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Article

Would a competitive real exchange rate be a driver of economic prosperity?

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Abstract:

This article assesses the effects of real exchange rate misalignment on long-term growth, between 1995 and 2018, in a set of 151 countries. Our findings indicate that a competitive real exchange rate is positively associated with growth over the long run. The novel element here is our demonstration that the enhanced international competitiveness generated by lower labor costs may increase growth. The study also includes a series of robustness checks and alternative estimates to better understand this association, using seven different measures of real exchange rate misalignment, controlling for the possibility that the real exchange rate has a non-monotonic effect on growth, testing the Washington Consensus, separately estimating the effects of real exchange rate devaluation and overvaluation, testing the argument that a real exchange rate policy is an important factor in explaining why Asian economies perform better than Latin American and African ones, and employing alternative measures for real exchange rate misalignment.

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A growing number of studies provide empirical evidence that a competitive real exchange rate (RER) positively affects growth (e.g., Cottani et al., 1990; Dollar, 1992; Razin and Collins, 1997; Aguirre and Calderón, 2005; Rodrik, 2008; Berg and Miao, 2010; Bhalla, 2012; Gabriel et al., 2020; Rapetti, 2020; Razmi, 2021). These studies put forward two opposing views about the best RER policy for economic growth (Schröder, 2013). The Washington Consensus claims that any RER misalignment hurts growth (Williamson, 1990). A non-competitive RER leads to crises in the balance of payments that require a "stop-and-go" strategy to reduce or control imports (Berg and Miao, 2010). However, a competitive RER produces inflationary pressures that reduce investment, curbing potential growth in output (Williamson, 1990). In other words, any misalignment of the RER (a more competitive/non-competitive RER in relation to

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its equilibrium position) harms growth (Williamson, 1990), and the most appropriate RER is therefore one in equilibrium (Schröder, 2013).

The opposite view posits that a competitive RER promotes growth. In export-led growth models (e.g., Kaldor, 1970; Dixon and Thirlwall, 1975), reduced labor costs may function as a growth engine, since they increase export competitiveness. The effects of this outward-oriented policy are more wide-reaching, since they reduce risks, shorten investment horizons, and benefit the tradable sector, which, to some extent, explains why Asian countries have grown more rapidly than Latin American ones (Sachs, 1985; Cottani et al., 1990; Dollar, 1992; Bresser-Pereira et al., 2014; Frieden, 2015; Razmi, 2021). Studies indicate certain additional, non-price channels through which a competitive RER positively influences economic growth (presented throughout this article).

In light of these perspectives, this article investigates the effects of RER on economic growth, between 1995 and 2018, in a set of 151 countries. Our study initially contributes to the existing literature by estimating a series of econometric regressions that employ various specifications and robustness checks to better understand the particularities of the positive association between a competitive RER and economic growth. Our estimates apply seven different measures of RER misalignment, calculated through various fundamentals. In this regard, we employ something which, to the best of our knowledge, is a new variable used as a determinant of international competitiveness, that is, a proxy for labor costs represented by the wage share of GDP. The introduction of this variable as one of the fundamentals of RER is grounded in Nurkse's argument (1945), in which the equilibrium values of the RER are associated with the economy's internal and external balances in terms of demand, prices, and income distribution, such that changes in these variables produce artificial RER misalignments. Our argument, therefore, is that increases in labor costs are associated with an artificial appreciation of the RER, which is harmful to economic growth *à la* Kaldor (1970), and vice versa. This element and the following contributions constitute the novel features of our study: (i) we control for the possibility of RER having a non-monotonic effect on growth, according to country income level; this was undertaken in various ways in order to provide robust results; (ii) we test the Washington Consensus, whereby the equilibrium values of RER (rather than its misalignments) are associated with economic growth; (iii) we separately estimate the effects of RER devaluation and overvaluation on growth for the purpose of investigating whether these effects are asymmetric; (iv) we test the argument that the pursuit (or non-pursuit) of a competitive RER is an important factor for a consistent explanation of the contrasting development experiences of Asian, Latin American and African economies; and (vi) we employ alternative RER misalignment measures, as calculated by other authors, and perform robustness checks.

To this end, we perform a series of equations addressing endogeneity and reverse causality by estimating econometric regressions using the system GMM (generalized method of moments). The results suggest that the RER is a tool for economic prosperity insofar as a competitive RER boosts long-run growth. Our argument that changes in labor costs influence the RER is confirmed, meaning that the higher this variable, the lower the international competitiveness (and the more appreciated the RER). This therefore suggests that a competitive RER, generated by lower labor costs, enhances long-run growth, as indicated by Kaldor (1970). Moreover, additional regressions provide empirical evidence that: (i) different measures of RER misalignment provide similar results; (ii) this effect is associated with country income level, indicating that the effect is more prominent in developing countries; (iii)

the Washington Consensus is not valid; RER misalignments are associated with economic growth; and, lastly, (iv) the contrasting RER policies in Asian and Latin American countries help to explain the countries' different growth paths. To the best of our knowledge, most of these results constitute an original contribution to the existing literature on this theme.

Although our findings indicate that pursuing a competitive RER is a consistent economic development policy, especially in developing countries, we note that these results need to be interpreted carefully because: (i) the literature indicates that a competitive RER is part of a broad set of development-oriented economic policies (such as public investment in infrastructure, educational policies, development-oriented institutions, and the emergence of a solid national system of innovation) adopted by Asian economies and neglected by Latin American ones (White and Wade, 1988; Amsden, 1989; Bresser-Pereira, 2010; Ang, 2016; Chu, 2016); (ii) a competitive RER increases income inequality in the short run (Diaz Alejandro, 1963; Blecker, 1989; Bahduri and Marglin, 1990), which might lead to the reverse growth effect (Guzman et al., 2018; Ribeiro et al., 2020); and (iii) a competitive RER does not fill the gap created by a lack of growth fundamentals (Eichengreen, 2007).

The article is composed of five sections in addition to this introduction. The following section provides a brief discussion of the empirical and theoretical literature that connects the RER to income growth. Section 2 discusses the empiric procedures for the computation of our measures of RER misalignment and the strategy employed in the growth equations. Section 3 presents the baseline results, regressions by country income, tests of Washington Consensus validity, and the results for Africa, Asia, and Latin America. Section 4 provides our robustness checks, while the article ends with section 5, which contains our final discussion.

1. Why pursue a competitive RER?

In this section, we very briefly discuss the empirical literature and the theoretical framework that associates a competitive RER with economic growth.

1.1. Empirical literature

Cottani et al. (1990) assessed the effects of RER misalignment and volatility on growth, exports, imports, investments, agricultural production, and capital-output ratio in 24 less-developed countries between 1960 and 1983. The authors concluded that higher RER volatility and the RER misalignment hurt all variables except for the capital-output ratio. Dollar (1992) performed regressions to assess the RER effect on economic growth in 95 less-developed countries between 1976 and 1985. He noted that RER volatility hurts growth, while an outward orientation is positively associated with it. Razin and Collins (1997) performed regressions in a panel data setting to test the relationship between RER misalignment and growth in 93 countries between 1975 and 1992. Their conclusions emphasized the existence of a non-linear relationship between these variables. Only high overvaluations are associated with slower economic growth, while a competitive RER is positively associated with growth. Easterly (2001) assessed the relationship between RER misalignment and growth in developing countries between 1980 and 1998 and demonstrated that a competitive RER is associated with faster economic growth.

Acemoglu et al. (2003) tested the effects of RER misalignment on growth volatility in the Penn World Table countries between 1970 and 1997 using cross-sectional regressions and panel regressions. The author associated the weak institutions inherited from the colonial era with distortionary macroeconomic policies, which encompassed a non-competitive RER and partially explained the high volatility of output growth. Aguirre and Calderón (2005) estimated the relationship between RER misalignment and economic growth in 60 countries between 1965 and 2003, in a panel data setting, showing that the effect followed a non-linear pattern. The higher the overvaluation, the lower the growth, while a moderately competitive RER is positively associated with growth. Hausmann et al. (2005) assessed the association between the RER and 83 episodes of growth acceleration between 1957 and 1992 in all the Penn World Table countries and indicated that growth is associated with more investments, exports, and a competitive RER. Johnson et al. (2007) tested the existence of an association between growth acceleration and RER in African countries, and argued that a competitive RER is essential for them to escape the historical trap of weak institutions, since it increases manufacturing exports.

Gala (2007) performed growth regressions in a panel data set of 58 developing countries between 1960 and 1999, in order to explain their growth, and concluded that a competitive RER is an important driver of economic expansion. Rodrik (2008) performed very similar growth regressions in a panel data set of 184 countries between 1950 and 2004, and the results indicated that a competitive RER supports income growth in a linear pattern. Employing the same sampling and estimation procedures, Berg and Miao (2010) obtained similar results: the more competitive the RER, the faster the economic growth. In turn, Rapetti et al. (2012) concluded that a competitive RER is strongly correlated with growth in developing countries, although they noted that this result is dependent on the GDP per capita cut-off used to define a developing country. Levy-Yeyati and Sturzernegger (2009) associated monetary authority interventions to avoid RER appreciation with growth in 179 countries between 1974 and 2004. They created two variables to represent "fear of appreciation": first, monetary authority interventions to avoid RER appreciation and, second, the annual change in the ratio between foreign assets and money from abroad. Their results indicated that "fear of appreciation" has a positive effect on economic growth. Berg et al. (2012) performed regressions to explain the length of sustained growth periods in 140 countries. They concluded that this variable is negatively associated with external shocks and macroeconomic volatility but positively associated with good institutions and better income distribution. RER matters because manufacturing exports are associated with a more extensive period of growth (Berg et al., 2012).

Vieira and MacDonald (2012) tested a variety of specifications for RER misalignment to explain growth in 90 countries between 1980 and 2004, using panel regressions. They concluded that a competitive RER spurs growth and that different measures of RER misalignment produce distinct results. Schröder (2013) performed regressions in a panel data set to explain growth in 63 developing countries between 1970 and 2007. The author concluded that a competitive RER hurts growth and that the Washington Consensus prescription is valid. Missio et al. (2015) performed growth regressions in a panel setting for three samples of countries between 1980 and 2008, to understand the effects of RER on economic performance. Their results revealed that a competitive RER boosts growth, following a non-linear pattern.

Ribeiro et al. (2020) re-evaluated the relationship between RER rate and economic growth by considering the additional effects of RER in developing economies and indicated that a competitive RER does not have a direct effect on economic growth, but rather it has a negative influence through its effects on income distribution and technological capabilities. Notwithstanding these findings, Rapetti (2020) and Demir and Razmi (2021) provided systematic surveys of the empirical evidence on this subject. Both articles indicated a preponderance of empirical studies that sustained the conclusion of the positive effect of a competitive RER on economic growth.

1.2. Theoretical literature

The theoretical literature on the positive effects of RER on economic growth can be separated into two distinct branches: traditional export-led models, whereby RER acts via export prices, and models in which the influence of RER occurs through non-price channels.

Kaldor (1970), and Dixon and Thirlwall (1975) provide a canonical Keynesian framework for the first theoretical branch. The rationale behind this approach states that lower real wages increase the international competitiveness of domestic goods (in our terms, the RER becomes more competitive), spurring growth in demand via expanded exports. Given the assumption that labor productivity grows hand in hand with growth in demand (the Kaldor-Verdoorn mechanism), this engenders a circular and cumulative causation growth process. Therefore, reduced labor costs may stimulate economic growth by increasing the international competitiveness of domestic goods. However, the effects of a competitive RER on demand growth are not straightforward and linear, as indicated by the above-mentioned theoretical framework, particularly since RER impacts on income distribution, which may adversely influence aggregate demand (Diaz Alejandro, 1963; Blecker, 1989; Bahduri and Marglin, 1990).

There is a large body of studies investigating the influence of a competitive RER via non-price channels. In this literature, the effects of a competitive RER are not temporary. The economic policies associated with RER values produce permanent effects on the economy, influencing a country's long-term growth. In this sense, there are some channels in the theoretical literature that link a competitive RER with economic growth; these include the "profitability effect" on the tradable sectors, since the RER lowers labor costs (Bhalla, 2012); the "distributive effect", whereby a competitive RER transfers income from a class with a low propensity to save (workers) toward a class with a greater propensity to do so (firms) (Glüzmann et al., 2012; Guzman et al., 2018); the "investment effect", with reverberation effects on technological progress (Rodrik, 2008; Bahmani-Oskooe and Hajilee, 2010); a structural change toward modern and manufacturing activities (Ros and Skott, 1998; Frenkel and Ros, 2006; Vaz and Baer, 2014; Ros, 2015), modernizing and diversifying the production structure (Gabriel and Missio, 2018); the "total factor productivity growth (TFP) channel", since a competitive RER incentivizes firms to move from non-tradable to tradable activities (Mbaye, 2013); the "foreign saving" and "tradable-led" channels (Rapetti, 2020); the "income-elasticities channel", since a competitive RER changes the composition of the production structure, favoring the manufacturing sectors and thus increasing the output growth rate in line with the balance of payment equilibrium *à la* Thirlwall's law (Missio et al., 2015; Oreiro et al., 2020a; Marconi et al., 2021). These channels represent the "development channel"; a competitive RER leads to a faster rate of capital accumulation, increases productivity factors,

and changes both the allocation of resources and the composition of the production structure, affecting long-term growth (Demir and Razmi, 2021).

Maintaining a stable competitive RER for a sufficient period promotes a structural change within the production structure in favor of high-tech tradable goods (Caglayan and Demir, 2019). The short-run effects of the RER on economic growth (price channel) are accompanied by a long-run effect through the structural change caused by a competitive RER (non-price channels), which then favors economic development. Following this reasoning, certain sections of the literature indicate that a competitive RER is a means of compensating for the technological gap and the difference in labor productivity between developed and developing economies (e.g., Gabriel and Missio, 2018; Gabriel et al., 2020), which, by expanding the international competitiveness of goods in developing economies, fosters their economic growth via gains in international trade. This transitory effect (via the price channel) becomes permanent, since a competitive RER favors economic complexity and the manufacturing sectors – that is, by promoting industrialization in developing economies, a competitive RER reduces the technological gap between developed and developing economies (Gabriel and Missio, 2018).

2. Empirical strategy and database

2.1. Real exchange rate misalignment

Rodrik's (2008) procedure is the literature benchmark for the calculation of RER misalignment measures. In this study, we employed this using RER data from the World Bank:

$$LRER_{it} = L(PPP_{it} \,/\, XRAT_{it}) \tag{1}$$

where i and t denote the country and time (five-year) index, respectively. The variables PPP_{it} and $XRAT_{it}$ stand for the conversion factor and nominal exchange rate, expressed as national currency units per US dollar (with L denoting that the variables are in logarithm form). When the $LRER$ is lower than zero, the national currency is lower (more depreciated) than the PPP, and vice versa.

According to the BEER (Behavioral Equilibrium Exchange Rate) approach, fundamentals need to be taken into account when calculating RER misalignment measures. Rodrik (2008) calculated RER misalignment adjusting for the Balassa-Samuelson effect (BS), captured by a RER regression on per capita GDP ($PIBCAPITA$):

$$LRER_{it} = \alpha + \beta LPIBCAPITA_{it} + f_t + u_{it} \tag{2}$$

where f_t and u_{it} are a (five-year) time fixed effect and the error terms. Rodrik (2008) estimated the coefficient to be around 0.24 and statistically significant for β, suggesting that increases of 1% in per capita GDP increase the value of national currency by 0.24%. Our estimates for equation (2) suggested that β is statistically significant at 1% and equals 0.19. Six additional specifications were performed, controlling for other fundamentals, given that Vieira and MacDonald (2012) indicated that different RER misalignment measures may produce distinct results. The data is for a set of 151 countries between 1990 and 2018. The variable net foreign asset (ASSET) was employed to capture external adjustment. Stronger current account positions were associated with appreciation in a country's national currency. Higher prices for

exports, as opposed to imports, are positively associated with RER; the variable terms of trade (TOT) was therefore introduced to capture this effect. Government consumption (GOV) was introduced to capture changes in demand composition, which is positively associated with RER (Viera and MacDonald, 2012).1 Lastly, the wage share of GDP (W) was included to capture the effects of labor costs on the prices of tradable goods. The argument here is that lower labor costs make exports cheaper, leading to a more competitive RER, and vice versa. Put differently, we argue that increases/decreases in labor costs are associated with changes in international competitiveness, represented by the RER. Our argument is that increases in labor costs lead to an artificial appreciation of RER (i.e., one not associated with the Balassa-Samuelson effect) and that, in turn, reductions in labor costs are associated with the increased international competitiveness of domestic production.

Table 1 reports the RER misalignment estimates for our various specifications.

Table 1 – *Estimates for RER misalignment*

Variables	**Model 1:** Mis_1	**Model 2:** Mis_2	**Model 3:** Mis_3	**Model 4:** Mis_4	**Model 5:** Mis_5	**Model 6:** Mis_6	**Model 7:** Mis_7
Hausman (FE x RE)	RE	FE	FE	FE	FE	RE	RE
Income per capita	0.19*** (0.03)	0.11** (0.05)	0.19*** (0.03)	0.10* (0.05)	0.20*** (0.06)		
Terms of trade		–0.02 (0.17)				–0.21 (0.18)	–0.21 (0.20)
Net foreign assets			–0.01 (0.01)			–0.009 (0.01)	–0.01 (0.01)
Government				–0.04 (0.04)		–0.10* (0.05)	
Wage share					0.16 (0.12)	0.29*** (0.11)	0.24** (0.11)
Obs.	876	840	680	840	673	510	510
Groups	148	142	141	142	114	109	109

Notes: (1) The logarithm of RER is the dependent variable. (2) FE and RE refer to fixed effect and random estimation. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Estimates performed with fixed effects for time and robust variance-covariance matrix for heteroscedasticity. (5) Robust standard errors between parentheses. (6) All variables in logarithm.

The Hausman test indicated that the random effect model is the most appropriate for models 1, 6, and 7, while the fixed effect is suitable for models 2, 3, 4, and 5. Models 1-5

[1] We note that we did not consider certain RER fundamentals in our study. Barbosa et al. (2017) assert the importance of financial variables as RER determinants in developing and emerging countries. Following this reasoning, the interest rate differential between countries is one of the determinants of RER misalignments, given the importance of capital flows for RER behavior in countries with open capital accounts. We have not followed this direction (which would require time-series regressions using yearly variables, rather than panel regressions using five-year averaged variables). We understand that this is a limitation of our work that needs to be addressed in future studies.

regressed RER on $PIBCAPITA$, taking the other four fundamentals individually. The BS remained positive and statistically significant, although its magnitude varied across models. In models 1-5, no other fundamental was statistically significant. Models 6 and 7 regressed RER on other fundamentals, disregarding the variable $PIBCAPITA$. Only the variable wage share of GDP was statistically significant, at not less than 5% in both models. The parameter equals 0.29 in model 6 and 0.24 in model 7; meaning that lower labor costs boost the international competitiveness of domestic goods.

The final step in constructing our RER misalignment indexes was to calculate the difference between the RER, and the RER adjusted by the different fundamentals provided in models 1-7. We followed Rodrik's procedure (2008), whereby negative values indicate that the RER is undervalued compared to its equilibrium values, and vice versa. The rationale behind this procedure comes from Nurkse's notion (1945) of medium-run equilibrium, according to which there are RER equilibrium values associated with the equilibrium of the economy in terms of demand, prices, income distribution, etc. One method to influence economic growth is to make artificial changes to these variables to induce a competitive RER (Nurkse, 1945).

2.2. Growth estimates

Our empirical strategy consisted of estimating econometric regressions to explain the long-run growth by employing databases in a panel setting of 151 countries between 1995 and 2018.[2] The dependent variable was the log difference of real GDP per capita from the World Bank. The first basic growth equation is represented as follows:

$$y_{ti} = \alpha + \beta Y_{bi} + \beta_1 mis_{t-1} + \beta_2 controls + f_t + f_i + u_{it} \quad (3)$$

where f_t and f_i are time fixed effect (five-year) variables, while the country fixed effects variable Y_{bi} represents the convergence term (the logarithm of per capita GDP at the beginning of the time period). The RER misalignment measures are lagged to ensure that causality runs from the right to the left side of the equation. A negative β_1 signal means that a competitive RER is positively associated with growth, and vice versa. The other variables associated with economic growth usually employed in the empirical literature are controlled. The variable years of education, which comes from Barro and Lee (2000), is employed to measure the influence of schooling on long-run growth. The inclusion of this variable is based on Barro and Lee's argument (2000) that education is associated with worker productivity and the absorption and development of new technologies. We then introduced a variable to capture the influence of institutions on long-term growth, represented by the constraint-on-the-chief-executive component from the Polity IV Project database. Countries with more robust institutions have a more equal distribution of political power, meaning that executive actions are limited by other social groups, favoring economic growth (Acemoglu and Robinson, 1999). Moreover, controlling the institutions is especially important in our context, because a non-competitive RER is associated with an economic policy directed at the interests of the economic elite (Acemoglu et al., 2003). Further, following Rodrik's seminal article (2008), we also controlled the saving rate, government consumption, trade openness, and the inflation rate. Table 1 presents these variables in detail.

[2] Table A2 in the Appendix lists all the countries in our sample.

The rationale of our empirical strategy is to estimate a (more parsimonious) baseline model with the lagged dependable variable (dynamic models), the convergence term, human capital, and one measure of RER misalignment (model 1). The model is then expanded by including the variables saving rate (model 2), government consumption (model 3), trade openness (model 4), and inflation (model 5), in addition to the baseline model variables. The final model takes account of all the independent variables (model 6).

We performed our estimates using dynamic panel data models in a system of equations that employed the levels and differences of independent variables as instruments. This methodology estimates the parameters using the system GMM and ensures control of individual unobserved characteristics and the elimination of endogeneity. We chose the system GMM rather than the difference GMM, because the latter may enlarge the variance of coefficients and produce bias in small sample estimates. The system GMM is a suitable methodology when: time periods are smaller than the number of cross-sectional individuals; equations are linear; independent variables are not strictly exogenous and are correlated with their past values and the error term; and the errors are heteroskedastic and autocorrelated (Roodman, 2009). Regressions were performed using the robust and two-step options. Validity in these results is associated with the non-rejection of the Arellano and Bond test's null hypothesis and the non-rejection of the Hansen test's null hypothesis that the instruments are valid.

3. Empirical results

3.1. Baseline results

Table 2 presents the key findings for the long-run growth equations. The output suggests that all the coefficients are statistically significant (at 10% critical values) and negative, meaning that a competitive RER boosts economic growth. The parameters of our RER misalignments differ somewhat according to the fundamentals and growth equation specifications. These parameters are: –0.20 ($LRER$), –0.19 (Mis_1), –0.20 (Mis_2), –0.14 (Mis_3), –0.19 (Mis_4), –0.19 (Mis_5), –0.19 (Mis_6), –0.18 (Mis_7). These results suggest that a 10% more competitive RER increases the growth of per capita income by 2%, 1.9%, 2%, 1.4%, 1.9%, 1.9%, 1.9%, 1.9%, and 1.8%, respectively.

Our findings are in line with results from the literature, such as the articles of Gala (2007), Rodrik (2008), and Vieira and MacDonald (2012), whose outcomes indicated that a competitive RER is a driver of long-run growth. In addition, our estimates explicitly advance the existing literature by suggesting that reduced labor costs may induce a more competitive RER, which, in turn, expands long-run growth, in the way that export-led growth models, such as Kaldor's (1970), advocate. In this sense, table 1 indicates that a 10% reduction in labor costs leads to a 2.9% (model 6) and a 2.4% (model 7) more competitive RER (i.e., this induces an RER misalignment in relation to its equilibrium values, making domestic goods more competitive on the international market), all else being constant. Introducing this into the estimates in table 2 results in increased growth in GDP per capita of 0.55% (Mis_6) and 0.43% (Mis_7). Our empirical results thus indicate that a competitive RER is associated with enhanced growth and that the effects of a more competitive RER on growth, resulting from a decrease in labor costs, are positive. This corroborates with the theoretical literature, such as Ros (2015), according to which increased international competitiveness, generated by lower labor costs in

the short term, leads to a more prosperous economy in the long term, via price- and/or non-price channels.

Table 2 – *Baseline results: models 01-06*

Model	01	02	03	04	05	06
$LRER$	−0.21***	−0.16***	−0.18***	−0.23***	−0.30***	−0.15***
	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.04)
Mis_1	−0.19***	−0.14***	−0.14***	−0.24***	−0.30***	−0.14***
	(0.05)	(0.05)	(0.04)	(0.07)	(0.06)	(0.04)
Mis_2	−0.22***	−0.15***	−0.14***	−0.26***	−0.29***	−0.14***
	(0.04)	(0.04)	(0.03)	(0.07)	(0.05)	(0.04)
Mis_3	−0.12*	−0.09**	−0.09**	−0.16*	−0.25***	−0.15***
	(0.06)	(0.04)	(0.03)	(0.08)	(0.05)	(0.04)
Mis_4	−0.21***	−0.14***	−0.14***	−0.25***	−0.30***	−0.14***
	(0.04)	(0.04)	(0.03)	(0.07)	(0.05)	(0.04)
Mis_5	−0.16**	−0.13***	−0.11**	−0.24*	−0.32***	−0.21***
	(0.07)	(0.04)	(0.05)	(0.12)	(0.05)	(0.04)
Mis_6	−0.13*	−0.12***	−0.12***	−0.22***	−0.32***	−0.27***
	(0.06)	(0.04)	(0.03)	(0.06)	(0.06)	(0.07)
Mis_7	−0.13*	−0.12***	−0.12***	−0.21***	−0.29***	−0.26***
	(0.07)	(0.04)	(0.03)	(0.06)	(0.06)	(0.07)

Notes: (1) Only the variable regarding the measure of RER misalignment was presented because of several numbers of estimated parameters and the limited characters; the remainder of the estimated parameters are available upon request via authors' email. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses.

3.2. The RER growth effect by income level

Despite the evidence that a competitive RER is positively associated with economic growth, studies in the literature note that this effect disappears at a certain level of per capita income. Development policies based on RER offer a catch-up mechanism for emerging countries. Nevertheless, as income grows, the Balassa-Samuelson effect comes into play, leading to higher wages/prices, which then reduce export competitiveness and its influence on growth. On the other hand, the influence of RER on economic growth may be associated with a country's level of income. Gabriel et al. (2020) stress that a competitive RER is a useful tool to offset the technological gap between low/medium-income countries, and richer economies. In other words, a competitive RER compensates for the low non-price competitiveness of low/medium-income countries compared to high-income ones, stimulating economic growth via increased exports (Gabriel et al., 2020). We would therefore expect that a competitive RER would stimulate economic growth up to a certain income level or that this effect may be more noticeable in countries that fall within a certain income range.

In view of this, the empirical exercises in this section test whether or not the growth effect of a competitive RER is associated with a country's income level. In this context, Rodrik's estimates (2008) suggest that the influence of RER on growth is valid until countries have a per capita income of $19,635. He also noted that this effect is stronger in developing countries

(those with a per capita income lower than $6,000). The results of Viera and MacDonald (2012) pointed in the same direction and demonstrated that the effects of RER on growth are more substantial in developing and emerging countries. In order to test the relationship between the RER effect on growth and income level, two empirical strategies were employed to ensure robust results. The results of these regressions are presented in the rest of this section.

3.2.1. Rodrik's (2008) strategy

In accordance with Rodrik (2008), the first strategy was to introduce an additional variable, represented by per capita income multiplied by the RER misalignment measure, into the most parsimonious growth equation specification (model 1). The results are reported in table 3.

Table 3 – *The RER effects by income level I: Rodrik's (2008) strategy*

Measure of RER misalignment	**(1)** $LRER$	**(2)** Mis_1	**(3)** Mis_2	**(4)** Mis_3	**(5)** Mis_4	**(7)** Mis_6	**(8)** Mis_7
y_{t-i}	0.16 (0.11)	0.11 (0.08)	0.16* (0.09)	0.14 (0.10)	0.18* (0.09)	0.19* (0.10)	0.16 (0.17)
Initial income	0.09** (0.04)	0.02 (0.04)	0.04 (0.04)	0.02 (0.03)	0.04 (0.04)	–0.01 (0.01)	0.02 (0.05)
Measure of RER misalignment	–0.24*** (0.06)	–0.33*** (0.08)	–0.29** (0.11)	–0.28*** (0.09)	–0.27** (0.11)	–0.09 (0.06)	–0.20** (0.10)
Measure of RER misalignment x income	2.39e–6 (3.6e–6)	8.6e–6*** (2.7e–6)	4.3e–06 (5.3e–6)	9.6e–6*** (3.2e–6)	3.9e–6 (5.1e–6)	–9.4e–6 (1.6e–6)	2.9e–6 (4.0e–6)
Education	–0.12 (0.09)	–0.07 (0.10)	–0.02 (0.09)	–0.05 (0.10)	–0.01 (0.09)	0.19*** (0.05)	0.10 (0.15)
Institutions	0.007*** (0.002)	0.005*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.0005 (0.0008)	0.003 (0.005)
AR (2)	0.69	0.22	0.28	0.79	0.25	0.34	0.54
Hansen	0.21	0.47	0.43	0.51	0.38	0.24	0.13
Hansen-Diff	0.84	0.81	0.71	0.43	0.67	0.83	0.11
Groups	111	111	109	106	109	90	90
Instruments	31	31	31	31	31	71	31

Notes: (1) The dependent variable is the growth rate of GDP per capita. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses. (5) All variables in logarithm. (6) The results employing the variables Mis_5 are not discussed because their regressions did not fit well.

The estimated parameters for the RER misalignment are statistically significant in all the regressions, except when the variable is Mis_6. All the parameters are negative, suggesting that a competitive RER is positively associated with output growth. The magnitude of the parameters rose because of the collinearity caused by the introduction of the interaction between income level and our RER misalignment measures. This variable is only statistically significant (at 1% critical values) in the growth regressions that employed the variables Mis_1 and Mis_3. The parameter of YN x Mis_1 is 0.000006, while for Mis_1 it is –0.33. The RER effects vanish when per capita income reaches US$ 5,500. The parameter of YN x Mis_2 is 0.00009,

while for Mis_2 it is –0.28. The additional RER effects – associated with income level – disappear when per capita income reaches US$ 3,111. This is a highly significant result and imposes severe restrictions on an RER policy for development. However, it is not robust, since it is not supported by the growth regressions employing the other RER misalignment measures and because it is not fully supported by the other empirical strategies presented below.

3.2.2. Grouping countries by income level

The second strategy was to perform growth regressions for countries grouped by income level. Rodrik (2008) employed a per capita income of US$ 6,000 as a cut-off point to define developing countries. This strategy tests whether or not the RER is sufficiently statistically significant to explain a country's growth within a range of per capita income values, thereby providing a parameter for these countries. The regressions performed using Rodrik's cut-off point are presented in table 4.

Table 4 – *RER and growth I: developing countries (Rodrik's cutline income level)*

	(1)[a]	**(2)[a]**	**(3)[a]**	**(4)[a]**	**(5)[a]**	**(6)[a]**	**(7)[a]**	**(8)[a]**
y_{t-i}	–0.52***	–0.53**	–0.49	0.20	–0.37	0.01	0.45	0.34
	(0.19)	(0.21)	(0.29)	(0.53)	(0.27)	(0.42)	(0.33)	(0.36)
Initial income	0.01	0.03	0.04	0.03	0.03	0.04	0.04	0.05
	(0.08)	(0.07)	(0.09)	(0.09)	(0.08)	(0.21)	(0.04)	(0.05)
$LRER$	–0.28**							
	(0.11)							
Mis_1		–0.14						
		(0.09)						
Mis_2			–0.23*					
			(0.14)					
Mis_3				–0.12				
				(0.14)				
Mis_4					–0.24*			
					(0.14)			
Mis_5						–0.12		
						(0.11)		
Mis_6							–0.08	
							(0.08)	
Mis_7								–0.10
								(0.08)
Education	0.13	0.15*	0.14**	–0.10	0.14**	0.04	0.001	0.006
	(0.08)	(0.08)	(0.06)	(0.18)	(0.06)	(0.5)	(0.07)	(0.08)
Institutions	0.006***	0.005***	0.005***	0.003	0.004***	0.001	0.001	0.0008
	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.002)	(0.001)	(0.001)
AR (2)	0.16	0.28	0.13	0.11	0.13	0.30	0.30	0.28
Hansen	0.57	0.65	0.77	0.39	0.78	0.16	0.48	0.45
Hansen-Diff	0.71	0.87	0.81	0.79	0.84	0.13	0.63	0.55
Groups	40	40	38	38	38	27	25	25
Instruments	20	20	21	23	21	23	23	23

Notes: (1) The dependent variable is the growth rate of GDP per capita. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses. (5) All variables in logarithm. [a] The instruments are collapsed.

For the latter two variables, only the estimated parameters for $LRER$, Mis_2, and Mis_4 are statistically significant at 5% and 10%. The parameter magnitudes are somewhat greater than the estimates for the full sample of countries: –0.28, –0.23, and –0.24 for $LRER$; Mis_2 and Mis_4 against –0.21, –0.22, and –0.21, respectively. These results therefore indicate that a competitive RER is associated with faster growth in developing countries.

Other values for the per capita income cut-off point were also used, leading to various estimates, although they all confirmed the importance of RER for developing countries. These results can be seen in table 5 below.[3]

Table 5 – *RER and growth II: developing countries (cutline income level by percentile)*

	(1)[a]	**(2)[a]**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	25% percentile[1]		50% percentile[2]			75% percentile[3]		
y_{t-i}	–0.18 (0.30)	–0.08 (0.22)	0.33*** (0.12)	0.22* (0.12)	0.16 (0.22)	0.30*** (0.09)	0.30*** (0.09)	0.19* (0.11)
Initial income	0.10 (0.13)	0.17 (0.10)	0.01 (0.02)	0.04 (0.03)	0.07 (0.05)	0.02 (0.02)	0.008 (0.02)	0.01 (0.02)
$LRER$	–0.10 (0.19)		–0.07** (0.03)			–0.10** (0.04)		
Mis_1		–0.002 (0.10)		–0.10* (0.05)			–0.08** (0.04)	
Mis_7					–0.22 (0.15)			–0.08 (0.05)
Education	0.12* (0.06)	0.12 (0.11)	0.05 (0.04)	0.01 (0.06)	–0.04 (0.12)	0.07* (0.04)	0.09* (0.04)	0.13*** (0.04)
Institutions	0.003* (0.001)	0.002 (0.001)	0.003* (0.001)	0.002 (0.001)	0.001 (0.002)	0.001 (0.001)	0.001 (0.001)	0.00003 (0.001)
AR (2)	0.31	0.66	0.17	0.11	0.22	0.75	0.70	0.15
Hansen	0.90	0.75	0.49	0.33	0.45	0.32	0.32	0.63
Hansen–Diff	0.93	0.87	0.74	0.77	0.66	0.45	0.47	0.95
Groups	27	27	53	53	37	83	83	62
Instruments	20	20	51	44	23	61	62	55

Notes: (1) The dependent variable is the growth rate of GDP per capita. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses. (5) All variables in logarithm. (6) The results employing the variables $LRER$ for 25% percentile are not discussed because their regressions did not fit well. [a] The instruments are collapsed. [1] GDP per capita<US$ 3,346. [2] GDP per capita< US$ 9,364. [3] GDP per capita< US$ 24,725.

When 25% of per capita income (US$ 3,346) was employed as the cut-off, no RER misalignment measure was sufficiently statistically significant to explain growth. When 50% (US$ 9,365) and 75% (US$ 24,725) of per capita income were employed as cut-off points, the

[3] Due to limited space, only the results employing $LRER$, Mis_1 and Mis_7 are presented here.

results changed considerably. The regression results were more robust once various RER misalignment measures were shown to be statistically significant. In the first set of regressions, all RER misalignment measures were at least statistically significant at 10% critical values, except for Mis_7. However, the estimated parameters are systematically smaller than that of model 1, as seen in Table 2; –0.07 ($LRER$) and –0.10 (Mis_1). Regarding the estimates which applied US$ 24,725 as the per capita income cut-off point, all RER misalignment measures were at least statistically significant at 10% critical values, except for Mis_7. Although sufficiently significant to explain growth, the parameters are systematically smaller than those for model 1, as seen in table 2: –0.10 ($LRER$) and –0.08 (Mis_1). In sum, our findings confirmed the argument that the growth effect of a competitive RER is associated with a country's income level, demonstrating that a competitive RER may be used to compensate for the technological gap between low/medium-income countries and richer economies in order to foster long-run growth via gains in international trade, which is especially valid for economies with a per capita income lower than US$ 9,364, as well as for those where per capita income is lower than US$ 24,725. We note, however, that these results depend on the cut-off point for per capita income employed in the econometric estimates.

3.3. Testing the Washington Consensus

The Washington Consensus represents an opposing view to the literature on export-led growth (Schröder, 2013). In this view, any misalignment of RER from its equilibrium is harmful to growth (Williamson, 1990). Pursuing a non-competitive RER may result in a balance of payments crisis (Berg and Miao, 2010), since a competitive RER increases inflationary pressures. Thus, the appropriate RER to induce growth is one in equilibrium – neither a competitive nor a valued RER. To the best of our knowledge, few studies in the literature have tested this argument. Schröder (2013) was a pioneer in investigating the Washington Consensus hypothesis. His findings indicate that the best RER values for economic growth are those associated with its equilibrium position – that is, in this case the Washington Consensus is valid. This section seeks to dialogue with this part of the literature, which is remarkable for providing a strategy to confirm (or refute) our previous findings, as well as for offering new findings about the above-mentioned notion. To this end, we performed the same equation as Schröder (2013), that is:

$$y_{ti} = \alpha + \beta Y_{bi} + \beta_1 \left| mis_{t-1,i} \right| + \beta_2 controls + f_t + f_i + u_{it} \quad (4)$$

where the standard RER misalignment measure is replaced by its absolute values, represented in the growth equation as $\left| mis_{t-1,i} \right|$. Negative values for β_1 would confirm the Washington Consensus, according to which any kind of RER misalignment hurts growth.

Table 6 presents a summary of the complete results.[4]

[4] Because of limited space, the results are not presented here in full but are available upon request.

Table 6 – *Testing the validity of the Washington Consensus view*

Model	01	02	03	04	05	06
$\|Mis_1\|$	–0.18 (0.20)	–0.08 (0.18)	–0.12 (0.20)	–0.04 (0.16)	0.10* (0.06)	–0.03 (0.09)
$\|Mis_2\|$	–0.15 (0.15)	–0.13 (0.14)	–0.05 (0.11)	–0.03 (0.11)	0.07 (0.05)	–0.14 (0.13)
$\|Mis_3\|$	0.03 (0.12)	0.02 (0.05)	0.16 (0.11)	0.13 (0.15)	–0.03 (0.07)	0.004 (0.08)
$\|Mis_4\|$	–0.26 (0.22)	–0.13 (0.13)	0.10 (0.09)	–0.18 (0.15)	–0.05 (0.08)	–0.13 (0.11)
$\|Mis_5\|$	0.17 (0.14)	–0.17 (0.16)	0.11 (0.07)	–0.05 (0.18)	–0.01 (0.10)	–0.12 (0.09)
$\|Mis_6\|$	–0.12** (0.06)	–0.03 (0.12)	0.02 (0.06)	–0.07 (0.06)	–0.04 (0.08)	–0.03 (0.03)
$\|Mis_7\|$	0.001 (0.10)	–0.03 (0.12)	0.02 (0.05)	–0.07 (0.05)	–0.04 (0.08)	–0.02 (0.03)

Notes: (1) Only the variable regarding the measure of RER misalignment was presented because of several numbers of estimated parameters and the limited characters. The remainder of the estimated parameters are available upon request via authors' email. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses.

Our results consistently fail to provide empirical support for the Washington Consensus. The vast majority of the estimated parameters for the various absolute value RER misalignment measures do not show statistical significance. To some extent, our results stand in contrast to Schröder's findings (2013). There is no evidence that any kind of RER misalignment damages the growth of per capita output. Actually, our estimates reinforce our earlier findings, according to which the pursuit of a competitive RER is the most appropriate RER policy strategy to instigate long-term growth.

3.4. The RER growth effect: Africa, Asia, and Latin America

Studies suggest that the RER has played an important role in recent economic performance in African, Asian, and Latin American countries (Sachs, 1985; Cottani et al., 1990; Dollar, 1992; Johnson et al., 2007; Rodrik, 2008; Razmi, 2021). However, these countries have had contrasting experiences with RER policies. Asian countries have adopted an export-led growth strategy by orienting their economic activities to the international markets. As stated by Gabriel et al. (2020), a competitive RER was adopted as an alternative means of compensating for the technological gap (i.e., non-price competitiveness) compared to developed countries, making Asian goods more competitive in international markets. As a result, exports became an important source of demand growth for these countries. Beyond the faster pace of economic growth in these economies, this has also led to a surplus in current accounts, a higher share of manufacturing activities, diversification in the production structure, and exports of high-tech goods, leading to a more significant share of industrial employment

in total employment (Razmi, 2021). This indicates that the adoption of a competitive RER in a long-term development strategy influences elements associated with the differential of non-price competitiveness, such as the production structure, with reverberation effects on capital accumulation, technological progress, and thus labor productivity.[5]

The majority of Asian countries have experienced a competitive RER, while Latin American economies have experienced a non-competitive one (Frieden, 2015; Razmi, 2021). This divergence has had varied consequences for Asian and Latin American countries (Frieden, 2015; Razmi, 2021). In contrast to Asian economies, Latin American ones have maintained an artificially non-competitive RER, resulting in economic stagnation (de Carvalho Filho and Chamon, 2008). However, we note that catching up in Asian countries is also associated with a broader development orientation in economic policies, such as macroeconomic policies, public investment in infrastructure, and a national system of innovation, education, and institutions (White and Wade, 1988; Amsden, 1989; Ang, 2016). On the other hand, the economic stagnation in Latin American economies is due, in part, to the adoption of an artificially non-competitive RER, which is associated with additional variables within the macroeconomic logic of the Washington Consensus, such as a reduction in public investments to pursue fiscal consolidation, the high-interest rates required to obtain an overvalued RER, the privatization of public companies and, consequently, the reduction of the state's capacity to drive economic development. A competitive RER is therefore only one aspect of Asian economic development, just as a non-competitive RER is only one feature of Latin American stagnation.[6] This section sheds light on these arguments by investigating the influence of RER on long-run growth in Asian, African, and Latin American countries.

In order to test the validity of this statement, a new set of regressions (model 1 of the growth equation) was performed for these countries. To test whether the RER policy helps to explain the prominent growth of Asian countries, a further regression was performed using the same sample of countries and a dummy for Asian countries which interacted with the RER misalignment measures.[7] Table 7 shows the outputs for these regressions.

Column 1 contains the estimated parameter for the $LRER$, which is statistically significant at 5% and equals -0.09. When the interaction between the dummy for Asian countries and the $LRER$ is also taken into consideration (column 2), the $LRER$ parameter becomes non-statistically significant and the interaction − significant at 5% − equals –0.04. Columns 3 and 4 present the same estimates using the variable Mis_1 rather than $LRER$. Without the interaction, the estimated parameter for Mis_1 (column 3) is not significant; and this remains non-significant when combined with the interaction with the dummy (column 4), which is significant at 5% and equals –0.32. Finally, columns 5 and 6 present the estimates using the variable Mis_7, which is significant at 5% and equals –0.10 without the interacted term. Nevertheless, both parameters (for Mis_7 and its interaction) are not significant when considered jointly. Put differently, even with a different sample containing fewer countries, the estimates confirmed the benefits of a competitive RER on economic growth.

[5] A theoretical basis for this statement can be found in the literature regarding the Kaldorian growth perspective, for example Kaldor (1966, 1970) and Ros (2015).

[6] Our study is interested in understanding the effect of the RER on growth, so it is reasonable to accentuate the importance of this variable for economic growth. However, we should make clear that RER policies are only one important feature of a broader, consistent strategy for economic development. The contrasting experiences of Asian and Latin American economies provide an example of this.

[7] To facilitate the estimation of the growth equations, we chose only three RER misalignment measures: $LRER$, Mis_1 and Mis_7.

Table 7 – *RER and growth: Africa, Asia, and Latin America*

	(1)	**(2)**	**(3)**	**(4)[a]**	**(5)[a]**	**(6)[a]**
y_{t-i}	0.32* (0.17)	0.38*** (0.07)	0.27 (0.18)	0.18 (0.12)	0.46*** (0.09)	0.39*** (0.10)
Initial income	–0.01 (0.03)	–0.03** (0.01)	–0.04 (0.03)	–0.04* (0.02)	–0.01 (0.02)	–0.02 (0.02)
$LRER$	–0.09** (0.04)	0.02 (0.04)				
$LRER_{AS}$		–0.04** (0.02)				
Mis_1			–0.06 (0.05)	0.05 (0.10)		
Mis_{1AS}				–0.32** (0.16)		
Mis_7					–0.10** (0.05)	–0.04 (0.05)
Mis_{7AS}						–0.10 (0.12)
Education	0.17* (0.09)	0.09** (0.03)	0.22** (0.10)	0.17*** (0.06)	0.18*** (0.06)	0.17** (0.06)
Institutions	0.001 (0.003)	0.001 (0.001)	0.0001 (0.002)	0.004* (0.002)	0.0003 (0.001)	0.0004 (0.001)
AR (2)	0.34	0.19	0.43	0.66	0.27	0.22
Hansen	0.31	0.29	0.33	0.24	0.62	0.66
Hansen-Diff	0.33	0.84	0.28	0.20	0.97	0.88
Groups	71	71	71	71	31	35
Instruments	34	62	35	33	54	54

Notes: (1) The dependent variable is the growth rate of GDP per capita. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses. (5) All variables in logarithm. (6) The sample has only countries from Latin America, Africa, and Asia. [a] The instruments are collapsed; $LRER_{AS}$ = $LRER$ X dummies for Asian countries, Mis_{AS} = Mis X dummies for Asian countries.

On the one hand, these results suggest the robustness of our previous regressions (i.e., our results remain valid, even when used on a different set of countries). On the other hand, they suggest that a competitive RER is an important feature in the explanation of the contrasting changes in per capita output of countries in Africa, Asia, and Latin America, and this effect is especially valid for Asian economies. In relation to the empirical results using Mis_7, we note that the positive effect of a competitive RER is almost 50% smaller than those found in table 2. This implies that a comparatively greater reduction in labor costs is required in these countries, in order to induce enhanced growth via a competitive RER.

4. Robustness checks

1.1. Robustness check I

The first robustness check consists of separately testing the effects of a devalued and a valued RER. A procedure that tests the existence of non-symmetric effects of devaluation and overvaluation on economic growth is not commonly found in the literature[8] and therefore represents another contribution this study makes to the existing literature. To this end, the same empirical strategy discussed in section 3, which was employed to estimate equation (1), applies to these estimates. However, following Schröder (2013), the RER misalignment measure is split into two new variables:

$$y_{ti} = \alpha + \beta Y_{bi} + \beta_1 dev_{t-1,i} + \beta_2 over_{t-1,i} + \beta_3 controls + f_t + f_i + u_{it} \quad (5)$$

where dev represents a dummy for the negative values of RER misalignment (1 for negative values and 0 otherwise) multiplied by the RER misalignment measure, and $over$ represents a dummy for the positive values of the RER misalignment (1 for positive values and 0 otherwise) multiplied by the RER misalignment measure. Negative values for estimated parameters β_1 and β_2 indicate the robustness of our previous results, in that they confirm that a competitive RER is positively associated with growth. Moreover, we only performed the equation that considers all the independent variables (model 6). Table 8 contains these results.

The estimated parameters for the variable dev were –0.16 (dev_1), –0.21 (dev_2), –0.22 (dev_3), –0.29 (dev_4), –0.23 (dev_5), –0.23 (dev_6), and –0.25 (dev_7), which suggest that a 10% more competitive RER increases per capita income growth by 1.6%, 2.1%, 2.2%, 2.9%, 2.3%, 2.3%, and 2.5%, respectively. In turn, the estimated parameters for the variable $over$ were –0.13 ($over_1$), –0.10 ($over_2$), –0.10 ($over_3$), –0.14 ($over_5$), –0.23 ($over_6$), and –0.22 ($over_7$), which suggest that RER overvaluations at around 10% reduce per capita income growth by 1.3%, 1%, 1%, 1.4%, 2.3%, and 2.2%, respectively.

The equation 5 estimates confirmed our previous results, according to which a competitive RER is good for growth, while the parameters vary across the various specifications and RER misalignment measures. The results also reveal that RER devaluations/valuations have non-symmetric effects on economic growth; the positive effect of a competitive RER is greater than the negative effect of a non-competitive one.

We ran two further specifications, which separately considered the variables dev and $over$ with the variables Mis_1 and Mis_7. These new estimates answered two questions. Is a competitive RER a necessary condition for growth? Or, is avoiding RER overvaluations a sufficient condition for the promotion of growth? These estimates are also presented in table 8. The findings indicate the same direction as the previous results and suggest that the answer for both questions is affirmative, that is, a competitive RER is a sufficient condition for growth, and avoiding overvaluations is beneficial. The estimated parameter for dev is –0.29 (Mis_1) and –0.12 (Mis_7), indicating that RER devaluations of around 10% increase per capita income by 2.9% and 1.2%. In turn, the estimated parameter for $over$ is –0.26 (Mis_1) and –0.23 (Mis_7), indicating that overvaluations of around 10% reduce per capita income by 2.6%.

Finally, table 9 presents the regressions performed to explain economic performance in Asian countries compared to Latin American and African ones, using the variables *dev* and *over* in order to verify our previous findings.[9]

[8] To the best of our knowledge, only Schröder (2013) has performed growth equations to test this.
[9] Here, we chose only the Mis_1 and Mis_7 RER misalignment measures.

Table 8 – *Robustness check I*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Measure of RER misalignment	Mis_1	Mis_2	Mis_3	Mis_4	Mis_5	Mis_6	Mis_7	Mis_1	Mis_1	Mis_7	Mis_7
y_{t-i}	0.21***	0.20***	0.26***	0.10	0.19***	0.10	0.12	−0.01	−0.02	0.19*	0.13
	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.13)	(0.14)	(0.07)	(0.11)	(0.11)	(0.20)
Initial income	−0.05***	−0.04**	−0.05***	−0.06***	−0.06**	−0.01	−0.01	−0.01	0.05	−0.02	0.08
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)	(0.02)	(0.06)
Dev	−0.16**	−0.21***	−0.22***	−0.29***	−0.23***	−0.23**	−0.25**	−0.29***		−0.12*	
	(0.06)	(0.07)	(0.07)	(0.09)	(0.06)	(0.11)	(0.10)	(0.09)		(0.07)	
$Over$	−0.13**	−0.10*	−0.10	0.002	−0.14**	−0.23**	−0.22**		−0.26***		−0.23***
	(0.06)	(0.06)	(0.07)	(0.10)	(0.07)	(0.09)	(0.11)		(0.10)		(0.08)
Education	0.19***	0.19***	0.14***	0.26***	0.19***	0.19***	0.17**	0.24***	−0.17	0.17**	−0.13
	(0.04)	(0.04)	(0.04)	(0.02)	(0.05)	(0.07)	(0.08)	(0.06)	(0.14)	(0.08)	(0.23)
Institutions	0.001	0.001	0.001	0.0001	0.00001	−0.0005	−0.0001	0.004***	0.006***	0.0004	0.004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.0007)	(0.003)
Saving	0.03	0.03	0.05	0.02	0.06	0.12	0.13*				
	(0.03)	(0.04)	(0.03)	(0.04)	(0.05)	(0.07)	(0.07)				
Government	−0.02	−0.02	−0.05	−0.11*	−0.15**	−0.18**	−0.20**				
	(0.04)	(0.04)	(0.04)	(0.06)	(0.06)	(0.07)	(0.07)				
Openness	−0.004	0.005	0.09	−0.01	0.14*	0.24*	0.27**				
	(0.07)	(0.08)	(0.08)	(0.10)	(0.07)	(0.12)	(0.12)				
Inflation	−0.007***	−0.007***	−0.005***	−0.008***	−0.006**	−0.002	−0.002				
	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)	(0.003)	(0.003)				
AR (2)	0.11	0.13	0.95	0.15	0.11	0.35	0.65	0.30	0.23	0.24	0.87
Hansen	0.14	0.16	0.54	0.18	0.15	0.30	0.25	0.15	0.42	0.13	0.50
Hansen-Diff	0.31	0.34	0.50	0.13	0.72	0.93	0.87	0.94	0.30	0.18	0.82
Groups	109	109	104	109	95	90	90	111	111	90	90
Instruments	91	91	97	91	89	54	54	43	20	62	19

Notes: (1) The dependent variable is the growth rate of GDP per capita. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses. (5) All variables in logarithm. (6) Dev_1 = Mis_1 x dummy for devaluations; $Over_1$ = Mis_1 x dummy for overvaluations.

Table 9 – *Robustness check I: Africa, Asia, and Latin America*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Measure of RER misalignment	Mis_1						Mis_7					
Dev	−0.07	0.03			−0.10*	0.02	−0.04	−0.01			−0.07	0.03
	(0.05)	(0.06)			(0.05)	(0.09)	(0.06)	(0.08)			(0.08)	(0.08)
Dev x dummy Asia		−0.20*				−0.19**		−0.16**				−0.06
		(0.11)				(0.09)		(0.08)				(0.11)
$Over$			0.03	−0.04	0.05	−0.11			−0.44**	−0.41**	−0.12	−0.34***
			(0.08)	(0.13)	(0.11)	(0.20)			(0.21)	(0.16)	(0.09)	(0.12)
$Over$ x dummy Asia				0.11		0.23				0.28*		0.23*
				(0.17)		(0.20)				(0.15)		(0.12)

Notes: (1) Only the variable regarding the measure of RER misalignment was presented because of several numbers of estimated parameters and the limited characters. The remainder of the estimated parameters are available upon request via authors' email. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses. (5) All variables in logarithm. (6) Dev_1 = Mis_1 x dummy for devaluations; $Over_1$ = Mis_1 x dummy for overvaluations.

The results are mixed, and partially support our previous findings. When the RER measures are represented by Mis_1, neither the variables *dev* or *over* are statistically significant when considered individually (columns 1 and 3). This result is especially valid for the variable *over*, given that none of its estimated parameters are significant. Nevertheless, when the interaction between a dummy for Asian countries and the variable *dev* is considered, its parameter is statistically significant and around –0.20 (columns 2 and 6), suggesting that the pursuit of a competitive RER is important for the more rapid growth in Asian countries, compared to Latin American and African ones. When the RER measure is represented by Mis_7, the estimated parameter for the variable *dev* remains non-significant, even though the estimated parameters for the interaction between a dummy for Asian countries and the variable *dev* are significant and around –0.16 (column 2), thereby confirming its importance in explaining Asian economic growth. The results change considerably when the estimated parameter for *over* is analyzed; its parameter becomes significant (except for column 11) and negative, indicating that avoiding RER overvaluations is beneficial for growth in Asian, African, and Latin American countries.

4.2. Robustness check II

This section provides a further robustness check by employing the RER misalignment calculated by Couharde et al. (2017), which is known as Mis_{CEPII}. This variable's calculation also follows the BEER approach and controls for the Balassa-Samuelson effect, net-foreign assets, and terms of trade as fundamentals of RER. This RER misalignment measure is calculated using co-integration techniques for econometric panels, thereby providing an annual variable (i.e., a single-period RER, rather than a five-year averaged variable). Using a yearly variable may change the growth estimate results (Vieira and MacDonald, 2012; Schröder, 2013). A robustness check that considers an annual RER misalignment measure is therefore important and justifies our efforts in this section. The empirical strategy discussed in section 3 to estimate equation (1) applies to the current estimates. However, here, the strategy is used with the values for the first year of the variable Mis_{CEPII} (1995, 2000, 2005, 2010, and 2015), instead of its five-year average. In addition to a strong robustness check of our results – one, to the best of our knowledge, not addressed in previous studies – this expunges possible simultaneity and provides an additional robustness check. The results are presented in table 10.

The results confirm our previous findings that a competitive RER positively influences growth. All the estimated parameters are statistically significant at least at 10% and are negative: –0.52 (model 1), –0.17 (model 2), –0.06 (model 3), –0.45 (model 4), –0.09 (model 5), and –0.19 (model 6). On average, the estimates suggest that a 10% more competitive RER increases growth by 2.4%.

Table 10 – *Robustness check II*

	(1)	(2)	(3)	(4)	(5)	(6)
y_{t-i}	0.08	0.29***	0.14	–0.17	0.14	0.26***
	(0.16)	(0.07)	(0.10)	(0.14)	(0.09)	(0.08)
Initial income	–0.08*	–0.02*	–0.04**	–0.10**	–0.08***	–0.08
	(0.04)	(0.01)	(0.02)	(0.04)	(0.01)	(0.02)
Mis_{CEPII}	–0.52***	–0.17**	–0.06**	–0.45***	–0.09*	–0.19***
	(0.13)	(0.08)	(0.03)	(0.14)	(0.05)	(0.07)
Education	0.34**	0.11***	0.14**	0.47***	0.23***	0.23***
	(0.13)	(0.03)	(0.06)	(0.12)	(0.05)	(0.06)
Institutions	0.0007	0.003**	0.001	0.001	0.002	0.003***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Saving		–0.05				–0.004
		(0.03)				(0.04)
Government			–0.10*			–0.15***
			(0.05)			(0.04)
Openness				–0.11		0.10
				(0.17)		(0.07)
Inflation					–0.002	–0.002
					(0.002)	(0.003)
AR (2)	0.17	0.10	0.11	0.12	0.17	0.25
Hansen	0.15	0.11	0.12	0.14	0.15	0.10
Hansen-Diff	0.53	0.82	0.80	0.63	0.86	0.86
Groups	111	109	109	109	108	109
Instruments	29	51	54	29	58	68

Notes: (1) The dependent variable is the growth rate of GDP per capita. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses. (5) All variables in logarithm.

4.3. Robustness check III

The final robustness check introduces a variable to represent the technological capabilities of the countries in our previous growth regressions, in line with the Ribeiro et al. (2020) study. This was proven relevant, since its results indicate that taking this variable into consideration could change our previous findings, according to which a competitive RER is positively associated with long-run growth. To this end, the same empirical strategy discussed in section 3 (employed to estimate equation (1)) is applied to current estimates. The only difference is the introduction of the Ribeiro et al. (2020) measures for country technological capability (the ratio between the country's GDP per capita and the GDP per capita of the USA) as an explanatory variable of long-run growth.[10] The results are presented below.

[10] We did not control initial income (convergence term) in these estimates, because of its strong association with the measure for country technological capability.

Table 11 – *Robustness check III: introducing the technological capabilities in our estimates*

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
y_{t-i}	0.11 (0.08)	0.18** (0.07)	0.18** (0.07)	0.08 (0.09)	0.12 (0.09)	0.17** (0.07)	0.13 (0.16)	0.14 (0.11)
Initial income							0.09* (0.05)	0.02 (0.02)
RER	−0.19*** (0.03)	−0.16*** (0.03)	−0.17*** (0.03)				−0.23*** (0.06)	
Technological capabilities	0.02 (0.03)	0.03 (0.03)	0.02 (0.02)	−0.02 (0.03)	0.001 (0.03)	−0.01 (0.02)		
RER x Tech. capabilities							0.17* (0.10)	
Mis_1				−0.18*** (0.04)	−0.14*** (0.05)	−0.17*** (0.04)		−0.31*** (0.08)
Mis_1 x Tech. capabilities								0.31*** (0.12)
Education	0.13** (0.06)	0.07 (0.05)	0.13** (0.04)	0.15** (0.07)	0.08 (0.06)	0.14** (0.06)	−0.09 (0.10)	−0.02 (0.02)
Institutions	0.003 (0.13)	0.002 (0.002)	0.001 (0.001)	0.002 (0.002)	0.002 (0.003)	0.001 (0.001)	0.006** (0.001)	0.003 (0.002)
Saving	0.02 (0.05)		0.02 (0.04)	0.03 (0.06)		−0.04 (0.04)		
Gov.		−0.02 (0.03)	−0.02 (0.04)		−0.06 (0.05)	−0.02 (0.06)		
Openness			−0.03 (0.74)			−0.07 (0.09)		
Inflation			−0.005 (0.003)			−0.006* (0.003)		
AR (2)	0.26	0.12	0.11	0.21	0.11	0.11	0.43	0.14
Hansen	0.16	0.25	0.15	0.11	0.11	0.10	0.14	0.15
Hansen-Diff	0.80	0.75	0.54	0.54	0.51	0.38	0.87	0.15
Groups	109	109	109	109	109	109	111	111
Instruments	48	48	84	45	40	79	28	38

Notes: (1) The dependent variable is the growth rate of GDP per capita. (2) Estimates using robust two-step system GMM with time dummies. (3) *, ** and *** indicate significance at 10%, 5%, and 1%. (4) Robust standard errors between parentheses. (5) All variables in logarithm.

The results in table 11 corroborate our previous findings. All the estimated parameters regarding our RER misalignment measure were statistically significant at 1% and negative: –0.19 (model 1), –0.16 (model 2), –0.17 (model 3), –0.18 (model 4), –0.14 (model 5), and –0.17 (model 6), indicating that a competitive RER is positively associated with long-run growth, even when controlling the variable differential of country technological capability.

Moreover, we performed two further equations (models 7 and 8) to test whether the growth effect of a competitive RER is associated with the differential of country technological

capability. To this end, we introduced the variable RER misalignment measure[11] multiplied by technological capability using the same growth equation specification as found in subsection 3.2.1. The estimated parameters for the variables RER and Mis_1 were statistically significant and negative: –0.23 and –0.31, respectively. In turn, the estimated parameters for the variables RER x technological capability and Mis_1 x technological capability were statistically significant and positive: 0.17 and 0.31, respectively. Thus, the lower the country technological capability compared to the US economy (i.e., the greater the gap between technological capabilities), the greater the growth effect of a competitive RER. In contrast to the Ribeiro et al. (2020) results, our findings corroborate our previous results, where a competitive RER has a more intense growth effect in developing countries.

5. Concluding remarks

This study constitutes an effort to investigate the effects of RER misalignment on economic growth for a set of 151 countries between 1995 and 2018, in the light of the existing empirical and theoretical literature and the recent contrasting experiences of Asian, African, and Latin American economies. We have argued that a competitive RER induced by lower labor costs favors economic growth. In fact, our empirical regressions indicate that the pursuit of a competitive RER must be considered a driver of economic prosperity, since our different RER misalignment measures have proved to be statistically significant and quite robust, given that we employed various sets of countries, income level controls, specifications, and robustness checks. Further, our results indicate that pursuing a competitive RER helps to explain the successful growth of Asian economies, while a non-competitive RER is an important feature of the explanation for the poor performance of Latin American countries.

Our results suggest that reducing labor costs improves long-run growth by enhancing the international competitiveness of domestic goods (i.e., by promoting devaluation of the RER), which is a valid explanation of the contrasting experiences of Asian and Latin American economies. Nonetheless, to obtain a balanced view of the importance of RER for the promotion of long-run growth, two contrasting aspects should be borne in mind.

On the one hand, our results should be viewed with caution, especially as a prescription for development policy. Although outward-oriented policies – such as the pursuit of a competitive RER and controlled labor costs – were adopted by Asian economies, we note that these policies were adopted in combination with a wide range of development-oriented policies – fiscal, monetary, technological, educational, and development-oriented institutions (White and Wade, 1988; Amsden, 1989; Ang, 2016; Chu, 2016), which, since the 1990s, have been neglected by Latin American countries (Bresser-Pereira, 2010). Moreover, a competitive RER increases income inequality in the short term by reducing real wages and the wage share of GDP (Diaz Alejandro, 1963; Blecker, 1989; Bahduri and Marglin, 1990), which might produce the opposite growth effect in the long run (Guzman et al., 2018; Ribeiro et al., 2020). A competitive RER should not therefore be interpreted as a magic solution to all the problems of underdevelopment but as a limited policy, which does not fill the gap left by a lack of growth fundamentals (Eichengreen, 2007) but which, when adopted with a broad set of development-oriented policies, constitutes a tool to achieve economic prosperity. In other words, a

[11] RER and Mis_1.

competitive RER is a necessary, but not sufficient, condition for development in developing countries (Oreiro, 2020).

On the other hand, we should also stress that there is a wide-ranging literature, in particular by the authors associated with the New Developmentalist school, that has demonstrated the importance of a competitive RER in overcoming the disadvantages of the non-price competitiveness experienced by developing countries (as opposed to developed ones) (Oreiro, 2020); it generates increased price competitiveness, sparking long-term growth (Rodrik, 2008; Oreiro et al., 2020a; Oreiro et al., 2020b). However, as we have argued, it turns out that a competitive RER also positively influences economic growth through its effects on non-price variables, which are crucial for long-run growth, such as capital accumulation, technological progress, growth in labor productivity, and the development of manufacturing activities and high-tech sectors. From this perspective, the adoption of a growth strategy based on the adoption of a competitive RER is therefore associated with a long-term solution for economic underdevelopment. Insofar as a competitive RER favors the manufacturing sectors, more social resources (such as investments and the employment of workers in other non-manufacturing sectors) are absorbed by manufacturing firms (Frenkel and Ros, 2006; Ros, 2015). That is, a competitive RER promotes the industrialization and diversification of the production structure (Ros and Skott, 1998; Gabriel and Missio, 2018; Gabriel et al., 2020. Consequently, as workers are included in manufacturing activities, greater labor productivity is absorbed by higher real wages in the long-run (Ros, 2015). The adoption of a growth strategy based on a competitive RER is therefore a path to economic prosperity in the long run, meaning that lower real wages/consumption should be temporarily accepted in the short run, for the future benefit of higher real wages.

In sum, our findings reveal important aspects of open economies: a competitive RER is positively associated with long-run growth and reduced labor costs in the short term. Expanding international competitiveness may induce economic growth in the long run. However, these results should be further investigated in relation to additional non-price transmission channels, such as the RER, which may influence an economy in many ways – very often in contrary directions. Further studies should also look at the associations between RER influence and the structural features of economies, as well as the best institutional policy designs to maximize the benefits of pursuing a competitive RER and minimizing its damaging effects. We still have a long way to go in order to understand these aspects, which are ripe for future study.

Appendix

Table A1 – *Variables*

Variable	Definition	Source	Obs.
RER	Bilateral real exchange rate (Price level ratio of PPP conversion factor to market exchange rate)	World Bank	878
GDP per capita	Real GDP per capita (PPP)/ $LPIBCAPITA$	World Bank	877
Terms of trade	Ratio of export to import prices	Penn World Table 9.1	852
Net foreign assets	Net foreign assets as % of GDP	World Bank	799
Government	Government consumption as % of GDP	Penn World Table 9.1	852
Wage share	Wage share as % of GDP	Penn World Table 9.1	684
Growth rate of GDP per capita	Log difference of Real GDP per capita (PPP)	World Bank	729
Initial income	Real GDP per capita (PPP) level in 1990, 1995, 2000, 2005, 2010, and 2015	World Bank	869
Education	Number of schooling of the population above 15 years in 1990, 1995, 2000, 2005, 2010, and 2015	Barro and Lee (2000)	726
Institutions	Constraint in chief executive	Polity IV Project	780
Saving	1 minus the consumption share of GDP	Penn World Table 9.1	842
Openness	Sum of exports and imports of goods as % of GDP	Penn World Table 9.1	852
Inflation	Consumer prices %	World Bank	842
Mis_1	Measure of RER (model 1)	Authors	876
Mis_2	Measure of RER (model 2)	Authors	840
Mis_3	Measure of RER (model 3)	Authors	680
Mis_4	Measure of RER (model 4)	Authors	840
Mis_5	Measure of RER (model 5)	Authors	673
Mis_6	Measure of RER (model 6)	Authors	510
Mis_7	Measure of RER (model 7)	Authors	510
Mis_{CEPII}	Measure of RER (calculated by $CEPII$)	Authors	828
Technological capabilities	The ratio of the country's GDP per capita and the USA's GDP per capita (the data come from the PWT database)	Authors	888

Table A2 – *List of countries*

Albania	Canada	Gabon	Kyrgyz Republic	Norway	South Africa
Algeria	Central African Republic	Germany	Lao PDR	Oman	Spain
Angola	Chad	Ghana	Latvia	Pakistan	Sri Lanka
Antigua and Barbuda	Chile	Greece	Lebanon	Panama	Sudan
Armenia	China	Grenada	Lesotho	Papua New Guinea	Sweden
Australia	Colombia	Guatemala	Lithuania	Paraguay	Switzerland
Austria	Comoros	Guinea-Bissau	Luxembourg	Peru	Tajikistan
Bahrain	Costa Rica	Guyana	Madagascar	Philippines	Tanzania
Bangladesh	Cote d'Ivoire	Haiti	Malaysia	Poland	Thailand
Barbados	Croatia	Honduras	Maldives	Portugal	Togo
Belarus	Cyprus	Hong Kong	Mali	Qatar	Tonga
Belgium	Czech Republic	Hungary	Malta	Romania	Trinidad and Tobago
Belize	Denmark	Iceland	Mauritania	Russia	Tunisia
Benin	Dominica	India	Mauritius	Rwanda	Turkey
Bhutan	Dominican Republic	Indonesia	Mexico	Samoa	Turkmenistan
Bolivia	Ecuador	Ireland	Moldova	Sao Tome and Principe	Uganda
Bosnia and Herzegovina	Egypt	Israel	Mongolia	Saudi Arabia	Ukraine
Brazil	El Salvador	Italy	Morocco	Senegal	United Arab Emirates
Brunei Darussalam	Equatorial Guinea	Jamaica	Namibia	Serbia	United Kingdom
Bulgaria	Estonia	Japan	Nepal	Seychelles	United States
Burkina Faso	Eswatini	Kazakhstan	Netherlands	Sierra Leone	Uruguay
Burundi	Ethiopia	Kenya	New Zealand	Singapore	Vietnam
Cabo Verde	Fiji	Kiribati	Niger	Slovak Republic	Yemen
Cambodia	Finland	Korea	Nigeria	Slovenia	
Cameroon	France	Kuwait	North Macedonia	Solomon Island	

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