Growth Impacts of the Exchange Rate and Technology

Alejandro Márquez-Velázquez

Institute for Latin American Studies, Freie Universität Berlin, Berlin, Germany

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Abstract

Purpose – The purpose of this paper is to assess whether the growth impacts of real exchange rate undervaluation and domestic technological capabilities are stable across development levels.

Design/methodology/approach – On the one hand, a real exchange undervaluation measure is constructed based on the purchasing-power-parity theory corrected by the Balassa-Samuelson effect. On the other hand, the index of technological specialization,
1 which is derived from the National Innovation Systems framework, is used as a measure of domestic technological capabilities. Time-series–cross-section growth regressions with development level interactions are used to test whether the growth impact of these variables is stable across development levels.

Findings – Empirical results show that real undervaluation is a more important growth driver for low-income developing and developed countries than for emerging markets. The evidence also suggests that developing countries at low income levels grow faster when they are globally competitive in low-technology manufacturing and natural resource intensive industries.

Practical implications – The empirical analysis points to the relevance of policymakers considering the development level of countries when they design or recommend policies to implement a development strategy, especially when it comes to pursuing real exchange rate undervaluation and types of industries to promote.

Originality/value – This research attempts to explain the lack of significance found in previous studies of the growth impact of real undervaluation in emerging markets by accounting for an explicit role of technological capabilities in the development process.

Keywords – Economic growth, Domestic technological capabilities, Economic development, Real exchange rate undervaluation.

Paper type – Research paper.

1. Introduction

There is a strand of literature concerned with the positive correlation between growth and real exchange rate undervaluation (RERU) that appears to be disconnected to another strand related to the importance of domestic technological capabilities (DTC) as growth drivers[1]. However, taking stock of the lessons provided by both bodies of knowledge could help explaining some of the unexpected empirical results of the RERU literature, such as the one obtained in Rapetti, Skott and Razmi (2012), where RERU did not have a significant growth impact in emerging countries, while it did have one in developing and developed countries. However, at first sight it is not obvious that higher RERU should increase growth rates, since increases in RERU imply real depreciations, which on their own do not always translate into growth.

Many empirical studies using the before-after approach to analyze the output impact depreciations have failed to find a positive growth impact since such studies are unable to control for other factors that might affect output apart from depreciations during depreciation episodes. To control for this, Agénor (1991) considered that there are two types of depreciations, expected and unexpected. Using time-series–cross-section (TSCS) regressions following this insight Agénor finds that all the negative impacts of depreciations can be attributed to expected depreciations that occur as a consequence of high RER overvaluation (RERO). RER depreciations should therefore spur growth whenever they are not the result of steep RER corrections following large RERO episodes.

The discussion so far presented has overlooked the impact that DTC have on growth. These capabilities can be defined as the degree to which natural resource intensive industries and low-, mid- and high-technology manufacturing industries are economically viable within a country[2]. Given that technology has been considered the major growth driver in most growth theories, a relative increase in the global competitiveness of a country's mid- and high-technology industries should increase the growth rate of a country, *ceteris paribus*. Historically, the successive wave of countries on sustained economic development paths implemented a set of policies aimed at fostering the development of DTC in mid- and high-technological capabilities (Amsden, 2001, 1989).

However, many of the developing countries that have failed to sustain long-term catch-up growth also implemented similar policies (Commission on Growth and Development, 2008, p. 48). The difference between these two sets of countries is that only the successful catching-up economies have been able to shift their economic structure away from natural resource intensive and low-technology manufactures towards mid- and high-technology sectors. While there is a strand of the political economy literature that focuses on the importance of industrial and technological policies with an appropriate mix of stick-and-carrot incentives that aim building up internationally competitive mid- and high-technology sectors, this study follows the view that another crucial issue that needs to be considered is that the type of industries to be promoted need to be adapted to the level of DTC of countries.

Following this view one could expect that the path towards high sustained growth rates for a country with low DTC begins by specializing in natural resource or low-technology tradable industries that are labor intensive and less knowledge-intensive. Such a development strategy has three major benefits for developing countries: it generates high employment levels, higher back- and forward linkages, and less dependence on imported inputs. Therefore, such a development strategy will probably be responsible for high income multipliers and lower balance of payments constraints, which should pave the way to a high growth rate.

This piece of research aims to test two major hypotheses derived from the previous explanation. The first one is to assess whether low income developing countries, which one can assume as generally having low DTC, have grown faster when specializing in natural resource and low-technology industries. A related question is to establish whether middle-income countries, or the so-called emerging markets[3], have achieved higher growth by increasing the relative importance of mid- and high-technology sectors in their economies. The second hypothesis to test is whether the impact of RERU on growth has been the same across development levels.

This paper contends that RERU should be a more important growth driver for low-income developing countries that will tend to compete in low-technology industries, since competition in these sectors is mainly cost based. On the other hand, the paper argues that high growth emerging markets should depend less on RERU as a source of competitiveness, since their pool of competing nations will gradually shift towards developed countries as they acquire technological capabilities that allow them to compete against the latter in mid- and high-technological sectors. Lastly, the paper makes the case that fast growing developed countries, which are more heavily represented in mid- and high-technology international markets, will rely more on RERU as a growth driver to be able to fend off competition stemming from emerging markets. The next two sections will briefly review the literature concerned with the growth impact of RER misalignments and the impact of trade patterns and technology on economic development. Section 4 reassesses the lessons of the literature and section 5 presents and analyzes the evidence of the relevance of the development level.

2. The Impact of Real Exchange Misalignments on Growth

Nominal devaluations tend to be seen as a tool to correct RERO, i.e. a type of RER misalignments (Edwards, 1989, p. 3) that has been often associated with low levels of growth. It is therefore relevant to understand how RER misalignments can have an impact on growth. Before briefly reviewing the strand of literature interested in the effects of RER misalignments on growth in section 2.2, the main RER equilibrum theories will be presented and analyzed in section 2.1.

2.1. Main Real Exchange Rate Equilibrium Theories

RER misalignment occurs when the RER differs from its equilibrium value. Therefore, analyzing RER misalignments is closely related to RER equilibrium theories. The fundamentals aproach, which is one popular RER equilibrium theory, argues that the RER has reached its equilibrium when an economy has simultaneously reached its external and internal equilibria (Edwards, 1989, p. 18; Razin and Collins, 1999, p. 59). On the other hand, according to the purchasing-power-parity (PPP) theory in either its strong or weak versions, equilibrium RER remains constant across time, in order that the law of one price prevails, in accordance to its strong version, or that nominal devaluations equate with the difference between foreign and domestic inflation, as its weak version holds (Dornbusch, 1985). Needless to say, the PPP aproach to RER exchange equilibria has been subject to great criticism, however, it has evolved in the sense that it allows the equilibrium RER to no longer to be a constant.

Balassa (1964) and Samuelson (1964) are often cited as the seminal works providing empirical evidence and developing models that explain why price levels of nontradables, and therefore the equilibrium RER, increase as countries attain a higher development level. Under the Balassa-Samuelson corrected PPP theory of equilibrium RER, there will be RER misalignments whenever the domestic price level of a country is either higher or lower than expected given its level of income per capita. This insight of ever-moving equilibria depending on the development level of a country will be important to keep in mind while reading the next section, when the literature focused on the growth consequences of RER misalignments will be explored.

2.2. Explaining the Impact of Real Exchange Rate Misalignment on Growth: Theories and Evidence

While there is an extensive body of knowledge concerned with Dutch disease as a theory explaining the short-term growth impact of RERO and resource curse as a theory explaining the long-term growth impact of RERO[4], the literature analyzing the growth impact of RERU is rather recent and builds upon the literature that claims that RERU can be sustained in the medium-term (Levy-Yeyati and Sturzenegger, 2007). Rodrik (2008) expands the arguments of the Dutch disease and resource curse literatures by arguing that RERU should have a positive impact on growth, because it implies a higher relative price of tradables with respect to nontradables than RER equilibrium warrants. Therefore, RERU should incentivize investments in the tradable sector, and especially wihin manufacturing, since it increases the return of investors in this sector in comparison to a situation of RER equilibrium. The author argues that market and government failures in developing countries affect more modern tradables and, therefore, investment in such sector—and therefore growth—is lower when the RER is in equilibrium.

Rodrik (2008, p. 375) estimated a TSCS model of annual growth on initial income and RERU with country and year fixed effects, in order to control for country-specific time invariant characteristics and yearly shocks that might have affected several countries. The author's results support the hypothesis that RERU had a positive impact on growth for developing countries during the 1950–2004 period. In a similar vein, by running Rodrik's (2008) growth regressions with different developing country income thresholds, Rapetti et al. (2012) find evidence in favor of a changing relationship between RERU and growth, with RERU having a positive and significant impact for low- and high-income countries, yet not for middle-income countries.

Rapetti et al. (2012) point out that the non-significance of the impact of RERU on growth in Rodrik's (2008) sample of richer economies seems to be driven by its lack of impact in the so-called emerging economies, a result that puzzles the authors. Nevertheless, Glüzmann, Levy-Yeyati and Sturzenegger (2012) provide empirical evidence, similarly based on TSCS regressions, supporting the hypothesis of RERU also having a positive and significant impact on growth in emerging markets. Despite the different growth impacts reported in this sample of studies, one can argue that at least a consensus seems to exist on the RER equilibrium theory used, i.e. the PPP approach corrected by the Balassa-Samuelson effect (BSE), and the econometric approach of TSCS regressions.

Given that the modern manufacturing tradable sector is considered to be the main driver of productivity growth in the economy, economies suffering from RERO will suffer from low growth rates. From the side of RERU theories, Rodrik (2008) proposes that modern tradable sectors in developing countries are smaller than is optimal for them, because they are plagued by market and government failures that are typical of developing countries, which affect them disproportionally. The literature review of the next section will attempt to show how authors have underscored the relationship between development, technology and trade patterns, so as to justify the inclusion of DTC proxies in the growth regressions of section 5.

3. Development, Technology and Trade Patterns: A Literature Review

The literature reviewed in this section focuses on the role that technology plays in the development process, especially in its relationship with a developing country's growth prospects and patterns of trade. The review underscores the view that theories explaining increases in DTC in developing countries are highly relevant to the process of economic development, given that technology is a crucial determinant of trade patterns and growth.

3.1. Trade Patterns, Technology, the Prebisch-Singer Hypothesis and Balance-of-Payments Constraint

In a world with developed and developing countries, the Ricardian model predicts that developed countries will specialize in high productivity sectors to be able to maintain a high wage level. In the Hesckscher-Ohlin setting, if technology is considered a factor of production, then developed countries should specialize in the production of technology intensive goods. Based on these predictions, one could argue that the optimal international labor division would be that developing countries specialize in natural resource intensive and low-technology manufacturing goods and that developed countries specialize in mid- and high-technology manufacturing goods.

However, early development economists warned against an apparent secular trend against the relative prices of primary goods in comparison to manufactures (Prebisch, 1959; Singer, 1950). Such a negative trend in the terms of trade represents a growth constraint for developing countries exporting primary goods and importing intermediary and final goods, and can be explained by a low income elasticity of demand towards primary goods (Prebisch, 1959, p. 252). Moreover, as pointed out by Kaldor

(1966), the BoP can limit growth in developing countries, since it can be the source of imported input and capital bottlenecks or of BoP crises if not properly managed.

3.2. Domestic Technological Capabilities and the National Innovation System Framework

The basic ideas related to the National Innovation System (NIS) literature can be traced back to Friedrich List's proposal regarding a catching-up strategy for 19th century Germany. Perhaps the most important of these ideas is that not only human capital is needed to develop a NIS, but also innovation supporting infrastructure (Lundvall, 2007, p. 113). But what is a NIS? Given that there are several definitions of this and related terms in the literature, for the purpose of this paper a NIS will be understood as a system within a country that enables it to develop DTC in mid- and high-technology sectors.

Last but not least, even if one agrees with the usefulness of the NIS approach for the developing world, it seems more realistic to expect that a NIS in a developing country relates more to innovations of the technology assimilation type, than to Schumpeterian innovations, i.e. those that expand the technological frontier, which tend to occur in developed countries (Lundvall et al., 2009, p. 3). Therefore, an indicator such as the Index of Technological Specialization (ITS), introduced by Alcorta and Peres (1998)—which is the ratio of the revealed comparative advantage of a country in mid- and high-technology manufacturing sectors over its revealed comparative advantage in natural resource intensive and low-technology manufacturing industries—seems better suited than patents or R&D expenditures, the usual innovation measures within the NIS literature focused in developed countries, to measure increases in the relative importance of DTC in mid- and high-technology sectors in the developing world.

3.3. Domestic Technological Capabilities as Drivers of Economic Growth

DTC can be understood as the result of cost discovery activities (CDA), which Hausmann and Rodrik (2003, p. 605) define as the activities related to the process of ascertaining what a country is good at producing. CDA relate more to the developing world because the kind of innovations that first movers engage in developing countries have more to do with innovations of the technology assimilation type than with Schumpeterian innovations, as mentioned in the previous section. However, in the absence of government intervention, CDA will be undersuplied since they generate positive externalities. This means that the value for a society of discovering the costs of production in new sectors of activity is much higher than what the first investor in this sector, who performed the CDA, can appropriate as benefits. This externality can be measured in terms of the benefits captured by copycats once costs have been 'discovered' by first movers.

The undersupply of CDA will reduce the growth rate of countries, *ceteris paribus*. To be able to exploit Gerschenkron's advantage of backwardness, i.e. being able to achieve high growth rates thanks to innovations produced elsewhere; governments in developing countries need to manage the externality problem generated by CDA. However, intervention needs to go beyond intellectual property rights regulation, since an important part of CDA will consist of technology assimilation of standardized foreign technology, which cannot be patented yet, nevertheless requires high learning investments (Hausmann and Rodrik, 2003, p. 624).

Theories explaining technological change taking place within developing countries are of central importance for research like this, which is focused on the topic of growth in the context of economic development, with this last term understood as the structural change of a developing country's economic activities in favor of those more intensive in knowledge (Amsden, 2001, p. 2). A key insight of the literature reviewed in this section is the importance of the production structure, and the trade patterns that it reflects, for the growth perspectives of developing countries. This insight together with the potential of RERU for increasing growth in the developing world will be further analyzed in the next section.

4. Reassessing the Literature's Lessons

This section presents a critique to the literature on the relationship between RER misalignments and growth and the one concerned with technolgy, trade patterns and development in order to lay the foundations of the main argument of this piece of research, which is that RERU should have larger growth impacts in developing countries and developed countries, while developing DTC in mid- and high-technology sectors should have larger growth impacts in emerging and developed countries.

4.1. The Real Exchange Rate Misalignment Concept Revisited

This section presents the arguments in favor of selecting the PPP exchange rate theory corrected by the BSE over the fundamentals theory when studying the growth impacts of RER misalignments. From the point of view of economic development, the problem with the fundamentals theory of RER equilibrium is that it considers at least part of real appreciations resulting from commodity booms as a movement of a country's RER towards a new equilibrium, given that the terms of trade are one of the determinants of a country's external equilibrium. Therefore, the resulting RER misalignment caused by improvements in the terms of trade will in principle be lower when measured according to the fundamentals theory than when measured following the PPP approach corrected by the BSE. A misalignment measure following the latter approach will consider most of RER appreciations as generating RER misalignment, as long as the impact of appreciations on the income level of the country is not very strong. This means that a RER misalingment measure derived from this approach will be better able to capture the growth slowdown related to RERO that has been underscored in the Dutch disease and resource curse literature.

4.2. Reexamining the Evidence of the Link between Real Undervaluation and Growth

According to Rodrik's (2008) theory, it is expected that the impact of RERU on growth will be lower if the income threshold for the developing country group is increased or if the developing countries with the lowest income levels are taken out of the sample. Nevertheless, by using a higher income per capita threshold to define developed countries Rapetti et al. (2012) find a significant growth impact in developed countries and no significant growth impact in middle-income countries. Regarding the transmission channel between RERU and growth, one can criticize Rodrik's (2008) lack of match between theory and evidence, since the industries that tend to be promoted by RERU in low-income countries tend not to be considered as mid- or high-technology industries. Following the results of Rajan and Subramanian (2011), the manufacturing sectors promoted by RERU are rather low-technology, labor-intensive sectors, such as textile, clothing, leather and footwear. Moreover, the lack of growth impact of RERU in emerging countries reported in Rapetti et al. (2012) can be interpreted as evidence in favor of the view that the RERU is not a main driver of industries in which these countries compete.

4.3. Theoretical and Empirical Contributions to the Literature

The main contribution of this research from a theoretical point of view is the argument that one should not expect constant growth impacts of RERU and DTC across development levels. The next section attempts to present empirical evidence to support this claim. One reason explaining why the RERU's positive impact on growth disappears for developed countries defined with a relatively low GDP per capita threshold in Rodrik (2008) might be that developing countries with an income level slightly above this threshold, the so-called emerging markets, compete in industries that are not so sensitive to RERU, as is the case with many mid- and high-technology manufactured goods. Among producers of these goods, the lower income level of emerging markets already represents a decisive competitive factor when they compete against developed countries. Therefore, increases in DTC in mid- and high-technology sectors should have larger growth impacts in emerging markets and RERU should be more important in developing countries that compete against each other in cost-competing low-technology industries and in developed countries that compete against emerging countries.

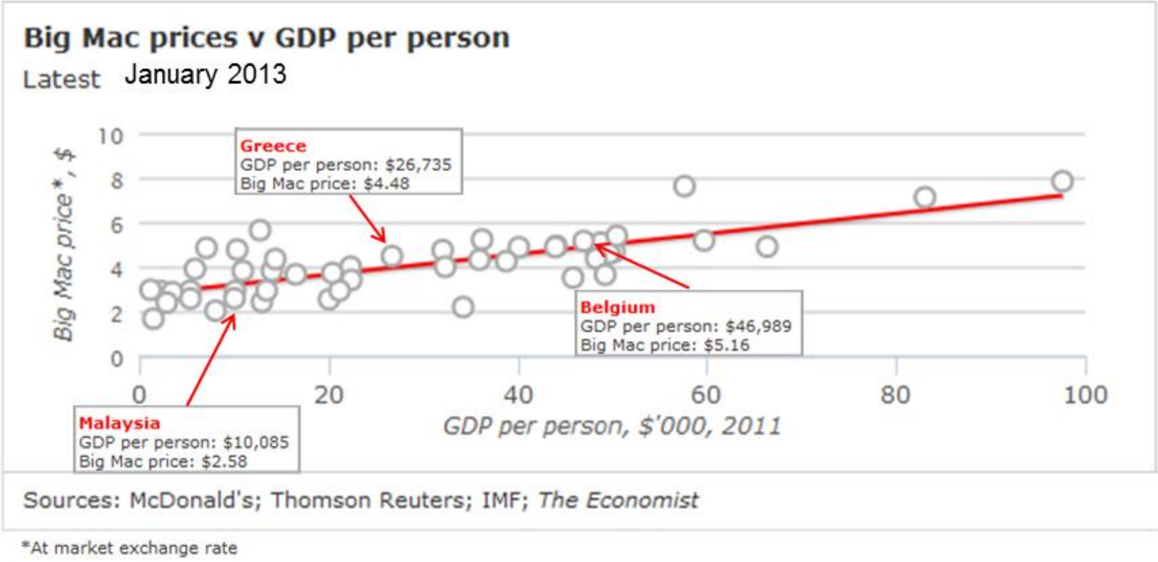
The combination of labor abundance, which in theory should facilitate successful competition in labor intensive goods, and high RERU levels made low-income developing Asian economies super-competitive in low-technology manufacturing goods. However, within high growth low-income developing countries, raising income levels can reduce competitiveness in these sectors. To face this challenge governments have basically two choices: further repress wage growth to achieve high RERU levels or intervene in favor of building up DTC in mid- and high-technological manufacturing sectors (Amsden, 2001, p. 6). Governments that have decided in favor of the latter alternative, while keeping an eye on RERU and the BoP constraint, seem to have been the ones able to achieve structural transformation and grow faster. Following the methodological approach used in the literature, in the next section TSCS or panel data regressions will be run to reassess the impact of RERU and DTC on growth in developing, emerging and developed countries.

5. Evidence of the Relevance of the Development Level

This section presents and discusses the results of TSCS models used to test the main hypothesis of this research, namely that RERU should be more relevant for the growth perspectives of developing countries at low-income levels and developed countries, while the higher the income level of a developing country, the more important role DTC in mid- ad high-technology sectors should play as a growth driver.

5.1. Generating the Real Exchange Rate Undervaluation Variable

Figure 1. Example of Price Differences of a Nontradable Good across Countries



Source: The Economist (2013).

The need to control for the BSE in order to obtain an equilibrium level of the RER is illustrated in Figure 1, which presents the positive correlation of the Big Mac's USD price at market exchange rates and the GDP per capita level of countries. As can be seen in Figure 1, Big Macs tend to be more expensive in developed countries such as Belgium and Greece, than in developing countries such as Malaysia. However illustrative of the BSE the price of the Big Mac, a nontradable good, might be, in order to generate a RERU measure a proper RER index needs to be used. Following Rodrik (2008), I used nominal exchange rate in local currency units per USD over the PPP exchange rate in local currency units per international dollars as a measure of the RER.

Nevertheless, data on these variables was taken from a more recent version, 7.0, of the Penn World Table (Heston et al., 2011). Last but not least, the approach used here to deal with data missingness differs from Rodrik's (2008, p.373), which involved taking five-year averages of his variables of interest, resulting in only 11 time periods. Among the several limitations of this approach are the acute loss of degrees of freedom and the fact that it causes the new averaged dependent variable to lose variability (Honaker & King 2010, p.562). For these reasons, the multiple imputation model suggested by Honaker and King (2010) to handle data missingness in both the dependent and independent variables was followed.

Table 1. The Effect of Gross Domestic Product per Capita Increases on the Real Exchange Rate during 1985-2004

Independent Variable	
Intercept	1.5348***
	(0.0824)
GDP per capita (in logs, PPP 2005 USD)	-0.1291***
	(0.0101)
% of significant year fixed-effects	53%
Observations	3,820
	(N=191, T=20)
Adjusted R^2	0.1046
LM test p-value	1.2633×10^{-178}

Source: author's calculations. Panel corrected standard errors in parenthesis; *** p-value<0.01; ** 0.01<p-value<0.05; * 0.05<p-value<0.10. Year fixed effects reported as significant when their p-value<0.10.

The results presented in Table 1 are obtained after estimating the following equation, which was originally proposed by Rodrik (2008, p. 371), and later used within other studies (Glüzmann et al., 2012; Rapetti et al., 2012):

$$\ln RER_{i,t} = \beta_0 + \beta_1 \ln RGDPCH_{i,t} + y_t + \varepsilon_{i,t}$$

The RERU measure thus obtained is the error term $\varepsilon_{i,t}$, which constitutes the unexplained level of RER that cannot be accounted for by a country's income level nor by time-specific shocks. One salient feature of the results presented in Table 1 is that the BSE estimate ($\hat{\beta}_1 = -0.1291$) is almost half the magnitude than in related studies (Glüzmann et al., 2012; Rodrik, 2008). The difference in the estimation results could be mainly due to differences in the sampled time period, approach to deal with data missingness, and the use of a more recent data set. Moreover, the results in Table 1 could be criticized due to the model's low goodness of fit (0.1046). However, adding more covariates to improve the goodness of fit of the RER model, as conducted in the RER fundamentals literature, may lead to arguing that the RER of some countries for given periods is close to equilibrium, when in fact it might be over- or undervalued.

5.2. Baseline Results and an Alternative Proxy for Domestic Technological Capabilities

After removing growth outliers from the sample, the general message of the results of specification 6 in Table 2 is in line with the prediction of the hypothesis that RERU as a growth driver should be less important for emerging markets, in comparison with developing and developed countries. The results of specification 6 also contrast with the growth impacts of RERU reported in Rodrik (2008, p.375), who reported a positive yet not significant coefficient for the case of developed countries, and a much larger positive and significant coefficient for the case of developing countries. Moreover, the ITS' growth impact resulted not to be significant in any country group after removing the growth outliers.

Table 2. The Impact of Real Exchange Rate Undervaluation and the Index of Technological Specialization on Growth during 1986–2004 [†]

Independent Variables	Specification Number					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	24.2*** (3.42)	25.16*** (3.35)	25.11*** (3.38)	25.58*** (3.45)	1.083** (0.483)	0.92* (0.499)
Lagged GDP per capita (in logs, PPP 2005 USD)	-3.91*** (0.55)	-4.07*** (0.55)	-4.07*** (0.55)	-4.12*** (0.58)	-0.173** (0.078)	-0.151* (0.081)
ITS		2.24** (1.12)	2.25** (1.14)	2.82* (1.12)	0.026* (0.015)	0.021 (0.016)
RERU	0.2 (0.69)		0.28 (0.71)	-0.1 (1.56)	0.057** (0.027)	0.067** (0.027)
ITS x developing country dummy				-2.73 (1.52)	-0.028* (0.016)	-0.024 (0.017)
ITS x emerging economy dummy				0.91 (2.89)	0.012 (0.011)	0.007 (0.012)
RERU x developing country dummy				0.35 (1.26)	-0.029 (0.036)	-0.027 (0.034)
RERU x emerging economy dummy				0.68 (1.43)	-0.04 (0.029)	-0.052* (0.028)
Lagged Growth						-0.007 (0.123)
% of significant country fixed-effects	94	93	93	89	85	78
% of significant year fixed-effects	6	6	6	6	6	59

Observations	3,629 (N=191, T=19)	3,629 (N=191, T=19)	3,629 (N=191, T=19)	3,629 (N=191, T=19)	3,002 (N=158, T=19)	2,844 (N=158, T=18)
Adjusted R-Square	0.18	0.2	0.2	0.2	0.12	0.13
LM test p-value	0.17	0.35	0.35	0.27	0	0.22

Source: author's calculations. Panel corrected standard errors in parenthesis; *** p-value<0.01; ** 0.01<p-value<0.05; * 0.05<p-value<0.10. Country and year fixed effects reported as significant when their p-value<0.10. † Specifications 6 and 7 were regressed with 158 countries and the time frame of specification 7 was 1987–2004.

The results of specification 8 in Table 3 provide statistical evidence to support the hypothesis that increases in the development-level corrected ITS (DCITS) have a negative impact on growth in developing countries, *ceteris paribus*. This is evidence in favor of the idea that increases in the competitiveness in mid- and high-tech sectors beyond what can be expected for developing countries given their development level instead of representing a more developed NIS, are probably more related to excessive processed exports in these sectors. Furthermore, this result points to the idea that developing countries following a growth-model based on cheap labor in the labor-intensive sections of mid- and high-technology manufacturing industries are actually hurting their growth perspectives.

Table 3. The Impact of Real Exchange Rate Undervaluation and the Development-Level Corrected Index of Technological Specialization on Growth in 158 Countries between the mid-1980s and mid-2000s

	Specification Number	
	(7)	(8)
Intercept	1.103** (0.485)	0.941* (0.503)
Lagged GDP per capita (in logs, PPP 2005 USD)	-0.176** (0.078)	-0.155* (0.081)
Development-level corrected ITS (DCITS)	0.015 (0.01)	0.011 (0.011)
RERU	0.058** (0.027)	0.068** (0.027)
DCITS x developing country dummy	-0.051* (0.02)	-0.045* (0.022)
DCITS x emerging economy dummy	0.020 (0.013)	0.015 (0.014)

RERU x developing country dummy	-0.033 (0.036)	-0.03 (0.034)
RERU x emerging economy dummy	-0.040 (0.042)	-0.054* (0.028)
Lagged Growth		-0.009 (0.122)
% of significant country fixed-effects	85	78
% of significant year fixed-effects	6	59
Observations	3,002 (N=158, T=19)	2,844 (N=158, T=18)
Adjusted R-Square	0.12	0.13
LM test p-value	0.002	0.329
Time frame	1986-2004	1987-2004

Source: author's calculations. Panel corrected standard errors in parenthesis; *** p-value<0.01; ** 0.01<p-value<0.05; * 0.05<p-value<0.10. Country and year fixed effects reported as significant when their p-value<0.10.

5.3. Discussion of the Main Results

In specification 8, the short-run growth impact of increases in the DCITS in developed countries (0.011) is positive and not significant, as can be seen in Table 3, and about half the size of the equally non-significant coefficient of the ITS for developed countries in specification 6, as can be seen in Table 2. This means that correcting the ITS for the development level of countries did not make increases in DTC in mid- and high-technology sectors have significant growth impacts in developed countries. Moreover, the interaction between the developing country dummy and the DTC proxies is negative in specifications 6 and 8, however, only significant when DCITS is used. Last but not least, the interaction between the DTC proxies and the emerging market dummy is positive and not significant in both specifications, yet its magnitude doubles in specification 8.

All these results are evidence in favor of the view that between the mid-1980s and mid-2000s, increases in DTC in mid- and high-technology sectors have been slightly more relevant for growth in emerging markets than in developed countries. Moreover, the results suggest that developing countries that specialized in natural resource intensive and low-technology manufacturing sectors had slightly higher growth rates, ceteris paribus. Regarding the growth impact of RERU, it was positive and significant in specifications 6 and 8 for developed countries, while its growth impact in developing and emerging countries is somewhat lower, although still significant. Nevertheless, it is only significantly lower in the case of emerging markets.

6. Conclusion and Future Research Endeavors

The results obtained in section 5 provide a clearer support in favor of the hypothesis related to the different growth impacts of RERU across development levels, than for the hypothesis related to the different growth impacts of DTC. This means that the empirical evidence in favor of the hypothesis that RERU should be a less relevant growth driver for emerging markets than for developing and developed countries was more robust than the evidence supporting the hypothesis that the growth impact of increases in DTC in mid- and high-technological manufacturing sectors should be greater in emerging and developed countries. The results point nevertheless to the relevance for policymakers of considering the development level of countries when designing or recommending policies to implement a development strategy, especially when it comes to the importance given to pursuing RERU.

Analyzing the direction of trade of emerging countries that have continuously increased their DTC in mid- and high-technology manufacturing sectors seems a suitable future research endeavor that could help to shed light on whether the direction of trade is a relevant characteristic needed to be taken into account to make the DTC proxies' growth impact significant. For instance, Amsden (1986) presents historical evidence showing that East Asian developing countries that were able to catch up with the income levels of the developed world, or that were still in the catching up process, have shown a particular pattern of trade, which other developing economies that failed to catch up could not replicate. The pattern that the author uncovers is that catching up developing countries have tended to start exporting mid- and high-technology manufactures to other developing countries before being able to export them to the developed world. A case in point is Japan, the latest market economy joining the ranks of the developed world in the mid-1980s, when the author carried out her study. Amsden (1986, p. 261) underscores that the mid- and high-technology exports of Japan were mostly exported to the developing world throughout the 20th century, until the beginning of the 1980s.

Notes

[1] For literature on the importance of RERU refer to Eichengreen (2007), Rajan and Subramanian (2011) and Rodrik (2008), among others. For the importance of DTC, refer to Kaldor (1966); Hausmann, Hwang and Rodrik (2007) and Lundvall (2007), among others.

[2] Sectors can be classified as low-, mid- and high-technology depending on the intensiveness of R&D expenditure associated to them in developed countries (ECLAC, 2011), whose industries tend to be close to the technological frontier.

[3] Throughout this paper the term developing countries will also include the group of countries referred to as emerging economies, markets or countries, unless a precise

distinction needs to be made. In such a case, the term emerging economies will refer to developing countries with higher levels of income.

[4] For a review of the Dutch disease and resource curse literature refer to Márquez-Velázquez (2009).

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Corresponding author

Alejandro Márquez-Velázquez can be contacted at: alejandro.marquez@fu-berlin.de