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On the Link between Real Exchange Rate Misalignment and Growth: Theory and Empirical Evidence

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Abstract

This paper analyzes the effect of real exchange rate (RER) on economic growth both theoretically and empirically. The first part builds an endogenous growth model which illustrates that an RER appreciation reduces the growth rate in the centralized and decentralized economies. Additionally, the model shows that taxes have a negative effect on growth. The second part employs the new Cross-Sectionally Augmented Distributed Lag Estimator to empirically study the impact of RER misalignment on economic growth. The results demonstrate that RER misalignment acts harmfully on growth. Thus corroborating what we found theoretically. The empirical findings also confirm the adverse effect of taxes on growth. The negative impact of RER misalignment on growth are maintained when we use alternative measurements of RER misalignment and subsamples of developed and developing countries. Finally, we discovered that very large misalignments have even greater damaging impacts on growth.

Keywords: Cross-Sectionally Augmented Distributed Lag Estimator; Heterogeneous Panels; Dynamic Optimization; Endogenous Growth Theory; Long-Run Relationships; Mean Group Estimator; Misalignment; Real Exchange Rate; Taxes

JEL Classification: C61, H20, H61, O41, O47, O50

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1 Introduction

Over the last five decades, many studies have shown that real exchange rate (RER) plays a non-negligible role in the economy. For instance, the RER is the key variable in decisions involving the balance of payments (current and capital accounts). It is an important determinant, through low volatility, of productivity growth. Mismanagement of the RER has also bad consequences for the economy: high RER appreciations, excessive overvaluations, large RER volatility can affect investment decisions, undermine households and firms' choices, cause balance-of-payments disequilibrium, currency and debt crises, altogether having damaging effects for productivity, growth and macroeconomic performance in general. The RER occupies a central position in trade and exchange policies between countries and regions around the world.

In the same line of thought as those mentioned above, researchers have examined the relationship between RER misalignment and economic growth. Razin and Collins (1997) find that RER misalignment acts nonlinearly on growth. Very large overvaluations seem to have negative effects on growth, whereas moderate under-valuations are related with very high growth rates. Employing GMM panel data methods, Aguirre and Calderon (2005) also discover that the effect of misalignment on growth is nonlinear. High misalignments and large under-valuations hinder growth, while moderate under-valuations boost the growth rate. Rodrik (2008) demonstrates that RER undervaluation increases growth in developing countries which predominantly suffer from institutional weaknesses and product-market failures. The channel through which under-valuation affects growth is the size of the tradable sector which is hampered by market failures that prevent developing countries from attaining high GDPs. Berg and Miao (2010) compare the "Washington Consensus" view that stipulates that RER misalignment creates macroeconomic imbalances that hurt growth to the Rodrik (2008) thesis which defends that undervaluation is favorable to economic growth. Their central result illustrates that the "Washington Consensus" view and Rodrik (2008) thesis are mainly the same for the principal growth regressions Rodrik (2008) presents. But there exist some identification issues insofar as the determinants of RER misalignment are also, in most cases, the regressors in growth estimations. MacDonald and Vieira (2010) use panel data techniques to explore the effect of RER misalignment on growth for 90 countries from 1980 to 2004.

They extend the Rodrik (2008) approach by including more determinants of RER in the computation of the misalignment indicator. Their panel data estimation method also correct for too many instruments using the Hansen-Diff test. Sallenave (2010) examines the effects of RER misalignment on macroeconomic performance for the G20 countries from 1980 to 2006. The author finds a negative relationship between RER misalignment and growth. Elbadawi, Kaltani and Soto (2012) study the link between aid, RER misalignment and growth in Sub-Saharan Africa. They discover that aid do not cause RER overvaluation, aid increases growth but its effect is diminished in countries with high overvaluations and finally overvaluation hinder growth but its negative impact is attenuated by financial development. Mbaye (2012) analyzes the RER undervaluation-growth nexus for 72 countries over the period 1970-2008. He shows that undervaluation mostly affects growth through total factor productivity.

Similarly to the works cited above, this paper examines the connection between RER misalignment and economic growth. It makes several contributions. On the theoretical front, this paper is the first to introduce a fully-micro-founded endogenous economic growth model that illustrates the explicit effect of RER on long-run growth. In this study, we show that RER and taxes have a straight clear effect on growth. This have not been done before. On the empirical front, the paper has many innovations. First, in the computation of real effective exchange rate (REER) misalignment, we use the Pesaran and Smith (1995) Mean Group Estimator and we introduce Total Factor Productivity to control for the Balassa-Samuelson effect instead of real GDP per capita as a proxy. Second, in the growth regressions, we employ the newly invented Cross-Sectionally Augmented Distributed Lag Estimator of Chudik, Mohaddes, Pesaran and Raissi (2013). This variable and these estimations techniques have not been used in previous analyzes on the REER misalignment-growth nexus. The theoretical endogenous growth model demonstrates that an RER appreciation diminishes growth in the centralized and competitive economies. The model also shows that taxes act negatively on growth. The econometric results illustrate that RER misalignment hinders growth in the overall sample and in the subsamples of developed and developing countries. We also found that taxes are harmful to growth. These empirical results confirm what was found theoretically. These results are maintained by using alternative measurements of RER misalignment. Moreover, we discovered that very large misalignments have larger damaging effects on growth.

The remaining of the paper is organized in the following manner: the first section presents the theoretical model, the second section exposes the empirical investigations and the last part concludes.

2 Theoretical Model

In this section, we expose the theoretical model and illustrate how the main equations are obtained.

2.1 Setting the Model

The social planner picks out a consumption path that maximizes his global utility function subject to some dynamic and other constraints, and the initial values of capital stocks. His optimization program is given by [1]:

$$Max_{\{c(t),iv_T(t),iv_N(t)\}}U(0) = \int_0^{\infty} \frac{\left(c(t)^{1-\sigma} - 1\right) e^{-\rho t}}{1-\sigma} \, dt \quad (1)$$

Subject to:

$$\frac{d}{dt}k_T(t) = iv_T(t) - \delta\, k_T(t) \quad (2)$$

$$\frac{d}{dt}k_N(t) = iv_N(t) - \delta\, k_N(t) \quad (3)$$

$$y(t) = Ak_T(t)^{\alpha}\, k_N(t)^{1-\alpha} \quad (4)$$

$$y(t) = c(t) + iv_T(t) + \epsilon\, iv_N(t) \quad (5)$$

And

$k_T(0)$ and $k_N(0)$ are given

In equation (1), $C(t)$ is consumption, σ^{-1} measures the constant intertemporal elasticity of substitution in consumption, ρ represents the subjective rate of time preference. It is assumed that both σ and ρ are strictly positive. Equality (2) gives the law of motion of capital stock in the tradable sector. In this equation, $k_T(t)$ is capital in the tradable sector, $iv_T(t)$ is investment for the tradable good and $\delta \in (0,1)$ is the capital depreciation rate in both sectors. Similarly (3) is the law of motion of capital stock for the non-tradable good. Its components are defined analogically as in the previous equation. Equation (4) defines output $y(t)$ as a Cobb-Douglas production function where A is total factor productivity, $\alpha \in (0,1)$ constitutes the share of tradable capital in the production. The

[1] To certain extents, the model presented here could be viewed as an extended version of Barro and Sala-i Martin (2004) model, pp. 240-242.

production function exhibits Constant Returns to Scale to tradable and non-tradable capital together. The resource constraint of the economy is represented by equivalence (5). It says that income equal to consumption $c(t)$ plus both types of investments. The last two expressions tells us that the initial capital stocks, $k_T(0)$ and $k_N(0)$, are given.

Now we turn to some more elucidations on the model presented above.

Definition. *The internal RER ϵ, in foreign-currency terms, is expressed as the price of non-tradable goods p_N divided by the price of tradable goods p_T. An increase in this RER is an appreciation.*

$$\epsilon = \frac{p_N}{p_T} \tag{6}$$

Assumption 1. *We assume that production and consumption are measured in terms of tradables. We also assume that investment in tradables represent the same good as capital in tradables. Likewise we suppose that investment in nontradables constitutes the same good as capital in nontradables. In addition, we assume that all tradables goods represent the same good and all nontradables also constitute the same good. Finally tradables and nontradables are expressed in the same monetary unit by multiplying each good by its respective price.*

Assumption 2. *Households possess two capital goods, $k_T(t)$ and $k_N(t)$. The income gained from hiring out these capital goods to the companies is their unique source of private revenue. We thus presume that there is no wage coming from labor services.*

Assumption 2 will become more important when we will talk about the decentralized economy. Let us now turn to the solution of the social planner's problem.

2.2 Economic Equilibrium

The present value Hamiltonian, $H(\cdot)$, of the social planner is:

$$\begin{aligned} H(\cdot) = {} & \frac{\left(c(t)^{1-\sigma} - 1\right) \mathrm{e}^{-\rho t}}{1-\sigma} + \mu_T(t)\left(A k_T(t)^{\alpha} k_N(t)^{1-\alpha} - c(t) - \epsilon\, iv_N(t) - \delta\, k_T(t)\right) \\ & + \mu_N(t)\left(iv_N(t) - \delta\, k_N(t)\right) \end{aligned} \tag{7}$$

The variables $\mu_T(t)$ and $\mu_N(t)$ are the costate variables. The first order conditions for this problem are:

The derivative of the Hamiltonian with respect to consumption.

$$\frac{c(t)^{1-\sigma}\,\mathrm{e}^{-\rho t}}{c(t)} - \mu_T(t) = 0 \tag{8}$$

The derivative of the Hamiltonian with respect to investment in the non-tradable sector.

$$-\mu_T(t)\,\epsilon + \mu_N(t) = 0 \tag{9}$$

We take the derivative of the Hamiltonian with regard to the two state variables, set the results equal to the negative of the derivative of the costate variables in each sector relative to time and rearrange the equations to get.

$$\mu_T(t)\left(Ak_T(t)^{-1+\alpha}\,\alpha\,k_N(t)^{1-\alpha} - \delta\right) = -\frac{\mathrm{d}}{\mathrm{d}t}\mu_T(t) \tag{10}$$

$$\mu_T(t)\,Ak_T(t)^{\alpha}\,k_N(t)^{-\alpha}\,(1-\alpha) - \mu_N(t)\,\delta = -\frac{\mathrm{d}}{\mathrm{d}t}\mu_N(t) \tag{11}$$

Combining equations (8) and (10), doing lots of algebra and oversimplifications, we get:

$$\frac{\frac{\mathrm{d}}{\mathrm{d}t}c(t)}{c(t)} = \frac{Ak_T(t)^{-1+\alpha}\,\alpha\,k_N(t)^{1-\alpha} - \delta - \rho}{\sigma} \tag{12}$$

Similarly joining equalities (9), (10) and (11) performing more algebra and simplifications, we obtain:

$$k_T(t) = \frac{\alpha\,k_N(t)\,\epsilon}{1-\alpha} \tag{13}$$

Substituting equation (13) in (12) and simplifying, we have:

$$\frac{\frac{\mathrm{d}}{\mathrm{d}t}c(t)}{c(t)} = \frac{1}{\sigma}\left(A\left(\frac{\alpha\,\epsilon}{1-\alpha}\right)^{-1+\alpha}\alpha - \delta - \rho\right) \tag{14}$$

Before saying anything about this last equation, we need some more assumptions that we will have to derive. Firstly, solving the differential equation given in (14), we find:

$$c(t) = c(0)\,\mathrm{e}^{\frac{t}{\sigma}\left(A\left(-\frac{\alpha\epsilon}{-1+\alpha}\right)^{-1+\alpha}\alpha-\delta-\rho\right)} \tag{15}$$

Assumption 3. *In order to have positive endogenous consumption growth, we need*

$$\delta + \rho < A\left(-\frac{\alpha\,\epsilon}{-1+\alpha}\right)^{-1+\alpha}\alpha \tag{16}$$

Secondly, the two transversality conditions are:

$$\begin{aligned}\lim_{t\to\infty}\mu_T(t)\,k_T(t) &= 0\\ \lim_{t\to\infty}\mu_N(t)\,k_N(t) &= 0\end{aligned} \tag{17}$$

Working through these expressions we get the following assumption.

Assumption 4. *For the transversality conditions to hold, we need*

$$\delta < A\left(-\frac{\alpha\,\epsilon}{-1+\alpha}\right)^{-1+\alpha}\alpha \tag{18}$$

After stating these hypotheses, now we discuss the following propositions.

Proposition 1. *Under Assumptions 1, 2, 3 and 4, the growth rate in equation* (14) *is function of only the parameters of the model. Hence the growth rate is endogenous in the sense that it is engendered from inside the system as a direct outcome of internal mechanisms.*

The RER affects growth through the real interest rate.

Proof: See Appendix A for the proof of the second part of this Proposition.

Proposition 2. *Under Assumptions 1 and 2 the RER acts on production through compound total factor productivity.*

Proof: See Appendix B.

Proposition 3. *Under Assumptions 1, 2, 3 and 4, an RER appreciation (an increase in ϵ) reduces the growth rate in the centralized economy. An appreciation diminishes the real interest rate and pushes the agent to consume more today than tomorrow. This decreases saving and hence decreases growth.*

Proof: See Appendix C.

2.3 Taxes on Tradable and Non-Tradable Investments

Now we turn to the decentralized economy where we analyze the impacts of taxes on tradable and non-tradable investments. We formulate first the problem for the tax on tradable investment.

The household's budget constraint is:

$$c(t) + (1+\tau_T)\, iv_T(t) + \epsilon\, iv_N(t) = r_T(t)\, k_T(t) + \epsilon\, r_N(t)\, k_N(t) + T(t) \tag{19}$$

In this equation, τ_T is the tax rate on tradable investment; $r_T(t)$ and $r_N(t)$ are the net real interest rates in the tradable and non-tradable sectors respectively; $T(t)$ is the lump-sum government transfer.

The government budget constraint is given by:

$$T(t) = \tau_T iv_T(t) \tag{20}$$

The profits $\pi fs(t)$ of the firm are:

$$\pi fs(t) = A k_T(t)^{\alpha} k_N(t)^{1-\alpha} - r_T(t)\, k_T(t) - \epsilon\, r_N(t)\, k_N(t) \tag{21}$$

Now solving the household's problem by maximizing the objective function (1) subject to equations (2), (3), the initial capitals and (19); maximizing the firm's profits (equation (21)); taking into account the government's budget constraint (20), and finally allowing for general equilibrium, after many calculations, we obtain:

$$\frac{\frac{d}{dt}c(t)}{c(t)} = \frac{1}{\sigma}\left(\frac{A\alpha^{\alpha}}{1+\tau_T}\left(-\frac{\epsilon}{(-1+\alpha)(1+\tau_T)}\right)^{-1+\alpha} - \delta - \rho\right) \tag{22}$$

This last equation provides the endogenous growth rate in the competitive equilibrium when investment in tradables is taxed. We can now enunciate the following propositions.

Proposition 4. *Under Assumptions 1, 2, the transversality and positive growth conditions, an RER appreciation (an increase in ϵ) reduces the growth rate in the decentralized economy.*

Proof: See Appendix D.

Proposition 5. *Under Assumptions 1, 2, the transversality and positive growth conditions, an augmentation of the tax on tradable investment diminishes the growth rate in the decentralized economy.*

Proof: See Appendix E.

Similarly, setting and solving the problem for the tax on non-tradable investment, we find:

$$\frac{\frac{\mathrm{d}}{\mathrm{d}t}c(t)}{c(t)} = \frac{1}{\sigma}\left(A\alpha^{\alpha}\left(-\frac{(1+\tau_N)\epsilon}{-1+\alpha}\right)^{-1+\alpha} - \delta - \rho\right) \tag{23}$$

This last equation gives the endogenous growth rate in the competitive equilibrium when investment in non-tradables is taxed. We now state the following proposition.

Proposition 6. *Under Assumptions 1, 2, the transversality and positive growth conditions, an increase of the tax on non-tradable investment lowers the growth rate.*

Proof: See Appendix F.

Having finished to present the theoretical part of the paper, now we turn to the empirical part.

3 Empirical Investigations

This section presents the estimation methods, the data and variables, and the econometric results.

3.1 Estimation Methods

To empirically analyze the effect of real effective exchange rate (REER) misalignment on growth, we estimate the following econometric model:

$$\begin{aligned} \ln\left(gdpcap_{it}\right) = {} & c_i + \alpha_i misal_{it} + \beta_{i0}\Delta misal_{it} + \theta_i' x_{it} + \delta_{i0}'\Delta x_{it} \\ & + \omega_{iy}\overline{\ln\left(gdpcap_t\right)} + \omega_{i,m0}\overline{misal_t} + \omega_{i,x0}'\overline{x_t} + e_{it} \end{aligned} \tag{24}$$

Where $\ln\left(gdpcap_{it}\right)$ is the logarithm of real GDP per capita; $misal_{it}$ is REER misalignment; x_{it} is a set of control variables: logarithm of the human capital index, logarithm of general government final consumption expenditures over GDP, logarithm of openness (exports + imports over GDP), logarithm of terms of trade (exports prices over imports prices), logarithm of investment over GDP, logarithm of 1 + the inflation rate, logarithm of domestic credit to private sector over GDP (financial development), logarithm of tax revenue over GDP; a Δ in front of a variable designates its first difference and a bar over a variable indicates the cross-sectional (CS) average of that variable; e_{it} is the error term; i specifies the countries and t the time; all parameters are heterogeneous and the long-run coefficients of interest are α_i and θ_i'.

To estimate equation (24) we employ the Cross-Sectionally Augmented Distributed Lag (CS-DL) Estimator developed by Chudik et al. (2013). This regression technique takes into account nonstationarity, parameter heterogeneity, cross-section dependence and dynamics. Since our data are annual data from 1980 to 2011, nonstationarity may be of concern. Numerous studies show that some moderate undervaluation have a positive impact on growth, especially for developing countries while high undervaluations and large overvaluations may harm growth in some other countries. This put forward that the impacts of misalignment on growth differs across countries according to their institutions and particularities. It is thus crucial to consider heterogeneity in countries. As pointed out by Chudik et al. (2013), conditioning only on country-specific-variables does not guaranty cross-sectional error independence because there could be omitted common factors, probably associated with the independent variables, which affect these countries. Not considering these linkages could result to biased estimated coefficients. We must also think about the dynamics of the regressed equations. The CS-DL Estimator addresses all the issues raised previously and allows us to estimate the long-run effects of REER misalignment on growth. These are the first set of reasons why we use this estimator in this paper. Additionally, our theoretical model is of AK type. This implies that the model does not have transitional dynamics and that per capita growth rates are independent of the initial levels of capital and output per capita. Hence there is no conditional convergence in our model. This is the theoretical explanation why we do not include the initial value of GDP per capita in our regressions. Likewise the empirical model does not explicitly allow the introduction of the lagged value of the dependent variable in the estimations and in the computation of the long-run coefficients these dynamics are already accounted for, see Chudik et al. (2013). The AK framework also means that at the steady-state all variables grow at the same rate. But the expression of the growth rate in (14) implies that the corresponding levels of the variables in our model are nonstationary. Moreover, econometrics theory suggest that cointegration is the method that we should use to estimate relationships between nonstationary variables. These are the second set of reasons why we employ the CS-DL Estimator is this research.

Note that since we have lots of regressors in the above equation with possibly some missing values, we could not include more lags of the regressors because, for the above estimation to work, the size of the matrices used internally by the estimator must be at least as large as the number of panels in the estimation sample. Hence we decided to stick to a reasonable, feasible and tractable specification. But to test the robustness of our main results, we estimate again this equation by including only $\ln\left(gdpcap_{it}\right)$ and $misal_{it}$ taking into account more lags of the REER misalignment variable and its transformations. We have:

$$\begin{aligned} \ln\left(gdpcap_{it}\right) = {} & c_i + \alpha_i misal_{it} + \beta_{i0}\Delta misal_{it} \\ & + \omega_{iy}\overline{\ln\left(gdpcap_t\right)} + \omega_{i,m0}\overline{misal_t} + \omega_{i,m1}\overline{misal_{t-1}} \\ & + \omega_{i,m2}\overline{misal_{t-2}} + \omega_{i,m3}\overline{misal_{t-3}} + e_{it} \end{aligned} \tag{25}$$

Where all the variables are as defined in equation (24).

Before calculating the REER misalignment, we first compute the equilibrium real effective exchange rate (EREER). The economic literature on exchange rate states that REER is affected by its determinants called "fundamentals" (Williamson (1994), Edwards (1998)). We use the Pesaran and Smith (1995) standard Mean Group (MG) method to estimate the relationship between the REER and its fundamentals. The estimated equation is:

$$\begin{aligned} \ln\left(reer_{it}\right) = {} & \beta_{1,i}\ln\left(prod_{it}\right) + \beta_{2,i}\ln\left(open_{it}\right) \\ & + \beta_{3,i}\ln\left(gcons_{it}\right) + \beta_{4,i}nfa_{it} + \beta_{5,i}\ln\left(tot_{it}\right) + u_{it} \end{aligned} \tag{26}$$

With $\ln\left(reer_{it}\right)$ is the logarithm of REER where the ponderations are measured as (Imports + Exports) without oil countries; $\ln\left(prod_{it}\right)$ is the logarithm of total factor productivity at constant national prices, a proxy for the Balassa-Samuelson effect; $\ln\left(open_{it}\right)$ represents the logarithm of openness, (exports + imports) over GDP; $\ln\left(gcons_{it}\right)$ is the logarithm of general government final consumption expenditures over GDP; nfa_{it} constitutes net foreign assets over GDP; $\ln\left(tot_{it}\right)$ is the logarithm of terms of trade (exports prices over imports prices); u_{it} represents the unobservables which are function of group fixed effects and some white noise terms; the regressors in (26) are also function of some other group fixed effects and white noise terms. In equation (26), all parameters are expected to be positive, except the one for openness which is supposed to be negative. The parameters are also heterogeneous. After estimating equation (26), we multiply each parameter β_i by the corresponding Hodrick-Prescott filtered [2] fundamental given above. This result gives us the equilibrium REER (EREER). The REER misalignment is then computed according to the following formula:

$$misal_{it} = \frac{\ln(reer_{it})}{ereer_{it}} - 1 \tag{27}$$

In this last equation, a positive value of $misal_{it}$ represents an overvaluation.

3.2 Data and Variables

We need adequate time periods to estimate the parameters in our econometric models because our study permits slope heterogeneity through countries. Therefore we take account of only countries that have at least 30 successive years of observations. Similarly, we need a good number of countries to control for error cross-sectional dependence. Thus, the minimum number of countries is taken to be 17. Additionally, since we use the Hodrick-Prescott filter in the computation of REER misalignment, we need a balanced panel data. To satisfy all of these requirements we finished up with a sample of study that contains 37 countries [3]: 18 developed and 19 developing countries. We employ annual data from 1980 to 2011. The data essentially come from the World Bank (World Development Indicators, 2014), Centre d'Études et de Recherches sur le Développement International (CERDI, 2013) and the Penn World Tables 8.0. The REER is computed in foreign-currency terms meaning that an increase of the REER indicates an appreciation and, hence a potential loss of competitiveness. This way of formulating the REER allows us to be consistent through both of our theoretical and empirical models.

Before estimating the equilibrium real effective exchange rate (EREER), we run unit root tests on the REER and its fundamentals. Table 1 gives the results of the unit root tests for the variables expressed in level. In all tests, except the Hadri test, the null hypothesis

[2] The long-term trend.
[3] Except the regressions involving Tax Revenues which contain lots of missing values.

is that the panels contain unit roots [4], and the alternative is that the panels are stationary [5]. For the Hadri test, the null hypothesis is that all panels are stationary and the alternative is that some panels contain unit roots. The Levin, Lin and Chu, Harris-Tzavalis and the Breitung tests make the simplifying assumption that the panels are homogenous while the other tests assume that the panels are heterogeneous. We see that for each variable listed in Table 1, there exist at least one test that says that the variable may contain a unit root. Moreover Table 2 illustrates that these variables are potentially $I(1)$. This last result leads us to the issue of cointegration among these variables. This is why we perform cointegration tests between the REER and its fundamentals in Table 3. Hence Table 3 exhibits Pedroni's panel cointegration tests. In these tests, the first four present the within dimension while the others give the between dimension. Under the null hypothesis of no cointegration, all tests follow a $N(0, 1)$ distribution. Here we also see that there exist at least one test that demonstrates that the estimated equations between the REER and its fundamentals are cointegrated.

Table 4 gives the estimations results of the EREER. This table shows that all parameters have the expected signs and nearly all of them are statistically significant. Total Factor Productivity takes into account the Balassa-Samuelson effect. Its coefficient is positive meaning that an increase in productivity augments the REER. This is the Balassa-Samuelson phenomenon which states that productivity augments faster in the tradable than in the non-tradable sector. This rises wages in the tradable sector and hence wages in the non-tradable sector. This in turn causes an increase in domestic inflation and an appreciation of the REER. Openness have a negative impact on REER. In fact, restricted trade applies a downward pressure on the price of tradables relative to non-tradables, thus causing an REER appreciation. Government consumption have a positive effect on REER. Indeed, higher government demand for non-tradable goods augments their relative price instigating an appreciation of the REER. Net foreign assets exert a positive effect on the REER. In reality, an increase in net foreign assets induces an amelioration of the current account. Terms of trade act positively on REER. Literally, if the income effect take over the substitution effect, an increase in terms of trade enhances the trade balance. After estimating the parameters in Table 4, we compute the EREER and the REER Mis-

[4] Or all panels contain unit roots depending on the nature of the test.
[5] Or some/at least one panels are/is stationary depending on the nature of the test.

alignment according to the techniques described in subsection 3.1. The resulting REER Misalignment variables are then labeled REER Misalignment 1, 2, 3 and 4 in the same order as the equations in Table 4.

3.3 Econometric Results

In this part, we will present the main estimation results and the robustness analysis.

3.3.1 Main Estimation Results

Table 5 gives the estimation results of the relationship between REER misalignment and growth using the CS-DL estimator for all countries. All nine equations show that REER misalignment is statistically significant at all conventional levels and have the expected sign. This implies that an augmentation of REER misalignment reduces the growth rate. The aforementioned results, empirically corroborate what we have found theoretically in Propositions 3 and 4. In particular, this means that REER overvaluation decreases the real interest rate and pushes the agents to consume more today than tomorrow causing saving to decline and hence growth to diminish. Our econometric outcomes were also found by Sallenave (2010) and Elbadawi et al. (2012). Our findings illustrate that, the negative effect of REER misalignment on growth is robust to the introduction of different control variables. In fact, through the nine equations we have varied the introduction of the control variables but the coefficient of REER misalignment retains its expected sign and is always statistically significant. The magnitude of the effect of REER misalignment on growth is very high. Referring to regression (1), a change in REER misalignment by one standard deviation reduces the growth rate by 88.18%. This is a very high value, suggesting that REER misalignment has a huge damaging impact on growth. We observe that the standard errors of the coefficients of REER misalignment are relatively small. This implies that the corresponding confidence intervals, though not reported, are tinier meaning that the coefficients of REER misalignment are estimated with great precision. The number of observations and the number of countries are approximately stable in all nine equations, hence our panel is satisfactorily balanced and the phenomenon we are studying covers most of our sample. The results also highlight that growth is negatively influenced by government consumption and inflation.

Investment, terms of trade, financial development and openness act positively on growth. Here also, these outcomes concerning the control variables were found by many empirical growth studies.

In Table 6 we incorporate the effect of taxes in our CS-DL estimations. Firstly, we notice that the number of observations is lower compared to our main regressions. This is because the variable tax revenue have lots of missing values [6]. However we are left with a good number of observations on which we can conduct statistical inference. Secondly, we use tax revenue as a proxy of taxes on tradable and non-tradable investments since theses latter two measurements are very hard to obtain. Referring to equation (3) and taking the logarithm of the tax revenue variable at its mean, a change of REER misalignment equivalent to one standard deviation, reduces the growth rate by 146.36%. This is 1.66 times the effect of REER misalignment that we found in our main growth regressions. We deduce that the negative impact of REER misalignment on growth is exacerbated when the economy is taxed. That is, the more we increase taxes, the more the growth rate is hindered by REER misalignment. Taxes taken alone have also a damaging effect on growth. As depicted by equation (2), an increase in taxes by 1% diminishes the growth rate by 0.371%. This last result roughly corroborates what we found theoretically in Propositions 5 and 6. The results also illustrate that human capital and investment act positively on growth.

In Table 7, we take into account the possibility of a non-linear effect of REER misalignment on growth. All nine equations show that REER misalignment and its square are negative and statistically significant. Here also, our two variables of interest are robust to the introduction of control variables because we have mixed the introduction of control variables but the coefficients of REER misalignment and its square keep their signs and continue to be significant in all equations. The results demonstrate that not only small values of REER misalignment hinder growth but also large values have even more damaging impact on growth. Based on equation (8), if we start from the mean of REER misalignment and assume a change of this variable equivalent to one standard deviation, from this point, we see the growth rate declining by 165.03%. This is 1.87 times the effect of REER misalignment that we found in our main regressions. Hence it is a

[6] We could not obtain a tax revenue variable which contains less missing values.

huge fall. The number of observations and the number of countries are approximately the same as in our main regressions. Inflation and government consumption continue to have negative effects on growth while openness, investment and terms of trade affect growth positively.

3.3.2 Robustness Analysis

The results in Table 8 illustrate that REER misalignment acts negatively and significantly on growth in the developed countries. As in the main estimations, we observe that the effect of REER misalignment is very large. The number of observations and the number of countries nearly represent the half of those we have in the main regressions. Hence they are fairly reasonable and we have a good representative subsample. As in the main regressions, government consumption and inflation affect growth negatively whereas openness has a positive impact on growth. The results we found in the main estimations are thus maintained for the developed countries.

Table 9 presents the results of the estimations for the developing countries. Similarly to the previous regressions, REER misalignment influences negatively economic growth. As in the main estimations, the effect of REER misalignment is very high. Consequently REER misalignment is very harmful to developing countries. The coefficients of REER misalignment are roughly stable in all nine equations. As for the developed countries, the number of observations and the number of countries are fairly reasonable. Also identically to the advanced economies, the results for the developing countries corroborates those found in our main regressions. Inflation and government consumption continue to have a negative impact on growth while openness, financial development, terms of trade, investment and human capital positively affect growth.

In Table 10, we provide the estimation results using the alternative measures of REER misalignment. We have taken equation (5) of the main results in Table 5 and included one by one the alternative measurements of REER misalignment calculated from Table 4. We see that all the three misalignment variables affect negatively and significantly economic growth. As in the main results, the effect of REER misalignment is very high and is approximately similar to its magnitude in equation (5) of Table 5. The standard errors of the coefficients of REER misalignment are relatively small, suggesting a high degree of precision in the estimation of the coefficients. Also these coefficients remain stable across all three equations. The number of observations and the number of countries are comparable to the ones we have in the main regressions. All the control variables are statistically significant and have the expected signs. The results found here suggest that changing the way the REER misalignment is computed does not alter the conclusions we found in our main estimations.

The results in Table 11 exhibit the estimations of the effect of misalignment on growth when we consider more lags of REER misalignment and its transformations. We see that REER misalignment continue to have a negative and significant impact on growth. The magnitude of the effect of REER misalignment is still large but is slightly smaller than those of most of the coefficients we found in our main regressions. Here also the results show that even after controlling for more lags of REER misalignment and its transformations [7], the conclusions of our main results do not globally change.

[7] i.e. more dynamics.

4 Conclusion

This paper examines the relationship between RER and economic growth both theoretically and empirically. The theoretical part shows that RER appreciation hinders the growth rate in the centralized and competitive economies. Taxes have also a negative impact on growth. Using new developments on nonstationary heterogeneous dynamic cross-section dependent panel data techniques, we find that REER misalignment has a strong negative impact on growth. A change in REER misalignment by one standard deviation reduces the growth rate by 88.18%. Furthermore, very large misalignments have more damaging effects on growth. The robustness checks illustrates that the negative impact of REER misalignment on growth is stable to the use of alternative measurements of REER misalignment and on subsamples of developed and developing countries.

Though the results found were informative, some extensions could be made. If data on both taxes on tradable and non-tradable investments were available, some regressions on these two variables would allow us to test more precisely Propositions 5 and 6. Some studies of threshold effects in the context of the CS-DL Estimator could also provide helpful information on the nonlinear impact of REER misalignment on growth. Concerning the theoretical model, a three-good approach of RER could also give us more insights on how the RER affect growth. These avenues of research are left for our future studies.

From economic policy perspectives, the results illustrate that RER mismanagements, in particular REER misalignment could have negative impacts on growth and that efforts made to reduce them might relaunch saving, investment and growth.

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A Proof of the second part of Proposition 1

The profits are given by:

$$\pi fs\,(t) = Ak_T\,(t)^{\alpha}\,k_N\,(t)^{1-\alpha} - R_T\,(t)\,k_T\,(t) - \epsilon\,R_N\,(t)\,k_N\,(t)$$

Where $R_T\,(t)$ and $R_N\,(t)$ are the gross interest rates in each sector. Maximizing profits with respect to $k_T\,(t)$, we get:

$$R_T\,(t) = Ak_T\,(t)^{-1+\alpha}\,\alpha\,k_N\,(t)^{1-\alpha}$$

Now combining this last equation with (13) and taking account of the fact that $r_T\,(t) = R_T\,(t) - \delta$, and performing some algebra, we have:

$$r_T\,(t) = A\left(\frac{\alpha\,\epsilon}{1-\alpha}\right)^{-1+\alpha}\alpha - \delta$$

■

B Proof of Proposition 2

Combining the production function (4) and equation (13) and doing some algebra, we get:

$$y\,(t) = A\left(\frac{\alpha\,\epsilon}{1-\alpha}\right)^{-1+\alpha}k_T\,(t)$$

$$y\,(t) = A\left(\frac{\alpha\,\epsilon}{1-\alpha}\right)^{\alpha}k_N\,(t)$$

■

C Proof of Proposition 3

We set $\gamma = \frac{\frac{d}{dt}c(t)}{c(t)}$ and calculate:

$$\frac{\partial}{\partial\epsilon}\gamma = \frac{A\,(-1+\alpha)\,\alpha}{\sigma\,\epsilon}\left(\frac{\alpha\,\epsilon}{1-\alpha}\right)^{-1+\alpha}$$

In this last equation, since $\alpha < 1$, the expression $-1+\alpha$ is negative and all the other expressions are positive. Hence $\frac{\partial}{\partial \epsilon}\gamma < 0$.

■

D Proof of Proposition 4

We set $\gamma = \frac{\frac{d}{dt}c(t)}{c(t)}$ and calculate:

$$\frac{\partial}{\partial \epsilon}\gamma = \frac{A\alpha^{\alpha}(-1+\alpha)}{\epsilon\,(1+\tau_T)\,\sigma}\left(-\frac{\epsilon}{(-1+\alpha)(1+\tau_T)}\right)^{-1+\alpha}$$

In this last equation, since $\alpha < 1$, the expression $-1+\alpha$ is negative and all the other expressions are positive. Hence $\frac{\partial}{\partial \epsilon}\gamma < 0$.

■

E Proof of Proposition 5

We set $\gamma = \frac{\frac{d}{dt}c(t)}{c(t)}$ and calculate:

$$\frac{\partial}{\partial \tau_T}\gamma = -\frac{A\alpha^{\alpha}\alpha}{(1+\tau_T)^2\,\sigma}\left(-\frac{\epsilon}{(-1+\alpha)(1+\tau_T)}\right)^{-1+\alpha}$$

The right hand side of this equality is negative because it is preceded by a minus sign and all of its remaining compound expressions are positive. Hence $\frac{\partial}{\partial \tau_T}\gamma < 0$.

■

F Proof of Proposition 6

Going through the same process as for the Proof of Proposition 5, we get $\frac{\partial}{\partial \tau_N}\gamma < 0$.

■

G Tables of the Empirical Investigations

Table 1: Panel Unit Root Tests of the Variables in Level

Variables	Levin-Lin-Chu	Harris-Tzavalis	Breitung	Im-Pesaran-Shin	Fisher-Type Tests	Hadri
REER	-3.9629	0.8543	-0.0684	-1.5183	118.3441	55.5482
	(0.0000)	(0.0002)	(0.4727)	(0.0645)	(0.0008)	(0.0000)
Total Factor Productivity	-5.6022	0.9332	5.2792	-1.3780	148.8802	91.0492
	(0.0000)	(0.9389)	(1.0000)	(0.0841)	(0.0000)	(0.0000)
Terms of Trade	-2.5352	0.8740	-0.2233	0.6144	88.5872	60.6851
	(0.0056)	(0.0123)	(0.4117)	(0.7305)	(0.1186)	(0.0000)
Openness	0.0065	0.9187	0.4807	2.6087	61.6831	79.8804
	(0.5026)	(0.7302)	(0.6847)	(0.9955)	(0.8459)	(0.0000)
Government Consumption	-3.8060	0.8801	0.0206	-1.1689	123.8603	56.7384
	(0.0001)	(0.0316)	(0.5082)	(0.1212)	(0.0003)	(0.0000)
Net Foreign Assets	-0.1374	0.8857	2.1116	4.7880	65.9136	81.4858
	(0.4454)	(0.0674)	(0.9826)	(1.0000)	(0.7374)	(0.0000)

The p-values are in parenthesis.

Table 2: Panel Unit Root Tests of the Variables in First Difference

Variables	Levin-Lin-Chu	Harris-Tzavalis	Breitung	Im-Pesaran-Shin	Fisher-Type Tests	Hadri
REER	-12.6202	0.0972	-10.8334	-15.9943	468.1702	1.1581
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.1234)
Total Factor Productivity	-12.7148	0.2087	-11.3859	-14.4296	445.5769	7.3797
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Terms of Trade	-14.7917	-0.0486	-12.4507	-17.8681	582.9731	0.6326
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.2635)
Openness	-15.7832	0.0064	-14.1022	-17.8504	529.7298	-1.0225
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.8467)
Government Consumption	-13.7062	0.0845	-12.5530	-16.3653	476.5463	0.5167
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.3027)
Net Foreign Assets	-8.5072	-0.3011	-13.3788	-16.4452	414.2475	-2.9369
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.9983)

The p-values are in parenthesis.

Table 3: Pedroni Panel Data Cointegration Tests (all test statistics are distributed $N(0,1)$, under a null of no cointegration, and diverge to negative infinity, save for panel v)

Pedroni Panel Cointegration Tests		(1)	(2)	(3)	(4)
Panel Cointegration Tests	panel v-stat	-0.4265	-0.7258	-0.7237	-1.0400
	panel rho-stat	1.0270	2.0350	1.3870	2.4490
	panel t-stat	-0.2811	-0.0348	-1.0770	-0.7612
	panel adf-stat	1.9410	2.0720	1.1130	1.8430
Group Mean Cointegration Tests	group rho-stat	2.7310	4.0840	2.5160	3.9980
	group t-stat	0.3130	0.7332	-1.7010	-1.2390
	group adf-stat	2.2650	3.1320	0.9579	2.3270

Table 4: Estimation of the Equilibrium Real Effective Exchange Rate (EREER)

Dependent Variable: Real Effective Exchange Rate (REER)				
Regressors	(1)	(2)	(3)	(4)
Total Factor Productivity	0.441**	0.490***	0.475***	0.550***
	(0.210)	(0.168)	(0.169)	(0.126)
Openness	-0.295***	-0.365***	-0.344***	-0.354***
	(0.0601)	(0.0570)	(0.0558)	(0.0475)
Government Consumption	0.293**	0.336***	0.361***	0.385***
	(0.131)	(0.114)	(0.0987)	(0.0963)
Net Foreign Assets		0.318*		0.179
		(0.183)		(0.156)
Terms of Trade			0.289**	0.289**
			(0.139)	(0.132)
Constant	0.555**	0.527**	0.642***	0.650***
	(0.270)	(0.260)	(0.206)	(0.209)
Observations	1,184	1,184	1,184	1,184
Number of Countries	37	37	37	37

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 5: Estimation of the Long-Run Effects Using the CS-DL Estimator for all Countries

Dependent Variable: Real GDP per Capita									
Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
REER Misalignment 4	-0.0868***	-0.0446**	-0.0822***	-0.0508*	-0.0642**	-0.0698**	-0.0509*	-0.0657**	-0.0556*
	(0.0303)	(0.0221)	(0.0273)	(0.0281)	(0.0283)	(0.0334)	(0.0293)	(0.0308)	(0.0299)
Government Consumption	-0.327***	-0.169***	-0.321***	-0.279***	-0.243***		-0.185***	-0.230***	-0.170***
	(0.0928)	(0.0549)	(0.0699)	(0.0673)	(0.0594)		(0.0525)	(0.0631)	(0.0650)
Inflation	-0.250*					-0.0334		-0.00213	-0.00295
	(0.138)					(0.135)		(0.103)	(0.120)
Investment		0.247***			0.224***		0.225***	0.224***	0.225***
		(0.0328)			(0.0289)		(0.0303)	(0.0337)	(0.0322)
Terms of Trade			0.209**	0.221**	0.242***	0.272**	0.187**	0.292***	0.198**
			(0.0965)	(0.0995)	(0.0906)	(0.126)	(0.0906)	(0.105)	(0.0982)
Financial Development				0.0599*		0.0637***	0.00739		0.00112
				(0.0306)		(0.0231)	(0.0318)		(0.0368)
Openness						0.0909*			
						(0.0545)			
Constant	-1.119	-0.847	-0.828	-0.290	-0.931	0.511	-1.069	-1.057	-0.671
	(1.149)	(1.159)	(1.097)	(1.145)	(1.240)	(1.632)	(1.230)	(1.382)	(1.269)
Observations	1,147	1,147	1,147	1,124	1,147	1,124	1,124	1,147	1,124
Number of Countries	37	37	37	37	37	37	37	37	37

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 6: Estimation of the Long-Run Effects Using the CS-DL Estimator Taking Taxes into Account

Dependent Variable: Real GDP per Capita			
Regressors	(1)	(2)	(3)
REER Misalignment 4	-2.820**	-0.153*	-2.828*
	(1.376)	(0.0796)	(1.546)
Tax Revenue	-1.403*	-0.371***	-1.635*
	(0.846)	(0.109)	(0.848)
REER Misalignment 4 * Tax Revenue	-1.532*		-1.471*
	(0.906)		(0.854)
Human Capital Index	3.692*		6.508*
	(1.965)		(3.324)
Investment		0.191***	
		(0.0553)	
Financial Development		-0.0536	
		(0.0521)	
Government Consumption			-0.137
			(0.217)
Constant	1.506	-0.635	1.576
	(2.358)	(1.829)	(4.386)
Observations	397	317	206
Number of Countries	22	17	10

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 7: Estimation of the Long-Run Effects Using the CS-DL Estimator: Considering Nonlinearity

Dependent Variable: Real GDP per Capita									
Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
REER Misalignment 4	-1.009*	-0.820*	-0.423**	-0.644**	-0.414*	-0.306**	-0.470*	-0.491**	-0.336*
	(0.586)	(0.495)	(0.178)	(0.295)	(0.217)	(0.148)	(0.258)	(0.230)	(0.173)
REER Misalignment 4 Squared	-0.445*	-0.383*	-0.202**	-0.300**	-0.187*	-0.120*	-0.231*	-0.200*	-0.132*
	(0.262)	(0.232)	(0.0837)	(0.147)	(0.0978)	(0.0690)	(0.130)	(0.103)	(0.0750)
Openness	0.128	0.0310	-0.0223		-0.0240	0.0388	0.00756	0.0237	0.0852*
	(0.0857)	(0.0719)	(0.0550)		(0.0614)	(0.0568)	(0.0555)	(0.0684)	(0.0499)
Inflation	-0.306*			0.119	-0.328***			-0.231***	-0.295*
	(0.165)			(0.126)	(0.102)			(0.0837)	(0.169)
Government Consumption		-0.262***	-0.196***	-0.342***	-0.133	-0.194***	-0.146**	-0.126	-0.225***
		(0.0752)	(0.0682)	(0.0645)	(0.0890)	(0.0648)	(0.0625)	(0.0898)	(0.0809)
Investment			0.196***		0.223***	0.191***	0.205***	0.221***	
			(0.0298)		(0.0348)	(0.0287)	(0.0298)	(0.0321)	
Human Capital Index				-0.961			-0.832		0.243
				(0.835)			(0.557)		(0.764)
Terms of Trade						0.168**		0.0725	
						(0.0766)		(0.0861)	
Financial Development									-0.0198
									(0.0344)
Constant	-0.798	-2.664	-0.826	1.261	0.433	-0.155	1.042	0.473	2.051
	(1.676)	(1.658)	(1.147)	(0.972)	(1.303)	(1.245)	(1.370)	(1.304)	(1.510)
Observations	1,147	1,147	1,147	1,147	1,147	1,147	1,147	1,147	1,124
Number of Countries	37	37	37	37	37	37	37	37	37

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 8: Estimation of the Long-Run Effects Using the CS-DL Estimator for the Developed Countries

Dependent Variable: Real GDP per Capita				
Regressors	(1)	(2)	(3)	(4)
REER Misalignment 4	-0.0761**	-0.0780*	-0.0874**	-0.116*
	(0.0341)	(0.0414)	(0.0422)	(0.0628)
Human Capital Index				-0.900
				(0.822)
Government Consumption	-0.270**	-0.247***	-0.223***	-0.317***
	(0.107)	(0.0938)	(0.0857)	(0.113)
Openness				0.161*
				(0.0905)
Terms of Trade		0.0179		-0.109
		(0.139)		(0.198)
Inflation	-0.273*		-0.276*	-0.0985
	(0.158)		(0.144)	(0.215)
Financial Development			-0.0509	
			(0.0331)	
Constant	0.221	0.477	0.587	0.554
	(1.026)	(1.166)	(1.739)	(1.703)
Observations	558	558	543	558
Number of Countries	18	18	18	18

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 9: Estimation of the Long-Run Effects Using the CS-DL Estimator for the Developing Countries

Dependent Variable: Real GDP per Capita									
Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
REER Misalignment 4	-0.0668*	-0.135***	-0.0704**	-0.0973***	-0.0688*	-0.0688*	-0.0629**	-0.0479*	-0.0712**
	(0.0360)	(0.0476)	(0.0333)	(0.0360)	(0.0401)	(0.0357)	(0.0320)	(0.0281)	(0.0340)
Openness	0.118	0.258***	0.0948*	0.119**	0.128*	0.102**	0.0586		0.101**
	(0.0717)	(0.0954)	(0.0575)	(0.0543)	(0.0698)	(0.0518)	(0.0369)		(0.0452)
Inflation	-0.160*	-0.217*			-0.129	-0.181		-0.0804	-0.175
	(0.0907)	(0.119)			(0.127)	(0.166)		(0.0759)	(0.188)
Financial Development	0.109***		0.118***		0.120***				
	(0.0382)		(0.0430)		(0.0376)				
Terms of Trade		0.0778		0.107*	-0.0191	0.151***	0.149**	0.0823*	0.142**
		(0.0831)		(0.0546)	(0.0572)	(0.0512)	(0.0585)	(0.0447)	(0.0583)
Government Consumption			-0.0497	-0.0533			-0.119*		-0.0897
			(0.0614)	(0.0843)			(0.0637)		(0.0678)
Investment						0.180***	0.165***	0.159***	0.163***
						(0.0540)	(0.0385)	(0.0257)	(0.0474)
Human Capital Index								1.926*	
								(1.029)	
Constant	0.363	0.00468	0.677	-0.752	-0.103	0.321	-0.268	0.799	0.318
	(1.251)	(1.408)	(1.199)	(1.559)	(1.158)	(1.449)	(1.391)	(1.404)	(1.345)
Observations	581	589	581	589	581	589	589	589	589
Number of Countries	19	19	19	19	19	19	19	19	19

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10: Estimation of the Long-Run Effects Using the CS-DL Estimator with Alternative Measures of REER Misalignment

Dependent Variable: Real GDP per Capita			
Regressors	(1)	(2)	(3)
Government Consumption	-0.218***	-0.238***	-0.207***
	(0.0570)	(0.0558)	(0.0559)
Investment	0.222***	0.215***	0.214***
	(0.0267)	(0.0279)	(0.0269)
Terms of Trade	0.237***	0.243***	0.222**
	(0.0908)	(0.0880)	(0.0930)
REER Misalignment 1	-0.0445**		
	(0.0222)		
REER Misalignment 2		-0.0569**	
		(0.0228)	
REER Misalignment 3			-0.0616**
			(0.0270)
Constant	-0.860	-1.110	-0.800
	(1.209)	(1.251)	(1.224)
Observations	1,147	1,147	1,147
Number of Countries	37	37	37

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 11: Estimation of the Long-Run Effects Using the CS-DL Estimator Considering More Lags of REER Misalignment and its Transformations

Dependent Variable: Real GDP per Capita	
Regressors	(1)
REER Misalignment 4	-0.0490*
	(0.0288)
Constant	-0.284
	(0.997)
Observations	1,073
Number of Countries	37

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$