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Currency misalignments and economic growth: the foreign currency-denominated debt channel

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Abstract

The literature on the growth effects of currency misalignments, although prolific, revolves around two main axes: one the one hand, the export-oriented growth literature which attributes positive effects to undervaluations (competitiveness gains) and, on the other hand, the *Washington Consensus* view according to which any deviations from equilibrium hamper economic growth. In this paper, we show that there is no "one size fits all" relationship in this regard. Indeed, relying on a panel of 72 developing and emerging countries, we evidence the existence of a foreign currency-denominated debt channel through which misalignments impact growth. Compared to the "traditional" competitiveness channel, this channel works in the opposite direction. The paper therefore reconciles the two strands of the literature: undervaluations may have indeed a positive growth effect, but it is crucial to take into account the possible costs related to this undervaluation to have a clearer picture of the net total effect.

Keywords: Currency misalignments; Economic growth; Foreign currency-denominated debt.

JEL Classification: F3, F43, C33, O11.

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1 Introduction

There is an ongoing debate on whether the real exchange rate (RER) level is truly a potential impediment to economic growth. There is as yet no agreement, and two positions can be identified. The so-called *Washington Consensus* (WC), coined by Williamson (1990), considers that the RER level should be consistent in the medium run with macroeconomic objectives to promote growth. It should therefore reach a level sufficient to ensure internal and external balance without exceeding a threshold above which it could lead to instabilities (e.g. inflation, resource depletions). Thus, the WC view argues in favour of a real exchange rate close to its equilibrium level, i.e. that satisfying both external and internal balances. Any misalignment, i.e. deviation from this equilibrium level, would be harmful for growth. The export-led growth theory, on the contrary, highlights the asymmetrical nature of misalignments, positing that economic growth is dampened by overvaluations while encouraged by undervaluations. This view is supported by several economists who illustrate the positive impact of undervaluation on growth by providing several transmission channels. For example, Elbadawi et al. (2009), Levy-Yeyati and Sturzenegger (2007), Rodrik (2008) state that this positive impact is channelled through respectively an increase in exports, an expansion of savings, of capital accumulation, and of investment as well as through learning-by-doing externalities in the tradable sector.

However, there are some good reasons to believe that the literature has not gone far enough in exploring this issue. Indeed, some key links —namely the interactions between the misalignments and macroeconomic variables, and the associated costs— are ignored by most studies and especially those in accordance with the arguments put forward by the export-oriented growth literature. For example, Grekou (2015) revisits the link between currency misalignments and economic growth by taking into account the foreign currency-denominated (FCD) debt dynamics for the CFA zone countries over the 1985-2011 period. His results show that the impact of currency misalignments on growth through the competitiveness channel is dampened by the foreign currency-denominated debt dynamics due to valuation effects. A real overvaluation and the subsequent deterioration of competitiveness, inhibits economic growth while, at the same time, it inversely fosters growth, by reducing the value of the FCD debt. Similarly, an undervaluation, while improving competitiveness, worsens the FCD debt position. The way currency misalignments could impact economic growth through these two antagonistic channels is thus of first importance for developing and emerging countries particularly vulnerable to exogenous economic shocks, with many vital export sectors, and important FCD debt levels.

In this paper we investigate the existence of this FCD debt channel —in parallel with the well-established competitiveness channel— in the currency misalignments-growth relationship. However, we go further from Grekou (2015) in three main ways: firstly, we consider a large sample of emerging and developing countries; secondly we use more adequate and robust methodological approaches; finally, as the countries of our sample differ in terms of exchange rate regimes, we include these latter in the analysis and assess their potential impact in the diffusion of valuation effects.

Our empirical analysis proceeds in three steps. In an initial stage, we resort to the Behavioral Equilibrium Exchange Rate (BEER) approach to assess currency misalignments. Then, after determining the growth determinants —using a Bayesian analysis, we empirically analyze how currency misalignments affect economic growth with an emphasis on the two aforementioned transmission channels. To this end, we use panel estimators (fixed/random effects) and test the robustness of our results using system generalized method of moments (SGMM). In a final section, we extend the earlier analyses by addressing more adequately the issue of heterogeneity among the countries in regard to the currency misalignments-growth relationship. To tackle this last issue, we rely on least squares dummy variable (LSDV) models with country-specific effects — on the variables of interest.

Considering a panel of 72 countries — over the 1980-2012 period, our empirical analysis provides mixed results regarding the competitiveness channel. Indeed, while panel results argue in favour of the *Washington Consensus* view —i.e. a negative impact of both under- and overvaluations on growth, results derived from LSDV models with country-specific effects are less clear-cut. However, the most striking feature of our results is that both analyses support the existence of a FCD debt channel, more prominent in the case of undervaluations. Overall, this paper reconciles the WC view and the export-oriented growth literature: indeed, if an undervaluation of the real exchange rate can foster growth, it also induces some negative valuation effects that may limit the initial competitiveness gains.

The paper proceeds as follows. In the next section, we review the literature on the impact of currency misalignments on economic growth and lay the underpinning foundations for our FCD debt channel. Section 3 presents our methodologies and describes the data. The results of our econometric analysis are given and discussed in Section 4. The last section provides concluding remarks.

2 Theoretical considerations and related literature

2.1 Currency misalignments and economic growth

The extensive literature addressing the issue of the growth effect(s) of currency misalignments, usually considers currency misalignments as a serious threat to growth as they induce distortions in relative prices of non-traded to traded goods. This latter assertion has been empirically proven since the early works of Cavallo et al. (1990) and Ghura and Grennes (1991) which argue that better economic performances are usually linked to lower levels of real exchange rate misalignments. This is also the observation of international organisations which, with the "*Washington Consensus*", have maintained that both under- and overvaluations situations were bad for growth. The basic idea behind this statement is that the equilibrium level of the real exchange rate, by satisfying both internal and external balances, maximizes economic growth. If any deviation of the real exchange rate from this equilibrium level may have some benefits, it could also have costs: undervaluations may lead to overheating and unnecessary inflationary pressures while overvaluations may cause external imbalances. This view has been recently supported by results evidenced by Berg and Miao (2010) and Schröder (2013). The literature on the global imbalances (see, among others, Blanchard and Milesi-Ferretti, 2011) sheds more light on the need to limit currency misalignments and therefore also falls within this scope.

However, this strand of the literature has also been debated in the literature, being matched by the questioning of the *Washington Consensus*. Indeed, another view has progressively emerged maintaining that, beyond the size of misalignments, the effects of currency misalignments on growth could depend on the nature of these misalignments, i.e. depend on whether currencies are under- or overvalued. In particular, the export-oriented growth literature tempers the WC view, by pointing to asymmetrical impacts of misalignments on economic growth. Collins and Razin (1997) and Aguirre and Calderón (2005), show that nonlinearities are inherent to the currency misalignments-growth link: economic growth is positively correlated with undervaluations while negatively impacted by overvaluations. This result has been reinforced by several studies based on regime switching models (see for instance, Béreau et al., 2012; Couharde and Sallenave, 2013). To support the idea of a positive growth effect of undervaluations, some studies suggest a number of transmission channels. Among them, Rodrik (2008) argues that undervaluation has a positive effect on the relative size of the tradable sector, and especially of industrial economic activities which in turn may boost growth. For Elbadawi et al. (2009), the positive effect of undervaluations operates through export diversification and sophistication. Gala (2008) also supports the export-led growth theory but in his view, investment and technological change are the two important channels through which exchange rates levels affect growth.[1] A relatively undervalued currency should lead to lower real wage levels and higher profit margins and then contribute to more employment and investment by increasing capacity utilization. In the same vein, Gluzmann et al. (2011), in line with the work of Levy-Yeyati and Sturzenegger (2007), suggest that undervaluation fosters growth by the channel of savings and investment rather than foreign trade dynamics: an undervalued exchange rate tends to increase the investment and the domestic saving rate, which in turn stimulate economic growth by increasing the rate of capital accumulation.

2.2 The foreign currency-denominated debt channel

The different transmission channels aforementioned are so far those discussed in the literature. However, although less explored, there are reasons to believe that the effects of currency misalignments on growth might also be channelled by the debt and more precisely by the foreign currency-denominated debt through valuation effects.[2] With the inclusion of a FCD debt channel, two antagonistic effects can be associated to currency misalignments. Separating the growth effects of under- and overvaluation, it can be expected that overvaluation entails a competitiveness loss and therefore hampers growth (competitiveness channel), while at the same time it also fosters growth by reducing the FCD debt (FCD debt channel; positive valuation effects).[3] In a similar way, undervaluation could entail, in addition to the competitiveness gain, an increase in the FCD debt burden (negative valuation effects). Ignoring these interactions between currency misalignments and the FCD debt could thus considerably blur our perception of the overall effect of currency misalignments. This is especially true for developing —and probably in a lesser extent for emerging— countries which are subject to balance sheet effects due

[1] A relatively undervalued currency may also help to avoid financial crises and therefore put the economy on a more sustained development path.

[2] As aforementioned, the existence of this FCD debt channel in the currency misalignments-growth nexus, has been, to the best of our knowledge, addressed by Grekou (2015) —but only for the CFA zone countries. Most studies on valuation effects —and their output effects— concentrate on real exchange rate movements during currency crises (Céspedes, 2005; Frankel, 2005).

[3] We do not discuss the effects of debt on growth. For a discussion on the effects of debt —namely the debt overhang theory, we refer to Cordella et al. (2005) and Patillo et al. (2011).

to their currency variations and their important FCD debt stocks (Calvo and Reinhart, 2001; Céspedes et al., 2004). The depreciation of the domestic currency considerably increases the FCD debt burdens, leading thus to a decrease in firms production because of corporate financial distress, absence of trade credit and increasing costs of imported inputs and goods. These balance sheet effects furthermore weaken the government fiscal position and the banks' balance sheets. Conversely, an appreciation reduces the value of the FCD debt and improves the ability to borrow. These balance sheet effects are inherent to developing/emerging countries as they generally cannot borrow in their own currencies (phenomenon better known as the "original sin"; see Eichengreen and Hausmann, 1999) and have therefore an important FCD debt stock. The causes of this situation are manifold but are primarily related to the financial markets development, the credibility of national macroeconomic policies and to institutional factors (Ul Haque, 2002; Goldstein and Turner, 2004). The exchange rate variations —and therefore misalignments— have important interactions with the FCD debt. Indeed, because external liabilities are more heavily denominated in foreign currency, the undervaluation of the currency against other currencies results in an increase of the domestic value of external liabilities. Ignoring these valuation effects could therefore produce spurious results when assessing the misalignments-growth relationship.

An other key issue when dealing with identifying the diffusion of valuation effects on growth that has not received sufficient attention in the literature is how exposure to valuation effects on FCD debt may be impacted by the exchange rate regime (ERR, hereafter). The reason why this relationship matters is that basic economic theory tells us that the ERR might operate both directly on the valuation effects of FCD debt stocks and indirectly through the real exchange rate dynamics.

As stressed by Dubas (2009) and Coudert et al. (2011), fixed ERR countries and more specifically pegged currencies tend to exhibit relatively important misalignments. They are therefore more exposed to valuation effects related to movements in the anchor currency. Moreover, as these countries benefit from credibility —conventionally associated to their irrevocable commitment to a fixed ERR— and guaranteed convertibility of their currency, they are more likely to borrow on financial markets. On the other hand, floating ERR are generally associated with higher volatility of the exchange rates in short-medium run —due to its sensitivity to expectations and news. Furthermore, putting together speculation with the observed hysteresis in exchange rate, the whole in an increasing financial integration context, the deviations are not corrected in the short/medium run and may even be exacerbated by further irrational behaviors. As a consequence, this short/medium run volatility is an important source of exchange rate misalignments, which may, under some circumstances, be even greater than under fixed ERR (Edwards, 1987). Thus, regarding this indirect effect of the ERR, one could expect less valuation effects for the ERR minimizing currency misalignments.

Regarding the direct impact of the ERR on the valuation effects —on the FCD debt, one can infer that the valuation effects on the debt stock might be weaker for pegged ERR if a part of the debt is denominated in the anchor currency. As a matter of fact, the extent to which the debt is denominated in foreign currency(ies) is often seen as one of the sources of fear of floating (Calvo and Reinhart, 2002). Indeed, due to the peg of the domestic currency (this is especially true in case of hard peg), the anchor currency denominated debt does not vary; so the larger the FCD debt composition in the anchor currency, the lower the valuation effects. However, valuation effects also depend on the credibility of the peg (Bleaney and Ozkan, 2011) and on the variations of the anchor currency vis-à-vis third currencies —in case of a multiple currencies composition of the FCD debt. Fixed ERR can thus isolate the economy from these valuation effects if the composition of the foreign indebtedness is coherent with the anchor currency or the basket peg and if the ERR is credible enough. Conversely, for floats, the valuation effects are total. The ERR might therefore play a catalytic/isolating role in the diffusion of the valuation effects underpinning the FCD debt channel.

In view of this, it appears that the relationship between currency misalignments and economic growth is not as straightforward as it seems, especially when considering the FCD debt channel. In addition, the relationship may be complicated by the diffusion of valuation effects associated with the ERR.

3 Estimation strategy and data

3.1 Assessing equilibrium exchange rates

We rely on the Behavioral Equilibrium Exchange Rate (BEER; see Clark and MacDonald, 1998) approach to assess the equilibrium exchange rates — and thus currency misalignments.[4] Simply put, the BEER approach relies on a modelling approach that attempts to explain the actual behaviour of the real exchange rate in terms of relevant economic variables. To assess the equilibrium real exchange rate (ERER), the BEER ap-

[4]For brevity, the BEER approach is not presented in this section. For further details and related concepts (e.g. PPP, FEER, DEER, NATREX), we refer to Edwards and Savastano (2000) and Driver and Westaway (2005).

proach proposes to estimate a long run relationship between the observed real exchange rate and a set of *fundamentals*, i.e. variables influencing the real exchange rate in the long run. This set of fundamentals derives from various theoretical models. Among many, the works of Edwards (1988), Elbadawi (1994), Hinkle and Montiel (1999) and Elbadawi and Soto (2008) provided a suitable theoretical and empirical framework to investigate equilibrium real exchange rates and their fundamentals in developing and emerging countries. Following Grekou (2014), we consider the three fundamentals that have found to be the most significant among a set of potential fundamentals of real effective exchange rates for emerging and developing countries: *(i)* the terms of trade, *(ii)* the relative productivity —per capita, and *(iii)* the net foreign assets position.[5] As documented by previous studies, a positive relationship between the real effective exchange rate and each of those fundamentals is expected. As a result, the long run relationship to be estimated is the following:

$$reer_{i,t} = \mu_i \ + \ \beta_1 \ tot_{i,t} \ + \ \beta_2 \ rprod_{i,t} \ + \ \beta_3 \ nfa_{i,t} \ + \ \varepsilon_{i,t} \qquad (1)$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$ respectively indicate the individual and temporal dimensions of the panel. $reer_{i,t}$ is the real effective exchange rate (in logarithms), $tot_{i,t}$ is the logarithm of terms of trade, $rprod_{i,t}$ stands for the relative productivity (the Balassa-Samuelson effect) also expressed in logarithms, and $nfa_{i,t}$ is the net foreign asset position (in percentage of GDP). μ_i are the country-fixed effects and $\varepsilon_{i,t}$ is an error term.

To estimate equation (1) —once the cointegration prerequisites are fulfilled, we rely on the Cross Sectionally Augmented Pooled Mean Group (CPMG) estimator which, in addition to take into account the heterogeneity among the countries, has the advantage of providing consistent estimates of a long-run relationship in presence of cross-sectional dependencies.

The Cross Sectionally Augmented Pooled Mean Group (CPMG) methodology

[5] Grekou (2014) conducts a Bayesian analysis to select relevant real exchange rate fundamentals for a panel of 40 developing and emerging countries. Among a set of 8 potential —and commonly used— fundamentals (terms of trade, government spending, foreign direct investment, net foreign asset position, official development aid, openness, investment, and a measure of relative productivity), the terms of trade, the net foreign assets position and the relative productivity have proved to be the most significant fundamentals. Besides the robustness of the analysis, the results are even more interesting in the case of a growth analysis like here. Indeed, by ensuring a parsimony of the ERER determination model, they limit the collinearity/endogeneity/simultaneity problems, some exchange rate fundamentals being also growth determinants.

In panel data analysis, there are different alternative estimation procedures depending on the structure of the panel, the purpose of the study and above all, the extent to which they account for parameter heterogeneity. Conventionally, there are two class of procedure. The first one, known as Mean Group approach, consists in estimating separate relationships for each group and averaging the group specific coefficients. The second class consists of procedures based on the pooled estimator that allow only for the intercepts to differ across individuals (e.g. fixed/random effects (FE/RE)). The CPMG procedure (see Pesaran, 2006; Binder and Offermanns, 2007; Cavalcanti et al., 2012), as in its initial version, i.e. the PMG procedure (see Pesaran et al., 1999) lies between these two extremes since it combines both pooling and averaging.

The CPMG estimator is highly appealing for our purpose as it allows a greater degree of heterogeneity among the countries — compared to other panel procedures (FMOLS, DOLS). It only imposes the long-run coefficients to be homogeneous over the cross-sections, while it allows for heterogeneity for the other coefficients. It is therefore particularly suitable in our study (in terms of consistency and efficiency) since we are dealing with fairly heterogeneous countries.[6]

The CPMG estimator —as the PMG estimator— is based on an Autoregressive Distributed Lags (ARDL) model. However, the ARDL model is extended with the cross-sectional averages of the dependent variable and of the regressors in order to capture the common factors or the heterogeneous time effects. To be more precise, let us consider the following ARDL $(p, q, q, \ldots, q)$ model:

$$reer_{i,t} \; = \; \mu_i \; + \; \sum_{j=1}^{p} \lambda_{i,j} reer_{i,t-j} \; + \; \sum_{j=0}^{q} \delta'_{i,j} Fund_{i,t-j} \; + \; u_{i,t} \tag{2}$$

where $Fund_{i,t}$ is the $k1$ vector containing the real effective exchange rate fundamentals and $\delta_{i,j}$ the associated $k1$ coefficients' vector.

To allow for cross-sectional correlation of the error terms, we assume a multi-factor error structure for the error term $u_{i,t}$:

$$u_{i,t} \; = \gamma'_i \mathbf{f}_t \; + \; \varepsilon_{i,t} \tag{3}$$

where $\mathbf{f}_t$ is a vector of unobserved common shocks. The source of error term dependencies across countries is captured by the common factors $\mathbf{f}_t$, whereas the impacts of these

[6] The CPMG estimator corrects for both the shortcomings of homogeneous panels methods (FMOLS, DOLS) and the cross-sectional dependencies.

factors on each country are governed by the idiosyncratic loadings in γ_i. $\varepsilon_{i,t}$, the error component, is assumed to be distributed independently across i and t with zero mean, variance $\sigma_i^2 > 0$ and finite four moments; uncorrelated with the unobserved common factors nor the regressors. To capture/control for the common factors or the heterogeneous time effects —although they are modelled as unobservable—, we augment the ARDL model (2) with the cross-sectional averages of the model's observable variables. Combining (2) and (3) and averaging across i leads to:

$$\overline{reer}_t \; = \; \bar{\mu} \; + \; \sum_{j=1}^{p} \bar{\lambda}_j \; \overline{reer}_{t-j} \; + \; \sum_{j=0}^{q} \bar{\delta}_j^{'} \; \overline{Fund}_{t-j} \; + \; \bar{\gamma}' \, \mathbf{f}_t \; + \; \bar{\varepsilon}_t \tag{4}$$

where the variables with a bar denote the simple cross section averages of the corresponding variables in year t. The common factors can be captured through a linear combination of the cross-sectional averages of the dependent variable and the regressors:

$$\gamma_i^{'} \, \mathbf{f}_t = a_i^* \; \overline{reer}_t \; + \; b_i^{*'} \; \overline{Fund}_t \; + \sum_{j=0}^{p-1} c_{i,j}^* \; \Delta\overline{reer}_{t-j} + \sum_{j=0}^{q-1} d_{i,j}^{*'} \; \Delta\overline{Fund}_{t-j} \; + \; c_i \; \bar{\mu} \tag{5}$$

where $c_i = \frac{\gamma_i^{'}}{\bar{\gamma}}$; $a_i^* = c_i(1 - \sum_{j=1}^{p} \bar{\gamma}_j)$; $b_i^* = c_i(\sum_{j=0}^{q} \bar{\delta}_j)$; $c_{i,j}^* = c_i(1 - \sum_{m=j+1}^{p} \bar{\gamma}_m)$; $d_{i,j}^* = c_i(\sum_{m=j+1}^{p} \bar{\delta}_m)$.

Using (5) in (3), the error correction representation of (2) can be written as follows:

$$\begin{aligned}\Delta reer_{i,t} = \mu_i - c_i \; \bar{\mu} + \phi_i \; reer_{i,t-1} + \beta_i^{'} \; Fund_{i,t} + \sum_{j=1}^{p-1} \lambda_{i,j}^* \Delta reer_{i,t-j} + \sum_{j=0}^{q-1} \delta_{i,j}^{*'} Fund_{i,t-j} \\ + \; a_i^* \; \overline{reer}_t \; + \; b_i^{*'} \; \overline{Fund}_t \; + \sum_{j=0}^{p-1} c_{i,j}^* \; \Delta\overline{reer}_{t-j} + \sum_{j=0}^{q-1} d_{i,j}^{*'} \; \Delta\overline{Fund}_{t-j} \; + \varepsilon_{i,t}\end{aligned} \tag{6}$$

where $\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{i,j})$; $\beta_i = \sum_{j=0}^{q} \delta_{i,j}$; $\lambda_{i,j}^* = -\sum_{m=j+1}^{p} \lambda_{i,m}$; and $\delta_{i,j}^* = -\sum_{m=j+1}^{q} \delta_{i,m}$.

Hence the long-run relationship between the real effective exchange rate and its fundamentals is defined by:

$$reer_{i,t} = \left(\frac{\beta_i^{'}}{\phi_i}\right) Fund_{i,t} + \eta_{i,t} \tag{7}$$

Finally, as aforementioned, the CPMG estimator imposes the long-run coefficients to be the same across countries, i.e. $\theta_i = \theta$ for $i = 1, \ldots, N$ with $\theta_i = \frac{\beta_i}{\phi_i}$. This long-run homogeneity hypothesis can however be tested using the joint Hausman test.

3.2 Investigating the existence of the debt channel

To investigate the existence of the debt channel, we adopt a gradual and sequential approach. As a starting point, we begin by testing whether currency misalignments impact growth in a linear equation framework and for both level and absolute values of the misalignments. The equation is as follows:

$$\Delta y_{i,t} \; = \; \mu_i \; + \; \beta Mis_{i,t} \; + \; \Phi' X_{i,t} \; + \; u_{i,t} \tag{8}$$

where $i = 1, \ldots, N$ denotes the country, and $t = 1, \ldots, T$ the time. $\Delta y_{i,t}$, the dependent variable is the growth rate of real GDP per capita. $Mis_{i,t}$ is the currency misalignments and $X_{i,t}$ is a $k-$dimensional vector of growth determinants including our debt variable. μ_i represent the fixed individual effects, and $u_{i,t}$ is an independent and identically distributed error term.

We then extend equation (8) by adding the squared values of the currency misalignments in order to investigate the presence of nonlinearity in the growth-misalignments relationship.[7] The equation under consideration here is as follows:

$$\Delta y_{i,t} \; = \; \mu_i \; + \; \beta_1 Mis_{i,t} \; + \; \beta_2 Mis^2_{i,t} \; + \; \Phi' X_{i,t} \; + \; u_{i,t} \tag{9}$$

If the coefficient associated to the squared values of the misalignments is significant, we then examine how the non-linear effect of misalignments on economic growth varies, by splitting misalignments into under- and overvaluations, and by investigating their respective effect on growth. The equation is then:

$$\Delta y_{i,t} \; = \; \mu_i \; + \; \beta_1 Under_{i,t} \; + \; \beta_2 Over_{i,t} \; + \; \Phi' X_{i,t} \; + \; u_{i,t} \tag{10}$$

This baseline analysis is fully in line with that can be usually found in the literature. But as aforementioned, we extend this literature by including a FCD debt channel through which currency misalignments may affect growth. Our assumptions —and

[7] We do not make any assumptions about the kind of the nonlinearity. The main goal here is to see whether there exist nonlinearities in the relationship, and more importantly if the effects of under- and overvaluations significantly differ.

necessary conditions— for the existence of this FCD debt channel are as follows: *(i)* the impact of currency misalignments on growth is nonlinear; *(ii)* this impact is channelled through a competitiveness effect and a valuation effect; and *(iii)* this impact varies depending on the sign and the size of the currency misalignments. To examine how the growth impact of valuation effects varies as a function of misalignments, we then estimate an interaction model of the form:

$$\Delta y_{i,t} \;=\; \mu_i \;+\; \beta_1 Under_{i,t} \;+\; \beta_2 Over_{i,t} \;+\; \gamma\; Debt_{i,t} * Mis_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t} \tag{11}$$

or differencing undervaluations from overvaluations (on the valuation effects' side):

$$\begin{aligned}\Delta y_{i,t} \;=\; \mu_i \;+\; \beta_1 Under_{i,t} \;+\; \beta_2 Over_{i,t} \;+\; \gamma_1\; Debt_{i,t} * Under_{i,t} \\ +\; \gamma_2\; Debt_{i,t} * Over_{i,t} \;+\; \Phi' X_{i,t} \;+\; u_{i,t}\end{aligned} \tag{12}$$

Following equations (11) and (12), β_1 and β_2 capture the direct effects that under- and overvaluations exert on growth. A negative coefficient on undervaluations (resp. overvaluations) supports the hypothesis that undervaluations (resp. overvaluations) foster (resp. harm) growth. γ — or γ_1 and γ_2 (in equation (12)) — captures the effect of the foreign currency-denominated debt conditional to the currency misalignments, i.e. valuation effects. The significance of this/these coefficient(s) will allow us to conclude regarding the existence of valuation effects and therefore of a FCD debt transmission channel.

As mentioned in the previous section, an additional issue underlying this FCD debt channel is the role played by the exchange rate regime. Indeed, the exchange rate regime may have —or not— an amplifying/isolating effect in the diffusion of the valuation effects. To investigate this issue, we use an interaction term between the currency misalignments, the FCD debt variable and the exchange rate regime (ERR). Doing so, the equation to be estimated can be written as follows:

$$\Delta y_{i,t} \;=\; \mu_i + \beta_1 Under_{i,t} + \beta_2 Over_{i,t} + \gamma\; Debt_{i,t} * Mis_{i,t} * ERR_{i,t} + \Phi' X_{i,t} + u_{i,t} \tag{13}$$

To get deeper on this issue, we modify equation (13) in order to taking account the specific effects of any particular regime. The equation is therefore:

$$\Delta y_{i,t} = \mu_i \ + \ \beta_1 Under_{i,t} \ + \beta_2 Over_{i,t} + \gamma_j \sum_{j=1}^{m} Debt_{i,t} * Mis_{i,t} * Dum_j * ERR_{i,t} + \Phi' X_{i,t} \ + \ u_{i,t} \tag{14}$$

where Dum_j is a dummy variable scoring 1 for regime j (0 otherwise), and m the number of exchange rate regimes considered. As we want to examine the overall effect that any particular regime can exert on valuation effects, the effect of the exchange rate regime is not differentiated according to the nature of the misalignments (under- or overvaluations).

3.3 Data

Our panel consists of 72 developing and emerging countries and cover the 1980-2012 period. Our analysis relies on annual rather than 5-years averaged data. Indeed, even if working with averaged data presents the advantage to remove business cycle effects from the growth rate, it has the disadvantage to be costly in observations. We therefore opt for a relatively high number of degrees of freedom by using annual data. This choice is further motivated by the so-called Nickell's bias (1981) inherent to dynamic fixed effects model with a small time dimension (relative to the individual dimension). As we rely on annual data, the time dimension of the analysis (from 1980 to 2012) is sufficiently important so that the bias resulting from the use of basic panel data estimators is very weak, if not non-existent.[8] Finally, working with annual data eliminates the need to use average data of misalignments which can generate misleading time series and in turn leads to implausible results.

In the first stage of the analysis, to assess currency misalignments, we estimate a long run relationship between the real effective exchange rate and the terms of trade, the net foreign asset position, and the relative productivity per capita. All the series are in logarithms, except the net foreign assets position which is expressed as share of GDP. The real effective exchange rates are from the Bruegel's database and correspond to the weighted average of real bilateral exchange rate against 67 trade partners. We use the same weights and trade partners for the calculation of the relative productivity, proxied here by the relative real GDP per capita (in PPP terms). The terms of trade are from the WDI database (*World Development Indicators*, World Bank). The net foreign asset

[8] See Judson and Owen (1999) and Bun and Kiviet (2006).

positions are extracted from the Lane and Milesi-Ferretti database and completed using informations provided by IFS (*International Financial Statistics*, IMF) and WDI.

In the second stage, we proceed to the estimations of growth equations. The dependent variable is the real GDP per capita growth rate. Regarding the selection of explanatory variables, we resort to Bayesian Model Averaging (BMA) techniques to tackle the issue of model uncertainty.[9] Based on the BMA results, we retain 9 growth determinants among an initial set of 22 different potential determinants. First, we identify a robust effect of the "Solow determinants" and human capital variables namely, investment, population growth, life expectancy, age dependency ratio, and the initial level of GDP per capita. We also identify two macroeconomic policy variables as robust namely government consumption and the foreign currency-denominated debt.[10] Note that we use the external debt stocks, public and publicly guaranteed to proxy the FCD debt and that the construction of the countries sample has been driven by its availability.[11] Finally, the BMA identifies two other robust variables: *(i)* a measure of regional major episodes of political violence (REGCIV), and *(ii)* the foreign direct investment. In addition to these determinants, we include: *(i)* a dummy variable to account for the Initiative for Heavily Indebted Poor Countries (HIPC initiative), and *(ii)* the *de facto* exchange rate regime classification to take into account the effects that might be exerted by exchange rate regimes.[12]

The list of countries and the details regarding the data (definitions, measurements, and sources) are respectively provided in Tables A.1 and A.2 in Appendix A.

[9]See Appendix C.

[10]The identification of the FCD debt, our key variable of interest, as a robust growth determinant further underlines the importance of the transmission channel. Although we use two measures of the debt in the BMA analysis, we only use the debt (in real terms) expressed in logarithms —and not as share of GDP— for our analysis. This is done to purge the debt channel from the evolution of the GDP. Moreover, we use the entire FCD debt —and not a finer— measure as we seek to highlight an *exchange rate regime effect*.

[11]As an extra criterion, we selected countries with population greater than one million.

[12]We choose the *de facto* exchange rate regime classification as it reflects the country observed practices (on the basis of the exchange rate's flexibility and the existence of formal or informal commitments) and is therefore more suitable to account for the valuation effects. We here rely the Reinhart and Rogoff classification (see Ilzetzki, Reinhart, Rogoff (2011); IRR henceforth) and extend/fill the gaps using various issues of the *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* (IMF). See Table A.3 for the classification details.

4 Results

4.1 Estimating equilibrium exchange rates and assessing currency misalignments

As indicated by the panel unit root and cointegration tests (see Tables B.1.2 and B.1.3 in Appendix B), our series are integrated of order one and cointegrated. Consequently, we proceed to the estimation of the long run relationship between the real effective exchange rates and the fundamentals. To this end, as stated earlier, we use the Cross Sectionally Augmented Pooled Mean Group (CPMG) procedure. However, as a condition for the efficiency of the CPMG estimator is the homogeneity of the long run parameters across countries, we also rely on the Cross Sectionally Augmented Mean Group (CMG) approach and test the long run slope homogeneity. Table 1 presents the CPMG and CMG estimates as well as the Hausman test statistic examining panel heterogeneity.

According to the Hausman test, the long run homogeneity restriction is not rejected for individual parameters and jointly in all regressions. We therefore focus on the CPMG estimates.[13] The results in Table 1 appear consistent with the theory —and our conjectures— since the coefficients have the expected signs. Indeed, the real effective exchange rate appreciates in the long run with the increase in the relative productivity per capita, the improvement in the terms of trade and in the net foreign asset position.

Using the CPMG estimates, we calculate the equilibrium real exchange rates ($reer^*_{i,t}$) which correspond to the fitted value of $reer_{i,t}$ (see equation (1)). Currency misalignments are then obtained doing the difference between the observed real effective exchange rate and its equilibrium level:

$$Mis_{i,t} = reer_{i,t} - reer^*_{i,t} \qquad (15)$$

Following this definition, a negative sign indicates an undervaluation of the real effective exchange rate (i.e. $reer_{i,t} < reer^*_{i,t}$) whereas a positive sign indicates an overvaluation of the currency (i.e. $reer_{i,t} > reer^*_{i,t}$). Figures D.1 and D.2 in Appendix D display the evolution of the real effective exchange rates (observed and equilibrium levels) and the corresponding misalignments.

[13] The CMG procedure provides consistent estimates of the averages of long run coefficients, although they are inefficient if homogeneity is present. Under long run slope homogeneity, the CPMG estimates are consistent and efficient (Cavalcanti et al. 2012).

Table 1 — Estimation of the long-run relationship

Dependent variable:	D.reer			
Estimation method:	CPMG		CMG	
	Coef.	Z	Coef.	Z
Long-run dynamic				
$rprod$	0.343***	6.79	1.076*	1.94
tot	0.111***	3.65	0.015	0.10
nfa	0.233***	9.26	0.332***	2.72
$L.\overline{reer}$	0.676***	4.53	-1.454	-1.04
$\overline{rprod}$	-0.764***	-4.33	1.761**	2.52
$\overline{tot}$	0.692***	2.68	0.421	0.84
$\overline{nfa}$	0.041	0.85	-0.101	-0.54
Short-run dynamic				
$ec.$	-0.193***	-8.60	-0.569***	-17.57
$D.rprod$	-0.030	-0.23	0.004	0.02
$D.tot$	-0.059	-1.53	0.025	0.67
$D.nfa$	0.242***	5.29	0.084*	1.93
$D.\overline{reer}$	0.283***	3.34	0.349**	2.45
$D.\overline{rprod}$	0.077	1.62	-0.306**	-2.29
$D.\overline{tot}$	-0.081	-0.91	-0.191	-1.22
$D.\overline{nfa}$	0.022	0.62	0.143*	1.78
$Constant$	-0.523***	-8.58	1.513	1.23
Specification test				
Joint Hausman test[a]	13.09			
$[\chi^2(7)]$	[p-value = 0.07]			
No. Countries / No. Observations:	72 / 2296			

Notes: Symbols ***, **, and * denote significance at 1%, 5%, and at 10%. "D." (resp. "L.") is the difference operator (resp. the lag operator); "*ec.*" is the error correction term. The bars over the variables indicate the cross-sectional averages of these variables.
a: Null of long-run homogeneity

4.2 Misalignments and growth: main channel effects

In order to ensure that our results are robust, we run our different specifications by using system generalized method of moments (SGMM) —developed by Arellano and Bover (1995) and Blundell and Bond (1998), in addition to the fixed/random effects (FE/RE) estimators.[14] Table 2 presents our estimates of the different transmission channels that misalignments may have on economic growth. While they differ in magnitude, they are qualitatively the same, regardless of model specification and estimation method.

[14]GMM estimator is well suited to deal with endogeneity issues —inherent to growth equation. One source of endogeneity bias is the use of the lagged dependent variable as explanatory variable. But, as aforementioned the structure of our panel (N and T) makes it difficult to take position regarding the superiority/appropriateness of FE estimator or SGMM estimator. For the more skeptical, the SGMM estimator would provide robust estimates and would thus be appropriate.

Our first estimations are run without distinguishing between under and over-valuations and without any interaction term between debt and misalignments (equation 8). These latter are reported in the first six columns of Table 2 (columns 2.1 to 2.6). As can be seen, misalignments' coefficients are negative and significant, even when expressed in terms of absolute value, indicating that any deviations of the real exchange rates from their equilibrium level hurt growth. Therefore this result, which is in line with those evidenced by earlier works (Cavallo et al. 1990; Ghura and Grennes, 1991), tends to support the *Washington Consensus* view.

In order to determine whether the effect of misalignments on growth is non linear, we add the squared values of misalignments (columns 2.6 to 2.9). The coefficient is significant. As shown in columns 2.10 to 2.12, this result —a non linear relationship between misalignments and growth— is supported when regressing GDP growth separately on undervaluations and overvaluations. The coefficients associated to undervaluations and overvaluations are significant, respectively positive and negative, supporting that growth is adversely affected by misalignments, regardless of their signs. These findings are in line with those of Schröder (2013) and underscore our earlier result in support of the WC view. They thus provide some *prima facie* evidence against the "traditional" export-led growth literature supporting that undervaluations, by reinforcing competitiveness, promote economic growth. However, the coefficients associated to undervaluations are smaller than those of overvaluations suggesting that growth is more negatively impacted by overvaluations.[15]

Our discussion in section 2 also suggests that a key channel through which misalignments affect economic growth is given by valuation effects due to the existence of debt denominated in foreign currency. We hence proceeded to interact the debt variable with misalignments in the following specifications. This interaction term can thus be interpreted as a way to capture the indirect growth effects of misalignments through the FCD debt channel. The results are displayed in columns (2.13) to (2.15). In all regressions, the associated coefficients are highly significant, suggesting that currency misalignments play an important role for the marginal effect that the foreign currency-denominated debt has on economic growth. We subsequently interact undervaluations and overvaluations with the debt variable, given that the impact that valuation effects have on growth may also depends on the nature of misalignments.

[15] We avoid, at this stage of the analysis to take position in a peremptory fashion given the smallness of the coefficients which might be due to heterogeneity between the countries in regard to the currency misalignments-growth nexus. Note however that the issue of heterogeneity will be addressed further below.

Table 2 — Growth regressions

Dependent variable:	Real GDP per capita growth (Δy)								
	FE	RE	S.GMM	FE	RE	S.GMM	FE	RE	S.GMM
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)	(2.8)	(2.9)
Variables of interest									
Mis	-0.024***	-0.025***	-0.042***				-0.022***	-0.025***	-0.032***
	(-3.17)	(-3.88)	(-4.27)				(-2.90)	(-3.84)	(-3.07)
Mis^2							-0.012*	-0.009*	-0.010
							(-1.94)	(-1.69)	(-1.35)
$\|Mis\|$				-0.020***	-0.012**	-0.019*			
				(-3.07)	(-2.05)	(-1.82)			
Under									
Over									
Debt	-0.026***	-0.023***	-0.027**	-0.025***	-0.020***	-0.017	-0.027***	-0.023***	-0.026**
	(-2.94)	(-4.01)	(-1.98)	(-3.08)	(-3.45)	(-1.40)	(-3.18)	(-3.97)	(-2.19)
*Mis*Debt*									
*Under*Debt*									
*Over*Debt*									
Growth determinants									
l.y	-0.018***	-0.006***	-0.006	-0.022***	-0.006***	-0.010	-0.018***	-0.007***	-0.007
	(-3.63)	(-3.14)	(-0.54)	(-4.51)	(-3.16)	(-1.12)	(-3.87)	(-3.29)	(-1.05)
Invest	0.116***	0.113***	0.144***	0.122***	0.113***	0.126**	0.115***	0.113***	0.114**
	(4.92)	(5.36)	(2.99)	(5.14)	(5.19)	(2.30)	(4.95)	(5.35)	(2.19)
Pop	-0.259	-0.581*	-0.241	-0.249	-0.650**	-0.400	-0.255	-0.577*	-0.391
	(-0.99)	(-1.90)	(-0.65)	(-0.96)	(-2.07)	(-0.67)	(-0.98)	(-1.89)	(-0.57)
Life	0.378***	0.454***	0.314*	0.348***	0.448***	0.254	0.378***	0.458***	0.412
	(2.89)	(4.36)	(1.89)	(2.77)	(4.96)	(0.67)	(2.91)	(4.28)	(1.12)
age.dep	-0.035	0.004	-0.011	-0.055***	0.003	-0.033	-0.035	0.004	-0.015
	(-1.61)	(0.90)	(-0.31)	(-3.05)	(0.51)	(-0.78)	(-1.66)	(0.85)	(-0.48)
Fdi	0.043	0.072*	0.028	0.058	0.098***	0.071	0.046	0.074*	0.024
	(1.07)	(1.80)	(0.54)	(1.59)	(2.60)	(0.83)	(1.14)	(1.85)	(0.30)
Gov	-0.066	-0.068	-0.073	-0.066	-0.071	-0.152*	-0.069	-0.072	-0.091
	(-1.39)	(-1.46)	(-0.84)	(-1.36)	(-1.48)	(-1.71)	(-1.46)	(-1.54)	(-1.23)
REGCIV	-0.025*	-0.007	-0.004	-0.024*	-0.007	-0.013	-0.026*	-0.008	-0.006
	(-1.90)	(-0.75)	(-0.22)	(-1.75)	(-0.79)	(-0.87)	(-1.97)	(-0.87)	(-0.38)
HIPC	-0.003	-0.006	-0.009	0.005	0.003	0.005	-0.002	-0.005	-0.007
	(-1.44)	(-1.47)	(-1.57)	(1.08)	(0.70)	(0.65)	(-0.51)	(-1.34)	(-0.92)
Constant	0.293***	0.042*	0.098	0.404***	0.049*	0.243	0.298***	0.046*	0.143
	(2.53)	(1.67)	(0.46)	(3.97)	(1.72)	(1.09)	(2.65)	(1.82)	(0.87)
R-sq.	0.10	0.10		0.09	0.08		0.11	0.10	
Obs./ Countries	2219/72	2219/72	2222/72	2219/72	2219/72	2222/72	2219/72	2219/72	2222/72
$\beta_{Und} - \beta_{Over} = 0$									
AR(2) test			0.21			0.18			0.19
Hansen test			0.63			1.00			1.00

Notes: ***, **, and * denote the levels of statistical significance at 1, 5, and 10%. Robust t-statistics are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). For the S.GMM estimations, we consider REGCIV and HIPC as exogenous and the rest as endogenous. For the "AR(2) test" and "Hansen test", we report the p.values. In line "$\beta_{Und} - \beta_{Over} = 0$" we test the significance of the difference between the under- and overvaluation coefficients; we report the p.values.

Continued on next page

Table 2 — *Continued.*

Dependent variable:	Real GDP per capita growth (Δy)								
	FE (2.10)	RE (2.11)	S.GMM (2.12)	FE (2.13)	RE (2.14)	S.GMM (2.15)	FE (2.16)	RE (2.17)	S.GMM (2.18)
Variables of interest									
Mis				-0.007	-0.011*	-0.018**			
				(-0.91)	(-1.65)	(-2.05)			
Mis^2									
$\|Mis\|$									
Under	0.002***	0.004	0.001**				0.001***	0.001**	0.002**
	(5.59)	(0.81)	(2.16)				(5.05)	(1.86)	(2.00)
Over	-0.009**	-0.006	-0.008*				-0.007*	-0.004**	-0.008*
	(-1.97)	(-1.39)	(-1.85)				(-1.88)	(-1.93)	(-1.82)
Debt	-0.024***	-0.020***	-0.019**	-0.040***	-0.032***	-0.036***	-0.024***	-0.021***	-0.026***
	(-2.97)	(-3.61)	(-2.15)	(-5.01)	(-5.69)	(-3.06)	(-3.42)	(-3.87)	(-2.33)
*Mis*Debt*				-0.038***	-0.030***	-0.028**			
				(-3.35)	(-3.77)	(-2.11)			
*Under*Debt*							0.046**	0.050**	0.066***
							(2.31)	(2.34)	(2.84)
*Over*Debt*							-0.040	-0.051	-0.044
							(-1.03)	(-1.30)	(-1.07)
Growth determinants									
l.y	-0.022***	-0.006***	-0.004	-0.021***	-0.007***	-0.009	-0.020***	-0.005***	-0.008
	(-4.46)	(-3.11)	(-0.79)	(-4.38)	(-3.86)	(-1.32)	(-4.40)	(-3.18)	(-0.86)
Invest	0.122***	0.113***	0.124***	0.120***	0.113***	0.118*	0.127***	0.118***	0.141***
	(5.09)	(5.21)	(2.72)	(5.12)	(5.43)	(1.81)	(5.31)	(8.59)	(3.37)
Pop	-0.257	-0.652**	-0.716	-0.306	-0.584**	-0.387	-0.282	-0.644***	-0.248
	(-0.99)	(-2.07)	(-1.31)	(-1.17)	(-1.98)	(-0.59)	(-1.11)	(-4.93)	(-0.42)
Life	0.354***	0.448***	0.496**	0.396***	0.455***	0.207	0.351***	0.408***	0.275
	(2.82)	(5.05)	(2.11)	(3.33)	(5.04)	(0.44)	(3.07)	(3.81)	(0.71)
age.dep	-0.056***	0.003	-0.014	-0.043**	0.004	-0.010	-0.053***	0.005	-0.026
	(-2.92)	(0.55)	(-0.52)	(-2.15)	(0.82)	(-0.30)	(-2.92)	(1.08)	(-0.69)
Fdi	0.054	0.095**	0.065	0.026	0.064	0.028	0.043	0.093***	0.031
	(1.44)	(2.50)	(1.19)	(0.59)	(1.58)	(0.37)	(1.11)	(3.29)	(0.59)
Gov	-0.068	-0.072	-0.047	-0.074	-0.076*	-0.101	-0.074	-0.065***	-0.196***
	(-1.39)	(-1.49)	(-1.03)	(-1.61)	(-1.69)	(-1.07)	(-1.50)	(-3.24)	(-3.16)
REGCIV	-0.021	-0.006	0.004	-0.017	-0.005	-0.009	-0.019	-0.003	-0.011
	(-1.59)	(-0.70)	(0.28)	(-1.43)	(-0.63)	(-0.60)	(-1.48)	(-0.42)	(-0.67)
HIPC	0.004	0.001	0.003	-0.004	-0.006	-0.009	0.003	-6E-4	-2E-4
	(0.88)	(0.33)	(0.51)	(-0.89)	(-1.50)	(-1.33)	(0.65)	(-0.17)	(-0.04)
Constant	0.401***	0.045	0.104	0.345***	0.053**	0.134	0.376***	0.034*	0.205
	(3.83)	(1.59)	(0.70)	(3.29)	(2.25)	(0.86)	(3.86)	(1.94)	(0.95)
R-sq.	0.09	0.08		0.12	0.11		0.10	0.09	
Obs./ Countries	2219/72	2219/72	2222/72	2219/72	2219/72	2222/72	2219/72	2219/72	2219/72
$\beta_{Und} - \beta_{Over} = 0$	0.03	0.09	0.03				0.02	0.06	0.04
AR(2) test			0.56			0.19			0.29
Hansen test			0.88			1.00			0.99

Notes: ***, **, and * denote the levels of statistical significance at 1, 5, and 10%. Robust t-statistics are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). For the S.GMM estimations, we consider REGCIV and HIPC as exogenous and the rest as endogenous. For the "AR(2) test" and "Hansen test", we report the p.values. In line "$\beta_{Und} - \beta_{Over} = 0$" we test the significance of the difference between the under- and overvaluation coefficients; we report the p.values.

As can be seen (columns 2.16 to 2.18), the interaction terms are significant and positive for undervaluations, reflecting a negative valuation effect: the negative impact exerted by the level of debt on economic growth tends to increase when the currency is undervalued. Conversely, overvaluations tend to reduce the negative effect of debt on economic growth. However, the coefficient is not statistically significant —at least at conventional level.[16] Valuations effects seem therefore to be more prominent in undervaluations' regime than in overvaluations' one.[17]

Finally, regarding our full set of control variables, we first note that the effect of the FCD debt on economic growth is negative and significant, which is in accordance with the literature (see among others, Cordella et al., 2005; Patillo et al., 2011). We also note that the *initial GDP per capita* coefficient is negative and significant —in all but SGMM's estimates—, meaning that the conditional convergence hypothesis is verified. *Investment*, through its positive impact on capital accumulation, increases growth. The coefficients are positive and highly significant, regardless of model specification. *Life expectancy* and *foreign direct investment* — although less significant — also appear to be positively correlated with economic growth. Conversely, any increase in the demographic variables (i.e. *population growth rate*— and *age dependency ratio*) tends to hamper economic growth. However those variables are almost never significant.[18] The picture is also the same regarding *government consumption* and *REGCIV*. Finally, we do not find any significant impact of the HIPC initiative.

A last issue is to see whether/how the valuation effects —i.e. the interactions between misalignments and the FCD debt— are impacted by the exchange rate regime (ERR). We then control for the ERR by interacting the misalignments and the debt variable with the (*de facto*) exchange rate regime classification. Our results are reported in Table 3.

As it can be seen, the interaction term is highly significant, supporting the role of the ERR in the diffusion of valuation effects. The associated negative sign indicates that countries with more flexible ERR may experience less valuation effects —or of lesser importance.

To document this, we create dummies, using the *de facto* classification (six-way), in order to capture three categories of ERR —fixed, intermediate, flexible— and interact them with misalignments and the debt variable. The results are given in the last three

[16]A possible explanation for this "imbroglio" could be that of two antagonistic effects: overvaluations might indeed reduce the negative effect of the debt, but, at the same time, they could significantly reduce exports earnings which in turn worse the burden of servicing public debt. As a result, the debt increases (the competitiveness losses lead to a recurring indebtedness to finance the economy and to service debt). In the absence of statistical significance for our coefficients, one may conclude that the competitiveness/income effect outweighs the valuation effect.

[17]It is important to note that due to the data, we only capture a part of the valuation effects which in reality might be more important.

[18]By the way, note that the fact that some growth determinants are not significant — contrary to the Bayesian analysis results— is due to the standard errors corrections applied here.

columns of Table 3. These latter support our last finding of a weaker transmission for flexible ERR and give also further insights.[19]

Table 3 — Investigating the exchange rate regime effect

Dependent variable:	Real GDP per capita growth (Δy)								
	FE	RE	S.GMM	FE	RE	S.GMM	FE	RE	S.GMM
	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)
Variables of interest									
Under	0.002***	0.001***	0.001***	0.002***	0.001***	0.001***	0.002***	0.001***	0.002***
	(4.43)	(4.48)	(2.76)	(4.37)	(4.37)	(3.22)	(4.45)	(3.92)	(2.80)
Over	-0.007**	-0.004*	-0.007***	-0.007***	-0.004*	-0.007***	-0.006***	-0.004*	-0.007**
	(-2.59)	(-1.81)	(-2.76)	(-2.75)	(-1.90)	(-2.70)	(-2.91)	(-1.84)	(-2.03)
Debt	-0.032***	-0.027***	-0.029**	-0.032***	-0.028***	-0.039***	-0.045***	-0.035***	-0.047***
	(-3.75)	(-5.10)	(-2.45)	(-4.16)	(-5.31)	(-3.80)	(-5.46)	(-6.00)	(-4.23)
*Mis*Debt*facto*	-0.010***	-0.010***	-0.011***						
	(-3.69)	(-4.37)	(-2.68)						
*Mis*Debt*ERR*				-0.017***	-0.018***	-0.024***			
				(-3.78)	(-4.45)	(-3.48)			
...**Fixed*							-0.051***	-0.042***	-0.056***
							(-4.37)	(-4.76)	(-3.26)
...**Interm.*							-0.018	-0.021	-0.013
							(-1.15)	(-1.47)	(-0.31)
...**Flex.*							-0.039***	-0.041***	-0.045
							(-2.71)	(-2.79)	(-1.48)
Growth determinants									
l.y	-0.021***	-0.007***	-0.007	-0.021***	-0.007***	-0.011	-0.023***	-0.008***	-0.014**
	(-4.19)	(-3.41)	(-0.73)	(-4.29)	(-3.52)	(-1.41)	(-4.86)	(-4.24)	(-2.34)
Invest	0.119***	0.112***	0.121**	0.120***	0.112***	0.137***	0.123***	0.112***	0.119***
	(4.93)	(5.26)	(2.55)	(4.97)	(5.29)	(3.08)	(5.34)	(5.41)	(2.74)
Pop	-0.277	-0.624**	-0.169	-0.283	-0.625**	-0.523	-0.306	-0.592**	-0.664
	(-1.08)	(-2.06)	(-0.33)	(-1.10)	(-2.06)	(-0.98)	(-1.17)	(-2.00)	(-1.13)
Life	0.398***	0.477***	0.412	0.404***	0.482***	0.433	0.377***	0.445***	0.361
	(2.98)	(4.90)	(1.16)	(4.04)	(4.87)	(1.21)	(3.31)	(5.34)	(1.00)
age.dep	-0.049**	0.003	-0.018	-0.048**	0.003	-0.016	-0.050***	0.003	-0.008
	(-2.53)	(0.66)	(-0.47)	(-2.53)	(0.69)	(-0.52)	(-2.85)	(0.67)	(-0.33)
Fdi	0.038	0.076*	0.033	0.035	0.074*	0.012	0.020	0.066	0.023
	(0.89)	(1.80)	(0.62)	(0.82)	(1.75)	(0.20)	(0.47)	(1.63)	(0.22)
Gov	-0.072	-0.076*	-0.178**	-0.072	-0.075*	-0.048	-0.079*	-0.081*	-0.055
	(-1.54)	(-1.66)	(-2.50)	(-1.55)	(-1.67)	(-1.04)	(-1.72)	(-1.80)	(-0.88)
REGCIV	-0.020	-0.006	-0.008	-0.021	-0.006	-0.007	-0.012	-0.005	-0.010
	(-1.59)	(-0.64)	(-0.49)	(-1.63)	(-0.72)	(-0.50)	(-1.04)	(-0.58)	(-0.78)
HIPC	6.7E-4	-0.001	-0.002	-1.2E-4	-0.002	-0.005	-0.004	-0.004	-0.010
	(0.14)	(-0.42)	(-0.36)	(-0.03)	(-0.52)	(-0.96)	(-0.81)	(-1.11)	(-1.46)
Constant	0.368***	0.050*	0.162	0.368***	0.051*	0.160	0.394***	0.062**	0.163
	(3.51)	(1.91)	(0.70)	(3.56)	(-1.95)	(0.92)	(4.13)	(2.52)	(1.17)
R-sq.	0.11	0.10		0.11	0.09		0.12	0.11	
Obs./ Countries	2219/72	2219/72	2222/72	2219/72	2219/72	2222/72	2219/72	2219/72	2219/72
$\beta_{Und} - \beta_{Over} = 0$	0.00	0.03	0.00	0.00	0.02	0.00	0.00	0.03	0.03
AR(2) test			0.21			0.66			0.58
Hansen test			0.96			0.96			1.00

Notes: ***, **, and * denote the levels of statistical significance at 1, 5, and 10%. Robust t-statistics are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). For the S.GMM estimations, we consider REGCIV and HIPC as exogenous and the rest as endogenous. For the "AR(2) test" and "Hansen test", we report the p.values. In line "$\beta_{Und} - \beta_{Over} = 0$" we test the significance of the difference between the under- and overvaluation coefficients; we report the p.values.

While both interaction terms are significant for *Fixed* and *Flexible ERR*, the *intermediate ERR* interaction term is insignificant. Thus, intermediate exchange rate

[19]It should be noted, before going further, that we have more or less equivalent FCD debt level for the different exchange rate regimes —regardless of the classification used. See Table B.1.4.

regimes seem to perform better than the two other ones in isolating economic growth from valuation effects induced by currency misalignments. The reason may be linked to the fact that intermediate exchange rate regimes, when credible, combine the best of the two other extreme regimes. Indeed, in such regimes the soft peg against the value of an anchor currency or a basket of currencies limits the volatility and reduce the possibility that exchange rates will overshoot their long run equilibrium —while allowing a considerable degree of flexibility. These two features, naturally, limit valuation effects. Another possible explanation for the insulation property of *intermediate ERR* may come from a consistent choice of the anchor(s) with the composition of both trade and capital flows.

Contrary to *intermediate ERR*, *fixed* and *flexible ERRs* do not —according to our results— insulate from valuation effects. As discussed in section 2, two reasons may justify this result. The first is related to the level of the FCD debt and the incoherence in its composition. The second is related to the dynamics of the real exchange rate. For *fixed ERR*, an important and non-consistent —with the anchor(s)— FCD debt entails valuation effects in case of misalignments. However, for hard peg, if the FCD debt is nearly or completely denominated in the anchor currency, valuation effects will be low or even non-existent in some cases. Pegging the currency to a basket of foreign currencies can induce valuation effects but these are somehow dampened since the peg to a portfolio of foreign currencies tends to weaken foreign exchange rate exposure.

Whatever be the case, these valuation effects are the result of misalignments which are themselves driven by movements in the country's real exchange rate —relative to its equilibrium level— and the movements in the anchor(s) currency(ies). This latter source of currency misalignments is not present in *flexible ERR*. Moreover, a flexible nominal exchange rate may act as a shock absorber, thus limiting valuation effects. This may explain why the coefficients associated with the valuation effects are weaker under *flexible ERR* than under *fixed ERR*. Those results do however not mean that *flexible ERR* are preferable to fixed ERR, since valuation effects can impact positively or negatively GDP growth. They instead show that *intermediate ERR* are significantly less likely to be associated with valuation effects driven by currency misalignments than the bipolar alternatives.

4.3 Sensitivity analysis

As our sample includes countries that differ in many respects (GDP per capita, degree of financial and economic integration, sectoral specialization...) we check if some of our results come from this heterogeneity. In particular, the heterogeneity among the countries in regard to the misalignments-growth relationship could explain the observed small under- and overvaluation's coefficients. Also, there is no consensus in the literature on the sign of the relationship between undervaluations and growth (i.e. positive or negative). By addressing the issue of heterogeneity, we broaden this debate and go upstream by questioning the real existence of a unique relationship. To address this issue of heterogeneity, we use LSDV (Least Squares Dummy Variable) model with country-specific effects in order to observe, for each country, the effects of both under- and overvaluations.

Consequently, we first rerun equation (10) by interacting undervaluation (resp. overvaluation) with country dummies in order to observe, for each considered country, the growth effects of under- and overvaluations.[20] Results are reported in the two first columns of Table B.2 (Appendix B.2). Accordingly, taking account of country specific effects in the specification affects our previous results particularly for undervaluations. As can be seen, the coefficient of undervaluations remains insignificant for most of the countries. But the most striking finding is that, while our previous results indicated that undervaluations had on average a negative effect on GDP growth and supported the WC view, this result is now significant for only 8 countries. We find more statistical evidence supporting the export-led growth theory, i.e. a positive effect of undervaluations, with 14 countries exhibiting a negative and significant coefficient. These seemingly incompatible results can, however be reconciled. Indeed, countries, in which undervaluations affect negatively GDP growth, have registered either important and often persistent undervaluations (e.g. El Salvador, Guinea), either structural weaknesses leading to recurrent devaluations (e.g. Dominican Rep., Mexico). For these countries, the highest growth rates are reached when real effective exchange rates are close to their equilibrium levels. In contrast, countries, in which the positive effects of undervaluations on GDP growth are the greatest, exhibit relatively low levels of undervaluations (e.g. China, Panama, Mozambique, Guinea-Bissau).[21] Thus, there is some evidence that the effect

[20] In other words, we relax the assumption of homogenous coefficients for both under- and overvaluations. The coefficients associated with the other variables are however constrained to be homogenous (as in general panel estimation procedures).

[21] China is, undoubtedly, the best example supporting the export-led growth theory. Indeed, for a long time, the authorities have been accused to maintain the exchange rate at low levels —i.e. undervaluations— to boost the competitiveness. We also observe for this country a considerable GDP

of undervaluations on GDP growth may differ, depending on the size of the misalignment, suggesting that threshold effects may be an important issue when analyzing the nexus between GDP growth and undervaluations. Evidence provided by the impact of overvaluations on GDP growth is more in accordance with our earlier findings. Indeed, when significant, our results similarly indicate that overvaluations are detrimental for growth.

To examine whether the foreign-currency denominated debt channel is robust to heterogeneity, we also rerun equation (12) by interacting undervaluation (resp. overvaluation), the debt variable and country dummies. As before, this is also done to investigate the heterogeneity issue with regard to the FCD debt transmission channel. Results are reported in the two last columns of Table B.2 (Appendix B.2).

Our results clearly indicate that misalignments have a significant impact on GDP growth through the debt channel. Indeed, we find statistical significance of valuation effects for about half of the 72 countries in our sample, with more prevalent/prominent evidence in the undervaluation's regime. Moreover, coefficients have in most cases the expected signs: undervaluations tend to increase the negative effects that the FCD debt exerts on GDP growth while overvaluations do the opposite —i.e. reduce the burden of the FCD debt. Few countries exhibit an opposite sign. This non-expected sign may be explained by two antagonistic effects. The fact that undervaluations can be associated with a positive valuation effect can come from a rise in export earnings sufficiently enough to ensure the debt's service (the positive income effect outweighs the negative valuation effects). Similarly, a positive sign of the coefficient in the case of overvaluations can be explained by a negative income effect outweighing the positive valuation effects. Finally, it is important to emphasize that the higher coefficients of valuation effects are associated with countries under fixed exchange rate regimes —throughout the studied period or for a long time.[22] Among them, those that have registered sizeable or repetitive nominal exchange rate adjustments considerably differ from the others in the importance of the valuation effects. This is especially the case for Botswana, which, between 1980 and 2012, experienced 7 devaluations. This observation is also valid for Latin American countries (e.g. Argentina, Brazil, El Salvador, Ecuador, Mexico, Panama, Venezuela), Asian countries (e.g. India, Malaysia, Thailand, Philippines) and a number of African countries namely the CFA zone countries (e.g. Benin, Burkina Faso, Cameroon, Mali). For countries experiencing intermediate or flexible ERRs, valuation effects seem to be weaker, thus confirming our previous panel results.

growth rate during this period.

[22] This assertion is based on the average of the ERR followed by the country (three-way classification).

Overall, considering how misalignments affect GDP growth within our LSDV framework can explain why misalignments have, on average, a small direct effect and a higher indirect effect on GDP growth. Indeed, our results clearly indicate that GDP growth seems to be related to misalignments through movements in competitiveness only in few countries of our sample, while there is more significant evidence of the existence of valuation effects. Growth patterns in emerging and developing countries are then linked to misalignments mainly through a debt channel rather through the traditional competitiveness one.

5 Conclusion

The aim of this paper was to investigate, for a sample of developing and emerging countries, the existence of a foreign currency-denominated debt channel through which currency misalignments can impact economic growth. By so doing, we contributed to the ongoing debate on the effects of currency misalignments on economic growth, by considering this indirect transmission channel in addition to the direct competitiveness channel.

We provide evidence that misalignments adversely affect economic growth in emerging and developing countries, thus supporting the Washington Consensus view. However, if such relationship is evidenced for most countries in case of overvaluations, undervaluations seem to enhance GDP growth for some countries, thus also supporting the export-oriented growth literature.

Moreover, we found that misalignments have a significant indirect effect on GDP growth through valuation effects, suggesting that in emerging and developing countries there exists an additional transmission channel through which misalignments can affect growth. Thanks to these valuation effects, the negative effect exerted by the foreign-currency denominated debt on GDP growth tend to increase in undervaluations' regime while, in overvaluations' regime, this negative effect tend to decrease. This means that a real undervaluation can positively affect GDP growth if and only if the improved export performance can offset the negative valuation effects —steaming from the increase in the debt libelled in foreign currency(ies)— and explains part of the mitigated performance of undervaluations on growth. Finally, our finding regarding a differentiated effect of exchange rate regimes on valuation effects highlight the role of exchange rate policies in shaping the effects of misalignments on valuations effects.

Our results have then important policy implications. In particular, policy analysts should pay closer attention to the composition of the FCD debt as a transmission channel through which misalignments can affect economic growth, as well as its consistency with the exchange rate regime.

Appendices

A. Data appendix

A.1 Sample

Table A.1 – List of the countries (72)

Algeria	Congo Rep.^{H}	Indonesia	Paraguay
Angola	Costa Rica	Jordan	Peru
Argentina	Cote d'Ivoire^{H}	Kenya	Philippines
Bangladesh	Dominican Rep.	Lesotho	Rwanda^{H}
Benin^{H}	Ecuador	Madagascar^{H}	Sao Tome & Principe^{H}
Bolivia^{H}	Egypt	Malawi^{H}	Senegal^{H}
Botswana	El Salvador	Malaysia	South Africa
Brazil	Ethiopia^{H}	Mali^{H}	Sri Lanka
Burkina Faso^{H}	Fiji	Mauritania^{H}	Sudan
Burundi^{H}	Gabon	Mauritius	Swaziland
Cabo Verde	Gambia^{H}	Mexico	Tanzania^{H}
Cameroon^{H}	Ghana^{H}	Morocco	Thailand
Central African. Rep^{H}	Guatemala	Mozambique^{H}	Togo^{H}
Chad	Guinea^{H}	Nicaragua^{H}	Tunisia
China	Guinea-Bissau^{H}	Niger^{H}	Turkey
Colombia	Haiti^{H}	Nigeria	Uganda^{H}
Comoros^{H}	Honduras^{H}	Pakistan	Venezuela, RB
Congo Dem. Rep.^{H}	India	Panama	Zambia^{H}

Note: "H" indicates the countries that benefited from the HIPC initiative and reached the completion point.

A.2 Data description

Table A.2 — Variable definitions and sources

Variable	Definition	Source
Exchange rate fundamentals		
$rprod$	Relative productivity: measured by the ratio of GDP per capita (PPP) in the country and the trade-weighted average GDP per capita PPP of the top 67 partner countries.	Author calculations
nfa	Net Foreign Asset position (%GDP)	Lane & Milesi-Ferretti
tot	Net barter terms of trade index (2000 = 100), expressed in logarithm	WDI
Variables used for the BMA analysis		
Dependent variable		
Δy	GDP per capita growth (annual %)	WDI
Solow determinants & human capital		
$l.y$	Initial real GDP per capita	WDI
$invest$	Total investment (%GDP)	WEO
pop	Total population (expressed in logarithm)	WDI
$life$	Life expectancy at birth (total years), expressed in logarithm	WDI
$age.dep$	Age dependency ratio (% of working-age population)	WDI
Macroeconomic variables		
fdi	Foreign direct investment, net inflows (% of GDP)	UNCTAD
$open$	Exports plus Imports as share of GDP	WDI
oda	Net official development assistance and official aid received (%GDP)	WDI
gov	General government final consumption expenditure (% of GDP)	WDI
tot	Net barter terms of trade index (2000 = 100), expressed in logarithm	WDI
$inflation$	Inflation (consumer price), expressed in logarithm	WEO
$debt$	External debt stocks, public and publicly guaranteed (expressed in logarithm and %GDP)	WDI
$debt.serv$	Public and publicly guaranteed debt service (% of GDP)	WDI
$exports$	Exports of goods and services (% of GDP)	WDI
$gfcf$	Gross fixed capital formation (% of GDP)	WDI
$money$	Broad money (% of GDP)	WDI
$remit.$	Personal remittances, received (% of GDP)	WDI
Socio-political indicators		
CL	Civil liberties; measured on a scale from 1 to 7, 7 being the lowest level of freedom.	Freedom House
PR	Political rights; measured on a scale from 1 to 7, 1 being the highest degree of freedom.	Freedom House
$Democ$	Democracy; measured on a 0-to-1 scale, 1 being the highest level of democracy.	CSP
$CIVWAR$	Magnitude score of episode(s) of civil warfare involving the state; measured on a scale from 0 to 1, 1 being the highest degree.	CSP
$REGCIV$	Magnitude scores of all societal (civil or ethnic) Major Episodes of Political Violence; measured on a scale from 0 to 1.	CSP
Other variables		
$de\ facto$	*de facto* exchange rate regime classification	IRR
$HIPC$	Dummy variable for the HIPC initiative: scores 1 from the completion point till the end of the studied period. Coded using informations provided by the IMF, the African Development Bank and the Club de Paris.	

Note: WDI: *World development Indicators* (World bank)
WEO: *World Economic Outlook* (International Monetary Fund)
CSP: *Center for Systemic Peace*
UNCTAD: *United Nations Conference on Trade and Development*
IRR: Ilzetzki, Reinhart, Rogoff (2011)

Table A.3 — Exchange rate regime classification

IRR *de facto* classification		**Our re-classification**	
Regime	**Code**	**Regime**	**Code**
No separate legal tender	1		
Pre announced peg or currency board arrangement	1		
Pre announced horizontal band that is narrower than or equal to +/-2%	1		
De facto peg	1	Fixed ERR	1
Pre announced crawling peg	2		
Pre announced crawling band that is narrower than or equal to +/-2%	2		
De facto crawling peg	2		
De facto crawling band that is narrower than or equal to +/-2%	2		
Pre announced crawling band that is wider than or equal to +/-2%	3		
De facto crawling band that is narrower than or equal to +/-5%	3		
Moving band that is narrower than or equal to +/-2% (i.e., allows for both appreciation and depreciation over time)	3	Intermediate ERR	2
Managed floating	3		
Freely floating	4		
Freely falling	5	Flexible ERR	3
Dual market in which parallel market data is missing	6		

B. Additional results

B.1 Test results

B.1.1 Cross-sectional dependence tests

Table B.1.1 — Cross-sectional dependence test results

	reer	***nfa***	***rprod***	***tot***
Pesaran (CD)'s test	99.54	51.82	80.71	14.12
	(0.00)	(0.00)	(0.00)	(0.00)

Notes: The test is based on the null of no cross-sectional dependence and is standard Normal under this null. p.values are given in parentheses.

B.1.2 Unit root tests

Table B.1.2 — Unit root test results

		reer	***rprod***	***nfa***	***tot***	***life***	***pop***
CIPS*	level	-2.44	-1.99	-2.09	-2.41	-1.62	-1.26
		(0.21)	(0.13)	(0.04)	(0.29)	(0.99)	(0.99)
	1^{st}	-3.06	-2.94	-3.90	-3.41	-2.57	-2.83
	diff.	(0.01)	(0.01)	(0.01)	(0.01)	(0.05)	(0.05)
Choi *Pm*	level	-0.51	-5.37	-0.07	1.65	7.84	11.31
		(0.69)	(1.00)	(0.52)	(0.05)	(0.00)	(0.00)
	1^{st}	49.77	41.21	60.80	45.06	8.75	8.47
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Choi *Z*	level	4.31	13.66	1.01	0.78	2.88	-0.57
		(1.00)	(1.00)	(0.84)	(0.78)	(0.99)	(0.28)
	1^{st}	-24.37	-20.33	-28.07	-19.41	-4.08	-3.39
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Choi *L**	level	5.04	16.78	0.91	0.69	4.40	0.67
		(1.00)	(1.00)	(0.81)	(0.75)	(1.00)	(0.75)
	1^{st}	-31.58	-25.92	-37.72	-26.18	-4.91	-3.67
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: We allow for individual deterministic trends and constants for all variables except *open* (only individual intercepts). The tests are built on the null of a unit root; *p*.value in parentheses. Appropriate lag orders are determined by running auxiliary ADF test regressions for each of the cross-sectional units. We also refer to the lag order that minimizes the Schwarz criterion. Conclusions are robust to change in model's specification.

Table B.1.2 — *Continued*

		fdi	***invest***	***gov***	***debt***	***gdp***	***age.dep***
CIPS*	level	-2.61	-2.08	-2.30	-2.25	-2.12	-2.34
		(0.03)	(0.05)	(0.52)	(0.63)	(0.10)	(0.01)
	1^{st}	-4.57	-4.41	-4.41	-3.51	-3.89	-2.61
	diff.	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Choi *Pm*	level	21.69	21.38	0.14	-2.95	-4.58	14.52
		(0.00)	(0.00)	(0.43)	(0.99)	(1.00)	(0.00)
	1^{st}	61.45	65.49	45.55	-41.80	60.98	18.35
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Choi *Z*	level	-13.17	-13.22	0.56	4.32	7.48	-3.50
		(0.00)	(0.00)	(0.71)	(1.00)	(1.00)	(0.00)
	1^{st}	-27.46	-29.92	-21.17	-21.56	-28.32	-10.14
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Choi *L**	level	-15.19	-15.28	1.01	4.84	7.63	-4.51
		(0.00)	(0.00)	(0.84)	(1.00)	(1.00)	(0.00)
	1^{st}	-37.15	-40.61	-28.08	-27.20	-38.06	-11.43
	diff.	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: We allow for individual deterministic trends and constants for all variables except *open* (only individual intercepts). The tests are built on the null of a unit root; *p*.value in parentheses. Appropriate lag orders are determined by running auxiliary ADF test regressions for each of the cross-sectional units. We also refer to the lag order that minimizes the Schwarz criterion. Conclusions are robust to change in model's specification.

B.1.3 Westerlund cointegration tests

Table B.1.3 — Westerlund cointegration test results

Specification				***reer*** ***rprod, tot, nfa***				
	With constant				*With constant and trend*			
Statistic	Value	$Z-$value	$p-$value	Robust $p-$value	Value	$Z-$value	$p-$value	Robust $p-$value
G_t	-2.905	-6.195	0.000	0.005	-3.107	-4.516	0.000	0.003
G_a	-9.230	-0.110	0.456	0.005	-10.833	2.504	0.994	0.062
P_t	-16.724	-5.317	0.000	0.070	-16.185	-1.313	0.095	0.087
P_a	-8.685	-3.308	0.001	0.055	-9.765	0.701	0.758	0.451

Note: Optimal lag and lead length determined by Akaike Information Criterion. Width of Bartlett-Kernel set to 3. Null hypothesis of no cointegration. Robust p-values are obtained via bootstrap (400 iterations).

B.1.4 Sample consistency

Table B.1.4 — Sample consistency: exchange rate regime and FCD debt level

	Exchange Rate Regime (three-way[a] *de facto* classification)		
	Fixed	*Intermediate*	*Flexible*
Mean	21.833	22.556	22.661
Std. Dev.	1.625	1.667	1.492

	Exchange Rate Regime (six-way[b] *de facto* classification)					
	de facto 1	*de facto 2*	*de facto 3*	*de facto 4*	*de facto 5*	*de facto 6*
Mean	21.511	22.178	22.556	22.249	22.983	20.122
Std. Dev.	1.537	1.647	1.667	1.592	1.261	1.217

Notes: a: Our re-classification; b: IRR classification (see Table A.3).

B.1.5 Causality tests

Results displayed in Table B.1.5 are those obtained from the test proposed by Dumitrescu and Hurlin (2012). For brevity, we do not present the technical details. Note however that under the null of Homogenous Non Causality (HNC), there is no causal relationship for all the cross-units of the panel. Under the alternative, there is a causal relationship for at least for one cross-unit.

Table B.1.5 — Causality test results

	$Mis_{i,t} \rightarrow \Delta y_{i,t}$			$Debt_{i,t} \rightarrow \Delta y_{i,t}$		
	K=1	*K=2*	*K=3*	*K=1*	*K=2*	*K=3*
W_{HNC}	2.615	4.891	5.934	1.122	2.217	3.358
Z_{HNC}	9.276***	23.490***	29.194***	0.694	1.739*	3.506***
$\tilde{Z}_{HNC}$	7.835***	9.560***	7.418***	0.256	0.218	0.293
	$Mis_{i,t} \rightarrow Debt_{i,t}$			$Mis_{i,t} * Debt_{i,t} \rightarrow \Delta y_{i,t}$		
	K=1	*K=2*	*K=3*	*K=1*	*K=2*	*K=3*
W_{HNC}	6.559	7.626	9.136	1.659	3.477	4.933
Z_{HNC}	31.692***	45.361***	60.588***	3.699***	11.726***	18.793***
$\tilde{Z}_{HNC}$	27.648***	18.965***	16.142***	2.914***	4.515***	4.545***

Notes: ***, **, and * indicate rejection of the null at the 1%, 5%, and 10% levels, respectively. K stands for the lag order. $X \rightarrow Y$ indicates that we test the null hypothesis of Homogenous Non Causality (HNC) from X to Y.

B.2 Sensitivity analysis

Table B.2 — Sensitivity analysis results

	Competitiveness channel		***Valuation effect***	
	Under.	*Over.*	*Under.* $*$ *Debt*	*Over.* $*$ *Debt*
Algeria	0.01 (1.04)	**-0.034***** (−3.94)	0.266 (1.00)	**-0.300*** (−1.80)
Angola	**-0.09***** (−3.22)	**-0.367***** (−4.22)	**-0.304***** (−2.73)	**-0.537***** (−5.51)
Argentina	-0.024 (-0.53)	-0.024 (-0.69)	**0.801***** (6.29)	**-3.231***** (−3.13)
Bangladesh	0.009 (0.08)	-0.074 (-0.65)	1.766 (1.32)	**-9.638***** (−3.06)
Benin	0.032 (0.69)	-0.143 (-1.53)	**0.294***** (4.42)	-0.634 (-1.27)
Bolivia	**-0.064***** (−3.42)	**-0.119***** (−7.65)	-0.154 (-1.57)	**-0.490***** (−5.73)
Botswana	-0.192 (-1.55)	**0.104**** (2.41)	**17.839***** (6.59)	0.031 (0.03)
Brazil	0.014 (0.35)	-0.005 (-0.13)	**2.101*** (1.85)	**-2.748***** (−2.68)
Burkina Faso	-0.059 (-1.46)	-0.054 (-1.20)	**1.275***** (3.07)	-1.248 (-1.25)
Burundi	0.059 (1.43)	**-0.176***** (−2.87)	0.281 (1.55)	-0.058 (-0.16)
Cabo Verde	0.237 (1.00)	0.069 (0.38)	**-16.652**** (−2.00)	**-3.905*** (−1.91)
Cameroon	0.029 (0.86)	**-0.218***** (−3.76)	**0.265**** (2.30)	-0.515 (-0.71)
Central Af. Rep	-0.034 (-0.76)	-0.138 (-1.58)	0.032 (0.17)	**-2.996**** (−2.26)
Chad	0.029 (0.34)	-4.3E-4 (-0.00)	2.137 (1.18)	**-8.007*** (−1.87)
China	**-0.174***** (−3.68)	0.049 (1.39)	2.685 (0.65)	0.130 (0.07)
Colombia	2.3E-4 (0.01)	**-0.098***** (−6.81)	-0.203 (-0.39)	-0.645 (-0.70)
Comoros	0.041 (0.86)	-0.080 (-1.10)	**1.067**** (2.30)	**0.599**** (2.09)
Congo Dem. Rep.	**-0.084***** (−3.38)	**-0.039**** (−2.11)	0.122 (1.60)	**0.045***** (3.96)
Congo Rep.	-0.024 (-0.48)	0.034 (0.32)	**0.516***** (3.03)	-0.488 (-1.36)
Costa Rica	-0.104 (-1.04)	0.054 (1.11)	**1.435***** (9.02)	-0.209 (-0.27)
Cote d'Ivoire	0.046 (0.48)	-0.058 (-1.11)	0.338 (0.68)	-0.348 (-0.79)
Dominican Rep.	**0.001***** (2.91)	-0.001 (-0.56)	-0.007 (-0.92)	-0.018 (-1.16)
Ecuador	0.065 (1.46)	-0.039 (-1.29)	**0.794***** (2.67)	-0.657 (-1.36)
Egypt	-0.018 (-1.00)	0.013 (1.00)	**0.513***** (3.19)	-0.024 (-1.04)
El Salvador	**0.155**** (2.08)	-0.064 (-1.36)	**3.317***** (4.72)	-0.876 (-1.04)
Ethiopia	**-0.032*** (−1.74)	—	0.083 (0.93)	—
Fiji	0.026 (0.27)	-0.151 (-1.58)	1.898 (0.42)	**-6.103**** (−2.52)
Gabon	0.067 (1.54)	-0.103 (-1.09)	-0.178 (-0.34)	**-1.349***** (−3.58)
Gambia	0.018 (0.54)	0.04 (0.99)	0.011 (0.07)	-0.088 (-0.55)
Ghana	**-0.033***** (−2.69)	**-0.027*** (−1.94)	-0.022 (-0.52)	**-0.816**** (−2.36)

Notes: ***, **, and * denote the levels of statistical significance at 1, 5, and 10%. Robust t-statistics are reported in parentheses.

Continued on next page

Table B.2 — *Continued*

	Competitiveness channel		*Valuation effect*	
	Under.	*Over.*	*Under. ∗ Debt*	*Over. ∗ Debt*
Guatemala	**0.056*****(3.43)	**-0.131*****(−4.49)	**0.354****(2.08)	-0.963 (-1.37)
Guinea	**0.014****(2.00)	—	-0.030 (-1.49)	—
Guinea-Bissau	**-0.275*****(−4.25)	0.043 (0.63)	0.091 (1.08)	-0.126 (-0.58)
Haiti	-0.208 (-0.51)	**-0.126****(−2.20)	0.358 (0.53)	2.131 (0.48)
Honduras	**0.071***(1.79)	**-0.054***(−1.68)	**0.498****(2.23)	0.455 (0.68)
India	-0.034 (-1.01)	-0.004(-0.19)	**1.903*****(2.63)	-0.999 (-0.75)
Indonesia	0.07 (1.32)	-0.042 (-1.54)	**0.489*****(10.07)	-0.384 (-0.80)
Jordan	-0.055 (-0.46)	0.052 (0.86)	**1.449*****(6.68)	**-1.572***(−1.75)
Kenya	0.068 (1.50)	**-0.084***(−1.89)	0.196 (1.54)	-0.753 (-0.58)
Lesotho	0.058 (1.06)	**-0.26****(−2.47)	**0.566*****(2.68)	**-2.375*****(−3.26)
Madagascar	**0.078***(1.84)	**-0.108*****(−2.92)	0.224 (1.17)	-0.709 (-1.49)
Malawi	-0.004 (-0.15)	-0.076 (-1.20)	-0.095 (-1.43)	**-0.528****(−1.76)
Malaysia	-0.015 (-0.28)	-0.009 (-0.38)	**4.647*****(5.03)	**-1.550*****(−4.07)
Mali	0.019 (0.60)	-0.087 (-1.22)	**0.347*****(3.09)	**-1.524*****(−2.77)
Mauritania	-0.063 (-1.36)	0.008 (0.23)	**0.517*****(3.32)	-0.147 (-0.92)
Mauritius	-0.003 (-0.71)	**0.027***(1.76)	0.195 (1.09)	-0.241 (-0.59)
Mexico	**0.175*****(4.14)	**-0.095*****(−2.65)	**0.878*****(2.93)	**-2.332****(−2.35)
Morocco	0.058 (0.70)	-0.108 (-1.07)	**2.794*****(2.79)	**-2.832****(−2.38)
Mozambique	**-0.093****(−2.44)	**-0.041***(−1.86)	**0.437*****(5.17)	0.105 (0.43)
Nicaragua	-0.01 (-1.17)	—	**0.030***(1.90)	—
Niger	0.082 (1.52)	**-0.193*****(−2.57)	0.455 (1.51)	-0.842 (-0.82)
Nigeria	-0.011 (-0.27)	**-0.062****(−2.49)	0.124 (0.85)	**-0.175***(−1.76)
Pakistan	-0.003 (-0.06)	**0.038****(2.46)	**2.445*****(3.49)	0.106 (0.44)
Panama	**-0.153*****(−2.97)	-0.005 (-0.10)	**2.729*****(5.55)	**-3.636*****(−2.88)
Paraguay	**0.08****(2.33)	**-0.079*****(−3.01)	0.883 (1.52)	0.129 (0.42)
Peru	0.043 (1.48)	-0.01 (-0.37)	**0.523*****(4.42)	0.646 (0.91)
Philippines	0.019 (0.49)	**-0.17****(−2.27)	**1.362****(2.21)	**-5.081*****(−4.80)
Rwanda	**-0.079****(−2.54)	-0.227 (-1.19)	0.102 (0.67)	**-2.266*****(−11.80)
Sao Tome & Principe	**-0.082*****(−3.03)	0.011 (0.10)	-0.018 (-0.60)	0.493 (1.05)
Senegal	0.031 (0.91)	**-0.079****(−1.71)	0.304 (1.17)	-0.938 (-1.07)
South Africa	-0.005 (-0.15)	0.011 (0.13)	-0.270 (-0.32)	0.166 (0.28)
Sri Lanka	-0.086 (-0.90)	**0.129*****(3.20)	1.516 (1.52)	-0.287 (-0.37)
Sudan	**-0.037***(−1.92)	0.009 (0.33)	-0.036 (-0.47)	-0.501 (-1.55)
Swaziland	**0.072***(1.85)	0.119 (1.09)	0.023 (0.06)	**-2.383***(−1.65)
Tanzania	-0.019 (-1.25)	**-0.814*****(−51.23)	0.296 (0.94)	—
Thailand	0.053 (0.54)	0.004 (0.13)	**10.571*****(11.56)	**-0.806*****(−4.68)
Togo	-0.113 (-1.17)	**-0.176*****(−2.68)	-0.153 (-0.35)	-1.129 (-1.63)
Tunisia	-0.059 (-1.25)	-0.064 (-1.35)	0.601 (1.32)	-0.476 (-0.31)
Turkey	0.017 (0.28)	0.057 (1.05)	**1.710*****(2.90)	**-6.813*****(−3.70)
Uganda	**-0.069*****(−2.84)	0.039 (0.82)	**0.258****(2.38)	**-1.528****(−1.99)
Venezuela, RB	-0.009 (-0.15)	**-0.163*****(−4.11)	**1.885*****(4.11)	-0.953 (-0.50)
Zambia	-0.027 (-0.95)	0.011 (0.35)	**0.058*****(2.56)	-0.075 (-0.90)

Notes: ***, **, and * denote the levels of statistical significance at 1, 5, and 10%. Robust t-statistics are reported in parentheses.

C. Selecting the growth determinants

This Appendix is devoted to the presentation of the Bayesian analysis on which we rely on to select the growth determinants used in the paper. We begin by a brief presentation of the Bayesian Model Averaging (BMA) methodology followed by that of the data and finally conclude with the results.

The Bayesian Model Averaging (BMA) methodology

To deal with the issue of model uncertainty plaguing a number of growth equations —due to the lack of clear theoretical guidance—, we resort to Bayesian Model Averaging techniques. Before going into technical details —although the BMA is briefly presented here[23]—, note that the starting point of the BMA methodology is the finding that there are different possible models, each of them defined by a different combination of regressors, and by a probability of being the "true" model. It proceeds by estimating these different models and constructing a weighted average of all of them.

Considering X potential determinants, one obtains 2^X possible combinations of determinants and thus 2^X potential models M_j with $j = 1, \ldots, 2^X$. Denoting D, the dataset available, and considering θ a function of θ^j parameters to be estimated, the posterior density of the parameters for all the models under consideration is given by:

$$p(\theta|D) = \sum_{j=1}^{2^X} P(M_j|D)\; p(\theta|D, M_j) \tag{C.1}$$

Thus, the posterior density of the parameters is defined by the weighted sum of the posterior density of each considered model, with weights being their posterior model probability.

Given the prior model probability $p(M_j)$, the posterior model probability is calculated using the Bayes theorem as follows:

$$P(M_j|D) = \frac{p(D|M_j)\; p(M_j)}{\sum_{j=1}^{2^X} p(D|M_j)\; p(M_j)} \tag{C.2}$$

where $p(D|M_j) = \displaystyle\int p(D|\theta^j, M_j)\; p(\theta^j|M_j)\; d\theta^j$ is the marginal likelihood of the data given the model M_j; $p(\theta^j|M_j)$ is the prior density of the parameter θ^j under the model M_j, $p(D|\theta^j, M_j)$ is the likelihood and $p(M_j)$ is the prior probability that M_j is the "true"

[23] See Hoeting et al. (1997, 1999), Fernàndez et al. (2001) and Moral-Benito (2012) for further details.

model.

Summing the posterior model probabilities for all the models including a specific regressor (determinant), we derive the *posterior inclusion probability* (PIP), i.e. the probability that this regressor belongs to the "true" model. It is calculated as:

$$p(\theta_h \neq 0|D) = \sum_{\theta_h \neq 0} p(M_j|D) \tag{C.3}$$

We base the inclusion of a variable —in our growth equation— on this statistic. In general, a variable is considered as robust if its posterior inclusion probability is greater or equal to 0.50. We here follow the same strategy. Regarding the BMA methodology, we follow the Fernàndez, Ley and Steel (2001a) (hereafter, FLS) BMA approach as we have no preference for any specific model.[24] We use improper noninformative priors for the parameters that are common to all models, and a g-prior structure for the slope parameters (with two values for the latter, identified as "*Prior 1*" and "*Prior 9*" as discussed in FLS (2001b)). Since the FLS approach as originally proposed is a cross-section analysis, we follow the methodology proposed by Moral-Benito (2012) for its implementation in the panel data context. For brevity, we do not report the details. Note however that in practice we will work with demeaned data.

The data

Since the aim of this section (nor that of the paper) is not to revisit the growth determinants, we surveyed the vast literature on growth analysis with a particular emphasis on studies that use Bayesian techniques and retained 22 different potential determinants. We restrain ourselves to these determinants which have proven to be important/robust growth determinants.

We consider five broad categories of potential determinants of growth. Following the neoclassical theory (Solow-Swan model), we retain the following variables: *(i)* investment and *(ii)* gross fixed capital formation to capture the effects of physical capital; *(iii)* life expectancy to proxy the human capital development[25]; and *(iv)* population and *(v)* age dependency ratio to take into account the effect of the population. We also include *(vi)* the initial income per capita (conditional convergence).

The impact of macroeconomic stability/policies is captured by *(i)* inflation, *(ii)*

[24]The FLS methodology assumes equal probabilities for all models, i.e. $p(M_1) = p(M_2) = \ldots = p(M_{2^X}) = 1/2^X$.

[25]We do not include school enrollment variables since these variables are not available for all the considered countries.

government consumption, *(iii)* debt (external debt stocks, public and publicly guaranteed[26]), *(iv)* debt service, and *(v)* broad money.

The trade regime is taken into account through *(i)* openness, *(ii)* export revenues, and *(iii)* terms of trade.

The socio-political context is proxy by *(i)* civil liberties, *(ii)* political rights, *(iii)* democracy, *(iv)* civil warfare, and *(v)* REGCIV (magnitude scores of all societal (civil or ethnic) major episodes of political violence).

Finally, we include *(i)* the foreign direct investment, *(ii)* the remittances, and *(iii)* the official aid received as measures of the external environment.

All data are annual and cover the period 1980-2012. The definitions, main sources and calculation details of the data are reported in Table A.2.

The results

Table C.1 presents the results of the estimations (the posterior inclusion probabilities) based on a universe of 2^{23} — i.e. 8,388,608 — possible models. For comparison purpose, we also report results obtained using uniform model prior. Since the main analysis of the paper will be done with annual data, we accordingly perform the Bayesian analysis with annual data rather than 5-year averaged data as it is often done. Doing so, we ensure a sample size that allows enough degree of freedom for estimations and purge the estimates from the Nickell (1981) bias.

Overall, the BMA analysis identified ten robust determinants with posterior inclusion probability higher than 0.50. Except "Gross fixed capital formation", all the Solow-Swan determinants are identified as robust variables. Furthermore, in most cases, these latter belong to the top 3 ranked models.

Regarding macroeconomic policies and the external environment variables, only the "foreign direct investment", the "government consumption" and the two measures of the "debt" enter with sufficiently high probabilities. These variables also belong to the top 3 models. Finally, the last robust variable suggested by the BMA is REGCIV.

Results being robust to priors' choice (see Figure C.1), we retain the 9 different determinants highlighted in Table C.1, i.e. the initial real GDP ($l.y$), the age dependency ratio ($age.dep$), the debt ($debt$), the foreign direct investment (fdi), the government consumption (gov), the investment ($invest$), the life expectancy ($life$), the population growth rate (pop), and $REGCIV$.

[26]We use two measures of the debt: the debt to GDP ratio and the debt (in real terms; we use the GDP deflator) expressed in logarithm.

Table C.1 — Posterior Inclusion Probabilities

Variable	Posterior Inclusion Probability				
	Model prior				
	Uniform	Fixed		Random	
		Prior 1	*Prior 9*	*Prior 1*	*Prior 9*
Initial GDP level	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]
Age dependency ratio	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]
Broad money	0.050	0.007	0.036	0.021	0.054
Civil liberties	0.026	0.001	0.019	0.010	0.028
Civil warfare (CIVWAR)	0.040	0.002	0.023	0.013	0.038
Debt (ln)	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]
Debt (%GDP)	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]
Debt service	0.317	0.144	0.255	0.199	0.311
Democracy	0.023	0.002	0.021	0.008	0.026
Exports	0.083	0.003	0.046	0.021	0.083
Foreign Direct Investment	**0.989**[1,2,3]	**0.807**[1,2,3]	**0.983**[1,2,3]	**0.963**[1,2,3]	**0.989**[1,2,3]
Government consumption	**0.899**[1,2,3]	0.311[2,3]	**0.877**[1,2,3]	**0.804**[1,2,3]	**0.890**[1,2,3]
Gross fixed capital formation	0.461	0.206[2]	0.473[1]	0.408[1]	0.487[1]
Inflation	0.036	0.001	0.022	0.012	0.037
Investment	**0.679**[2,3]	**0.797**[1,3]	**0.611**[2,3]	**0.633**[2,3]	**0.658**[2,3]
Life expectancy	**0.916**[1,2,3]	0.393[2,3]	**0.896**[1,2,3]	**0.842**[1,2,3]	**0.911**[1,2,3]
Official Dev. Assist. & Aid	0.030	0.002	0.018	0.011	0.031
Openness	0.136	0.011	0.092	0.050	0.137
Political rights	0.068	0.001	0.051	0.029	0.076
Population	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]
REGCIV	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]	**1.000**[1,2,3]
Remittances	0.155	0.058	0.119	0.085	0.153
Terms of trade	0.407[2]	0.085	0.329[3]	0.213[3]	0.387

Note: The dependent variable is the real GDP per capita growth rate. The results are based on 100,000 burn-ins and and 200,000 draws. Simulations made using birth-death MCMC sampler. The number over the posterior inclusion probability —e.g. "1" — indicates that the variable belongs to the nth best model among the top 2000 models.

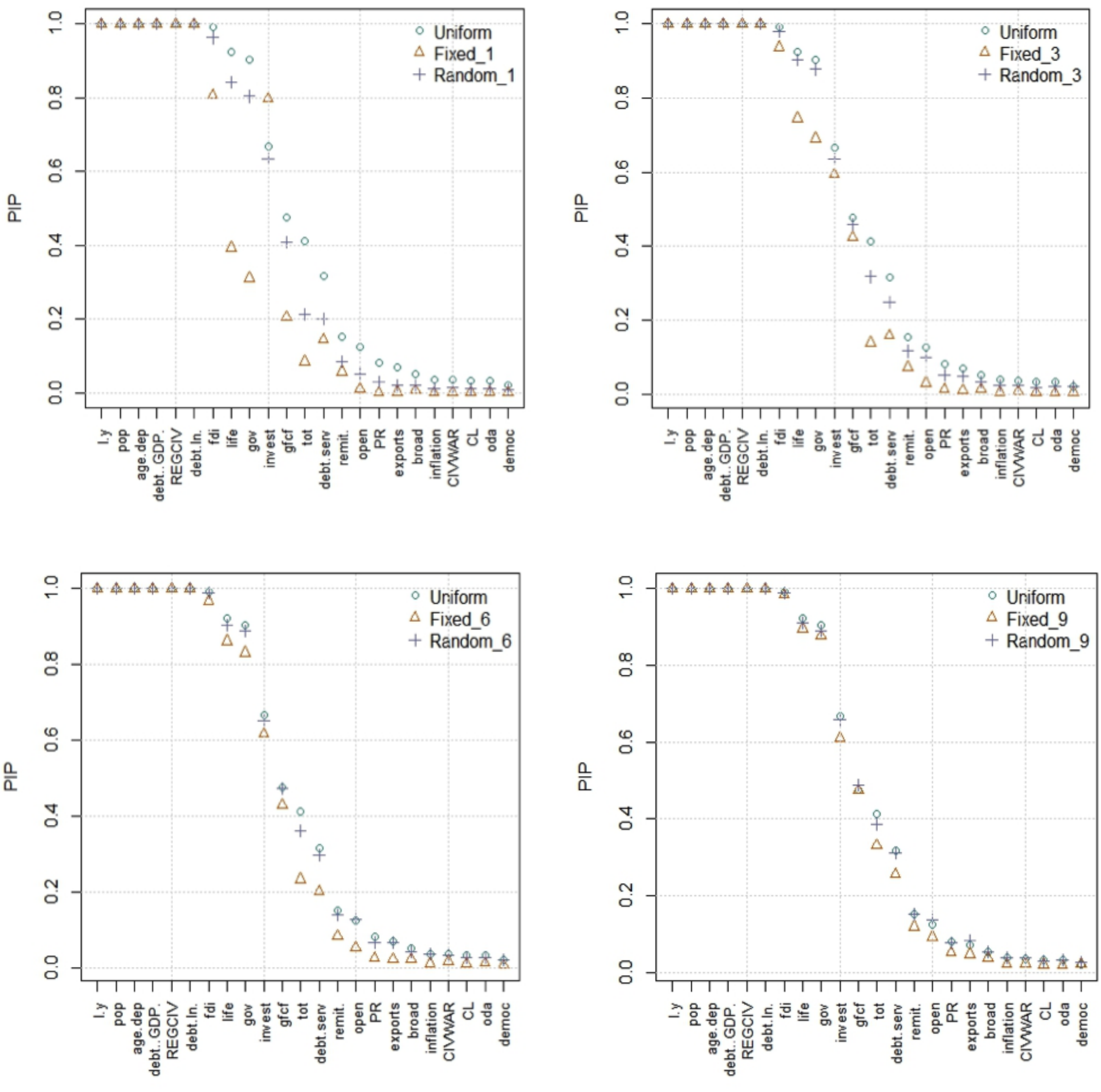

Figure C.1 — PIPs' sensitivity to priors' choice

C. Figures

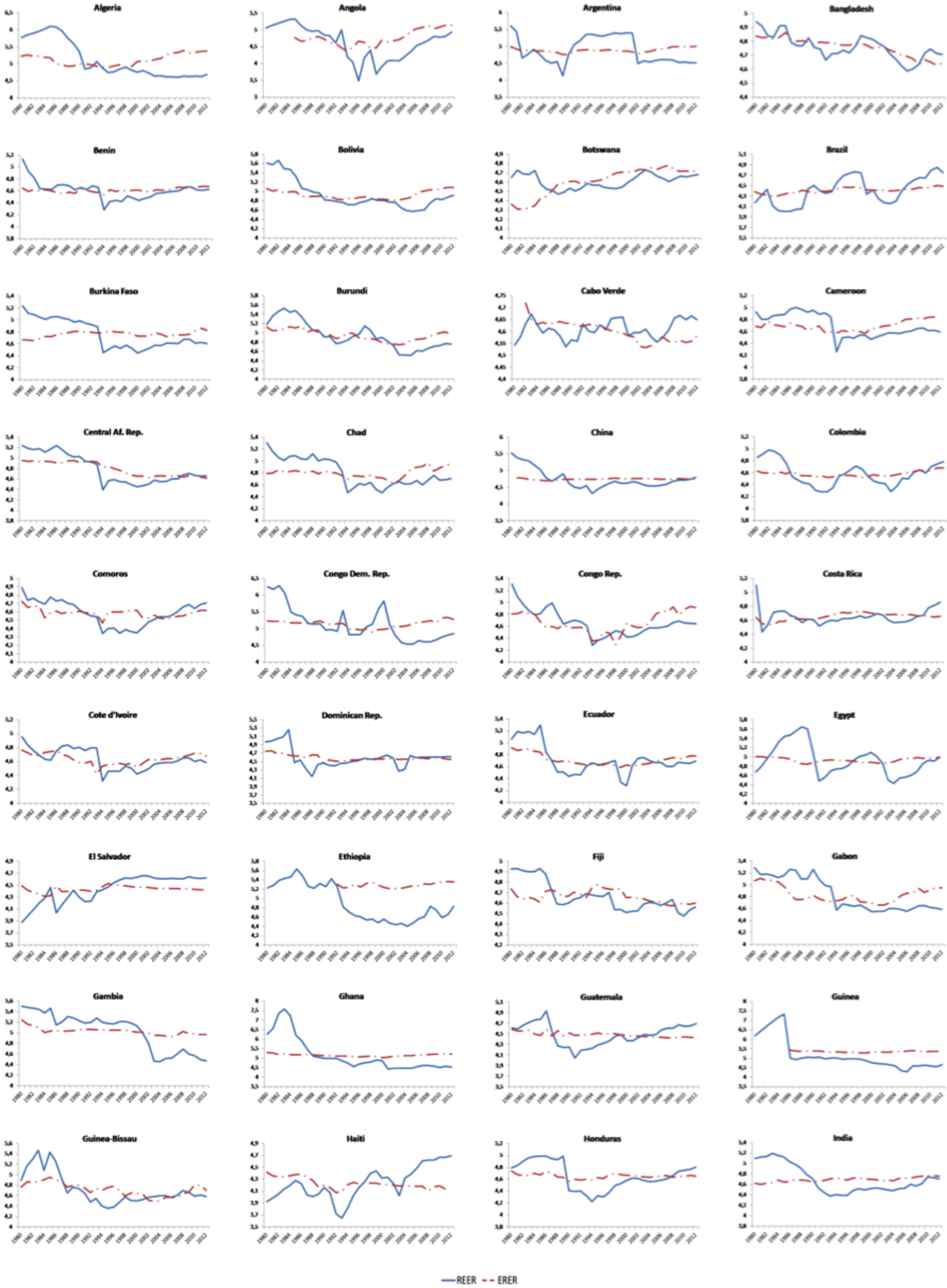

Figure D.1 — Real and Equilibrium Effective Exchange Rate (REER and ERER)

Note: An increase (resp. decrease) of the real effective exchange rate indicates an appreciation (resp. depreciation).

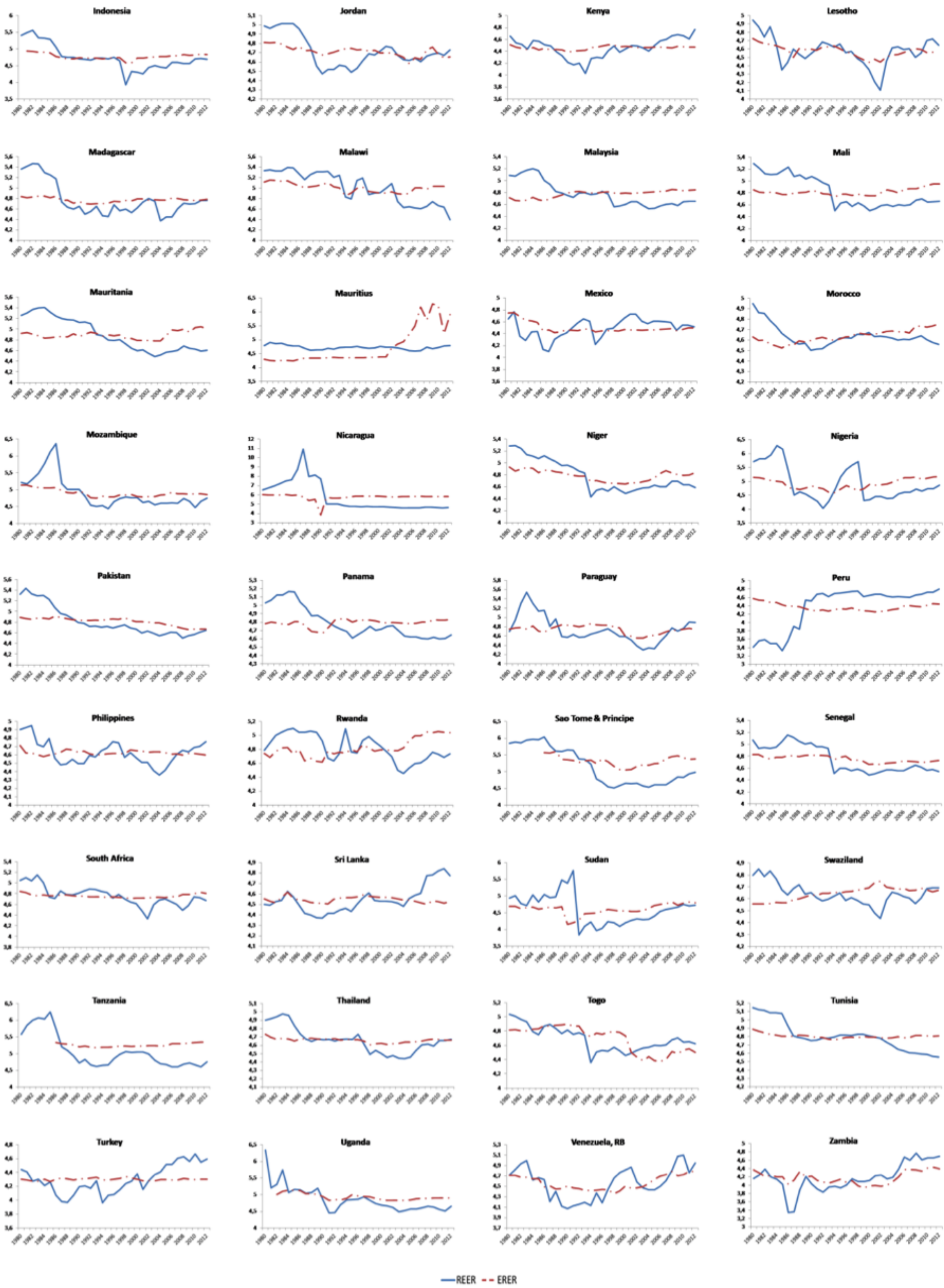

Figure D.1 — *Continued.*

Note: An increase (resp. decrease) of the real effective exchange rate indicates an appreciation (resp. depreciation).

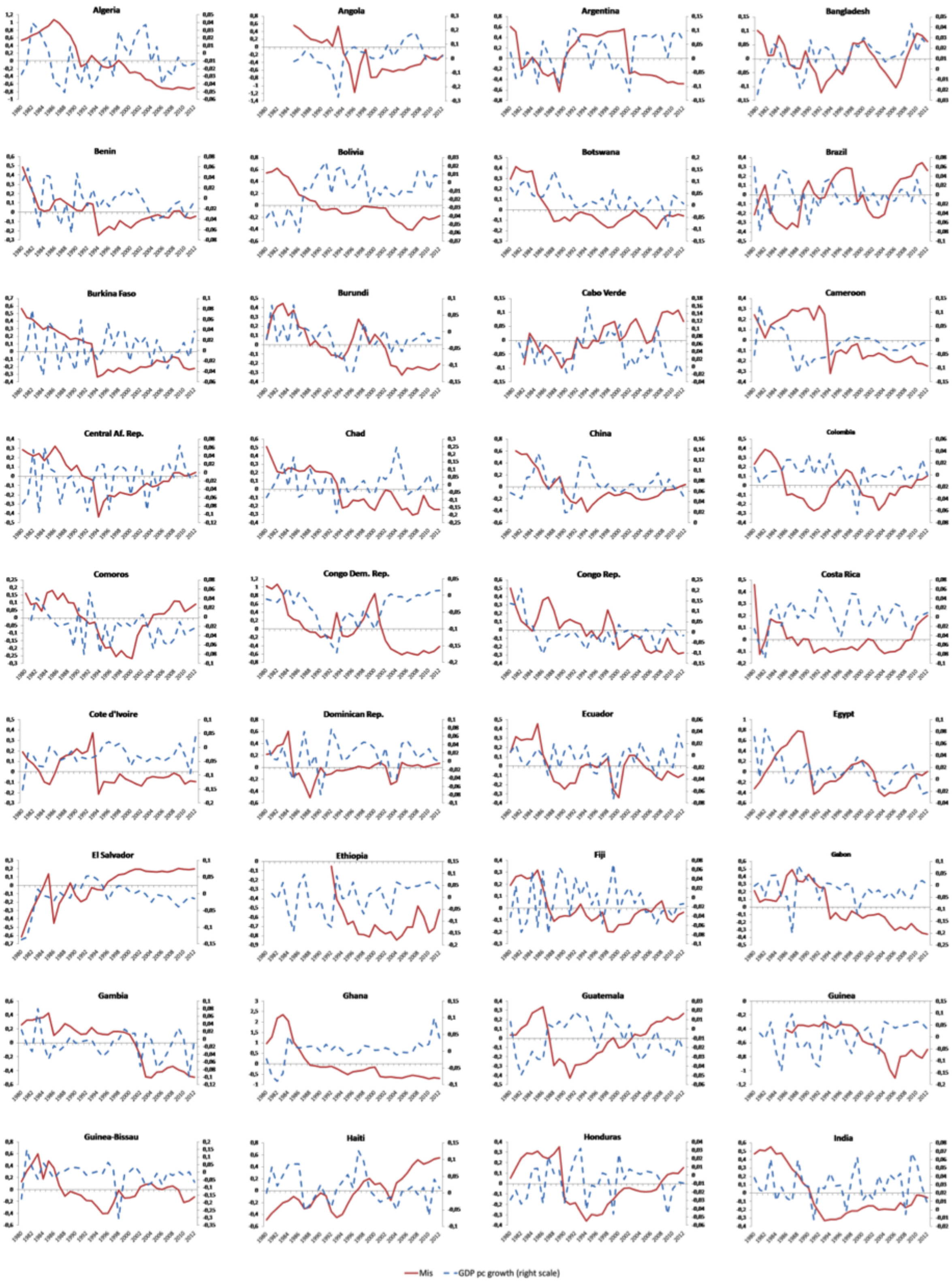

Figure D.2 — Currency misalignments (Mis) and growth

Note: A positive (resp. negative) value corresponds to an overvaluation (resp. undervaluation)

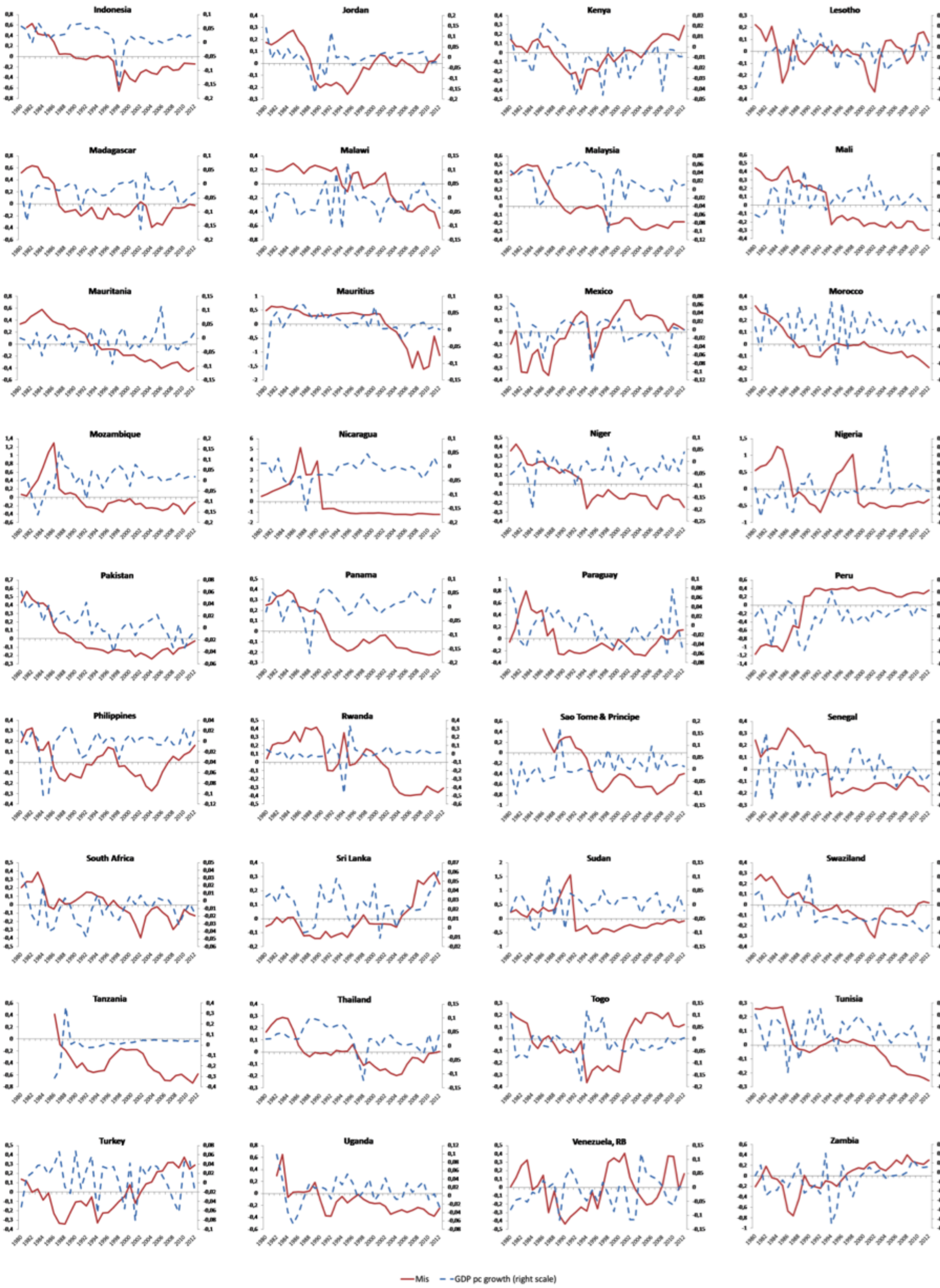

Figure D.2 — *Continued.*

Note: A positive (resp. negative) value corresponds to an overvaluation (resp. undervaluation)

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