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The role of exchange rate undervaluations on the inflation-growth nexus

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Abstract

The link between exchange rate undervaluations and growth has been an important source of concern over the past years, but the role of undervaluations on the inflation-growth nexus has not been yet studied. We fill up this gap by showing to what extent undervaluation's level change the effect of inflation on growth. Our analysis is based on a sample of 62 countries over the period 1980-2015. In a first time, we rely on the Bayesian Model Averaging (BMA) methodology to select the relevant growth determinants. Then, using the System Generalized Method of Moments (GMM), we find evidence that higher is the lagged undervaluation, higher is the negative effect of inflation on growth. This result is robust to the exclusion of currency crises episodes.

Keywords: Exchange rate undervaluation, Inflation, Growth, GMM, BMA.

JEL Classification: F41, O47, E31

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1 Introduction

Exchange rate undervaluations and overvaluations (i.e, misalignments) play a key role in countries' economic activity as illustrated by the interest of the Washington Consensus, for which any currency misalignment hampers economic growth. Their role is major in the design of exchange rate policies as well, as shown by the G20 countries' strategy to reduce currency misalignments (Sallenave, 2010). Furthermore, misalignments are also a source of concern for emerging and developing countries. In particular, devaluation effectiveness depends on the initial exchange rate distortion, one prerequisite for a successful devaluation in developing and emerging countries being a sizeable initial overvaluation (Grekou, 2014). The importance of misalignments can also be illustrated by considering the Chinese economy. China has been for a longtime accused to keep its currency undervalued against the US dollar in order to benefit from potential competitiveness gains against its major trade partners. This feature has, until the International Monetary Fund (IMF) affirmed that the Yuan is "no longer undervalued" (2015), been an important source of concern in the literature (see Cheung et al., 2007; Coudert and Couharde, 2008 among others).

Beside their usefulness for macroeconomic policies, exchange rate misalignments are also of primary importance in the economic growth literature (Razins and Collins, 1997; Gala, 2008 and Rodrik, 2008 among others). However, the conclusions emerging from this literature about undervaluation's effects on growth are far from being consensual (Mbaye, 2013). On the one hand, the literature has often highlighted the presence of benefits coming from a "weak" currency (Rodrik, 2008; MacDonald and Vieira, 2012). On the other hand, some authors find no growth-enhancing impact of undervaluations (Nouira and Sekkat, 2012). The inconclusive effect of undervaluations on growth may find one of its origin in the potential inflation generated by an undervalued currency. Specifically, Williamson (1990) speaking about undervaluations argues that :"The exchange rate should not be more competitive than that, because that would produce unnecessary inflationary pressures [...]". More recently, Chen (2017) shows the existence of a negative effect of undervaluations on R&D activities, concluding to a potential detrimental effect on growth. He explained the negative link between undervaluations and R&D activities through an imported inflation mechanism which could increase R&D investment costs.

A gap remains in the literature regarding the undervaluation-growth nexus that we intend to fill up. Specifically, the aim of our paper is to investigate the impact of exchange rate undervaluations on the inflation-growth relationship. To this end, we first employ the Bayesian Model Averaging (BMA) methodology to select the relevant growth determinants. Then, we examine if undervaluation size matters for the inflation-growth nexus. We contribute to the existing literature by revisiting the role played by undervaluations on the inflation-growth relationship. Hence, we also participate to the important debate on the role of the exchange rate as a policy development tool.

Our article is organized as follows. Section 2 provides a literature review on the misalignment-growth relationship and the transmission channels, as well as on the inflation-growth nexus. In section 3, we present the methodology and the data. Section 4 displays and discusses our econometric results and also offers a robustness check. Finally, section 5 concludes the paper.

2 Literature review

2.1 Relationship between currency misalignments and growth

Since the beginning of the 1990s, an important literature on the link between misalignments and growth has emerged. Constructing an index of "real exchange rate distortion ", Dollars (1992) showed that the higher was this index, the lower was the GDP growth rate. More recently, Aguirre & Calderon (2005) have provided evidence that misalignments were detrimental to growth, while Nouira & Sekkat (2012) failed to find support for this result. Contrary to Aguirre & Calderon (2005), Razins & Collins (1997) were unable to find a significant relation between misalignments' volatility and economic growth. The effect of an overvalued currency is somewhat more "consensual" in the literature, with a detrimental effect on growth usually highlighted (see Razins & Collins, 1997; Gala & Lucinda, 2006 and MacDonald & Vieira, 2012 among others).

Concerning the undervaluations-growth nexus, the reality is more mixed. Razins & Collins (1997) found that only high undervaluations were growth-enhancing whereas low, medium and very high undervaluations presented no significant relationship. Contrary to the previous findings, Aguire & Calderon (2005) put forward a positive link between low undervaluations and growth, while large undervaluations penalize the growth rate of GDP per capita. Furthermore, a growth-enhancing effect for a real depreciated exchange rate is evidenced by Rodrik (2008) and MacDonald & Vieira (2012). Nouira and Sekkat (2012) present no convincing support for this effect.

Another source of concern in the literature is the linearity of the misalignment-growth relationship. Indeed, it is important to assess whether misalignment's impact remains identical regardless of its sign and level. According to Rodrik (2008), there is no strong support in favor of the non linearity hypothesis. Relying on a Panel Smooth Transition Regression (PSTR) model, Béreau & al. (2011) concluded to the existence of a non linear relationship distinguishing 2 regimes. In the first regime, defined by undervaluations higher than 1.68%, an undervaluation increases growth by 0.56%. Above this threshold, misalignments (i.e undervaluations lower than 1.68% and overvaluations) lower growth. Using the same methodology, Mazier & Aflouk (2013) found that overvaluations hamper growth, whereas undervaluations upon a certain threshold are growth-promoting. Finally, Couharde & Sallenave (2012) confirmed the existence of a nonlinear relationship and showed that undervaluations higher than 18.69% hamper growth. Below this threshold, undervaluations have a growth-enhancing effect.

2.2 Currency misalignments and growth: effective transmission channels

Beyond the misalignment's impact on economic growth, it is also fundamental to have a better understanding of the effective transmission channels proposed by the literature to explain the relationship between currency misalignments and growth. Gala (2008) highlighted the existence of two main channels to explain the positive (resp. negative) impact of undervaluations (resp. overvaluations) on growth. The first channel is known as the "capital accumulation channel" according to which an undervalued currency causes an increase in the tradable goods prices. Then, real wages diminish, leading to a rise in profit margins. This upturn promotes investment which has a growth-enhancing effect. On the contrary, an overvalued currency impedes growth because of lower profit margins coming from lower tradable goods prices.

The literature focusing on the link between undervaluations and growth has also proposed a second channel, namely the "total factor productivity" (TFP) channel. It is generally advanced that an undervalued currency can foster economic growth through higher technological progress. A more depreciated currency promotes exportations thanks to competitiveness gains which lead to the development of the tradable sector driving a technological change. Mbaye (2013) was the first to properly assess this channel. The "TFP growth channel" is validated by the author revealing that TFP growth "induced" by the undervaluation has a significant and positive impact on growth. In line with Mbaye (2013), Rodrik (2008) found that the tradable sector size plays an important role in the transmission mechanism especially for developing countries. However, Gluzmann et al. (2012) failed to find support for this channel showing that undervaluations have no effect on industry share in emerging countries.

As can be seen from this brief literature review, various channels highlighting the growth-enhancing effect of undervaluation have been empirically assessed, but potential channels through which undervaluations can be harmful to growth are less studied. Grekou (2015b) proposed a new perspective on the undervaluation-growth nexus by taking into account the existence of valuation effects. He shows that above a certain threshold, the positive impact of undervaluations is mitigated by the foreign currency debt channel. Chen (2017) has also revisited the link between undervaluations and growth, considering the "R&D channel". He found evidence that R&D activities are negatively impacted by an undervalued currency, concluding to the existence of a negative effect of undervaluations on growth.

2.3 Inflation-growth nexus

As we aim at revisiting the role of undervaluations on growth through the inflation-growth nexus, let us briefly review the existing literature on this relationship. The potential link between inflation and growth retained the attention of academic economists as well as international institutions such as the IMF and the World Bank (Bruno & Easterly, 1995 and Sarel, 1996). Considering a large panel of countries, Barro (1995) and Gosh & Phillips (1998) showed that inflation was harmful to growth. However, this relationship is weakened as soon as high inflation episodes are excluded from the sample (Barro, 1995; Bruno & Easterly, 1996).

The nonlinearity in the inflation-growth relation is also investigated. Above different thresholds, inflation is found to be detrimental to growth (Gosh & Philips, 1998; Khan et al., 2001). Fisher (1993) also analyzed this issue through the division of his sample into sub-samples. He found that higher is the inflation rate in the sub-samples, lower is the impact on growth. A more formal evidence has been proposed by Lòpez-Villavicencio & Mignon (2011). The authors rely on PSTR models and found evidence of two distinct regimes. In the first regime, below a 15% threshold, inflation has a significant and positive impact on growth whereas beyond 15%, inflation hampers growth significantly.

Investigating the possible transmission channel explaining this relation, Barro (1995) highlighted that a higher inflation rate leads to a reduction in investment because of a shrink in the "propensity to invest". Paying also attention to possible transmission channels, Fisher (1993) found that a rise in inflation lowers significantly productivity growth and capital accumulation

3 Methodology and data

3.1 Methodology

3.1.1 Empirical strategy

To investigate if the inflation-growth nexus depends upon undervaluation's level, we proceed in two steps. The first one consists to apply the BMA methodology to select the relevant growth determinants. Then, variables which are identified as robust are used as controls in our growth regressions. The second step aims to investigate if undervaluations' level matters for the inflation-growth nexus. Our analysis starts by estimating the two following benchmark regressions:

$$Growth_{it} = \alpha_i + \lambda.\beta_1 Inflation_{it} + \beta_2 X_{it} + \epsilon_{it} \tag{1}$$

$$\lambda = \begin{cases} 1, & \text{if } Mis < 0 \\ 0, & \text{otherwise} \end{cases}$$

$$Growth_{it} = \alpha_i + \gamma.\beta_1 Inflation_{it} + \beta_2 X_{it} + \epsilon_{it} \tag{2}$$

$$\gamma = \begin{cases} 1, & \text{if } Mis > 0 \\ 0, & \text{otherwise} \end{cases}$$

Where α_i denotes a country fixed effects. X_{it} is our set of control variables, ϵ_{it} (resp. Mis) stands for the error term (resp. currency misalignments), and λ and γ are dummy variables.

These benchmark regressions allow us to assess if the inflation-growth nexus depends on the sign of the currency misalignments. In other words, we can verify if inflation is more able to affect growth if the currency is undervalued rather than overvalued. It is meaningful because as argued by Chen (2017), an undervalued currency rises costs of importing machinery and other inputs for firms, increasing domestic inflation. To investigate the role played by undervaluations on the inflation-growth nexus, we estimate the following equation:

$$Growth_{it} = \alpha_i + \beta_1 Inflation_{it} + \beta_2 Undervaluation_{it-1} * Inflation_{it} + \beta_3 X_{it} + \epsilon_{it} \tag{3}$$

Where $Undervaluation_{it-1}$ is the lagged undervaluation. Note that the use of lagged values is justified by the fact that there exists a delay to produce an inflationary effect of undervaluations.

An important source of concern when using panel data, is the presence of substantial heterogeneity among the different individuals. To control for the effect of such heterogeneity, in addition to the traditional fixed and random effects estimator, we also estimate equation (2) on two sub-samples. The first sub-sample is composed of 22 emerging countries and the second one contained 24developing countries. Using these sub-samples allows us to assess whether lagged undervaluation has different effects depending on the country type.

Finally, we check whether the previous findings are affected by the occurence of currency crises. Indeed, such crises could affect our results as they are followed by consequent devaluations and high inflation rates (Borensztein & De Gregorio, 1999). Such devaluations can lead to an undervalued currency. They also lead to lower GDP growth rate (Hong & Tornell, 2005), which could potentially drive our results.

3.1.2 The Bayesian Model Averaging (BMA) methodology

It is well known that growth regressions are hampered by uncertainty arising from the selection of the relevant growth determinants (Moral-Benito, 2012). In other words, there is no consensus on the most significant variables explaining the economic growth (Durlauf, 2008). To tackle this uncertainty, we rely on the BMA methodology which has been frequently used in the context of growth regressions with panel data. In the context of growth regressions using panel data, this approach has been several times employed (see Moral-Benito, 2012 and Grekou, 2015a among others). We briefly present the BMA methodology which consists to compute Posterior Inclusion Probability for each variable as the sum of the posterior model probabilities for all the models including that variable. The starting point of this approach is to consider a linear regression model as follows:

$$Y = X\beta + \epsilon \tag{4}$$

Where Y is the vector of the dependent variable, X the matrix of explanatory variables and β (q*1) contains the parameters to be estimated. q is the number of parameters to be estimated. ϵ stands for the error term which is i.i.d and normally distributed. Assuming that it is possible to set some components of β to be equal to zero, there are a total set of 2^q candidates models to be estimated - indexed by M_j for j=1,...,2^q. The posterior distribution given the data for β, calculated using M_j is computed as follows:

$$P(\beta|D) = \sum_{j=1}^{2^q} P(\beta|D, M_j)P(M_j|D) \tag{5}$$

$P(M_j|D)$ is the posterior model probability for model j, given data D.
As can be seen from equation (5), the posterior density is a weighted average of the posterior model probabilities for all models including a given variable weighted by the posterior model probability for all models.
Using Bayes rule and for a given prior model probability ($P(M_j)$), the posterior model probability for model M_j is given by :

$$P(M_j|D) = \frac{P(D|M_j)P(M_j)}{\sum_{j=1}^{2^q} P(D|M_j)P(M_j)} \tag{6}$$

This posterior model probability for a given model can be seen as a measure of relative data fit (Moral-Benito & Roehn, 2016) and is used to assess the relevance of different variables. More specifically, it is computed as the sum of the posterior models probabilities for all the models including a variable i :

$$pip = P(\beta_i \neq 0|D) = \sum_{\beta_i \neq 0} P(M_j|D) \tag{7}$$

To rank the potential growth determinants according to their relevance, we refer to the classification proposed by Raftery (1995).[1] More generally, a PIP over 0.50

[1]According to Raftery (1995), a PIP between 0.75 and 0.95 denotes positive evidence of a regressor having an effect. A PIP between 0.95 and 0.99 denotes very strong evidence and a PIP over 0.99 denotes a decive evidence of a regressor.

indicates a robust variable.
The BMA methodology involves several methodological choices about the priors distribution, which constitute an important challenge (Moral-Benito & Roehn, 2016). A prior distribution on the parameter as well as on the model space has to be specified. A large panel of priors has been proposed by the literature (see Moral Benito, 2015 for a survey). Concerning the prior on the parameter space, we follow Fernàndez et al. (2001a) and use an improper noninformative prior for the parameters common to all models and specify two alternative g-prior structures proposed by Fernàndez et al. (2001a), namely the Risk Inflation Criterion (RIC) and the Unit Information Prior (UIP). Concerning the model space, the most commonly used prior structure is the Binomial distribution (Moral-Benito, 2015). In most cases, a uniform prior is employed (see Fernàndez et al., 2001b for example) which is a special case of Binomial Priors. For our part, rather than using only a fixed prior for the model space, we follow Ley & Steel (2009) and also specified a random prior namely a Binomial Beta prior. The use of this prior rather than a fixed one allows to reduce the sensitivity of the posteriors model probabilities (Moral-Benito, 2015).

3.1.3 The System General Method of Moments (SGMM)

A general feature inherent to growth regressions is the presence of endogeneity. To tackle such endogeneity, we rely on the System GMM (SGMM) procedure proposed by Arellano & Bover (1995) and Blundell & Bond (1998).[2]

To correctly interpret our findings based on this methodology, the results of three tests have to be checked carefully: AR(1) and AR(2) tests, and Hansen test of overidentifying restrictions. The AR(1) (resp. AR(2)) test consists to test the null hypothesis of no first-order correlation (resp. no second-order correlation) in the error term. The joint null hypothesis for the Hansen test is that the instruments are valid, i.e. uncorrelated with the error term, and that they are correctly excluded from the estimated equation. GMM's results are valid if the null AR(1) hypothesis is rejected and if the null hypotheses corresponding to AR(2)

[2]We choose this procedure rather than Arellano and Bond (1991) estimator for the following reasons. According to Blundell and Bond, their estimator permits efficiency gains over the first difference equation. In their approach, lagged dependent variables (for T >2) are used as instruments but they also include lagged differences of the dependent variable contrary to the difference GMM estimator. The lagged differences of the dependent variable (two periods or more) are valid instruments because they verify the hypothesis of exogeneity and relevance.

and Hansen tests are not rejected. In fact, the null hypothesis of the AR (2) test must not be rejected because the GMM estimator efficiency relies on this assumption. Equations (1), (2) and (3) are estimated relying on the SGMM estimator.

Following Roodman (2006), equations (1) to (3) are estimated using temporal dummies as additional instruments, helping the assumption of no correlation across individuals in the idiosyncratic to hold. However, the addition of such temporal dummies increase significantly the number of instruments, justifying why we do not include them in sub-sample regressions. Furthermore, considering undervaluation episodes leads to an unbalanced panel dataset, we use forward orthogonal deviations to maximize the sample size as suggested by Roodman (2006).

3.2 Data

3.2.1 The sample of countries

We consider annual data over the period 1980-2015 for advanced (18), emerging (22) and developing (22) countries. A detailed description of the countries in our sample is available in appendix (Table 4). Unlike the common practice in the context of growth regressions, we rely on annual data rather than five-years average for two main reasons. Firstly, as argued by Grekou (2015a) averaging misalignments produce "misleading times series", which could significantly affect our results. Secondly, applying this transformation to the inflation series is also problematic as it does not account for its dynamic.[3]

We choose these countries and this time period for two reasons. Firstly, we start in 1980 in order to limit the number of missing values as there is a lack of data for developing countries before this date. Secondly, as we focus on the role played by undervaluations, we retained countries with at least 13 years of undervaluations on the EQCHANGE database provided by the CEPII (Couharde et al., 2017) over the period 1973-2016.[4] Following, Lòpez-Villavicencio & Mignon (2011), we apply a logarithm transformation to the inflation rate for several reasons. Firstly, as noticed by these authors inflation's distribution is highly skewed. In addition, we can control for the presence of high inflation episodes which were shown to

[3]Note that in the investigation of the inflation-growth nexus, it is common to use annual data (see Gosh and Phillips, 1998 and Lopèz-Villavicencio & Mignon, 2011 among others).

[4]Due to lack of data for some developing countries, they are not included in our sample.

potentially drive the result of the inflation-growth nexus (Gosh & Phillips, 1998). Specifically, we consider the following transformation:

$$inflation_{it} = log(1 + \pi_{it})$$

Where π_{it} is the growth rate of the Consumer Price Index between years t-1 and t.

3.2.2 Potential growth determinants

In this subsection, we briefly review the potential growth determinants retained to implement the BMA approach. Our set of explanatory variables aims to investigate the relevance of Solow determinants, macroeconomic variables, as well as social-political indicators for growth. We consider a set of 18 potential growth determinants. A detailed description of the definitions and sources of the different variables used is available in table 5 in appendix, as well as descriptive statistics (table 6).

Let us briefly describe the determinants. Firstly, we investigate the convergence hypothesis through the use of the initial level of real GDP per capita, proxied by the lagged real GDP PC (in log) as in Sallenave (2010). This variable is considered as the only one robust growth determinant (Durlauf et al., 2008). Still in reference to the Solow model (1956), we include the population, population growth and the gross capital formation in our set of potential determinants. An increasing stock of capital should enhance economic growth (Barro, 1991), while a growing population has a negative effect.

Now, let us turn to the macroeconomic determinants of growth. Following Becker et al. (1990), we retain the fertility rate as a potential determinant: by increasing the available labor force, a higher total birth per woman reduces the incentive to accumulate human capital. An important source of concern in the literature is the presence of eventual distortions that we proxy by the investment price level (extracted from PWT 9.0) as in Moral-Benito (2012). They are expected to affect negatively growth (Easterly, 1993). In line with previous study (Barro, 1991; Easterly & Rebelo, 1993), we also include government consumption expenditures in our set of variables. Through its distorting effects, an increase in government consumption expenditures which negatively impact savings can hamper economic growth. Furthermore, in reference to Barro-Sala I Martin (2004), the relevance of the life expectancy is considered. De la Croix & Licandro (1999) argued that a low life expectancy is expected to reduce human capital accumulation because of an important discount rate factor. In addition, as people die young, the development is hampered by a high depreciation rate of human capital.

Following Edwards (1998), we include a measure of trade openness. Edwards (1998) argued that more opened economies experience higher total factor productivity growth, because of an increasing ability to absorb technological progress coming from more advanced economies. We also investigate the relevance of the financial development channel using the broad money to GDP ratio. King & Levine (1993) stressed that a more developed financial system can improve long term growth by helping to invest in high quality projects and mobilize resources for the most promising investment project. In the context of the endogenous growth theory, the role of human capital accumulation has been highlighted (see Romer, 1986 among others). Mankiw et al. (1992) provide evidence that a rise in gross secondary school enrollment enhances economic growth. Higher level of human capital is expected to improve the path of innovations in the economy and, in turn, rise growth. We study the relevance of this determinant using the human capital index offered by PWT 9.0.[5]

Our set of potential determinants also includes the terms of trade (TOT). Greenaway & Bleaney (2001) argued that countries relying heavily on exports can be affected by a modification in their TOT. In fact, such modification creates a volatility in their revenues. Moreover, Greenaway & Bleaney (2001) showed that a deterioration in TOT of sub-Saharan African economies significantly lower their investment. Due to the majority of developing and emerging countries in our sample, we also consider the remittances received. By rising households' incomes, remittances can have a positive effect on consumption and also help to invest (Pradhan et al, 2008). The presence of a scarce financial system can penalize economies but personal remittances can help them to overcome this difficulty (Giulinano & Ruiz-Arranz, 2009). On a sample of developing countries, Pradhan et al (2008) and Giulinano & Ruiz-Arranz (2009) showed that higher remittances boost growth.

[5]We include the human capital index proposed by PWT 9.0 rather than the gross replacement rate arising from the WDI due to data availability.

Two other potential macroeconomic determinants included are the young and the old dependency ratios. Using the bayesian averaging of classical estimates (BACE) methodology, Moral-Benito (2012) shows that the young dependency ratio exhibits a significant high PIP. Finally, our last macroeconomic variable is the Foreign Direct Investments (FDI) which can enhance economic growth through a technological diffusion process (Borensztein et al, 1998), especially for developing countries with a sufficient educated population.

To investigate the relevance of the social-political indicators, our set of potential determinants includes political rights and civil liberties indexes, arising from the Freedom House database. The expected effect of such variable appears as ambiguous in the literature. On the one hand, following Inkeles & Sirowy (1990) growth can be facilitated by the institution of an authoritarian regime which implements the needed policies. On the other hand, we can assume that expansion of civil liberties and political rights provides an environment adequate to the innovation process with at the key a positive effect on growth. From an empirical point of view, Barro & Lee (1994) provide evidences of a negative effect of political freedom on growth.

Turning now to the exchange rate misalignment series, they are extracted from the EQCHANGE database (Couharde et al., 2017). A misalignment is defined as the deviation of the Real Effective Exchange Rate (REER) from its equilibrium level (ERER). As this latter is unobservable, it has to be estimated. Several methodologies exist in the literature to estimate exchange rate misalignments (see for example MacDonald, 2000 and Driver and Westaway, 2004 for a survey). We rely on the Behavioral Equilibrium Exchange Rate (BEER) approach proposed by Clark & MacDonald (1999) which is based on the existence of a long run, cointegrating relationship between the REER and its long term determinants. Specifically, the following equation is estimated :

$$reer_{it} = \mu_i + \beta_1 RPROD_{it} + \beta_2 NFA_{it} + \beta_3 TOT_{it} + \epsilon_{it} \tag{8}$$

Where μ_i stands for country-fixed effects. reer is the logarithm of the REER. RPROD is the logarithm of a proxy[6] for the Balassa Samuelson effect. NFA denotes the Net Foreign Asset position, expressed in % of GDP. TOT stands for the logarithm of the Terms Of Trade which is the ratio of the export prices to import

[6]The proxy used is the ratio between the real GDP per capita (PPP terms) in the considered country and the trade weighted average of the PPP real GDP per capita of the trade partners

prices and ϵ_{it} is an error term.[7] The estimated values[8] of REER from this relationship provide the equilibrium REER for each country. The misalignment is then given by the difference between the REER and its equilibrium level. A positive (resp. negative) misalignment implies an overvaluation (resp. undervaluation). The estimation results of equation (6) are given in table 7 in Appendix. As shown, the three long run determinants of the REER are significant and present the positive expected sign. An increase in the relative productivity leads to a rise in the equilibrium exchange rate. An improvement in both the NFA position and TOT increases the equilibrium exchange rate as well. Furthermore, the error correction term is also significant at the 1% level and is negative, confirming the mean-reverting behavior of the exchange rate.

As shown by the figures in Appendix D, the apparition of an undervalued currency is mainly due to a decreasing REER. Furthermore, increasing currency undervaluations generally come from a depreciation of the REER, motivating our interest to investigate how currency undervaluation affects the inflation-growth nexus. Finally, as can be seen from these figures, the ERER is only weakly volatile across countries.

4 Results

4.1 Growth determinants: A BMA approach

In this subsection, we present the results of the BMA methodology. The BMA approach is implemented using different model priors: a random, fixed and uniform prior. As highlighted in the presentation of this methodology, we assume two different parameter priors are considered: a Uniform Information Prior (UIP) and a Risk Inflation Criterion (RIC).

Among our initial dataset of 18 potential growth determinants, six variables emerge as robust , e.g having a PIP over 0.50. As expected, we find strong support for the conditional convergence hypothesis as the real initial GDP PC presents a PIP nearly equals to 1. This result is in line with Durlauf et al. (2008) and is not affected by a change in the model or parameter space. Furthermore, our results

[7]Data sources of each series are described in Couharde et al. (2017).

[8]The estimation is done using the Pooled Mean Group (PMG) estimator proposed by Pesaran et al.(1999). Compared to the DOLS procedure, PMG allows for heterogeneity among countries in the short-run dynamics. Hence, we rely on the PMG estimator as we are able to take into account some heterogeneity in our panel.

Table 1: Posterior Inclusion Probabilities

Model prior	Random	Random	Fixed	Fixed	Uniform
Parameter prior	UIP	RIC	UIP	RIC	
	Posterior	Inclusion	Probability		
Variable					
Gross fixed capital	**1.000**[a]	**1.000**[a]	**1.000**[a]	**1.000**[a]	**1.000**[a]
Government consumption	**1.000**[a]	**1.000**[a]	**1.000**[a]	**1.000**[a]	**1.000**[a]
Real initial GDP PC	**0.998**[a]	**0.998**[a]	**0.998**[a]	**0.996**[a]	**0.998**[a]
Fertility	**0.993**[a]	**0.996**[a]	**0.992**[a]	**0.993**[a]	**0.993**[a]
Terms Of Trade	**0.809**[b]	**0.797**[b]	**0.736**	**0.737**	**0.799**[b]
Human capital	**0.564**	**0.563**	0.495	0.495	**0.573**
FDI	0.313	0.322	0.206	0.212	0.319
Openness	0.251	0.248	0.167	0.167	0.252
Price level of investment	0.184	0.193	0.099	0.101	0.190
Old dependency ratio	0.166	0.165	0.104	0.098	0.162
Remittances	0.151	0.154	0.080	0.081	0.150
Young dependency ratio	0.140	0.143	0.084	0.083	0.135
Civil liberties	0.140	0.128	0.073	0.074	0.132
Life expectancy	0.132	0.136	0.078	0.070	0.141
Political rights	0.131	0.127	0.072	0.070	0.128
Broad money	0.131	0.122	0.072	0.068	0.131
Population growth	0.124	0.125	0.069	0.070	0.121
Population	0.114	0.116	0.070	0.063	0.117

Note: The results are based on 100.000 burn-ins and 200.000 draws. Simulations made using birth-death MCMC sampler. "[a]" denotes a PIP over 0.99 denotes and decive evidence of a regressor. "[b]" indicates a PIP between 0.75 and 0.95 denoting a positive evidence of a regressor having an effect. RIC=Risk Inflation Criterion. UIP= Unit Information Prior. Use of the BMS (Feldkircher & Zeugner, 2015) package.

point out that the fertility rate constitutes a relevant growth determinant. As in Moral-Benito (2012) & Grekou (2015a), government consumption expenditures belong to the robust growth determinants. In line with the Solow-Swan model, capital accumulation is shown to have a strong influence on growth, while population and population growth do not belong to the set of selected variables. For our sample of countries, the BMA approach also shows that terms of trade constitute a relevant determinant. This result can be explained by the presence of countries which rely heavily on export revenues to sustain their growth (Australia, Brazil, China, Indonesia and New-Zealand among others). Finally, we also find evidence of the relevance of the human capital index in the growth process. However, among our set of six variables this determinant seems to be the less relevant one. Under some priors, human capital capital can not be seen as a robust determinant because of a PIP below 0.50. Furthermore, we do not find strong support for the socio-political indicators, nor for other macroeconomic and demographic variables.

4.2 Undervaluations and the inflation-growth nexus

To assess the role played by exchange rate undervaluations on the inflation-growth nexus, we estimate equations (1) and (2). The corresponding are displayed in table 2 below.

Table 2: Benchmark regressions

	FE	RE	S.GMM	FE	RE	S.GMM
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)
Real initial GDP PC	-3.233***	-1.395***	-0.349	-3.491**	-1.868***	-3.518***
	(1.057)	(0.366)	(0.958)	(1.390)	(0.349)	(1.296)
Inflation	-0.466**	-0.480***	-0.760***	-0.414	-0.249	-0.576
	(0.207)	(0.166)	(0.279)	(0.269)	(0.193)	(0.403)
Gross fixed capital	0.139***	0.117***	0.210***	0.227***	0.223***	0.297***
	(0.0385)	(0.0269)	(0.0648)	(0.0520)	(0.0334)	(0.0605)
Government consumption	-0.378***	-0.218***	-0.399***	-0.330***	-0.153***	-0.0867
	(0.0926)	(0.0468)	(0.100)	(0.121)	(0.0457)	(0.166)
Human capital	3.206	0.731	-1.583	2.762	1.433***	3.046
	(2.088)	(0.489)	(1.620)	(1.690)	(0.527)	(2.588)
Terms Of Trade	0.922	1.040	1.613*	1.708	1.010*	0.823
	(0.757)	(0.642)	(0.973)	(1.030)	(0.596)	(1.305)
Fertility	-1.033*	-1.080***	-1.530***	-1.246***	-1.107***	-1.475
	(0.519)	(0.212)	(0.496)	(0.346)	(0.210)	(1.087)
constant	25.70***	13.03***	8.492	23.16*	11.51**	22.58*
	(7.304)	(4.186)	(9.358)	(12.68)	(4.987)	(13.20)
No. countries/No. observations	1002/62	1002/62	1002/62	785/61	785/61	785/61
Undervaluations episodes	YES	YES	YES	NO	NO	NO
Overvaluations episodes	NO	NO	NO	YES	YES	YES
AR(1)			0.000			0.000
AR(2)			0.060			0.062
Hansen			0.221			0.183
Time series dumies			YES			YES
No. instruments			49			49

***, **, and * denote the levels of statistical significance at 1, 5, and 10%. FE: Fixed effects, RE: Random Effects, SGMM: System General Method of Moments. Robust standard errors are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). In the SGMM, all the variables are treated as endogenous. Use of forward orthogonal deviations.

Let us discuss the results concerning our control variables. In at least one regression, all our control variables are significant and present the expected sign. More specifically, in line with the convergence hypothesis a higher level of initial real GDP PC is associated with a lower growth. Furthermore, we find support in favor of the capital accumulation channel as a rise in the level of physical capital enhances growth. Indeed, following a 1% increase in the gross fixed capital formation, growth improves from 0.117% to 0.297%. As Barro (1991) and Easterly and Rebelo (1993), we show that government consumption expenditures hamper significantly growth. This negative effect ranges from a low of 0.153% to a maximum of 0.399%. As suggested by Becker et al.(1990), growth is also negatively correlated with the fertility rate. By reducing the incentive to accumulate human capital, more births per woman reduce growth. Finally, among our different regressions, human capital and the TOT are only weakly significant. This result is expected as these determinants exhibit the lower PIP, illustrating their small explanatory power. Considering regression (2.5), an improvement in countries' TOT and a higher level of human capital enhance growth. Moving to the impact of inflation on growth, we find that inflation hampers growth for undervaluation episodes, while there is no negative effect under overvaluation periods. This result is expected as an undervalued currency should leads to an imported inflation which accentuates the potential negative effect of inflation. Indeed, inflation is negatively correlated with growth as soon as a certain threshold is reached as highlighted by the literature. After having identified that countries with an undervalued currency experienced a negative effect of inflation, we move to our next step. We investigate whether the inflation effect on growth depends on the level of undervaluation. To this end, we estimate equation (3) including our interaction variable. The corresponding results are displayed in table 3.

A first look at our results shows that inflation and our interaction term are always highly significant. The inflation-growth nexus crucially depends on lagged undervaluations. The most interesting finding is the negative sign associated to the interaction term, meaning that higher is the lagged undervaluation, higher is the negative effect of inflation on growth. More precisely, the effect of inflation on growth derivated from equation (3) is given by :

$$\frac{\partial Growth_{it}}{\partial inflation_{it}} = \beta_1 + \beta_2 * Undervaluation_{it-1} \tag{9}$$

Substituting β_1 and β_2 by their estimated values obtained from (3.4), we get :

Table 3: Regression for the interaction variable

	FE	RE	S.GMM	S.GMM
	(3.1)	(3.2)	(3.3)	(3.4)
Real initial GDP PC	-3.387***	-1.281***	2.828	-0.734
	(1.011)	(0.362)	(2.291)	(0.905)
Inflation	-0.636***	-0.689***	-1.113***	-0.825***
	(0.219)	(0.182)	(0.400)	(0.272)
Inflation*Undervaluation$_{i,t-1}$	-0.0128***	-0.0129***	-0.0248***	-0.0170***
	(0.00306)	(0.00298)	(0.00894)	(0.00560)
Gross fixed capital	0.132***	0.111***	0.183**	0.172***
	(0.0393)	(0.0275)	(0.0885)	(0.0617)
Government consumption	-0.373***	-0.218***	-0.371**	-0.319***
	(0.0901)	(0.0428)	(0.151)	(0.104)
Human capital	3.387	0.697	-6.255*	-1.869
	(2.039)	(0.461)	(3.300)	(1.435)
Terms Of Trade	0.767	0.838	6.811***	1.520
	(0.764)	(0.627)	(2.502)	(1.100)
Fertility	-0.908*	-1.030***	-1.064	-1.858***
	(0.508)	(0.214)	(1.004)	(0.538)
Constant	26.95***	12.99***	-34.58	13.64
	(7.436)	(4.038)	(26.55)	(9.644)
No. countries/ No. observations	1001/62	1001/62	1001/62	1001/62
AR(1)			0.000	0.000
AR(2)			0.069	0.062
Hansen			0.085	0.235
Time series dummies			NO	YES
No. instruments			17	51

***, **, and * denote the levels of statistical significance at 1, 5, and 10%. FE: Fixed effects, RE: Random Effects, SGMM: System General Method of Moments. Robust standard errors are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). In the SGMM, all the variables are treated as endogenous. Use of forward orthogonal deviations.

$$\frac{\partial Growth_{it}}{\partial inflation_{it}} = -0.825 - 0.0170 * Undervaluation_{it-1} \tag{10}$$

Finally, assuming that undervaluation sets at its median value, we have :

$$\frac{\partial Growth_{it}}{\partial inflation_{it}} = -0.825 - 0.0170 * 11.74 = -1.024 \tag{11}$$

We remark that a non negligeable part of the negative effect of inflation is conveyed by a higher undervaluation level. This higher undervaluation, especially if it comes from a depreciation of the currency, enhances inflation, which in turn affects negatively economic growth.

As highlighted in the sub-section devoted to the presentation of our empirical strategy, we also consider sub-samples regressions (table 8 in appendix). The first sub-sample is composed of emerging economies, and the second one of developing countries. The motivation beyond the creation of sub-samples is twofold. Firstly, as argued above, such decomposition allows us to limit heterogeneity arising from our sample. Secondly and more interestingly, countries setting at different stages of development show different tolerance to inflation (Lòpez-Villavicencio & Mignon, 2011) which could affect our findings.

Let us first discuss results concerning inflation. We find evidence of a negative inflation-growth nexus for emerging countries, while inflation does not hamper growth for developing economies. This result can be understood in light of two main explanations. The first one states that developing countries present a higher tolerance to inflation than emerging countries (Lòpez-Villavicencio & Mignon, 2011). In other words, due to the predominance of the Balassa-Samuelson effect for these countries, they can bear higher inflation as it occurs in response to a catching-up process. The second explanation lies in the presence of lower inflation in developing countries than in emerging ones. Indeed, as shown by the results in table 9 in appendix, as soon as high inflation episodes are excluded, mean inflation is significantly higher in emerging countries than in developing ones. This lower inflation originate from the presence of countries with a fixed exchange rate regime (CFA zone). Indeed, countries which pegged their currencies present significantly lower inflation rates (see Gosh et al., 1997). This lower inflation rate can also explain the non significance of this relationship as for developing countries, inflation negatively impacts growth as soon as a threshold equals to 11-12% is reached (Kahn et al., 2001).

In the following, we discuss the results concerning our interaction variable. We find a significantly negative interaction term for emerging countries, while for developing ones the inflation-growth nexus does not depend upon lagged undervaluations. This result is discussed in light of the three following explanations: length of undervaluation periods, level of undervaluations and inflationary environment. First of all, we examine if the insignificance of the interaction term for the developing economies can be relied to the length of undervaluation periods. In order to generate a supplementary inflationary pressure a sizebable length of undervaluation is expected. In fact, it is important because such long undervaluation period can arise from a depreciated currency which is source of inflation. Our test, available in table 9 in appendix, infirms this hypothesis as mean length undervaluation period is significantly higher in developing economies than in emerging ones.

Let us now verify if the fact that inflation does not depend upon lagged undervaluations can be explained by the level of undervaluations. In order to generate potential inflationary pressure, undervaluations should be sizable assuming that they were caused by important currency depreciation. This explanation is supported by our test showing that emerging countries have a statistically significant higher mean undervaluation than developing ones at the 5% level (see table 9 in appendix). These higher undervaluation episodes are able to generate inflation, which can affect negatively growth as suggested by significance and negative sign of our interaction variable. Hence, it explained why inflation depends upon undervaluation's level for emerging countries.

Turning to the inflationary environment, it plays a key role in the context of the Exchange Rate Pass Through to Prices (ERPT) as argued by Lòpez-Villavicencio & Mignon (2017). It is important for the purpose of our analysis as undervaluations can rise following either an improvement in the fundamentals, or more interestingly, a deterioration of the REER. The inflationnary environment can be more propice to a high EPRT for emerging countries than for developing ones, explaining our previous findings. In fact, higher inflation rate translates into higher ERPT (see Taylor, 2000; Choudhri & Hakura, 2007; Lòpez Villavicencio & Mignon, 2017). In other words, lower is the inflation rate lower is the ERPT, meaning that an undervalued currency is more likely to produce inflation pressure if the environment is inflationary. Hence, a possible explanation for the fact that the negative effect of inflation depends on the lagged undervaluation for emerging countries but not for developing ones is the difference in the inflationary environment. It is supported by our findings showing that mean inflation is significantly higher in emerging countries than in developing ones (table 9 in appendix). Countries which pegged their currency experience lower inflation and less variation in undervaluations.

4.3 Robustness checks

Given the long time span of our panel data set, countries were hit by several currency crisis episodes. More specifically, our sample contains countries belonging to the CFA zone which were hit by a crisis in 1994 due to a modification in parity. Furthermore, there are also Asian economies affected by currency crises in 1997-1998. The presence of such events can affect our previous findings in several ways. Firstly, one symptom inherent to currency crises is the presence of large currency overvaluations (Kaminsky et al., 1999) which are then followed by a sharp devaluation leading generally to an undervalued currency. These crises can affect our results as they are followed by lower GDP growth (Hong & Tornell, 2005) in the three years following the crisis. Moreover, the years following these crises are characterized by higher inflation because of the devaluations (Borensztein & De Gregorio, 1999). This higher inflation rate could lower economic growth by penalizing the investment rate in the economy (see Hong & Tornell, 2005). All in all, our results can be affected by the currency crises.

In order to check the robustness of our results to the presence of currency crises episodes, we use the database proposed by Laeven and Valencia (2012). A detailed description of the different episodes of currency crises is available in table 11 in appendix. We control for the currency crises by creating a dummy which is equal to 1 during the year of the currency crises and the following two years.[9] Specifically, we have :

$$Dummy = \begin{cases} 1, & \text{if year=t,t+1,t+2} \\ 0, & \text{otherwise} \end{cases} \tag{12}$$

Where t stands for the year of the currency crisis.

As soon as the dummy variable is equals to one, we exclude these observations from our sample. The results are displayed in table 10 in appendix. As expected the exclusion of episodes of currency crises from our sample leads to weaken the significance for inflation. More precisely, considering regressions (3.4) (table 3) and (6.4) (table 10), inflation becomes significant at the 10 % level and the interaction term is still significantly negative. Hence, as previously an increase in the lagged undervaluation leads to an intensification of the negative effect of inflation

[9]We control for 2 years after the currency crisis due to lasting effects.

on growth. Our results are thus robust to the presence of currency crises.

5 Conclusion

Our article aims at assessing to the role played by undervaluation on growth. While it is generally admitted that undervaluation has a growth-enhancing effect (Rodrik, 2008; Macdonald & Vieira , 2012), we put into perspective these potential gains by considering the role of undervaluations on the inflation-growth nexus.

After having selected the relevant growth determinants using the BMA approach, we reconsider the inflation-growth nexus by taking into account undervaluation's influence. We find evidence that higher is the lagged undervaluation, higher is the negative impact of inflation on growth. In other words, undervaluation reinforces the negative effect of inflation on growth probably through an imported inflation mechanism. Considering sub-sample regressions, we show that this finding holds only for emerging countries, but not for developing economies. This result is explained in light of undervaluations' level and the inflationary environment. Emerging countries present a statistically significantly higher mean undervaluation than developing ones. Moreover, the former also show an inflationary environment more propice to a high ERPT than the latter. Finally, we find evidence that the effect of higher lagged undervaluations and inflation on growth is robust to the exclusion of currency crises.

In light of our results, several economic policy recommendations can be drawn. Beside the potential gains coming from an undervalued currency, the inflation-growth nexus is reinforced if undervaluation rises. Hence, countries which based, to a certain extent, their development policy on an undervalued currency have to weight the pros and cons of such choice. In fact, the positive impact on growth of an undervalued currency is not the alone sole factor, but has to be considered keeping in mind its potentially inflationary effect.

A Data appendix

A.1 Sample

Table 4: List of countries (62)

Advanced countries	Emerging countries	Developing countries
Australia	Algeria	Bangladesh
Belgium	Argentina	Bolivia
Canada	Brazil	Cameroon
China Hong Kong SAR	Chile	Central African Republic
France	China	Congo
Germany	Colombia	Costa Rica
Greece	Côte d'Ivoire	Ethiopia
Ireland	Ecuador	Gabon
Israel	Egypt	Ghana
Korea Republic	Guatemala	Honduras
Netherlands	India	Madagascar
New Zealand	Indonesia	Mauritania
Norway	Jordan	Mozambique
Singapore	Kenya	Niger
Spain	Malaysia	Nigeria
Sweden	Mexico	Panama
United Kingdom	Morocco	Paraguay
USA	Philippines	Senegal
	Thailand	South Africa
	Tunisia	Sri Lanka
	Turkey	Togo
	Venezuela	Trinidad and Tobago

A.2 Data description

Table 5: Variables definitions and sources

Variables	**definitions**	**sources**
Real initial GDP PC	Lagged real GDP per capita (expressed in logarithm)	WDI
Population	Total population (expressed in logarithm)	WDI
Population growth	Population growth	WDI
Life expectancy	Life expectancy at birth (total years), expressed in logarithm	WDI
Old dependency ratio	Population over 65 years old divided by the working age population	WDI
Young dependency ratio	Population under 15 years old divided by the working age population	WDI
Macroeconomic variables		
FDI	Foreign direct investment, net inflows (% of GDP)	WDI
Openness	Exports plus Imports (% GDP)	WDI
Government consumption	General government final consumption expenditure (% of GDP)	WDI
Terms Of Trade	Net barter terms of trade index (2000 = 100), expressed in logarithm	WDI
Inflation	Inflation (consumer price)	WDI and USDA
Gross fixed capital	Gross fixed capital formation (% of GDP)	WDI
M2GDP	Broad money (% of GDP)	WDI
Remittances	Personal remittances, received (% of GDP)	WDI
Fertility	total (births per woman)	WDI
Human capital	Human capital	P.W.T 9.0
Price level of investment	Price level of capital formation, price level of USA GDPo in 2011=100	P.W.T 9.0
Socio-political indicators		
Civil liberties	Civil liberties; measured on a scale from 1 to 7, 7 being the lowest level of freedom.	Freedom House
Political rights	Political rights; measured on a scale from 1 to 7, 1 being the highest degree of freedom.	Freedom House
Misalignment exchange rate	Measure of misalignment using a BEER approach	EQCHANGE (Couharde et al., 2017).

Note: WDI: World Development indicators. USDA : United States Department of Agricultural. PWT : Penn World Table

B Additional results

B.1 Descriptive statistics

Table 6: **Descriptive statistics**

Variable	Observations	Standard deviation	Mean	Min	Max
Broad money	1814	37,42	45,01	3,81	362,86
Civil liberties	2186	1,71	3,38	1,00	7,00
Employment	2170	98,72	30,98	0,22	798,37
Fertility rate	2232	1,75	3,42	0,90	7,89
Foreign direct investment	2172	5,71	3,09	-10,08	87,44
GDPPC	2231	14247,26	14112,38	354,28	80892,06
GDP PC growth rate	2228	4,18	1,76	-36,83	30,36
Government consumption	2174	5,23	15,04	2,98	45,30
Gross fixed capital formation	2212	8,03	22,95	0,00	61,47
Human capital	2232	0,71	2,27	1,02	3,73
Inflation	2220	281,53	24,63	-29,81	11749,64
Life expectancy	2162	11,48	64,43	35,00	84,28
Misalignment	2217	29,47	0,04	-170,28	269,85
Open	2183	57,54	75,21	6,32	442,62
Population	2170	198,54	70,63	0,73	1369,44
Population growth	2266	1.97	1.06	-4.03	7.51
Old dependency ratio	2232	4,59	6,99	1,93	21,12
Young dependency ratio	2232	10,28	32,54	11,06	50,22
Political rights	2186	2,02	3,28	1,00	7,00
Price level investment	2170	0,27	0,57	0,05	2,47
Remittances	1431	3,55	2,08	0,00	24,90
Terms of trade	1938	40,90	114,11	21,40	357,58

Source: Author's calculations.

B.2 Cointegration relationship estimation

Table 7: Equilibrium exchange rates estimation

Dependent variable : Δreer	
	Coef.
Long run dynamic	
RPROD	0.0740***
	(0.0209)
NFA	0.0432***
	(0.00569)
TOT	0.419***
	(0.0307)
Short-run dynamic	
ec	-0.185***
	(0.0165)
ΔRPOD	0.189
	(0.123)
ΔNFA	0.0553**
	(0.0237)
ΔTOT	0.419***
	(0.0307)

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. "e.c." denotes the error-correction term. Cointegration relationship estimated relying on the PMG estimator.
Source: Couharde et al. (2017).

B.3 Sub-samples regressions

Table 8: Sub-samples regressions

	FE	RE	S.GMM	FE	RE	S.GMM
	(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)
Real initial GDP PC	-4.829***	-2.152***	-3.393***	-1.776	-1.776	7.051
	(1.226)	(0.524)	(0.959)	(1.711)	(1.711)	(4.445)
Inflation	-1.045***	-0.842***	-0.673*	-0.134	-0.134	-2.655
	(0.300)	(0.244)	(0.390)	(0.319)	(0.319)	(3.327)
Inflation*Undervaluation$_{i,t-1}$	-0.0164***	-0.0190***	-0.0153***	-0.00745	-0.00745	-0.0164
	(0.00357)	(0.00360)	(0.00491)	(0.00535)	(0.00535)	(0.0191)
Gross fixed capital	0.330***	0.207***	0.215***	0.0465	0.0465	0.101
	(0.0686)	(0.0449)	(0.0603)	(0.0310)	(0.0310)	(0.319)
Government consumption	-0.452***	-0.258***	-0.154	-0.268**	-0.268**	-1.404**
	(0.132)	(0.0591)	(0.124)	(0.120)	(0.120)	(0.600)
Human capital	4.324	0.615	1.772	3.862	3.862	-14.20
	(3.600)	(0.804)	(2.443)	(3.663)	(3.663)	(9.251)
Terms Of Trade	-0.690	0.414	-0.712	0.728	0.728	9.322
	(1.138)	(0.746)	(2.137)	(0.939)	(0.939)	(7.882)
Fertility	-1.002	-1.075***	-1.409**	-0.739	-0.739	-0.921
	(0.890)	(0.271)	(0.613)	(0.780)	(0.780)	(2.111)
Constant	42.07***	21.20***	34.37***	11.11	11.11	-47.72
	(8.104)	(7.509)	(13.13)	(9.154)	(9.154)	(36.27)
No. countries / No. observations	22/425	22/425	22/425	24/413	24/413	24/413
Sub-samples	EME	EME	EME	DE	DE	DE
AR(1)			0.006			0.013
AR(2)			0.427			0.225
Hansen			0.473			0.466
Time series dummies			NO			NO
No. instruments			25			17

***, **, and * denote the levels of statistical significance at 1, 5, and 10%. FE: Fixed effects, RE: Random Effects, SGMM: System General Method of Moments. Robust standard errors are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). In the SGMM, all the variables are treated as endogenous. Use of forward orthogonal deviations.

B.4 Statistics test

Table 9: Tests of difference in mean between emerging and developing countries

Alternative Hypothesis	P-value difference mean undervaluation	P-value difference mean inflation
Difference <0	0.957	0.999
Difference=0	0.087*	0.001***
Difference>0	0.0428**	0.000***

***,**,* indicates rejection of the null hypothesis respectively at the 1%,5% and 10% level in favor of the alternative hypothesis. Welch for unequal variances is used. Mozambique and high inflation episodes are excluded (inflation >100%) as the latter tend to increase mean inflation for emerging countries. Absolute value of the undervaluations used.
Source: Author's calculations.

B.5 Robustness checks

Table 10: Robustness checks

	Dependent Variable:	GDP PC growth rate		
	FE	RE	S.GMM	S.GMM
	(6.1)	(6.2)	(6.3)	(6.4)
Real initial GDP PC	-3.006***	-1.078***	1.143	-0.313
	(0.947)	(0.359)	(1.032)	(0.908)
Inflation	-0.499**	-0.431**	-1.260***	-0.636*
	(0.212)	(0.174)	(0.438)	(0.377)
Inflation*undervaluation$_{i,t-1}$	-0.00994***	-0.00959***	-0.0126***	-0.0185***
	(0.00360)	(0.00338)	(0.00484)	(0.00545)
Gross fixed capital	0.112***	0.0968***	0.0598	0.105**
	(0.0350)	(0.0268)	(0.0472)	(0.0424)
Government consumption	-0.372***	-0.218***	-0.253**	-0.360***
	(0.0918)	(0.0453)	(0.113)	(0.0900)
Human capital	2.332	0.311	-4.867***	-1.938
	(1.813)	(0.409)	(1.816)	(1.640)
Terms Of Trade	0.752	0.778	0.427	-0.275
	(0.856)	(0.731)	(1.196)	(1.140)
Fertility	-0.954*	-1.135***	-1.687***	-1.775***
	(0.482)	(0.225)	(0.497)	(0.484)
Constant	26.57***	12.78***	11.00	19.93**
	(7.571)	(4.250)	(10.37)	(9.611)
No. countries/ No. observations	62/918	62/918	62/918	62/918
AR(1)			0.000	0.000
AR(2)			0.071	0.047
Hansen			0.714	0.252
Time series dummies			NO	YES
No. instruments			25	51

***, **, and * denote the levels of statistical significance at 1, 5, and 10%. FE: Fixed effects, RE: Random Effects, SGMM: System General Method of Moments. Robust standard errors are reported in parentheses: robust clustered (resp. Windmeijer correction) standard errors for FE (resp. for two-step SGMM). In the SGMM, all the variables are treated as endogeneous. Use of forward orthogonal deviations.

C Currency crises episodes

Table 11: Currency crises episodes

Country	Year of currency crisis	Country	Year of currency crisis
Algeria	1988, 1994	Madagascar	1984, 1994, 2004
Argentina	1981, 1987, 2002	Mauritania	1993
Bolivia	1981	Mexico	1982, 1995
Brazil	1982, 1987, 1992, 1999	Morocco	1981
Cameroon	1994	Mozambique	1987
Central African Republic	1994	New Zealand	1984
Chile	1982	Niger	1994
Colombia	1985	Paraguay	1984, 1989, 2002
Congo	1994	Nigeria	1983, 1989, 1997
Costa Rica	1981, 1991	Philippines	1983, 1998
Côte d'Ivoire	1994	Senegal	1994
Ecuador	1982, 1999	South Africa	1984
Egypt	1979, 1990	Spain	1983
Ethiopia	1993	Sri Lanka	1978
Gabon	1994	Sweden	1993
Ghana	1983, 1993, 2000, 2009	Thailand	1998
Greece	1983	Togo	1994
Guatemala	1986	Trinidad and Tobago	1986
Honduras	1990	Turkey	1978, 1984, 1991, 1996, 2001
Indonesia	1979, 1998	Venezuela	1984, 1989, 1994, 2002, 2010
Israel	1980, 1985		
Jordan	1989		
Kenya	1993		
Korea Rep	1998		

Source: Laeven and Fabian Valencia (2012)

D Figures

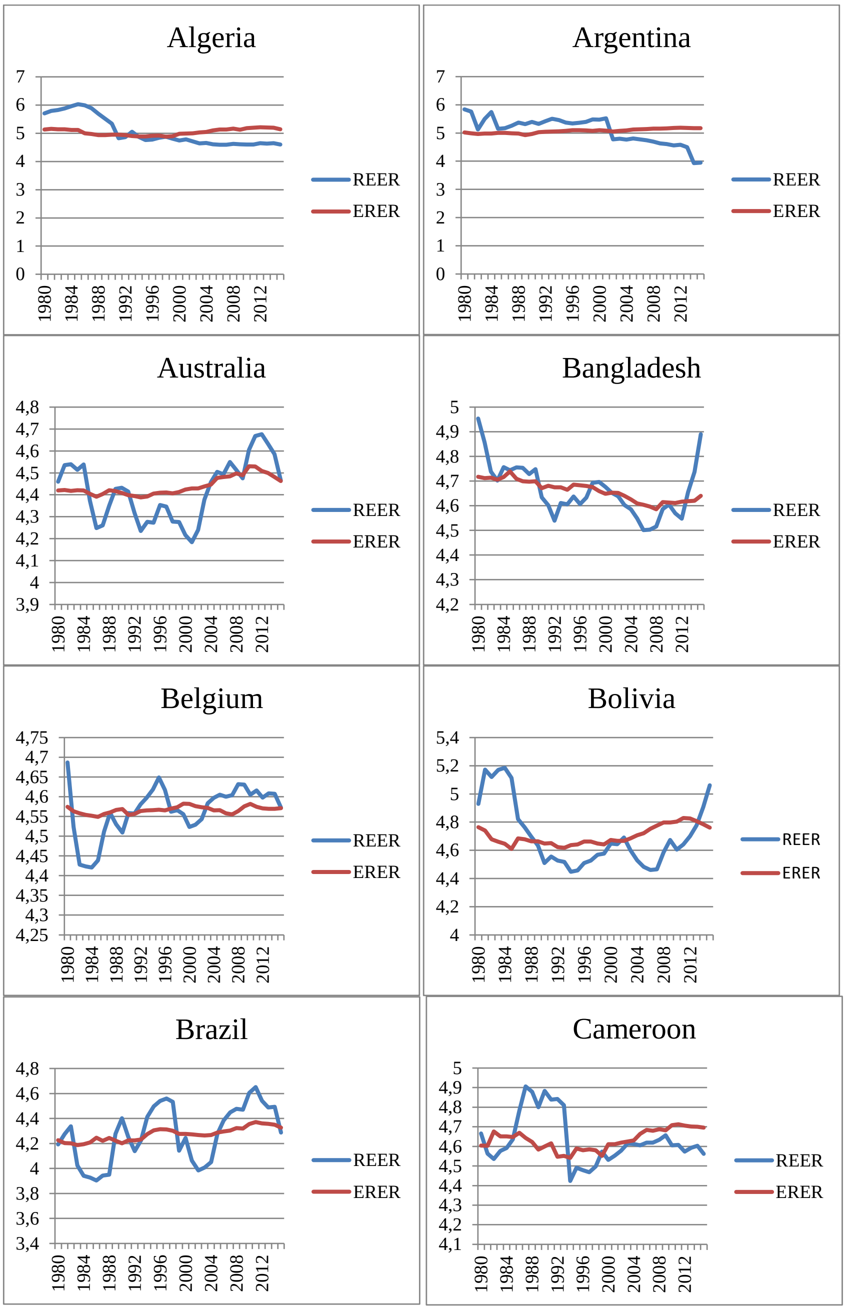
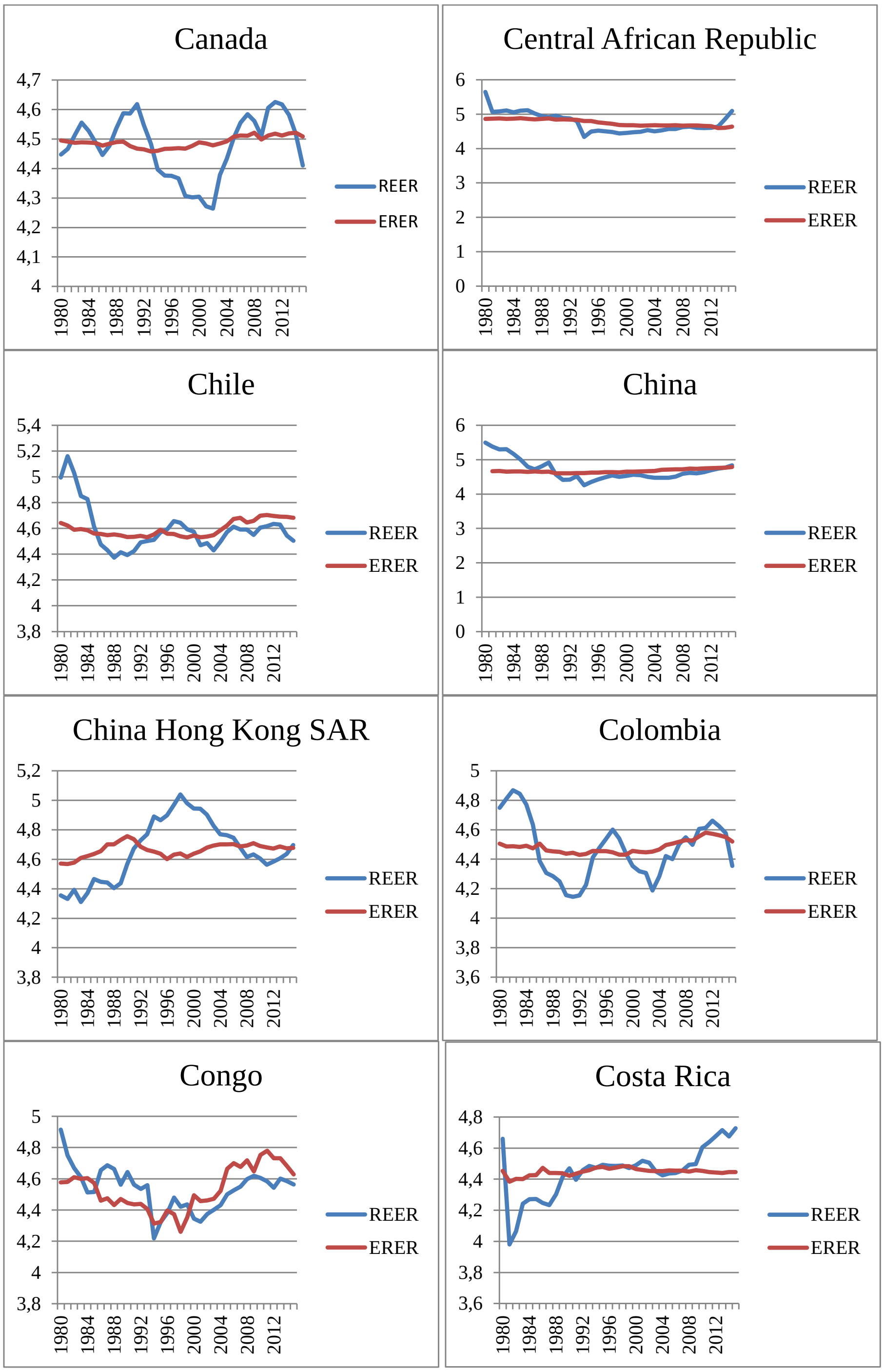


Figure 1: Real and Equilibrium Effective Exchange Rates (REER and ERER)

Note: REER (resp. ERER) indicates the logarithm of the Real Effective Exchange Rates (resp. Equilibrium Real Exchange Rate). A decrease (resp. increase) of the real effective exchange rate indicates a depreciation (resp. appreciation).



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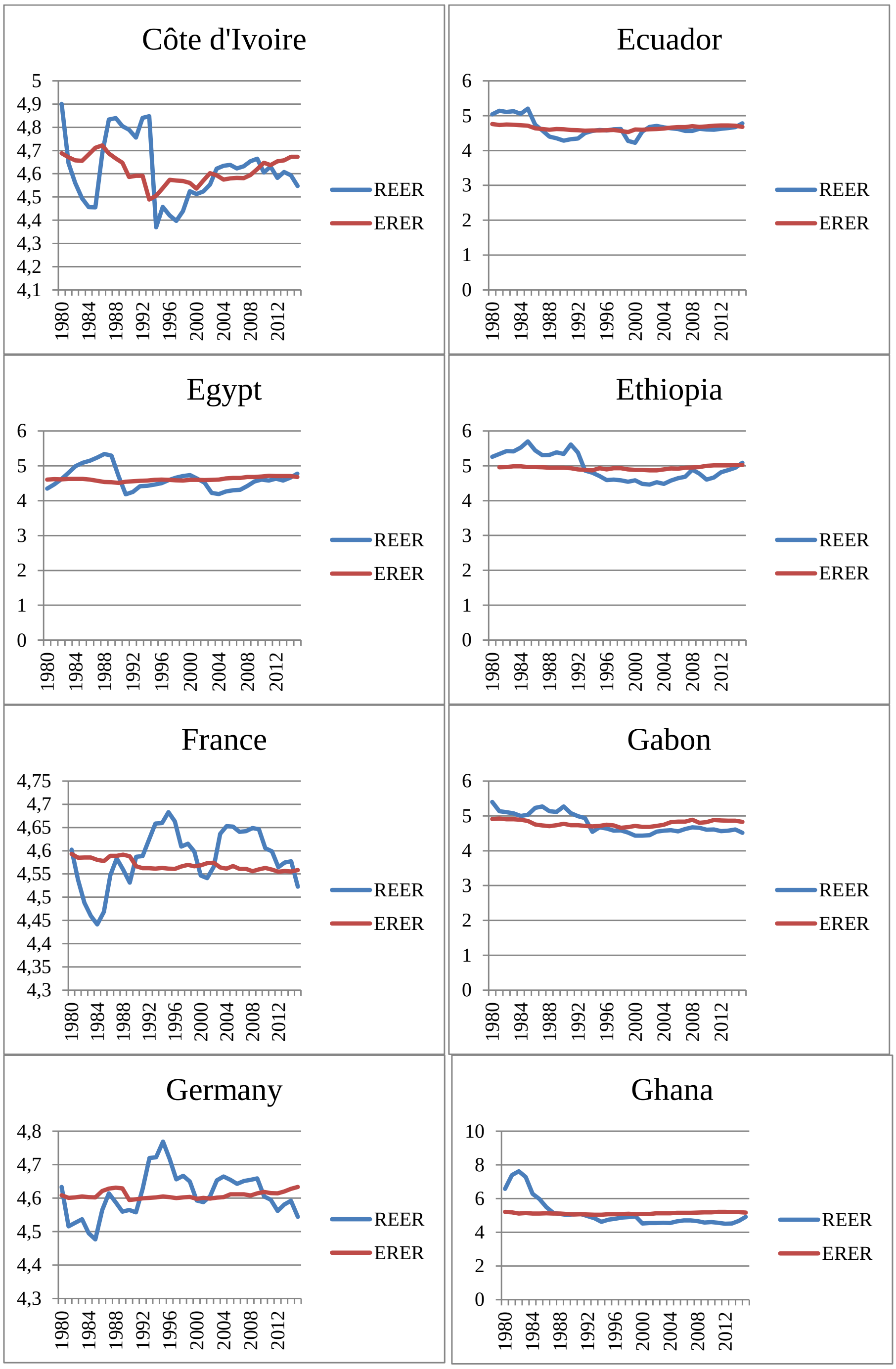

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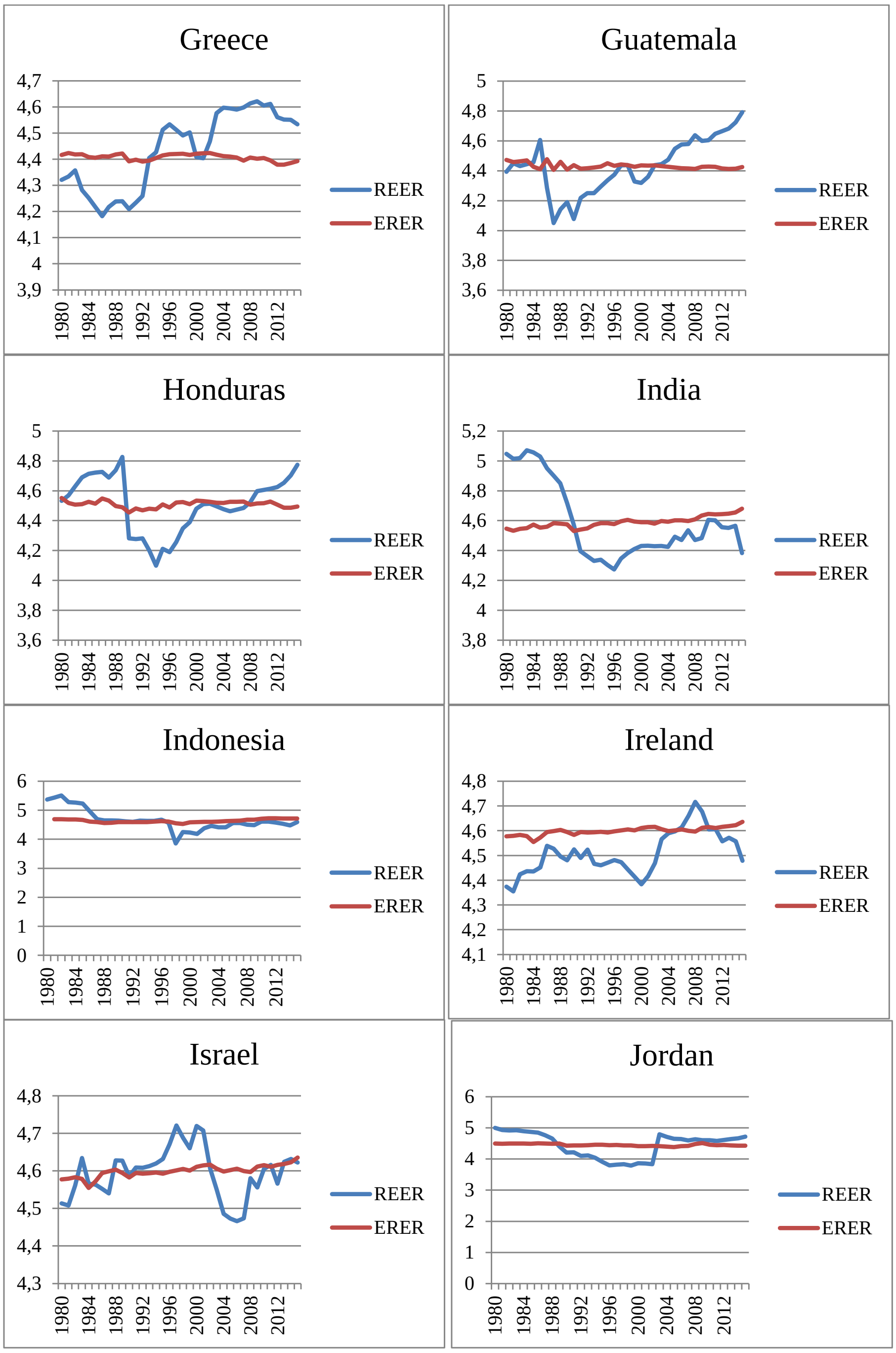

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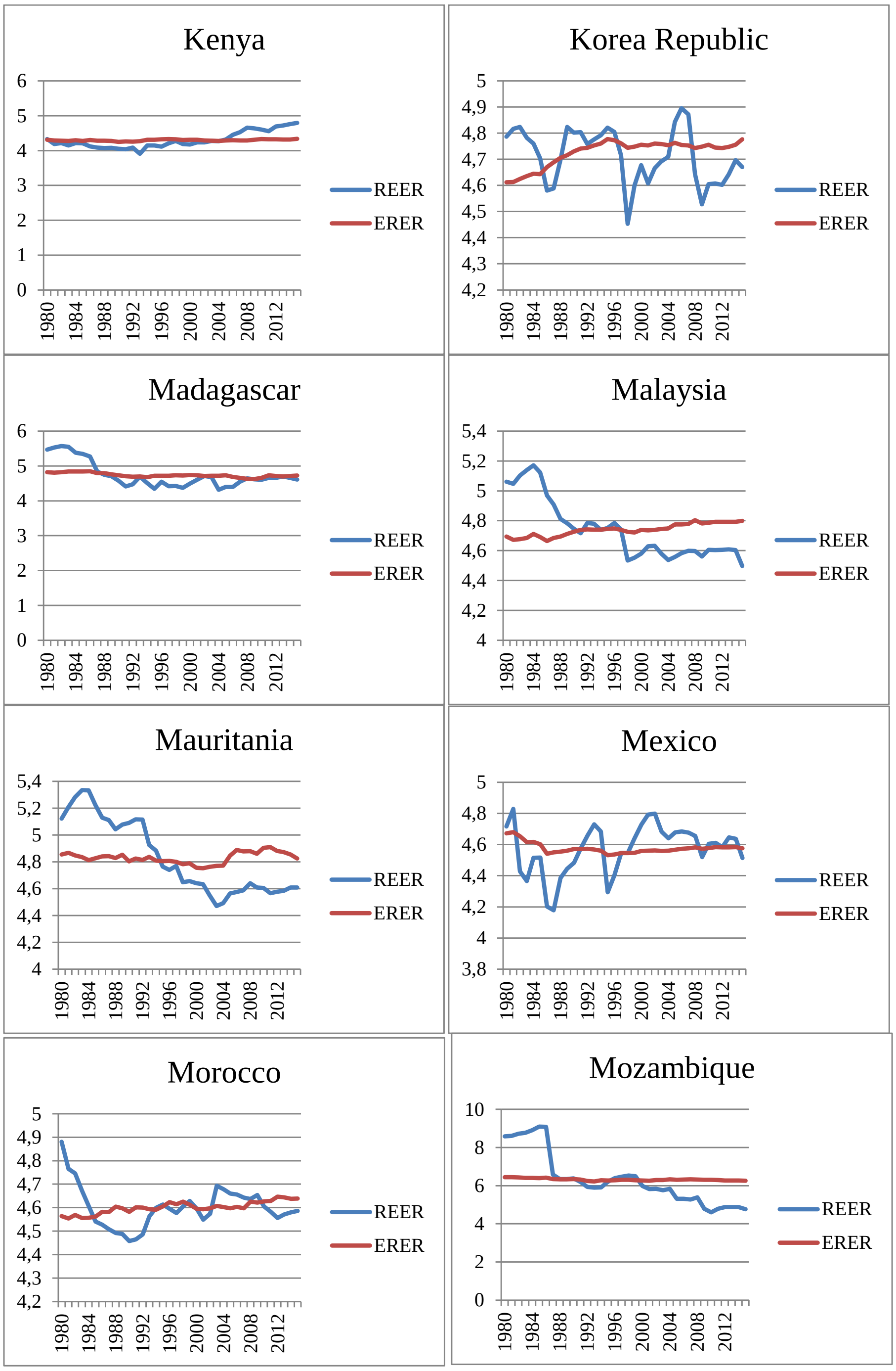

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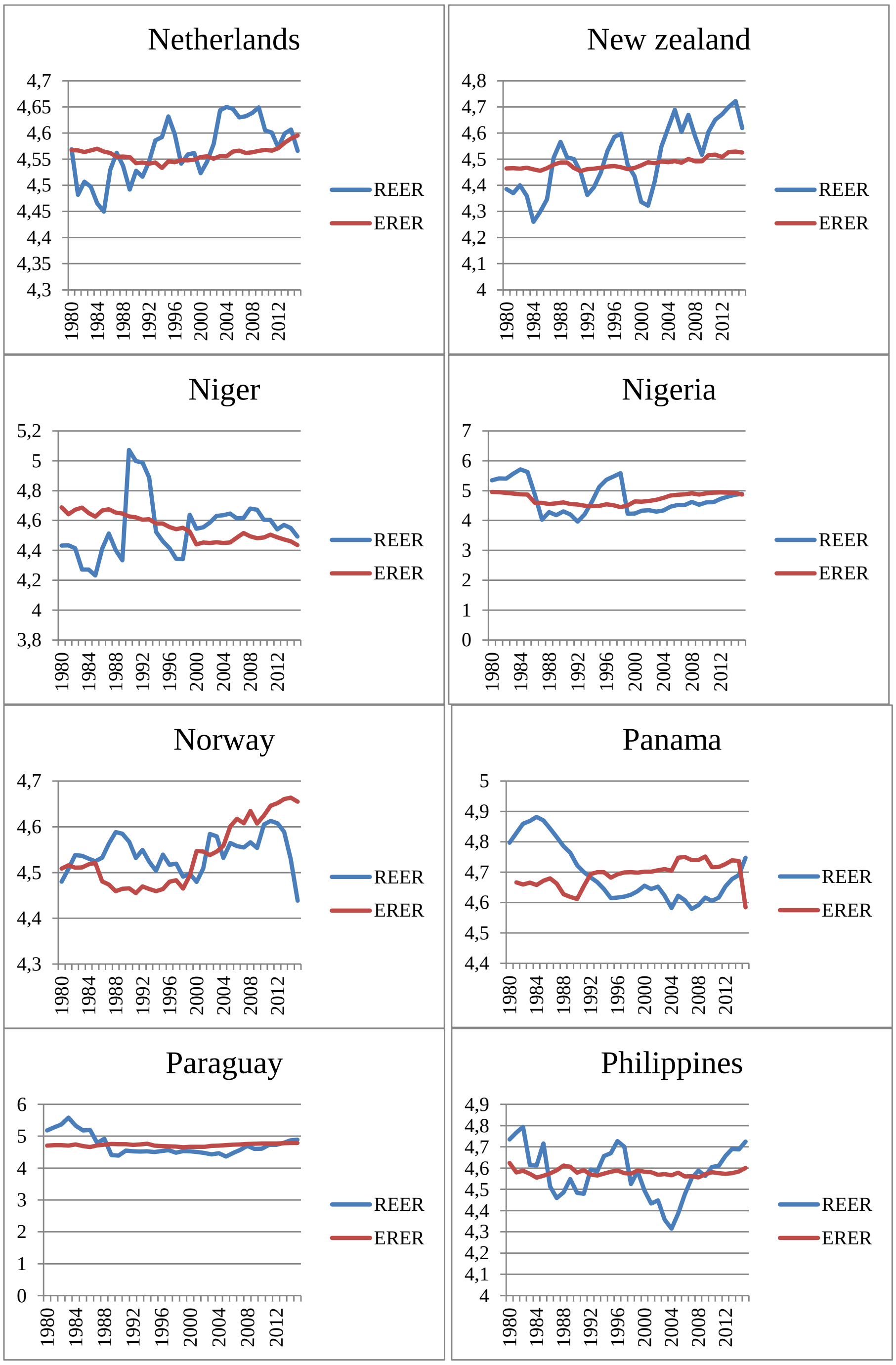

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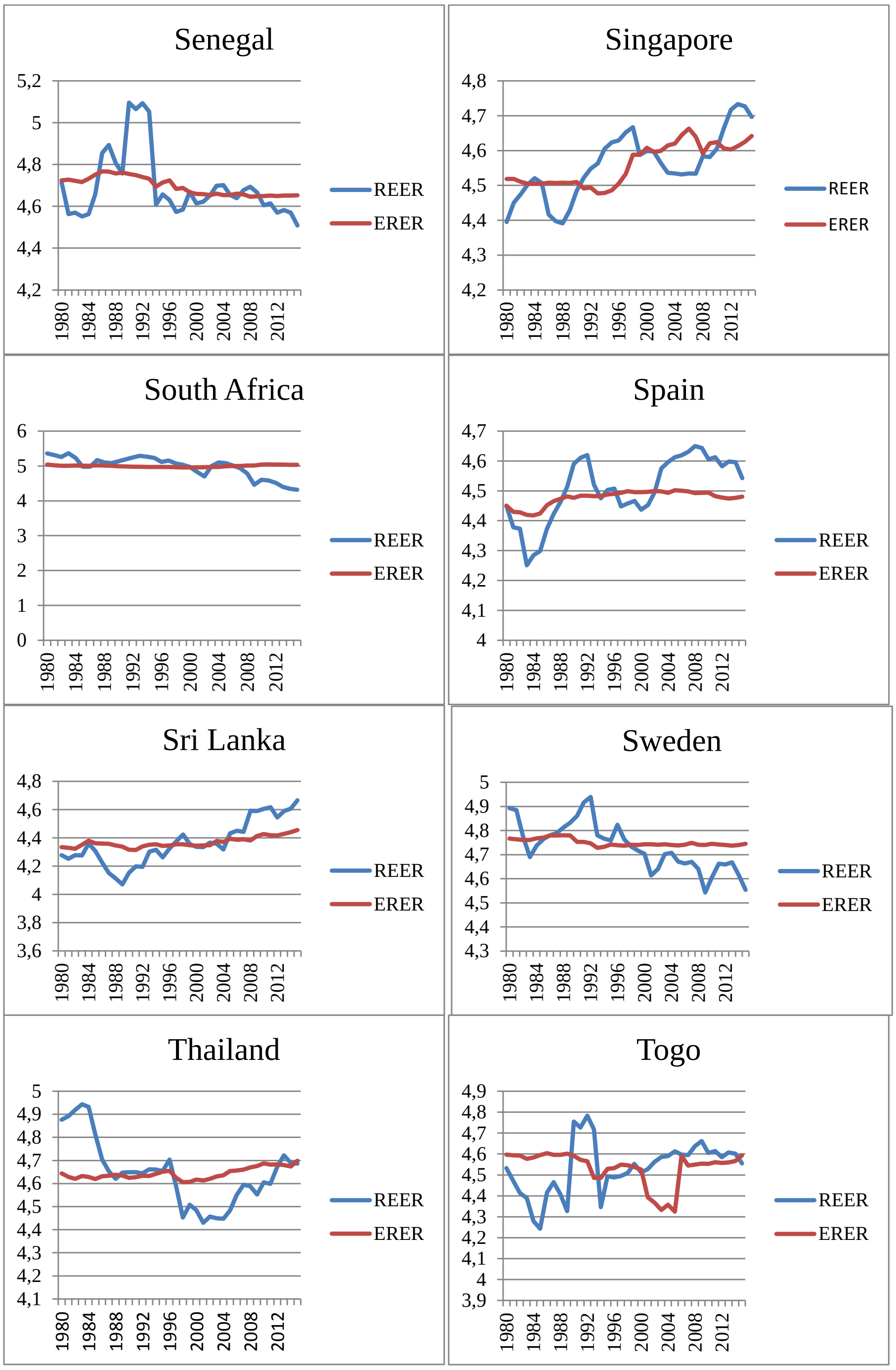

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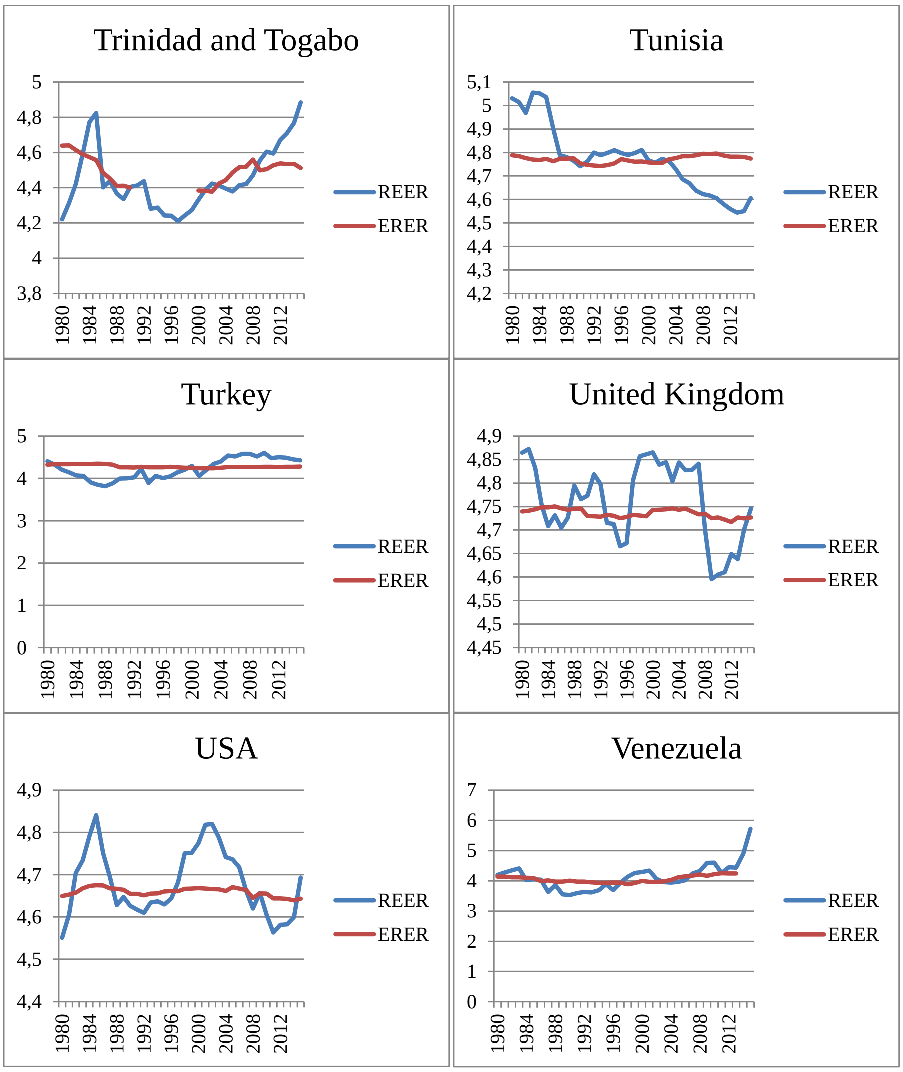

Figure 1— Continued.

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