtained from the data bank of Feenstra et al (1962-2000) and WITS (2000-2008) at a 3-digit level.

Share of sectors of medium and high technology in total exports, *MHT*: Based on the classification of Lall (2000), using the SITC at a 2-digit level.

Terms of trade, *TOT*: World Bank, World Development Indicators.

Openness, *openc*: Exports plus imports as percentage of GDP, Penn World Tables.

Share of agricultural production in GDP, *VBAgri*: World Bank, World Development Indicators.

Agricultural land per capita, *Algrilandpc*: km2 de arable land per capita, World Bank, World Development Indicators.

Energy and Minery per capita, *lenergy* and *lminery*, were taken of Haber and Menaldo (2011)

Appendix II: List of Countries

Countries		
Afghanistan	Gambia, The	Nicaragua
Albania	Ghana	Niger
Algeria	Greece	Norway
Argentina	Guatemala	Pakistan
Australia	Guyana	Panama
Austria	Haiti	Papua New Guinea
Bahrain	Honduras	Paraguay
Bangladesh	Hong Kong	Peru
Barbados	Hungary	Philippines
Belgium	Iceland	Poland
Belize	India	Portugal
Benin	Indonesia	Rwanda
Bolivia	Iran	Senegal
Brazil	Iraq	Sierra Leone
Bulgaria	Ireland	Singapore
Burundi	Israel	South Africa
Cambodia	Italy	Spain
Cameroon	Jamaica	Sri Lanka
Canada	Japan	Sudan
Central African Republic	Jordan	Sweden
Chile	Kenya	Switzerland
China	Korea	Syria
Colombia	Laos	Taiwan
Congo, Republic of	Liberia	Tanzania
Costa Rica	Macao	Thailand
Costa de Marfil	Malawi	Togo
Cuba	Malaysia	Trinidad &Tobago
Cyprus	Mali	Tunisia
Denmark	Malta	Turkey
Ecuador	Mauritania	Uganda
Egypt	Mauritius	United Kingdom
El Salvador	Mexico	United States
Fiji	Mongolia	Uruguay
Finland	Morocco	Venezuela
France	Mozambique	Vietnam
Gabon	Nepal	Zambia
Netherlands	New Zealand	Zimbabwe