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From nominal devaluations to real depreciations

Carl Grekou

Abstract

In this article, we assess the factors that enable a nominal devaluation to lead to a real depreciation. To this end, we rely on panel data techniques in order to estimate the contribution over time of the key factors influencing devaluations' effectiveness —as well as their mutual interactions, for a sample of 57 devaluation episodes. The results of our econometric analysis suggest that several prerequisites —namely in terms of exchange rate misalignments and accompanying macroeconomic policies— must be met to ensure that devaluations will have the expected effect in terms of real depreciations. Furthermore, due to its inflationary impact, devaluation exerts a nonlinear effect on the dynamics of the real exchange rate, thus emphasizing the importance played by the size of the nominal adjustment.

Keywords: Currency misalignments; Emerging and Developing Countries; Macroeconomic policies; Nominal devaluations.

JEL Classification: C1, E6, F3, F41

1. Introduction

Emerging economies and developing countries facing economic hardship have often undertaken a number of macroeconomic adjustment programs, including exchange rate adjustments, i.e. nominal devaluations, to restore "equilibrium". In addition, several of those countries faced currency crisis that were reflected in a substantial depreciation of their nominal exchange rate.

Devaluations have been usually part of a wider policy package with the objective of lessening, through their effects on relative prices, the real costs of disequilibrium corrections (Collier and Joshi, 1989). One other positive effect expected from nominal exchange rate adjustments, whether intended or not, was the improvement of competitiveness, through a real depreciation, in order to reduce macroeconomic imbalances.¹

Studies on this latter issue, though few, have in common to emphasize that some prerequisites must be fulfilled to ensure that a nominal devaluation will be effective, i.e. it will be translated into a real depreciation. These prerequisites include, among others, those relating to the institutional environment, the exchange rate system, the wage indexation policies and stabilization policies (Edwards, 1989; Edwards and Santaella, 1992; Morrisson, Lafay and Dessus, 1993; Guillaumont and Guillaumont, 1995; inter alios). However, while the theoretical literature is well aware of the role of these prerequisites on devaluation's effectiveness, it is still grey area regarding the empirical literature —very little, if any, quantitative estimates. In particular, most of these empirical studies, except Guillaumont and Guillaumont (1995), neglect the potential role exerted by the rate of devaluation itself and by the

¹ For our discussion in the rest of the paper, we will generally use the term devaluation even if the exchange rate adjustment rather refers to a depreciation.

initial disequilibrium situation in which the nominal devaluation is implemented. At the same time, they are unable to distinguish the effects of the nominal adjustment from other characteristics potentially correlated with it. Finally, based on descriptive statistics, comparative analyses and cross-country regression analyses, most of these studies by omitting the temporal dimension cannot credibly provide evidence about likely impacts over time of nominal adjustments.

Taking account of all these issues, our paper presents an original approach which allows us to identify and to derive the contribution over time of the key factors influencing devaluations' effectiveness —as well as their mutual interactions. It is important to point out again that this paper only focuses on the effectiveness of the devaluation which is the extent to which a nominal devaluation translates into a real depreciation. Hence, this paper focus is upstream of the literature on the success of devaluation (e.g. the final effect of the devaluation on trade balance, current account, etc) for which effectiveness is only a first (necessary but not sufficient) condition; the success of the devaluation ultimately depending on the price elasticities of exports and imports. Our empirical analysis is carried out in two stages. First, we develop a sample of devaluation episodes for a set of developing and emerging countries and assess real exchange rate misalignments prior to these episodes. Second, relying on this sample, we assess devaluations' effectiveness, i.e. the degree to which movements in the nominal exchange rate are transmitted to those of the real exchange rate; and investigate the key factors influencing their effectiveness. Specifically, we place special emphasis on three factors omitted, or at least, misspecified by the literature, i.e. the importance of: *(i)* the economic environment, *(ii)* the size of the devaluation, and *(iii)* the initial disequilibrium situation —proxied here by the distortion (or misalignment) of the real exchange rate. This latter key measure is here derived

relying on the Behavioral Equilibrium Exchange Rate (BEER; see Clark and MacDonald, 1998) approach.²

The paper contributes to the literature in two respects. First, from a methodological point of view, we add a time series dimension by relying on panel data techniques —comparatively to previous studies based on cross-section regressions— to assess the initial exchange rate distortions. In addition, we consider a wider sample of devaluation episodes compared to previous studies. Second, we extend the existing literature by assessing in an unified framework the impact of the economic/socio-political environment, of the size of the devaluation and of the initial currency misalignment. In particular, we analyze the magnitude of the two latter effects over time, and control for their possible interrelations through their impact on inflation.

While our results confirm the importance of the macroeconomic policies implemented along with the devaluation, they also highlight the initial real exchange rate misalignment and the size of the devaluation as relevant *ex ante* effectiveness' factors. Furthermore, we show that, due to their inflationary impact, devaluations exert a nonlinear effect on the dynamics of the real exchange rate, thus highlighting the importance played by the size of the nominal adjustment.

The rest of the paper is organized as follows. Section 2 sets the background for our analysis by integrating the main contributions of the existing literature in an unified framework. In Section 3, we present our methodological approaches as well as the data. The results and related comments are displayed in Section 4. Section 5 is devoted to robustness analysis. Finally, Section 6 concludes.

² See section 3.2 for the motivations regarding the use of this approach.

2. On the effectiveness of nominal devaluations

2.1. Theoretical and empirical background

A number of studies, among them the noticeable contributions of Edwards (1988, 1989, 1992, 1994), have addressed the issue of the effectiveness of nominal exchange rate adjustment, i.e. the extent to which it may generate a real depreciation.

Edwards (1988) derived from a model of a small open economy with three goods (exportables, importables and nontradables) the following equation describing the dynamics of the real exchange rate in the short/medium run:

$$\Delta q_t = \beta \underbrace{(q_t^* - q_{t-1})}_A - \gamma \underbrace{(Z_t - Z_t^*)}_B + \Phi \underbrace{(e_t - e_{t-1})}_C - \omega \underbrace{(PMPR_t - PMPR_{t-1})}_D \quad (1)$$

where q_t and e_t are respectively the real and nominal exchange rates (expressed in log). An increase in e_t (resp. q_t) indicates a nominal (resp. real) depreciation of the domestic currency. q_t^* is the equilibrium real exchange rate, i.e. that prevailing when the economy reaches both internal and external balances and is explained by a set of real variables, called *fundamentals*. Z_t is an index of macroeconomic policies, and Z_t^* is the sustainable level of macroeconomic policies. $PMPR_t$ stands for the parallel — black— market premium.³

According to Equation 1, the dynamics of the real exchange rates is driven by changes in the nominal exchange rate (term C), measured by the coefficient Φ , and other control variables that may also influence the behavior of the real exchange rates. These latter variables include three elements. First, the convergence process of the real exchange rate towards its equilibrium level —term A. Second, the consistency

³ The inclusion of a parallel market premium is justified by the existence of dual exchange rate systems in developing countries: a fixed nominal exchange rate for commercial transactions and a freely floating nominal exchange rate for financial transactions.

and/or sustainability of macroeconomic policies (term B). Finally, the last element (term D) refers to the effect exerted by changes in the parallel market premium — which can be seen as an indicator of the market distortions/pressures and/or of the confidence in the economic authorities.

If Equation 1 has the advantage of considering the effectiveness of devaluations — through the coefficient Φ — by controlling with the main factors that can also influence the dynamics of real exchange rates in the short/medium run, it however suffers from ignoring other key elements that may influence devaluations' effectiveness.

2.2. Interaction between nominal exchange rate adjustment and inflation dynamics

One of the key elements —in the effectiveness of devaluation— concerns the size of the nominal adjustment and its interaction with inflation. Indeed, devaluation, by "nature", has a direct inflationary effect. The magnitude and timing of this effect are uncertain and dependent on the exchange rate pass-through as well as the size of the devaluation. On the one hand, a too weak devaluation could fail in improving the economic situation and could thus lead to other devaluations, triggering in turn an increasingly inflation (Kiguel, 1994; Guillaumont and Guillaumont, 1995). This finding has been investigated by Guillaumont and Guillaumont (1995) who point to the importance of a surprise effect associated to a devaluation in order to avoid rising inflationary expectations: the more devaluation is frequent, the more inflation expectations will be widespread. Thus, with inflation expectations closer to real inflation, the devaluation is likely to be less effective. This consideration is in line with the results evidenced by Edwards (1989) who finds for stepwise devaluations a very low success rate. On the other hand, a too large devaluation could trigger unnecessary inflationary pressures that would annihilate its expected effects.

Guillaumont and Guillaumont (1995) discuss this issue and note an ambivalent relationship between the size of a devaluation and its effectiveness due to an effect which they describe as a *saturation effect*. Their argumentation is built around the idea that a devaluation, by decreasing the relative price of nontradable goods (the main one being labor), implies a reduction in the real wage and is then likely to face an increasing social resistance. Thus, fiscal and monetary policies aimed at containing the nominal increase in the labor price will be even more difficult to implement if the nominal devaluation —and thus the increase in the relative price of tradable goods— is too substantial. Hence, according to Guillaumont and Guillaumont (1995) the marginal effectiveness of devaluation could be decreasing; it could probably have no impact, or even be negative if the devaluation exacerbates social claims.⁴ Then, the relationship between changes in nominal exchange rates and changes in real exchange rates is likely to be nonlinear, depending on the size of the devaluation —because of its inflationary effect. Following Guillaumont and Guillaumont (1995), we take into account this potential nonlinear relationship by considering a quadratic function of the nominal exchange rate's variation.

Furthermore, to capture the effect of the socio-political environment, we also include a number of variables intended to reflect this context.⁵ Usually, devaluation, due to its urgent nature, triggers unpopular measures (e.g. lower subsidies, increased or new taxes, reduction of the public wage bill). These unpopular measures in turn generate an extremely tense political and social climate that typically ends up with unrests (strikes or public protests), contributing thus significantly to inflation (Aisen and Veiga, 2005). In such context, some governments have been "forced" to ease or

⁴ Social claims can be seen as an increasing function of inflation; the more the inflation, the more the social claims.

⁵ Further details will be given in the empirical section.

even cancel the stabilization programs undertaken before or along with the devaluation, hereby limiting the effectiveness of the nominal adjustment (e.g. Ecuador 1982, Zambia 84, Nigeria 1988, Côte d'Ivoire 1990).⁶ The important social and political costs of devaluation have therefore led policy makers and international organizations (namely, IMF) to precede devaluation by adjustment programs—in some cases—in order to enhance the effectiveness of the former. The importance of the socio-political context is therefore noticeable and should be taken into account.

The empirical framework of Edwards can then be extended by taking into account the additional abovementioned factors:

$$\Delta q_{i,t} = \beta MIS_{i,t-1} + \gamma Macro_{i,t} + \Phi_1 \Delta e_{i,t} + \Phi_2 \Delta e_{i,t}^2 + \lambda SP_{i,t} \quad (2)$$

where $\Delta q_{i,t}$ (resp. $\Delta e_{i,t}$) denotes changes in the real (resp. nominal) effective exchange rate; $MIS_{i,t-1}$ stands for the difference between the equilibrium real exchange rate and the lagged value of the observed real effective exchange rate ($q_{i,t}^* - q_{i,t-1}$). $Macro_{i,t}$ is the vector including the macroeconomic policy variables; $SP_{i,t}$ is a vector containing socio-political variables; $\Delta e_{i,t}^2$ is the squared value of the nominal exchange rate's variation — which stands for the saturation effect.

2.3. The importance of the economic environment

A further specification issue raised by Equation 1 is to what extent the effectiveness of nominal exchange rate adjustment can be affected by the economic environment. A number of studies have addressed this issue.

In particular, given that devaluation aims at restoring macroeconomic equilibrium through a real depreciation, those studies stress that devaluation should be

⁶ For further examples, see Morrisson (1996).

implemented in situations where the real exchange rate is overvalued (see among others Edwards, 1989; Guillaumont and Guillaumont, 1995). Indeed, in this context, a devaluation can be an useful tool to restore macroeconomic balance since it helps avoiding the costly and lengthy process consisting in putting and keeping the domestic inflation below the international level in order to generate a real depreciation. A nominal devaluation is thus particularly useful when prices and wages movements are rigid downward. Also, the devaluation's effectiveness is even greater in low inflation countries —where prices and wages adjust relatively slowly— because in that case, it is more likely to affect the real exchange rate (Abbritti and Fahr, 2011).

Political economy approaches, also dealing with initial conditions, focus on the importance of institutional determinants in the successfulness of adjustment programs (see among others, Cukierman et al., 1992; Edwards and Santaella, 1992; Morrisson et al., 1993; Edwards, 1994). Evidence from this literature suggest that political stability is a key factor in the success of any adjustment program and more particularly of devaluations. Some factors such as political cycles (proximity of the elections, government turnover rates) and the socio-political unrest appear to strongly influence the implementation of fiscal adjustments and anti-inflationary policies which are necessary for the success of devaluation.⁷

Regarding the macroeconomic policies accompanying a devaluation, it has been widely argued, with reasons, that they play a key role in the effectiveness of the exchange rate policy (Khan and Lizondo, 1987; Edwards, 1989). Indeed, nominal

⁷ Note however that, despite the important lessons drawn from these studies, it is worth recalling the potentially endogenous nature of political unrest. Indeed, as pointed out by Guillaumont and Guillaumont (1995), devaluation may itself be a factor of social unrest because it reduces real wages. For Morrisson (1996), social unrest are the result of the inflation generated by the devaluation itself.

adjustments are often implemented —through a devaluation— or occur when the real exchange rate is considerably overvalued. These overvaluations are in most cases the result of inconsistent macroeconomic policies which cause a decline in international reserves. Expansive fiscal and/or monetary policies are often the roots of this problem, as they may cause an increase of the domestic inflation rate and a deterioration of current account, thus making almost inevitable the adjustment if the situation persists.⁸ Similarly, speculative pressures on currencies have often been fueled by inconsistent policies and/or the uncertainty over the future course of policies. Thus, an essential step in the adjustment program seems to be the re-establishment of consistent macroeconomic policies (i.e., fiscal balance and/or financial monetary discipline). In particular, aggregate demand restraint measures are usually recommended in order to limit inflationary pressures caused by the devaluation. These inflationary pressures might have different sources. They can be the result of the shift of consumption from imported to cheaper domestic goods (demand-pull inflation). The increase in import prices can also lead to an increase in production costs. As a result, the increased costs are transmitted to consumer prices, thus raising the general price level (cost-push inflation).⁹ Finally, along with demand restraint measures, any indexation scheme linking nominal wages to prices should be eliminated in order to contain inflation.

A number of studies (see among others; Edwards, 1999 and 2001; Stiglitz, 2002) also mention the potential role played by exchange control policies in

⁸ Naturally, a real shock (e.g. a term-of-trade shock) can also be the cause of macroeconomic imbalances.

⁹ It is worthwhile noting that the degree of the exchange rate pass-through to the prices depends on the market structures. For instance, if the domestic market is close to imperfect competition, producers may maximize their profits by reflecting the changes in the exchange rate into sales prices ("producer currency pricing" behaviour; see Obstfeld and Rogoff, 1995). In case of more competitive markets, producers are forced to bear a part of the exchange rate changes by reducing their mark-ups ("pricing to market" behaviour; see Krugman, 1987).

stabilizing the economy, arguing that restricting capital mobility would reduce macroeconomic instability. For countries facing a currency crisis, the introduction of capital controls presents another interest by giving additional leeway to restructure their economies (Edwards, 1999). The more recent literature on capital flows provides complementary insights on this issue. As highlighted by some studies (Calvo, et al., 1993; Saborowski, 2009; Combes et al., 2011), the significant increase in capital inflows that has followed the financial openness of most developing and emerging countries has often resulted in an appreciation of their real exchange rates, which has turned in a real overvaluation. This situation, by undermining the competitiveness and widening current account and fiscal deficits, creates major problems for macroeconomic management. In case of sudden stops in capital flows, the fiscal position would be more problematic, therefore making the fiscal adjustment needed to achieve real depreciation more difficult.¹⁰ Exchange rates and capital controls policies, through their stabilizing effects, might therefore play an important role in the successfulness of devaluation.

It is then key to examine how the marginal effect of changes in the nominal exchange rate on the dynamics of real exchange rates varies as a function of the economic environment. To deal with this issue, we extend Equation 2 by considering an interaction model of the form:

$$\begin{aligned} \Delta q_{i,t} = & \beta_1 MIS_{i,t_{k-1}} + \Phi_1 \Delta e_{i,t_0} + \Phi_2 \Delta e_{i,t}^2 + \gamma_1 Macro_{i,t} + \beta_2 MIS_{i,t_{0-1}} \times \Delta e_{i,t_0} + \\ & \gamma_2 Macro_{i,t} \times \Delta e_{i,t_0} + \lambda_1 SP_{i,t} + \lambda_2 SP_{i,t} \times \Delta e_{i,t_0} + \varepsilon_{i,t_k} \end{aligned} \quad (3)$$

¹⁰ See Calvo (2003) for a review of literature on sudden stops.

Then Equation 3 offers the advantage of isolating the direct effect of a devaluation on the real exchange rate (including a saturation effect) apart from those attributable to the economic environment (interaction terms).

3. The empirical framework

3.1. Investigating the effectiveness over time of devaluations

Since we are interested in assessing the effectiveness of a devaluation over the short and medium terms, we consider a time window of four years, i.e. from the devaluation's year to the three following years. For each year, variables are taken in variation with respect to the year prior to the devaluation.¹¹ Equation 3 can then be rewritten as follows:

$$\begin{aligned} \Delta q_{i,t_k} = & \beta_1 MIS_{i,t_{k-1}} + \Phi_1 \Delta e_{i,t_0} + \Phi_2 \Delta e_{i,t_0}^2 + \gamma_1 Macro_{i,t_k} + \beta_2 MIS_{i,t_{0-1}} \times \Delta e_{i,t_0} + \\ & \gamma_2 Macro_{i,t_k} \times \Delta e_{i,t_0} + \lambda_1 SP_{i,t_k} + \lambda_2 SP_{i,t_k} \times \Delta e_{i,t_0} + \varepsilon_{i,t_k} \end{aligned} \quad (4)$$

where $k = 0, \dots, 3$ indicates the considered time horizon (t_0 : the devaluation's year; $t_{1,2,3}$: 1, 2, 3 year(s) after the devaluation).

Before proceeding to the estimation, some additional adjustments are needed. Indeed, first, Equation 4 cannot be estimated since the equilibrium levels of real exchange rates ($q_{i,t}^*$) are unknown. These latter need to be determined in order to make Equation 4 operational. This will be done in the next subsection.

Second, in its current form, the estimation of Equation 4 using panel data techniques would create a phase difference between our words and deeds. Indeed, estimates from panel data techniques would not reflect completely the different

¹¹ Except the initial distortion. Edwards and Santaella (1992) also adopted the same approach.

mechanisms described in the previous section. The first problem involves the appropriate definition of the initial distortion of the real exchange rate. The variable $Mis_{i,t_{k-1}}$ in a panel data setup would not adequately capture the importance of this initial distortion; rather it would tend to reflect the autonomous tendency for the real exchange rate to reach its equilibrium level. The second issue here to be taken into consideration is the *saturation effect*. As stated earlier, this effect implies a potential nonlinear relationship between changes in the nominal and the real exchange rates, depending on the threshold reached by the devaluation and the subsequent increase in inflation. However, the effect of a devaluation on inflation, as it can be seen in Figure 1, tends not to be persistent. We plotted in Figure 1 the evolution of the inflation rate (changes in the Consumer Price Index) around the devaluation's year (from two years before the devaluation to three years after) for different quartiles —based on our countries sample. As can be seen, the inflation rate reaches a peak during the devaluation year (at the most one year after the devaluation for high inflation countries), then returns to its pre-devaluation level no more than two years after the devaluation.¹² Therefore, it is quite unlikely that the *saturation effect* persists over time and, as a consequence, the coefficient of the squared value of the nominal exchange rate variations derived from a panel data estimation might not adequately reflect this time-varying property.

¹² Borensztein and De Gregorio (1999) studied the effect of devaluation on inflation and made the same observations. They argued that the non-persistence of the effect of devaluation on inflation is not surprising since if fundamental determinants of inflation do not change after the devaluation, the economy should return to its initial level of inflation. Note however that for some Latin America countries, the inflation has followed a different path specifically during the debt crisis. Inflation has remained higher than its pre-devaluation level, and even in some cases countries have experienced periods of hyperinflation. A possible explanation may stem from the fact that these countries devalued with already high inflation rates. This is also in line with the findings of Cebotari (2013). See Figure C.1 in Appendix C for the evolution of inflation for each considered country.

To overcome these issues related to the initial distortion and to the saturation effect, we estimate equation 4 on the different time horizons, i.e. for the devaluation year, 1, 2 and 3 years after the devaluation.¹³ One of the benefits associated to this approach is that it allows us to investigate the evolution of the coefficients associated with the variables over the 4 years time horizon. Indeed, due to changes in the economic environment, we may expect that the parameters are time-varying. This is specially the case of the coefficients associated with the initial distortion of the real exchange rate and the rate of devaluation as these two latter variables may have considerable effects only during the first year of the devaluation ($k = 0$).

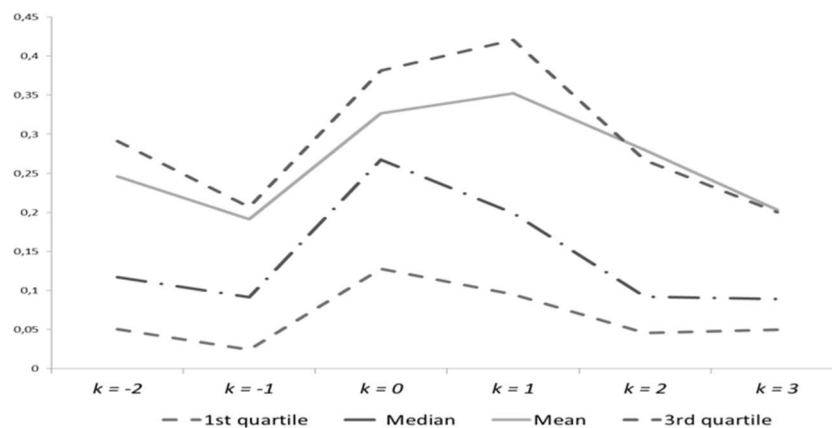


Figure 1 — Inflation rate

Note: We do not represent the extremums as they distort the graph, making thus unobservable/unclear the non-persistence of inflation following devaluations.

Source: World Development Indicators database (World Bank).

3.2. Assessing equilibrium exchange rates

Equilibrium exchange rates are, by definition, unobservable. To tackle this issue, we rely on the Behavioral Equilibrium Exchange Rate (BEER) introduced by

¹³ It should be noted that while an alternative to our estimation strategy would consist in including dummies for each time horizon and interact them with the variables of interest (i.e. the initial distortion and saturation effect variables). However, this latter leads to a considerable increase in the estimated coefficients and so reduce the degree of freedom. Nonetheless, adopting such an approach does not reverse the results.

Clark and MacDonald (1998).¹⁴ The BEER approach consists in estimating a long-run relationship between the observed real effective exchange rate and a set of fundamentals. This estimated long-run relationship is assumed to give an assessment of the real equilibrium exchange rate. Hence, deviations from these equilibrium rates correspond to currency misalignments. It is worthwhile noting that the BEER approach is one of the three approaches generally used in the literature; the other two approaches being (i) the Fundamental Equilibrium Exchange Rate (FEER; Williamson, 1994) approach also called the *macroeconomic approach*; and (ii) the external sustainability approach (IMF, 2006). In the FEER approach, currency misalignments are computed as the differences between the current account (CA) projected over the medium term at prevailing exchange rates and an estimated—or assumed—equilibrium current account, or “CA norm”. The external sustainability approach calculates the difference between the actual current account balance and the balance that would stabilize the net foreign asset position at some benchmark level.

Our choice in favor of the BEER approach can thus be first explained by the fact that the other two approaches have an important normative content. Indeed, one of the difficulties when assessing equilibrium exchange rates is to identify the long run equilibrium path of the economy. The BEER approach which is more pragmatic, does not require to estimate or to make assumptions on the long run values of the economic fundamentals (such as current account norms for instance) as in the FEER approach. Second, in contrast with the BEER approach, (i) the FEER approach does not take into account stock effects (through the dynamics of the net foreign asset position and of the stock of capital), and (ii) the external sustainability approach focuses on external balance therefore neglecting internal balance. Hence, the BEER

¹⁴ For extensive survey on the BEER approach and related concepts (e.g. PPP, FEER, NATREX) we refer to Driver and Westaway (2005).

approach allows us to take into account, for each country, both internal and external balance without any *ad-hoc* judgments.¹⁵

To select our set of real effective exchange rate fundamentals, we resort to a —preliminary— Bayesian analysis to account for the multiplicity of potential models and fundamentals inherent to the BEER approach. Indeed, Bayesian approaches, by providing coherent methodologies to address the issue of model uncertainty, allows the identification of the most relevant fundamentals with regard to our sample of countries. More specifically, we here follow the Bayesian Averaging of Classical Estimates (BACE) approach proposed by Sala-i-Martin et al. (2004) and assume diffuse priors.¹⁶ This latter assumption is made to reflect our ignorance about (or unwilling to specify) prior beliefs. Our results show that, among an initial set of 8 potential determinants¹⁷, 3 are found significantly related to the long-run behavior of real exchange rates: the terms of trade (*tot*), the relative productivity (*rprod*), and the net foreign assets (*nfa*).¹⁸ Moreover, a positive relationship between the real effective exchange rate and each of these 3 fundamentals is expected. Indeed, an increase in the relative productivity as well as an improvement in the terms of trade and the net foreign assets tend to appreciate in the long run the real effective exchange rate. The equation to be estimated is therefore as follows:

¹⁵ We do not postulate that the BEER methodology achieves superior performance against other equilibrium exchange rate approaches. Indeed, all these approaches, far from being opposed to each other, are rather complementary insofar as they assess equilibrium exchange rates over different time horizons (Bénassy-Quéré et al., 2010). As such, the IMF *Consultative Group on Exchange Rate Issues* (CGER) methodology consists in using these three approaches (IMF, 2006).

¹⁶ BACE combines the averaging of estimates across models, with classical ordinary least-squares (OLS) estimation which comes from the assumption of diffuse priors. I thank the authors for making their original GAUSS code available: <http://www.nhh.no/Default.aspx?ID=3075>

¹⁷ Terms of trade, government spending, foreign direct investment, net foreign assets, official development aid, relative productivity, openness, and investment.

¹⁸ To save space, the BACE results are displayed in Table C.1 in the online appendix (Supplementary material). We follow the methodology proposed by Moral-Benito (2012) for the implementation of the BACE analysis in the panel data context.

$$q_{i,t} = \alpha_i + \beta_1 rprod_{i,t} + \beta_2 tot_{i,t} + \beta_3 nfa_{i,t} + \varepsilon_{i,t} \quad (5)$$

where $i = 1, \dots, N$ and $t = 1, \dots, T$ respectively indicate the individual and temporal dimension of the panel. $q_{i,t}$ denotes the real effective exchange rate; α_i are the country-fixed effects and $\varepsilon_{i,t}$ is an error term.

The estimation of Equation 5 is based on the following usual procedure. The first step consists in determining the order of integration of the variables (real effective exchange rates and fundamentals) and then in testing the existence of a cointegration relationship between the real effective exchange rate and the fundamentals. If the cointegration hypothesis is not rejected, the coefficients of the long-run relationship will be estimated using an efficient panel estimation procedure.

3.3. Selecting devaluation episodes

A devaluation episode is included in our sample if it satisfies two main conditions: (i) the change in the nominal exchange rate must be greater or equals to 15%, and (ii) no devaluation has occurred during the three years preceding the selected devaluation, nor during the three following years. The threshold chosen for the nominal adjustment (i.e. at least 15%), while arbitrary, is used by most empirical studies (Edwards 1989, 1992; Frankel and Rose 1996; Milesi-Ferretti and Razin 1998; Céspedes 2005). The first explanation is that during large devaluation episodes all effects tend to be stronger and therefore easier to highlight. The second is that small devaluations frequently happen without being sufficiently spaced in time to investigate their respective effects. Finally, the selected devaluation episodes correspond to both *de jure* —official decision— and *de facto* —observed variations— rates of devaluation. *De facto* devaluations are calculated from changes in the nominal

effective exchange rate.¹⁹ *De jure* devaluations are selected from various issues of the *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* (AREAER, International Monetary fund) as well as other sources.²⁰

These criteria to select devaluation are meant to achieve two main objectives. Firstly, by defining a devaluation episode based on both *de jure* and *de facto* adjustments in exchange rates as well as on sizeable changes in the nominal effective exchange rate, we exclude from our sample unsuccessful speculative attacks that are usually taken into account by studies focusing on financial crises (see among others; Eichengreen et al., 1995; Kaminsky and Reinhart, 1999). Secondly, by imposing that none devaluation has occurred during the three years prior and following the selected devaluation, we definitely focus our attention on the short-medium run. Our selection criteria are then a bit more restrictive than those of Edwards (1989, 1992) which only exclude devaluations that have occurred two years before and after the devaluation. Guillaumont and Guillaumont (1995) do not impose such a constraint and select devaluation episodes relying on changes in the nominal effective exchange rate. Their analysis has then a major drawback: it does not clearly define the time horizon of devaluations' effects and therefore leads to select, for a country, several episodes that have occurred, but not sufficiently remote in time to investigate their effectiveness.

Overall, our selection criteria lead to a sample of 57 devaluation episodes. This sample consists of devaluations that have occurred over the 1976-2009 period in

¹⁹ Note that *de jure* devaluation is computed in a preliminary analysis as a dummy variable based on the statements by monetary authorities regarding a devaluation of the nominal exchange rate (1 in case of nominal devaluation; 0 otherwise). Since we are working with annual data, devaluations that occurred at year-end are recorded as they had occurred the following year because the most important variation of the exchange rate will be that of the following year. This choice was dictated by the data analysis.

²⁰ Kaminsky's currency crises database (2006), and information from the *Historical Exchange Rate Regime* database (International Economics). This latter is available at: http://intl.econ.cuhk.edu.hk/exchange_rate_regime/index.php?cid=20

40 developing and emerging countries. It includes most notable Latin American currency crises (e.g. Argentina 2002; Brazil 1999; Mexico 1994 and 2001; Venezuela 2002), some Asian and European crises (e.g. Philippines 1997; Russia 1998; Turkey 1994 and 2001) and a number of devaluations that have occurred in African countries (namely the CFA Franc devaluation in 1994). Table A.2 in Appendix A provides further details regarding the selected episodes.

3.4. Selected indicators

The real effective exchange rate is the dependent variable. It is calculated as the weighted average of real bilateral exchange rates against trade partners (CPI-based). The devaluation is assessed by changes in the nominal effective exchange rate. Those multilateral measures give a more accurate picture of nominal adjustments as they reduce a considerable bias owing from the use of the bilateral exchange rates *vis-à-vis* the US dollar: indeed a country's currency could depreciate against the US dollar, while appreciating against trading partners' currencies. Both real and nominal effective exchange rates are from the Bruegel's database.²¹

Our set of macroeconomic indicators includes variables intended to reflect the economic environment as well as the macroeconomic policies implemented along with the devaluation.²²

To capture the nature of the fiscal policy implemented along with the devaluation, we include the fiscal balance. Most specifically, we include the exogenous component of fiscal balance estimated as the residual of fiscal balance

²¹ Data availability mainly motivated the recourse to the Bruegel's database. Indeed, while IMF and WB databases include data on effective exchange rate, these latter do not cover a number of the countries in this paper.

²² We include few macroeconomic indicators to limit endogeneity and simultaneity problems.

regressed on GDP (simple reaction functions). Indeed, raw data on fiscal balance are not only endogenous to the business cycle but also a bad proxy of discretionary policies. Since an overvalued real exchange rate is usually the result of an inconsistent fiscal policy —manifested by increasing fiscal deficits, the improvement in the fiscal balance by helping to limit the real exchange rate's appreciation, can only enhance the effects of a devaluation. The implementation of the devaluation will then be more effective if it is accompanied by a fiscal adjustment.²³ In the same vein, we also estimate reaction functions of monetary policy to capture the nature in the change in the monetary policy —here mainly proxied by money and quasi-money supply (M2).²⁴ As in the case of fiscal policies, expansionary monetary policies are expected to seriously weaken the effectiveness of devaluations. We also take into account effects that may be exerted by possible changes in the exchange rate regime. Indeed, devaluation episodes are often followed by switch in exchange rate regimes that may impact the adjustment process of the real exchange rate or the implementation and the success of stabilization programs (Gosh et al., 2003). Following the distinction made in the selected devaluation episodes, we consider the *de jure* and the *de facto* exchange rate regime classifications. The *de jure* classification corresponds to the exchange rate regime officially announced by the country while the *de facto* classification reflects actual arrangements (on the basis of the exchange rate's flexibility and the existence of formal or informal commitments). We here rely on the Reinhart and Rogoff *de facto* classification (see Ilzetki, Reinhart and Rogoff 2011).

²³ We do not discuss the issue of the means by which the fiscal deficits are reduced (e.g. increase in taxes, government expenditures reduction). Even if these ways of reducing the fiscal deficits have different implications regarding the real exchange rate dynamics, they always go the same direction: the reduction of the fiscal deficit limits the appreciation of the real exchange rate or even reduce the overvaluation; the only difference lies in the degree of this effect. For a discussion on fiscal deficits reduction and real exchange rate dynamics, see Khan and Lizondo (1987).

²⁴ The inflation rate was included, in addition to the GDP, as a regressor in the reaction functions of monetary policy.

We also include the Chinn-Ito *kaopen* index (Chinn and Ito, 2008) in order to take into account the existence of exchange controls.²⁵

Finally, in order to include the potential role that the socio-political context may play in devaluations' effectiveness, we add some variables capturing the political climate as well as the electoral cycle since the proximity of election can impact the real exchange rate dynamics.²⁶ We use several available indicators: the *Political violence* index —from the *Center for Systemic Peace*— to proxy the socio-political context and the *Political Terror* index (from the *Political Terror Scale*) which can be seen as a global indicator encompassing both civil and political rights. Additionally, we create two dummy variables: (i) "*Conflict*" which scores 1 in case of conflict —armed or not— and 0 otherwise; and (ii) "*Election*" which scores 1 the year of elections, 0 otherwise, to account for the electoral cycle.

All data are annual. Sources, definitions and calculation details are provided in Appendix A.1.

4. Results

4.1. Estimating equilibrium exchange rates

The first step in the estimation of equilibrium exchange rates consists in applying unit root and cointegration tests. We begin by testing the presence of unit root in our series (the real effective exchange rates and their fundamentals). To do so, we rely on the second-generation unit root tests (Choi 2002; Pesaran 2003) which

²⁵ *kaopen* is a good proxy for restrictions on capital account transactions and current account transactions.

²⁶ See, among others, Rogoff and Sibert (1988).

relax the assumption of cross-sectional independence.²⁷ Both tests are based on the null hypothesis of unit root. Results are displayed in Table B.2 in Appendix B, and as it can be seen, all tests conclude that the variables —*reer*, *rprod*, *tot*, and *nfa*— are integrated of order one. We then test for the existence of a long-run relationship between the real effective exchange rate and the fundamentals. To this end, we perform the Westerlund (2007) cointegration test which, in addition to be robust to cross-sectional dependence, allows for various form of heterogeneity.²⁸ As displayed in Table B.3 in Appendix B, results indicate that there is a cointegration relationship between the real effective exchange rate and the three identified fundamentals. We can therefore estimate the cointegration relationship.

To do so, we rely on the Pooled Mean Group (PMG; see Pesaran, Shin and Smith 1999) procedure. The choice of the PMG estimator is mainly motivated by the fact that it allows a greater degree of heterogeneity among the countries —compared to other panel cointegration estimation procedures (FMOLS, DOLS)— which is particularly suitable since we are dealing with quite heterogeneous countries. Estimation results of the long-run relationship are reported in Table 1. They are in accordance with theory and existing empirical results: an increase in the relative productivity as well as an improvement in the terms of trade and the net foreign assets lead to an appreciation of the equilibrium real exchange rate in the long-run. Furthermore, only the terms of trade impact the real exchange rate in the short-run.²⁹

²⁷ The use of these second-generation tests is validated by the cross-sectional dependence test, the CD test (Pesaran, 2004). See Table B.1 in Appendix B.

²⁸ Among the four tests that constitutes the Westerlund (2007)'s test, two are designed to test the alternative hypothesis that the panel is cointegrated as a whole while the other two test the alternative that at least one unit is cointegrated. The null of the test is that there is no cointegration.

²⁹ The coefficient of the error-correction term (*ec.*) — -0.212 — corresponds to half-life of approximatively 3.60 years.

Table 1 — PMG estimation results

	<i>Long-run dynamic</i>		<i>Short-run dynamic</i>	
	Coef.	Z	Coef.	Z
<i>rprod</i>	0.132 **	2.28	0.017	0.04
<i>tot</i>	0.358 ***	8.96	-0.087 **	-1.99
<i>nfa</i>	0.108 ***	2.64	-0.080	-1.38
<i>ec.</i>	—	—	-0.212 ***	-8.39
<i>const.</i>	—	—	0.260 ***	8.90

Note: ***, **, and * denote respectively significance at 1%, 5% and 10% level. Estimates over the 1975-2011 period.

The initial distortion of the real exchange rate, $Mis_{i,t_{k-1}}$, is then derived from the difference between the observed real effective exchange rate at $t-1$ ($q_{i,t-1}$) and its equilibrium level at t ($q_{i,t}^*$) which corresponds to the fitted value of $q_{i,t}$ obtained from the estimation of (5):³⁰

$$Mis_{i,t_{k-1}} = q_{i,t}^* - q_{i,t-1} \quad (6)$$

4.2. Factors influencing devaluations' effectiveness

In order to investigate the potential factors that allow devaluations to be effective, we, as aforementioned, perform cross-sectional regressions over the different time horizons —i.e. from $k=0$ to $k=3$. The estimation results (equation 4) are reported in Table 2.³¹

As it can be seen, in all the regressions, a nominal devaluation generates — *ceteris paribus*— a real depreciation but the pass-through decrease over time. Indeed, the associated coefficient varies between 0.685 -for the devaluation year- and 0.535 -

³⁰ Figure C.2.2 in the online appendix displays the obtained exchange rate misalignments.

³¹ Note that while the results presented in Table 2 are those of the complete model described by equation 4, we also considered the other models and progressively include variables till we obtain the complete model. Results, not reported here to save space are available upon requests. Note also that for brevity, our comments focus only on the direct effects of a devaluation on the real exchange rate and those attributable to the economic environment (interaction terms). Finally, it is worthwhile noting that in "Section C.3" of the online appendix, we present a preliminary analysis of the data —i.e. stylized facts.

three year after the devaluation- meaning that the response of the real effective exchange rate following an infinitesimal variation of the nominal effective exchange rate is, in average, between three fifths. This result may be explained by the impact that exchange rate movements exert on prices and could then reveal a quite strong exchange rate pass-through on domestic prices –especially after the devaluation. From a policy viewpoint, this result might justify an overshooting of the initially required devaluation rate to obtain a significant depreciation of the real exchange rate. However, this overshooting could also be inadequate due to a potential nonlinear effect of the devaluation on the real exchange rate.

Indeed, the coefficient of the squared value of the devaluation rate —i.e. the change in the nominal exchange rate in the first year— has a significant and negative sign for $k=0$ —i.e. for the devaluation year. However, this latter becomes positive and significant from the second year following the devaluation. This transitory negative effect could be explained by the immediate inflationary effect of devaluation —as observed in Figure 1— coupled with the delay in policy responses —after the devaluation— which may significantly erode positive effects expected from the devaluation at least during the first year. This result therefore confirms the findings of Guillaumont and Guillaumont (1995) about the existence of a *saturation effect*. However, in contrast with their results, our findings show that this effect decreases over time as it is significant only during the devaluation year.

It also appears that the effectiveness is directly and strongly linked to the existence of an overvalued real exchange rate before the devaluation. Indeed, the coefficients associated with the initial misalignment of the real exchange rate as well as the interaction term between the initial misalignment of the real exchange rate and the change in the nominal exchange rate is negative and significant for the devaluation

year, thus suggesting that the more the real exchange rate is overvalued prior to the devaluation, the easier it will depreciate following the devaluation.

Controlling for changes in the exchange rate regime, our results tend to suggest that the move towards a more flexible regime after a devaluation reduces the effectiveness of the nominal adjustment.³² In fact, the coefficient is positive and significant from $k=1$. The causes can be found in the benefits usually attributed to fixed exchange rates. Indeed, it has been extensively argued that fixed exchange rate regime, by committing countries to both monetary and fiscal discipline —and thus credibility— contribute to the creation of a stable internal economic environment (e.g. low inflation, low uncertainty on the exchange rate; see Ghosh et al., 2003) which plays a key role in the effectiveness of devaluation.

Table 2 — Investigating devaluations effectiveness factors

Dependent variable:	$\Delta REER_k$			
	$k=0$	$k=1$	$k=2$	$k=3$
$\Delta NEER_{t_0}$	0.685 ^{***} (0.184)	0.608 ^{***} (0.242)	0.552 ^{***} (0.219)	0.535 ^{**} (0.266)
$\Delta NEER_{t_0}^2$	-0.461 ^{***} (0.171)	-0.231 (0.275)	0.419 [*] (0.226)	0.349 ^{**} (0.207)
$MiS_{i,t_0-1} * \Delta NEER_{t_0}$	-0.392 ^{***} (0.125)	0.244 (0.246)	0.157 (0.438)	0.066 (0.165)
$ERR^a * \Delta NEER_{t_0}$	0.021 ^{**} (0.010)	0.015 [*] (0.008)	0.027 (0.019)	0.016 (0.012)
$Fis.bal. * \Delta NEER_{t_0}$	0.416 ^{***} (0.149)	0.348 ^{**} (0.161)	0.312 [*] (0.185)	0.291 ^{**} (0.146)
$M2/GDP * \Delta NEER_{t_0}$	-0.556 ^{***} (0.273)	-0.365 [*] (0.198)	-0.275 [*] (0.163)	-0.312 (0.276)
$kaopen * \Delta NEER_{t_0}$	0.099 (0.100)	0.029 (0.136)	0.227 (0.178)	0.259 ^{***} (0.088)

³² For brevity, we only report the results obtained using the *de facto* classification. Results are robust to change in the exchange rate regime classification and are available upon request.

<i>Credit</i> ^b * Δ NEER _{t0}	0.216* (0.127)	0.293 (0.815)	-0.162 (0.430)	0.877 (0.747)
<i>Pol.violence</i> * Δ NEER _{t0}	-0.136 (0.428)	0.601 (1.337)	0.416 (0.807)	0.236 (0.514)
<i>Conflict</i> * Δ NEER _{t0}	-0.513 (0.324)	-1.012 (0.912)	-0.137 (0.499)	-0.393 (0.274)
<i>Election</i> * Δ NEER _{t0}	0.014 (0.194)	0.186 (0.267)	0.186 (0.215)	-0.556 (0.493)
<i>Mis</i> _{t,t0-1}	-0.139*** (0.051)	-0.206* (0.120)	-0.110** (0.054)	-0.085** (0.041)
<i>ERR</i> ^a	0.039 (0.022)	0.054* (0.029)	0.059* (0.034)	0.105*** (0.028)
<i>Fis.bal</i>	0.086* (0.046)	0.172** (0.074)	0.338** (0.171)	0.449* (0.246)
<i>M2/GDP</i>	-0.224** (0.108)	-0.475 (0.513)	-0.485** (0.252)	0.166 (0.391)
<i>Credit</i> ^b	0.282* (0.161)	0.136 (0.317)	-0.276 (0.371)	0.292 (0.313)
<i>Kaopen</i>	0.026* (0.014)	0.041* (0.023)	-0.038 (0.053)	-0.025 (0.023)
<i>Political violence</i>	-0.015 (0.069)	0.127 (0.343)	0.065 (0.188)	0.265 (0.191)
<i>Conflict</i>	-0.113 (0.076)	-0.181 (0.314)	0.015 (0.181)	-0.090 (0.115)
<i>Election</i>	-0.020 (0.039)	-0.009 (0.067)	0.111 (0.137)	-0.200* (0.108)
<i>Constant</i>	0.087 (0.083)	-0.268 (0.224)	0.200 (0.171)	0.314* (0.178)
Devaluation episodes	57	57	57	57
Adj. R-squared	0.677	0.527	0.453	0.429

Notes: ***, **, and * denote respectively significance at 1%, 5% and 10%. Robust standard errors in parentheses.

a: *de facto* exchange rate regime classification

b: Domestic credit to public sector (GDP)

Regarding macroeconomic policy variables, our results confirm the role played by prudent macroeconomic policies in the effectiveness of devaluations: fiscal deficit and/or expansionary monetary policy tend to erode the depreciating effect of the devaluation on the real exchange rate. In other words, as long as the governments are able to control their fiscal and monetary policies, they will significantly enhance the effectiveness of the devaluation. Finally, regarding the *de jure* financial openness, results are less clear-cut. It appears, at first sight, that the implementation of exchange control policies enhances the effectiveness of devaluations as the coefficient associated with the interaction term between *kaopen* and the change in the nominal exchange rate is positive and statistically significant. But, the fact that the coefficient is only significant in one of the four regressions calls for caution in interpreting the results.

As regards the socio-political environment, our results do not support the existence of impact of the socio-political context. In a broader context, it is therefore difficult for us to take position regarding the link between devaluation effectiveness and the socio-political context.³³

5. How robust are these results?

Testing the sensitivity of our results to the sample of devaluation episodes is a natural extension of our analysis. In order to do so, we rely on alternative selection criteria. Indeed, different criteria have been used in the empirical literature to select devaluation episodes. More specifically, we here adopt the definition proposed by

³³ This inconclusive result may also be due to the quality and the relevance of the indicators used which remain questionable. Also, it could be the result of our methodological choice. Indeed, if the dependent variable was the inflation rate or even the real bilateral exchange rate, the effects of the socio-political variables might have been more noticeable. One can therefore think that the use of the real effective exchange rate blurs our perception of the effects of those variables.

Milesi-Ferretti and Razin (1998), which, compared to our definition, adds two additional criteria: *(i)* the rate of depreciation would have to increase by more than 10 percent compared to the previous year, and *(ii)* the rate of depreciation during the previous year must be below 10 percent. These two additional conditions restrict our initial sample to episodes in which the exchange rate was relatively stable the year prior the devaluation —and therefore is closer to the concept of currency crises as described in theoretical models.³⁴ The application of these criteria reduces our sample from 57 to 42 devaluation episodes (33 countries).³⁵

Results —displayed in Table 3— confirm our previous findings which then appear robust to changes in the definition of devaluation episodes. For all the variables we identify the same effects than the ones highlighted in Table 2. Indeed, looking at our main variables of interest, results confirm *(i)* the importance of the existence of substantial exchange rate misalignments prior to the devaluation, and *(ii)* a nonlinear relationship between the rate of devaluation and its effectiveness. Furthermore, those new results confirm that expansive macroeconomic policies tend to reduce the effectiveness of devaluation by inducing an appreciation of the real effective exchange rate. Changes in the exchange rate regime towards a more flexible one also seem to alter the effectiveness of devaluations. Finally, as previously, the socio-political context does not impact the effectiveness of devaluation.³⁶

³⁴ Note also that these criteria are particularly well suited for crawling pegs.

³⁵ See Table A.2 for details.

³⁶ In addition to these criteria, we also test the robustness of our results with a 25% threshold. This criterion, compared to the robustness check sample, leads to the exclusion of four devaluation episodes (Fiji 1998, Mauritius 1979, Mexico 1994 and Philippines 1997). Results are not reported to save space but they are in line with our previous findings.

Table 3 — Robustness check: robustness to the devaluation episodes sample

Dependent variable:	$\Delta REER_k$			
	$k=0$	$k=1$	$k=2$	$k=3$
$\Delta NEER_{t_0}$	0.686 ^{***} (0.259)	0.647 ^{***} (0.297)	0.631 ^{***} (0.212)	0.630 ^{***} (0.234)
$\Delta NEER_{t_0}^2$	-0.401 ^{***} (0.156)	-0.644 (1.016)	0.361 [*] (0.194)	0.483 ^{**} (0.239)
$Mis_{i,t_0-1} * \Delta NEER_{t_0}$	-0.497 ^{**} (0.234)	-0.529 (0.846)	0.463 (0.942)	0.161 (0.136)
$ERR^a * \Delta NEER_{t_0}$	0.028 [*] (0.016)	0.019 (0.014)	0.011 [*] (0.006)	0.016 [*] (0.009)
$Fis.bal. * \Delta NEER_{t_0}$	0.349 ^{**} (0.148)	0.370 [*] (0.194)	0.314 ^{**} (0.159)	0.268 [*] (0.157)
$M2/GDP * \Delta NEER_{t_0}$	-0.636 ^{**} (0.322)	-0.280 [*] (0.157)	-0.322 (0.270)	-0.291 [*] (0.170)
$kaopen * \Delta NEER_{t_0}$	0.108 (0.109)	0.031 (0.150)	0.252 (0.226)	0.385 ^{**} (0.154)
$Credit^b * \Delta NEER_{t_0}$	0.256 (0.405)	0.248 [*] (0.127)	0.392 [*] (0.225)	0.449 (0.283)
$Pol.violence * \Delta NEER_{t_0}$	0.435 (0.294)	0.981 (1.746)	0.768 (0.955)	0.859 (0.918)
$Conflict * \Delta NEER_{t_0}$	-0.345 (0.304)	-1.723 (1.267)	-0.758 (1.315)	-0.813 (0.556)
$Election * \Delta NEER_{t_0}$	-0.195 (0.146)	0.159 (0.280)	-0.628 (0.712)	-0.344 (0.307)
Mis_{i,t_0-1}	-0.089 ^{**} (0.042)	-0.114 ^{**} (0.056)	-0.132 [*] (0.069)	-0.146 ^{**} (0.071)
ERR^a	0.065 ^{**} (0.029)	0.049 [*] (0.026)	0.026 (0.036)	0.054 ^{**} (0.027)
$Fis.bal$	-0.041 (0.043)	0.080 ^{**} (0.036)	0.190 ^{**} (0.083)	0.169 [*] (0.094)
$M2/GDP$	-0.269 [*] (0.151)	-0.306 [*] (0.172)	-0.114 (0.684)	-0.286 ^{**} (0.131)
$Credit^b$	0.173 (0.219)	0.061 (0.305)	-0.673 (0.535)	0.440 (0.461)
$Kaopen$	0.067 ^{***} (0.019)	0.0726 [*] (0.042)	0.056 (0.061)	0.053 (0.033)
$Political violence$	0.089 [*] (0.051)	0.186 (0.415)	0.133 (0.228)	0.450 (0.265)
$Conflict$	-0.095 (0.069)	-0.291 (0.371)	-0.204 (0.334)	-0.223 (0.182)
$Election$	-0.070 [*] (0.039)	-0.019 (0.072)	-0.107 (0.195)	-0.160 (0.098)
<i>Constant</i>	0.110 (0.084)	-0.208 (0.258)	0.133 (0.191)	0.496 [*] (0.265)
Devaluation episodes	42	42	42	42
Adj. R-squared	0.617	0.569	0.554	0.528

Notes: ***, **, and * denote respectively significance at 1%, 5% and 10%. Robust standard errors in parentheses.

a: *de facto* exchange rate regime classification

b: Domestic credit to public sector (GDP)

6. Conclusion

In this paper, we have assessed the factors that enable a nominal devaluation to lead to a real depreciation by paying a particular attention to the role played by the size of the nominal adjustment and the initial distortion of the real exchange rate. To do this, we have studied the evolution of the real effective exchange rate from the year in which the devaluation occurs to the three following years, using a large sample of devaluation episodes in developing and emerging countries.

Our results indicate that the effectiveness of a devaluation depends not only on the implementation of appropriate accompanying macroeconomic policies, but also on the economic context in which the devaluation occurs and the size of the nominal adjustment. In particular, the existence of an overvaluation prior to the devaluation and the devaluation rate appear as important *ex ante* effectiveness factors. On the contrary, we find no strong support that the effectiveness of a devaluation is related to the socio-political context.

Several lessons regarding economic policy might be drawn from those results. First, devaluations that are not justified by considerable exchange rate misalignments and are implemented without appropriate accompanying macroeconomic policies, are likely to fail in improving competitiveness, and thus the economic situation. Second, the existence of a weak pass-through between the nominal and the real exchange rates may require an overshooting of the rate of devaluation which is initially needed. But, at the same time, a too high rate of devaluation can also trigger an immediate inflationary spiral. In this respect, the first two years after the devaluation appear to be pivotal years in which the effectiveness of a devaluation may be compromised. This reinforces the necessity of accompanying economic policies in order to overcome immediate inflationary pressures. If these different prerequisites are not met, a nominal exchange rate adjustment is likely to bring to countries more disadvantages than benefits.

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Appendices

A. Data appendix

Table A.1 — Data sources and definitions

Variables & Definitions	Sources
Exchange rate	
Nominal Effective Exchange Rate (NEER): weighted average of bilateral exchange rates against 67 trading partners.	Bruegel's database
Real Effective Exchange Rate (REER): weighted average of real bilateral exchange rates against 67 trading partners.	Bruegel's database
Exchange rate regime	
<i>de jure classification</i>	IMF
<i>de facto classification</i>	Ilzetzki, Reinhart & Rogoff
Exchange rate fundamentals	
Terms of trades (<i>tot</i>): expressed in logarithms	WDI
Government consumption (<i>gov</i>): in percentage of GDP	WDI
Foreign direct investment (<i>fdi</i>): in percentage of GDP	
Net Foreign Assets ^a (<i>nfa</i>): in percentage of GDP	Lane & Milesi-Ferretti
Official Development Aid (<i>oda</i>): in percentage of GDP	WDI
Relative productivity (<i>rprod</i>): measured by the ratio of GDP PPP per capita in the country and the weighted average GDP per capita PPP of partner countries. The weights and partners are the same than those used for the calculation of the real effective exchange rate.	
Openness (<i>open</i>)	WDI
Investment (<i>invest</i>): in percentage of GDP	WEO
Macroeconomic indicators	
Fiscal balance (<i>fis.bal</i>): in percentage of GDP	WEO
Domestic credit (<i>dom.cred</i>): in percentage of GDP	IFS
Domestic credit provided to public and private sector.	
Domestic credit to public sector (<i>cred.PS</i>): in percentage of GDP	IFS
Money and quasi-money (M2): in percentage of GDP	WDI
<i>kaopen</i> ^b : Financial openness measured on a zero-to-one scale, 1 being the highest financial openness degree.	Chinn & Ito
Consumer Price Index (<i>CPI</i>): expressed in logarithm	WEO
Socio-political indicators	
Political violence ^b : measured on a scale from 0 to 1, 1 being the highest degree of political violence.	Center for Systematic Peace
Political Terror Scale (PTS) ^b : bounded between 0 and 1, 0 being absence of political terror.	Political Terror Scale
Election: scores 1 years of Presidential and/or Legislative elections, 0 otherwise. Computed using informations in <i>Constituency-Level Elections Archive</i> and <i>African Elections Database</i> .	Uppsala
Conflict: scores 1 if the country is involved in a conflict.	Conflict Data Program

Continued on next page

Table A.1 — *Continued from previous page*

Variables & Definitions	Sources
<i>Other indicators</i>	
GDP current US\$: expressed in logarithms	WEO
GDP per capita: expressed in logarithms	WEO
Notes: a: Updated by adding current account balances in the last years where data on net foreign assets were not available. Data relative to current account balance are from WDI database.	
b: We modified the original scale.	
IFS: <i>International Financial Statistics</i> (International Monetary Fund)	
WDI: <i>World Development Indicators</i> (World Bank)	
WEO: <i>World Economic Outlook</i> (International Monetary Fund)	

Table A.2 — Selected countries and devaluation episodes

Country	Date	Country	Date
<i>Asia & Pacific</i>			
Fiji	1987, 1998*, 2009	Philippines	1997*
<i>Europe & Central Asia</i>			
Russian Federation	1998*	Turkey	1980, 1994, 2001
<i>Latin America & Caribbean</i>			
Argentina	2002*	Jamaica	1983*
Brazil	1983, 1999*	Mexico	1976*, 1982*, 1985, 1994*, 2001*
Costa Rica	1981*, 1991*	Peru	1982
Dominican Rep.	1985*, 1990*, 2003*	Trinidad & Tobago	1985*, 1993*
Ecuador	1999	Uruguay	1982*, 2002*
El Salvador	1986*, 1990*	Venezuela	1995, 2002*
<i>Africa</i>			
Benin	1994*	Kenya	1993
Burkina Faso	1994*	Madagascar	1993*
Cameroon	1994*	Mali	1994*
Central African Rep.	1994*	Mauritius	1979*
Chad	1994*	Mauritania	1992*
Congo Rep.	1994*	Niger	1994*
Côte d'Ivoire	1994*	Nigeria	1998*
Egypt	1979*	Senegal	1994*
Equatorial Guinea	1994*	Sierra Leone	1985
Ethiopia	1992*, 2010	Tanzania	1986*
Gabon	1994*	Togo	1994*
Ghana	2009	Zambia	1992

Note: Successful devaluations correspond to underlined episodes. " * " indicates the devaluation episodes retained for the robustness check.

B. Further results

Table B.1 — Cross-sectional dependence test results

	<i>reer</i>	<i>gov</i>	<i>invest</i>	<i>fdi</i>	<i>nfa</i>	<i>Oda</i>	<i>open</i>	<i>Tot</i>	<i>Rprod</i>
Pesaran (CD)'s	45.32	4.14	13.01	56.07	99.65	34.83	34.80	9.96	56.83
test	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(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.

Table B.2 — Unit root test results

		<i>reer</i>	<i>gov</i>	<i>invest</i>	<i>fdi</i>	<i>nfa</i>	<i>oda</i>	<i>open</i>	<i>Tot</i>	<i>Rprod</i>
CIPS*	level	-2.51 (0.13)	-2.49 (0.17)	-2.50 (0.13)	-2.85 (0.01)	-2.26 (0.60)	-2.61 (0.04)	-2.14 (0.03)	-2.39 (0.34)	-2.41 (0.28)
	1 st diff.	-3.05 (0.01)	-4.01 (0.01)	4.49 (0.01)	-4.83 (0.01)	-3.24 (0.01)	-4.70 (0.01)	-4.15 (0.01)	-3.40 (0.01)	-2.92 (0.01)
Choi Pm	level	-0.91 (0.81)	1.17 (0.12)	5.17 (0.00)	22.93 (0.00)	0.37 (0.35)	11.00 (0.01)	11.02 (0.00)	0.23 (0.40)	-3.96 (1.00)
	1 st diff.	42.01 (0.00)	42.91 (0.00)	53.15 (0.00)	51.97 (0.00)	44.33 (0.00)	52.66 (0.00)	53.85 (0.00)	35.51 (0.00)	34.93 (0.00)
Choi Z	level	3.92 (1.00)	-1.41 (0.08)	-4.78 (0.00)	-12.88 (0.00)	-0.64 (0.26)	-7.66 (0.00)	-6.70 (0.00)	2.81 (0.99)	8.95 (1.00)
	1 st diff.	-19.38 (0.00)	-20.11 (0.00)	-24.32 (0.00)	-23.85 (0.00)	-20.46 (0.00)	-23.85 (0.00)	-24.68 (0.00)	-16.61 (0.00)	-17.04 (0.00)
Choi L*	level	4.13 (1.00)	-1.19 (0.11)	-4.68 (0.00)	-15.62 (0.00)	-0.48 (0.31)	-8.51 (0.00)	-7.63 (0.00)	3.61 (0.99)	11.19 (1.00)
	1 st diff.	-25.68 (0.00)	-26.77 (0.00)	-32.97 (0.00)	-32.26 (0.00)	-27.08 (0.00)	-32.49 (0.00)	-33.45 (0.00)	-22.29 (0.00)	-22.09 (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.3 — Westerlund cointegration test results

Specification	<i>Reer</i> <i>rprod, tot, nfa</i>					
	<i>With constant</i>			<i>With trend and constant</i>		
	Value	Z-value	<i>p</i> -value	Value	Z-value	<i>p</i> -value
G_t	-2.783	-3.453	0.000	-3.056	-2.391	0.008
G_a	-9.121	1.552	0.940	-9.381	4.524	1.000
P_t	-15.084	-3.522	0.000	-17.478	-3.087	0.001
P_a	-8.738	-1.153	0.125	-11.467	0.544	0.707

Note: Optimal lag and lead length determined by Akaike Information Criterion. Width of Bartlett-Kernel set to 2. Null hypothesis of no cointegration.