The Real exchange Rate, the Structure of Exports and Growth in the Post-War Period[1]

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Abstract

This paper discusses the interaction between the real exchange rate (RER), the economic structure and long run growth. Two hypotheses will be discussed and tested. The first one is that a higher RER allows for a higher diversification of exports and a change in its composition in favor of sectors with medium and high technological intensity. The second hypothesis is that the change in the export structure affects the long-run rate of economic growth. The paper thereby aims to contribute to the analysis of the links between the short run and the long run. Short-run cycles affecting the economic structure may give rise to long-run growth effects through path dependency in the pattern of specialization.

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Introduction

This paper discusses the interaction between the real exchange rate (RER), the economic structure and long run growth. Two hypotheses will be discussed and tested. The first one is that a higher RER fosters the diversification of exports and a change in its composition in favor of sectors with medium and high technological intensity. The second hypothesis is that a higher share of these sectors in total exports affects the long-run rate of economic growth. The paper thereby aims to contribute to the analysis of the links between the short run and the long run. Short-run policies affect the economic structure by changing the pattern of specialization. In turn, path dependency in the pattern of specialization implies that short run shocks may have persistent effects on growth.

The idea that the economic structure plays a crucial role in growth 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 since the early 1990s the topic was rediscovered and received increasing attention (see for instance Acemoglu, 2009, pp. 783-805).

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 a crucial variable for explaining why the periphery fails to develop (Prebisch, 1949; Rodríguez, 2007; Bielshowski, 2009). It has been present as well in models based on structuralist ideas[2] and in certain versions of neoclassical growth models[3]. Moreover, the historical evidence points out that all successful processes of catching up in the international economy relied on building up technological capabilities and the diversification of the export structure[4].

In conventional trade theory the pattern of specialization depends on endowments, which define the relative cost of producing goods with different factor-intensities. 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 in goods with medium and high technological-intensity[5]. Moreover, the very concept of endowments changes when technological change allows countries to

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

[3] See Hausmann et al (2007).

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

[5] See Dosi et al (1990).

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 perhaps one of the most significant policy variables affecting trade and growth (Cimoli, 1988; Rodrik, 2008). Since the RER allows countries to compensate for asymmetries in technological capabilities or endowments[6], its appreciation or depreciation redefines redefines the pattern of specialization. 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 a period of appreciation of the RER lasts long enough so as to reduce the share of technology-intensive sectors in exports, hysteresis and path-dependency phenomena will compromise the recovery of these sectors in the future. Path-dependence is more likely to occur in medium and high-tech activities because the intensity of learning by doing mechanisms is higher, externalities and complementarities across sectors stronger and technological change faster[7]. 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 a simple model of trade 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. Section 4 focuses on the effects of specialization on growth.

[6] This point is presented more formally in section 1. The whole arsenal of trade policies (tariffs, non-tariff protection, preferential trade agreements, export subsidies, export and import financing and son and so forth), fiscal policies (through taxes, counter-cyclical policies and government purchases) and monetary policies (that affects the interest rate and access to credit) 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 the region since the late seventies, and is related to the major external crises that occurred in Latin America in the past forty years (see Bresser, 2008; Frenkel and Rapetti, 2011; Ocampo, 2011).

[7] A rapidly moving international technological frontier implies that even a short period of contraction in investments in physical capital, human capital and R&D may lead to a large gap in international technological capabilities, which would be difficult to overcome thereafter.

1. RER and structural change

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. 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 the goods that are more technology intensive. In other words, the country on the technological frontier has higher comparative advantages in goods which are more technology intensive.

The combination of assumptions b) and d) implies that ranking the goods in terms of decreasing South-North relative productivity ($\pi_z = \pi_z^S / \pi_z^N$, where S is South, N is North, z denotes the good and π is productivity) is the same as ranking them in terms of increasing technology intensity. This gives rise to a downward sloping curve of Southern comparative advantage in which relative productivity is a function of 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), while as mentioned π is productivity, N is North and S is South. The left-hand-side of inequality (1) is the inverse of the wage-based real exchange rate

defined as $q = \frac{W^N e}{W^S}$ [8]. It is clear from (1) that *z* will be produced in the South if $q \geq 1/\pi_z$ where $\pi_z \equiv \frac{\pi_z^S}{\pi_z^N}$ and $1/\pi_z$ is the productivity gap.

The Real exchange Rate Function is defined as the set of values *q(z)* required to produce the good *z* in the South. It is straightforward that the level of *q* that makes the production of *z* viable in the South is precisely the North-South productivity gap in *z*:

2) $$q(z) = (\pi_z)^{-1}$$

The pattern of specialization of the South comprises all the goods that satisfy $q(z) \geq (\pi_z)^{-1}$, as depicted in Figure 1.

[Figure 1 about here]

The Ricardian model provides a simple form of directly linking the RER and technology to the production structure and renders simple empirical predictions. First, a higher RER favors the diversification of exports (increase in *z*); secondly, a rise in RER is not neutral across sectors, having more impact on activities of medium or high technology (recall that an increase in *z* implies an increase in the technological intensity of the goods produced in the South).

1.2. Specialization and growth

Supply-side variables and demand-side variables concur to explain why the pattern of specialization is so important for growth.

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 just adjusts in the long run to conform to the growth of potential output (Setterfield, 2009). How does specialization affect potential growth? Sectors are different: some of them boost externalities, complementarities, innovation and technological innovation / 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.

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[8] 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.

This view of marked asymmetries between sectors is a key concern of heterodox theory. Innovation and diffusion occur unevenly across sectors: this is why heterogeneity is the inevitable result of Schumpeterian competition (see Dosi et al, 2010). The centre–periphery system emerges precisely because the "best" activities of the continuum of (heterogeneous) activities concentrate in a few areas, while the lower-end activities prevail in the rest of the world (ECLAC 2007).

In addition, the heterodox tradition brings into the analysis the demand side of the equation. Potential growth does not necessarily translate into effective growth in heterodox models. If effective demand does not grow *pari passu* with labor supply and productivity, then there will be unemployed capital and labor. Demand and supply-sides interact in such a way that effective demand contributes to shape potential growth (Ciarli et al, 2010). In other words, potential output is endogenous (Setterfield, 2009).

There are different forms of introducing effective demand in heterodox growth models. The existence of an autonomous investment function and the differences in the consumption propensities of workers and capitalists are very important, especially in the short run. In the long run the focus lies on the demand for exports and imports and equilibrium in the Balance-of Payments (BOP). Particularly in developing economies, the external sector has been the binding constraint on growth. Changes in the supply-side will only have effects on growth if they ease the Balance-of-Payments (BOP) constraint. This can be formalized in the following equation, known as Thirlwall's law:

$$(3)\quad y^S = \frac{\varepsilon_X}{\varepsilon_M} y^N \equiv \varepsilon y^N$$

In equation (3) ε_X is the income elasticity of the demand for exports, ε_M is the income elasticity of the demand for imports, ε is the income elasticity ratio, y^N is the (exogenous) rate of growth of the North and y^S is the rate of growth of the South[9]. For this equation to be valid it is necessary to take on board a set of assumptions, in particular that autonomous expenditure (private and public) in the South always expand or contract so as to avoid the accumulation of reserves or an explosive external debt, respectively[10].

The income elasticity ratio (ε) depends on the pattern of specialization. We describe this pattern by the number z_c, which as mentioned is also an index of technological complexity. The empirical evidence suggests that demand for high-tech goods tends to grow faster in the international economy (ECLAC, 2007; UNCTAD, 2010). Therefore, the higher z_c, the higher is the income elasticity ratio ε. Of course, exceptions to this rule exist, such as the good luck of a

[9] The literature on the BOP-constraint is already extensive, see on this McCombie and Thirlwall (1994) and Thirlwall (2011).

[10] In other words, changes in autonomous expenditure always expand or contract aggregate demand so as to keep the effective rate of growth in line with the BOP-constrained rate of growth, even if for short periods of time these rates may differ. It should be observed that capital inflows may move the effective rate of growth away of the equilibrium rate of growth given by the simplest version of Thirlwall's Law, although this effect seems to be rather low and do not substantially alter the rate of growth predicted in equation (3).

country in the "commodity lottery". Countries which have natural resources in high demand in the international economy will grow faster (at least during some time) in spite of lagging behind in technological capabilities. Yet the evidence points out that in the long run there is a clear association between technological capabilities and the ability to compete in high-growth sectors[11].

The relation between the income elasticity ratio and the technological intensity of specialization can be stated as follows:

(4) $\varepsilon = \varepsilon(z_c),\ \varepsilon_z > 0$

And hence equation (3) can be rewritten as:

(5) $y^S = \varepsilon(z_c) y^N$

Figure 2 shows the relationship between the pattern of specialization and the income elasticity ratio (equation 4). Changes in *z* (due to technical change and/or a change in the RER) lead to changes in ε and hence in the equilibrium rate of growth. Growth may also rise out of an exogenous increase in ε (for instance, due to changes in preferences and patterns of demand) that shifts to the right the $\varepsilon(z_c)$ curve.

[Figure 2 here]

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

The influence of the RER on the export structure has been studied in different ways in the empirical literature. In general the evidence is favorable to the idea that a higher RER favors export diversification (see ECLAC, 2006 and Bastourre et al, 2011, p. 36). Agosin (2009) performed a comprehensive test for the period 1962-2000 that confirms this perspective. We will test the hypothesis for the period 1962-2008 using three different indicators of export concentration as the endogenous variable: the Gini Index (IG), the Herfindahl Index (IH) and the Theil Index (IT).

As explanatory variables we included the RER and several control variables that sought to capture the effects of technology and endowments on the export structure, among which human capital, physical capital and the availability of arable land per capita in the economy. We also

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

used as a proxy for technological capabilities the country's GDP per capita. The degree of openness was included as a control variable because tariff and nontariff barriers may alter the degree of export diversification. This variable also helps to control for the size of the country, recalling that large countries tend to have lower openness coefficients. Finally, the volatility of the RER was included as an explanatory variable. There are several mechanisms by which volatility may reduce diversification. In particular, it heightens uncertainty about profits and future market shares in tradable goods, and thereby makes less attractive to invest in the tradable sector beyond traditional export activities.

As mentioned, since path-dependency and inertia are important forces in the evolution of the pattern of specialization, the endogenous variable with a lag was included in the estimations. The estimation procedure is therefore a dynamic panel, which controls for inertial effects and uses instruments to avoid problems of endogeneity, as suggested by Arellano and Bond (1991)[12].

It is expected that a higher RER will reduce export concentration and hence it should be associated with a fall in the concentration indexes (IG, IH and IT). The inverse effect is expected as regards RER volatility (leading to more concentration). The results of the regression analysis are shown in Table 1.

[Table 1 about here]

Some of the conclusions that can be drawn from the analysis of Table 1 are the following:

a) Export diversification responds positively to a higher RER[13]. This is a robust result, verified with all the different specifications of the model for the three different indicators of the degree of concentration (IG, IH and IT[14]).
b) The volatility of the RER reduces diversification, although this result is less robust than the effect of the level of the RER on the export structure.
c) 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 upgrading of the production structure, as firms colonize new activities close to their technological basis. From a more conventional HOS perspective, this may be seen as the natural result of the accumulation of factors of production which in turn redefines comparative advantages though time. For the objectives of this paper, the point to be stressed is that the RER proved to be significant factor in the diversification process after controlling for the traditional explanatory variables in trade theory. The latter variables, in turn, have effects that were in general significant, but not robust to different specifications of the model.
d) As regards openness, in principle, the association between this variable and export concentration should be positive -- higher openness should mean more specialization and a

[12] The autocorrelation of residuals was used to confirm the presence of the dynamic variable and the Sargan contrast to test the validity of the instruments.

[13] A similar result is reported in ECLAC (2006), albeit with different indicators.

[14] Still, for some specifications of the model, the results obtained with the IH were more ambiguous.

higher concentration index. Large economies tend to have a lower coefficient of openness along with more diversified domestic capabilities and production, which implies opportunities for trade in more sectors. Inversely, a small economy with a narrow domestic productive basis should tend to be more open and more specialized. However, the results suggest that openness shows no influence on export concentration, with the exemption of the regressions with the Theil Index as dependent variable, in which case there is a positive association.

e) The variable GDP per capita was positively associated with export concentration. This result is at variance with what we expected. If GDP per capita is seen as a proxy for technological capabilities or (in more orthodox terms) for the accumulation of capital, it should favor diversification. There is no simple answer for this puzzle, but at least two factors may be at work. One of them is that the relationship between GDP per capita and productive diversification is not linear (Imbs and Wacziarg, 2003). Up to medium levels of income, countries tend to increase diversification, but when they reach high levels of income specialize in high-tech sectors and abandon sectors of low and medium technological intensity. In addition, it is likely that trade increasingly moves towards intra-industry trade. This kind of trade diversification (within sectors) may not be captured at the level of disaggregation with which concentration indexes are computed (3-digit level).

f) The variables related to the endowment of natural resources send contrasting messages. Arable land per capita is positively associated with export diversification, while the share of agricultural production in GDP has the opposite effect. Such a contradiction is however apparent. It is now widely accepted that natural resources are not by themselves a curse or a blessing (Cimoli and Porcile, 2011; Nugent and Robinson, 2010). Their impact on development depends on how the economy uses the rents obtained from these resources. Clearly, the abundance of arable land per capita may produce rents that can be used in very different ways, from consumption and exchange rate appreciation to investing in human capital and technological learning. The positive coefficient for arable land suggests that rents generally offer an opportunity to furthering diversification, in particular through industrialization. On the other hand, a productive structure that remained concentrated around agricultural goods indicates that the process of building up capabilities out of (initially) static comparative advantages failed to advance. This explains why export diversification was negatively associated to the share of agricultural value added.

g) Last but not least, the coefficient of the lagged endogenous variable was 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. Forces of hysteresis and path-dependence are at work in the evolution of the pattern of specialization, as argued before.

In sum, a higher RER is consistently related to a more diversified export structure. A higher volatility of the RER compromises this diversification, although this effect is less robust than the effect of the level of the RER. The accumulation of physical and human capital enhances export diversification. Finally, “endowments are not fate” (Nugent and Robinson, 2010): having natural resources not necessarily leads to less diversification.

3. RER and the Technological Intensity of Exports

It has been argued that a higher RER not only increases export diversification but that it does so by encompassing new exports which are more technology-intensive. 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 was devised in a similar fashion as the test for export diversification. The RER was included as an explanatory variable along with a set of control variables on the right-hand side. The dependent variable is an indicator of the technological intensity of exports: the share (in percentage) of medium and high technological exports, according to Lall's classification, in total exports (MHTE) (see Lall, 2000). As in the previous exercise, we made estimations using Arellano-Bond (1991), and included the lagged dependent variable ($MHTE_{(t-1)}$) among the explanatory variables to capture path-dependency[15]. We expect positive signs for the lagged endogenous variable, the RER, human and physical capital, and a negative sign for the share of agriculture in total production. No predictions are made as regards the availability of arable land, for the same reasons given before – the net effect depends on how rents are used.

Finally, the effect of openness cannot be predicted ex ante. More openness implies stronger competitive pressure that would strengthen the efforts for catching up with the leaders. On the other hand, this pressure may eliminate local producers before they have time to learn. The timing of both forces – catching up versus competitive advantages of the leaders –, and the existence of policies to speed up technological diffusion in the South, determine emerging patterns of specialization and market shares in the international economy[16].

The results of the econometric test are presented in Table 2.

[Table 2 about here]

These results can be summarized as follows.

a) The RER has a significant influence on the technological intensity of exports and the effect is robust to the various specifications of the model.
b) The laggard endogenous variable is significant, which corroborates the idea that specialization patterns are subject to path-dependence.
c) The coefficient of the GDP per capita is positive and consistently associated with a higher technological content of exports. This is the expected result if we consider this variable a proxy for the technological level of the economy. As shown in figure 1 above, the same RER will be compatible with more medium and high-tech exports when the productivity gap is lower (shift in the curve $q(z)$).
d) The variables openness, human capital and physical capital give no robust results, changing signs and/or losing significance when new control variables are added to the conditional set.

[15] See also note (13). The statistical appendix presents details about the sources and data.

[16] 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.

e) The coefficients of arable land per capita (positive) and of the share of agricultural production in GDP (negative) exhibit the same pattern of section (2). A production structure concentrated in goods intensive in natural resources indicates that rents were not deployed to enhance learning.

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. Both results are in conformity with the hypotheses set forth in section (1). The other explanatory variables produce less robust results.

4. Growth and specialization

The RER affects the pattern of specialization and this pattern shows path-dependency, forging a critical link between the short run and the long run. In this section we test the idea that the technological intensity of the export structure boosts growth. With this objective, we run a panel data regression of the rate of growth on a set of explanatory variables, including the share of medium and high tech exports in total exports (the variable MHT), human and physical capital and the level of the GDP per capita.

The variable AI (Adaptability Index) is defined as the ratio between the share in total exports of sectors with high demand in the international economy (*SHD*) and the share in total exports of sectors with low demand in the international economy (*SLD*)[17], as follows:

$$(5)\quad IA = \frac{SHD}{SLD}$$

This variable aims to capture possible "commodity lottery" effects on growth – i.e. demand growth not related to technological capabilities, but to an exogenous rise in the international demand of certain commodities.

The expected sign of the variable GDP per capita is negative, either as a result of decreasing returns in the accumulation of capital (as predicted in conventional models) or as a result of technological spillovers from the leaders (as predicted by catching up models)[18]. The variables physical and human capital are expected to show positive signs. The results of the econometric exercise are reported in Table 3.

[Table 3 about here]

[17] High demand sectors (HD) are those whose international demand grows above the average of all sectors. Symmetrically, the demand in low demand sectors (LD) grows below the average.

[18] The positive relationship between the technology gap and international spillovers of technology depends on the existence in the South of a critical level of technological capabilities that allows the South to learn from the technological leader. For a discussion of this point see Narula (2004).

The results of the model are compatible with the hypothesis that countries whose export structure is concentrated in medium and high tech goods attain higher rates of growth. The coefficient of the MHT variable is positive and significant for the different specifications of the model. No significant effect was found for the variable IA, which suggests that – at least for the 50-year period considered in the analysis – in the long run the dynamism of demand is related to technological capabilities and the "commode-lottery effect" is small.

While GDP per capita and physical capital show the expected signs, the coefficient of human capital is negative and contradicts theoretical predictions. Such a result is similar to what has been obtained in other empirical studies, in which the accumulation of human capital seems to have a negative influence on productivity growth[19]. Still, from the point of view of the focus of this paper, which is on RER, structural change and growth, the key hypothesis to be tested -- the positive effect of the diversification of the export structure on the rate of growth – is not rejected by the empirical evidence.

Concluding remarks

This paper addressed short run – long run interactions by discussing the role of the RER on structural change. It is shown that the RER affects the export structure, which in turn is a significant explanatory variable of the long-run rate of growth.

Path-dependence is an important concept linking the short run and long run effects. The econometric evidence confirms the existence of path dependence. This sends a clear message to policy-makers: there are significant endogenous forces 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 that redefine the parameters governing structural change. Only strong policy measures can compensate for the endogenous forces that perpetuate the structural constraints on growth.

The Latin America economic history combined periods of appreciation of the currency with subsequent external crises. Either as a result of improvements in the terms of trade (for the main exporters of natural resources in the region) or higher liquidity in the international financial markets, domestic currencies have tended to appreciate to unsustainable levels. Appreciation and volatility strongly discourages the production of tradable goods, particularly those of medium and high technological content. The outcome of this cyclical process is slowing down structural change and growth.

Path-dependency implies that the RER and the industrial and technological policies (ITP) should be seen together. An active ITP may cushion the effects of a low RER. The lower the RER, the more needed is ITP to provide encouragement to middle and high tech sectors. On the other

[19] This can be related to the quality of education, the quality of the data, and the type of activities to which skills are applied in many developing economies. See Pritchett (2001) and De la Fuente (2006).

hand, countries whose institutional capabilities are not well developed and cannot implement an efficient ITP will be more dependent on the RER to compete internationally. While a high RER without ITP allows countries to attain increasing returns and learning from exporting, it also implies slow increases in real wages and longer periods of unequal income distribution. Inversely, an active ITP with a low RER may boost learning in localized areas, but most firms will find it very difficult to effectively conquer and increase market shares in the international markets. Economic history teaches that in all the successful cases of catching up, as in SE Asia, both variables – a high RER and an active ITP – were present in the policy mix.

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Figures and Tables

Figure 1, The Real Exchange rate Function

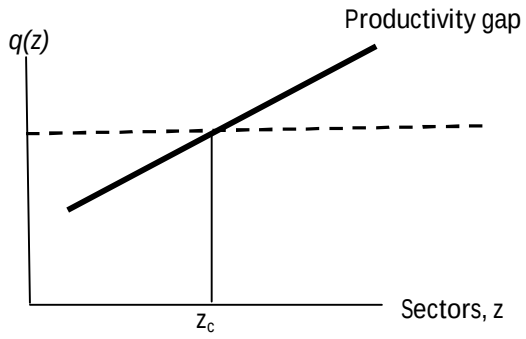

Figure 2. The Income Elasticity Ratio and the Pattern of Specialization

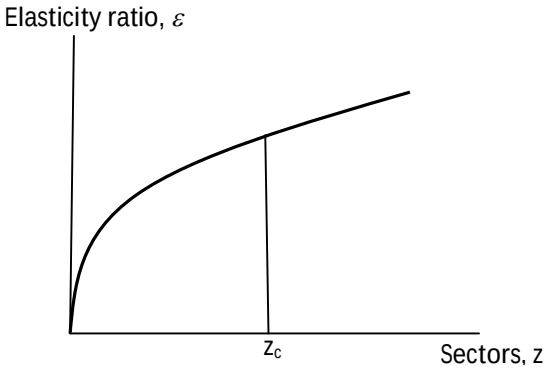

Table 1. RER and export diversification

Endogenous Variable: Gini Index

	GINI					
Variable / model	I	II	III	IV	V	VI
Concentration (-1)	0.236***	0.292***	0.223***	0.238***	0.220***	0.244***
	(7.73)	(9.41)	(7.19)	(7.35)	(6.74)	(4.67)
lpRER	- 0.456***	-0.360***	-0.330***	-0.346***	-0.340***	-0.428***
	(-8.65)	(-7.26)	(-7.18)	(-7.46)	(-6.91)	(-4.23)
volpRER		-0.517***				-0.483*
		(-3.99)				(-1.93)
Lhumancapital			-0.340***	-0.296***	-0.395***	-0.138
			(-5.53)	(-4.47)	(-6.10)	(-1.04)
Lrgdpch		0.0247	0.363***	0.371***		
		(0.38)	(3.75)	(3.89)		
Lopenc			0.645***	0.644***	0.734***	0.590***
			(10.71)	(10.44)	(11.53)	(5.51)
Ltot						0.131
						(1.23)
Lvabagri						-0.00672
						(-0.06)
Lagrilandpc				-5.863	-13.72	-97.33***
				(-0.51)	(-1.18)	(-3.15)
Lcapital			-0.496***	-0.572***	-0.338***	-0.228*
			(-5.28)	(-6.04)	(-4.75)	(-1.76)
Observations	741	741	741	715	715	359

Key for the variables: see appendix, t statistics in parentheses

Endogenous variable: Herfindahl Index

	HERFINDHAL			
Variable /model	I	II	III	IV
Concentration (-1)	0.182***	0.222***	0.218***	0.242***
	(5.71)	(6.79)	(7.12)	(7.60)
lpRER	-0.254***	-0.295***	-0.262***	-0.293***
	(-4.25)	(-4.93)	(-4.35)	(-4.85)
Lhumancapital	-0.198***	-0.0817	-0.0906	0.00207
	(-2.72)	(-1.03)	(-1.32)	(0.03)
Lrgdpch	-0.554***	-0.386***		
	(-4.27)	(-3.09)		
Lopenc	0.246***	0.204***	0.174**	0.155**
	(3.18)	(2.60)	(2.33)	(2.02)
Lagrilandpc		14.90		22.05
		(0.99)		(1.49)
Lcapital	0.390***	0.195	0.00297	-0.0673
	(3.19)	(1.60)	(0.04)	(-0.77)
Observations	741	715	741	715

Key for the variables: see appendix, t statistics in parentheses

Endogenous variable: Theil Index

	THEIL					
Variable	I	II	III	IV	V	VI
Concentration (-1)	0.247***	0.254***	0.261***	0.243***	0.281***	0.290***
	(8.06)	(8.23)	(8.42)	(7.76)	(5.61)	(5.82)
lpRER	-0.461***	-0.381***	-0.306***	-0.278***	-0.444***	-0.387***
	(-8.55)	(-7.39)	(-6.67)	(-5.63)	(-4.56)	(-3.86)
volpRER		-0.642***				-0.437*
		(-4.97)				(-1.76)
Lhumancapital			-0.298***	-0.391***	-0.0351	-0.0635
			(-4.86)	(-6.47)	(-0.26)	(-0.48)
Lrgdpch			0.319***			
			(3.28)			
Lopenc			0.625***	0.720***	0.643***	0.585***
			(10.39)	(11.55)	(5.91)	(5.46)
Ltot					0.169	0.166
					(1.56)	(1.56)
Lvabagri					0.00880	-0.0182
					(0.08)	(-0.17)
Lagrilandpc					-96.05***	-95.74***
					(-3.10)	(-3.12)
Lcapital			-0.487***	-0.269***	-0.272**	-0.275**
			(-5.16)	(-4.06)	(-2.03)	(-2.15)
Observations	741	741	741	741	359	359

Key for the variables: see appendix, t statistics in parentheses

Table 2: RER and Medium and High Exports (Five years panels 1965-2005)

Endogenous variable: Share of medium and high tech exports in total exports

	I	II	III	IV	V	VI
L.IMHTM_EXP	0.157***	0.140***	0.162***	0.125***	0.143***	0.148***
	(5.12)	(4.27)	(4.76)	(3.77)	(4.33)	(4.33)
lpRER	0.424***	0.186**	0.196**	0.209**	0.155*	0.186**
	(4.60)	(2.11)	(2.20)	(2.30)	(1.74)	(2.04)
volpRER					0.298	
					(1.33)	
Lhumancapital		0.291***	0.424***	0.223**	0.265**	0.334***
		(2.62)	(3.54)	(2.01)	(2.43)	(2.83)
Lrgdpch		0.221	0.431**			
		(1.16)	(2.27)			
Lopenc		-0.0517	-0.135	-0.0308	-0.0683	-0.127
		(-0.42)	(-1.09)	(-0.25)	(-0.56)	(-1.02)
Lvabagri						
Lagrilandpc			81.43***			68.38***
			(3.52)			(3.03)
Lcapital		0.368**	0.285	0.610***	0.540***	0.658***
		(2.00)	(1.53)	(4.68)	(4.22)	(4.65)
Observations	724	724	698	724	724	698

* p<0.10 ** p<0.05 *** p<0.01"

Key for the variables: see appendix, t statistics in parentheses

Table 3: Growth and Medium and High Exports (Five years panels 1965-2005)

Endogenous variable: economic growth

	I	II	III	IV	V	VI
export_MHTM_por	0.377***	0.416***	0.362***	0.579***	0.506***	0.531***
	(2.76)	(3.44)	(2.89)	(5.39)	(5.01)	(5.80)
Lrgdpc	-0.229***	-0.244***	-0.189***	-0.508***	-0.421***	-0.452***
	(-5.61)	(-6.75)	(-4.87)	(-9.69)	(-9.01)	(-10.43)
LIA		0.000692				0.00261
		(0.16)				(0.66)
Lhumancapital			-0.0288		-0.0325*	-0.0404**
			(-1.52)		(-1.76)	(-2.25)
Lcapital				0.165***	0.143***	0.171***
				(4.10)	(3.61)	(4.64)
Observations	565	565	565	565	565	565

Key for the variables: see appendix, t statistics in parentheses

Note: All the equations (for the three different measures of concentration) 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 Sargan contrast to test the validity of the instruments.

Appendix: 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 ANS 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.