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RESEARCH ARTICLE

Current Account Imbalances, Real Exchange Rates, and Nominal Exchange Rate Variability

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Abstract
This paper globally analyzes the bivariate relation between large current account imbalances and the real exchange rate over different degrees of nominal exchange rate variability. Employing both linear and nonlinear panel estimation procedures, we typically find an inverse long-run link between large imbalances and the real exchange rate at lower nominal exchange rate rigidity levels. This is in contrast to the often non-existent or positive comovement that materializes under lower nominal exchange rate variation. Our results thus suggest that greater nominal exchange rate adjustment can induce a stabilizing "current account"-"real exchange rate" relation. Meanwhile, current account adjustment speeds up with more flexible nominal exchange rates. Along the cross-section, the most salient findings are i) the striking positive relation between current account persistence and real exchange rate persistence based on country-specific estimates and ii) the inverse correlation between persistence in either the current account or real exchange rate and nominal exchange rate volatility.

Keywords External imbalances · Current account adjustment · Real exchange rate · Nominal exchange rate volatility · Flexibility · Persistence

JEL F00 · F31 · F32 · F41

1 Introduction

Is greater nominal exchange rate adjustment more conducive to a stabilizing link between large current account imbalances and the real exchange rate? Does it induce lower persistence in substantial external positions? The emergence of large external imbalances across the globe in the lead up to the last financial crisis renewed interest in the sources of such imbalances and their dynamics (Obstfeld 2012; Borio 2016; Monastiriotis and

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Tunali 2020; Chinn and Ito 2022). In particular, some studies have cast doubts over the relevance of the nominal exchange rate in the adjustment of current account positions, thereby directly calling into question the arguments of Friedman (1953) (Clower and Ito 2012; Chinn and Wei 2013; Hegarty and Wilson 2017). We examine whether these reservations are justified by taking a more complete picture based on Friedman's thesis. The notion advocated by Friedman is that nominal exchange rate flexibility accommodates optimal corrections in the terms of trade or real exchange rate on a continuing basis even in the case of nominal goods price stickiness. A more flexible exchange rate therefore allows for prompt smooth adjustment, and less protracted phases, of sizable external imbalances.

The hypothesis indicates that the nominal exchange rate is quite a pertinent factor for the relation between the current account and real exchange rate. Using a large global sample, we empirically examine the implications of greater nominal exchange rate flexibility for the basic bivariate relation between large current account imbalances and the real exchange rate, and moreover, the persistence of the current account.[1] Research conducted to date has not systematically scrutinized the former, especially in the context of state-switching frameworks, while limited research exists on the latter.

For large external imbalances, we typically find that relaxing the nominal exchange rate toward greater flexibility is associated with a stabilizing "current account"-"real exchange rate" relation over the long run. The link becomes stabilizing as exchange rate flexibility rises in the sense that an inverse relation between the two variables develops. This implies that under less rigid regimes the real exchange rate is able to absorb some of the pressure by engendering expenditure-switching effects that allow the current account to adjust. Allowing for asymmetric current account adjustment across real exchange rate episodes through a state-switching model however reveals that the relation becomes destabilizing at high nominal exchange rate flexibility levels when the real exchange rate is highly appreciated. We find that this result in the nonlinear setup is driven by high-income nations.[2]

Controlling for the real exchange rate, our results show that the current account observes faster convergence under greater flexibility. The current account coefficients in our dynamic framework may be interpreted as a proxy for "output shifting"-based adjustment.[3] In that case, the result suggests that further adjustment occurs through domestic economic activity in the presence of lower nominal exchange rate rigidity. The empirical finding is consistent with the notion that there may be greater scope for "interest rate"-based output-shifting effects under more flexible exchange rate arrangements.

[1] Throughout the paper, we use the terms "flexibility", "variability", and "volatility" interchangeably.

[2] The real exchange rate episodes constituting states across which switching in current account dynamics occurs in our model are phases of appreciated and depreciated real currencies relative to a real exchange rate threshold.

[3] An "output shifting"-based adjustment in the current account entails a change in home aggregate output or expenditure (economic activity), and correspondingly imports of foreign goods and services, that alters the external imbalance.

We also obtain a cross-section of country-specific measures of current account and real exchange rate persistence and find a positive correlation between the two variables. Following Curran and Velic (2019) who highlight the gap in the field, we are the first to explicitly investigate this nexus. Examining the determinants of inertia over the cross section, we consistently retrieve evidence of a negative link between persistence in either the current account or real exchange rate and nominal exchange rate variability.[4]

In a panel analysis of 70 countries, Clower and Ito (2012) report that the exchange rate arrangement is not a robust driver of current account inertia. However, persistence of imbalances is never gauged contingent on the real or nominal exchange rate within dynamic frameworks. Chinn and Wei (2013) obtain similar results over a much larger number of countries in basic linear (in parameters) first-order autoregressive models. Furthermore, without investigating the relation, they hypothesize that the current account responds to the real exchange rate, not the nominal exchange rate. They explain that if real exchange rate adjustment, in the form of mean-reversion, is not influenced by the choice of exchange rate regime, then one should not expect current account adjustment to be affected by it either. Hegarty and Wilson (2017) find little evidence that exchange rate regime choice matters significantly for export growth around recessions or output and domestic demand.

Theory on the other hand suggests that nominal variables can affect the aforementioned real variables (Engel 2019). In contrast, we directly examine the relation between large imbalances and the real exchange rate across varying degrees of nominal exchange rate flexibility in both i) linear models, and ii) nonlinear models that allow current account dynamics to differ across episodes of relatively appreciated and depreciated real currencies. The aforementioned studies in the literature also rely on discrete measures of nominal exchange rate flexibility thus exposing them to classification and accuracy issues. We augment our analysis with continuous measures of flexibility. Our study yields evidence of a Friedman-style role for the nominal exchange rate in current account adjustment.

If the exchange rate regime does not matter, the task of adjustment for both fixed and flexible regime countries is ultimately left up to relative national prices and/or domestic economic activity. In practice though, both nominal prices and wages usually move quite sluggishly, implying that any adjustment is borne primarily by economic activity. In addition, as Lane and Milesi-Ferretti (2012, 2015) note, to the extent that current account corrections are engendered by a deviation of output and demand from "potential", adjustments may prove to be temporary unless more meaningful expenditure switching occurs through exchange rate changes. Edwards (2007) notes that realignments of global growth rates would have only a modest impact on external imbalances and that significant real exchange rate movements are likely to be needed.

[4] The inverse relation between real exchange rate persistence and nominal exchange rate flexibility is consistent with the findings of Curran and Velic (2019). Fidora et al. (2021) meanwhile report that real exchange rate misalignments are more persistent in the euro area.

In a series of papers on the U.S. current account position, Obstfeld and Rogoff (2001, 2005, 2007) conclude that a narrowing of the U.S. external deficit is likely to entail a large real domestic currency depreciation, as well as a sharp decline in the nation's consumption and welfare levels. Nam (2011) studies the contribution of the nominal exchange rate and relative price levels respectively to real exchange rate convergence. He finds that when the real exchange rate is sufficiently far away from its unconditional mean that adjustment is almost entirely driven by nominal exchange rate movements.[5] Eichenbaum et al. (2017) meanwhile document that real exchange rates in the medium and long run overwhelmingly adjust through changes in nominal exchange rates, and not inflation differentials, with Taylor rules across countries maintaining relative price stability. According to Engel (2019), the intuition drawn from theoretical models is that both price changes and nominal exchange rate determination play roles in the adjustment of real exchange rates, and hence both price stickiness and the degree of interest rate smoothing.

The importance of the relation between the current account and real exchange rate in traditional models, new open economy macroeconomics, and the theory of optimum currency areas provides a further reason to study the strength of this relation in disparate settings. According to the Mundell-Fleming- and Obstfeld-Rogoff-style frameworks, the link between the two variables is given by changes in the composition of the demand side. The expenditure-switching effect is often cited as the key mechanism through which changes in the real exchange rate engender movements in the current account in these models. In the case of a home real currency depreciation for example, expenditure-switching would entail the shifting of domestic and foreign residents' spending toward the home country's goods. Theory predicts that the magnitude of the expenditure-switching effect will vary with the exchange rate regime.[6] Nevertheless, as Engel (2002) notes, the expenditure-switching effect is eradicated in the Redux model in the presence of market segmentation in home and foreign countries and pricing-to-market by monopolistically competitive firms.

Given free international capital flows, we highlight that more flexible exchange rates provide scope for larger and more frequent independent interest rate changes at home. By uncovered interest rate parity, the rate of currency depreciation is tied to the domestic interest rate. Thus, under autonomous monetary policy, there is added potential for output-shifting arising from the impact of domestic interest rate changes on aggregate expenditure, including that on imports. That is, "interest rate"-induced output-shifting effects can also act as another outlet for current account adjustment, or alternatively be of the variety that act in the offsetting direction to a correction. The persistence of the interest rate depends on the extent to which the national authorities engage in interest rate smoothing as reflected in the policy rule (Engel 2016; Engel 2019).

[5] Moreover, Goldfajn and Valdés (1999) conclude that overvaluations of real exchange rates have been typically corrected by adjustments in the nominal exchange rate rather than changes in inflation differentials.

[6] The strength of the expenditure-switching effect also depends on the degree of price stickiness, producer currency pricing, and substitutability between home and foreign tradable goods.

An unanticipated appreciation of the currency today makes financial investments abroad more attractive. This occurs not only because of the initial currency appreciation, but also because a depreciation is likely at the maturity of the investment. This type of expenditure-switching provides a link between large and persistent changes in the current account and the long-run behavior of the real exchange rate. High exchange rate volatility, at the same time, can indicate greater uncertainty or economic instability (Baker et al. 2016; Leduc and Liu 2016; Curran and Velic 2020b), and therefore lead to heavier private capital outflows (sudden stops). These outflows can be associated with sharp current account deficit reversals if they are not replaced by public flows.

The remainder of the paper is structured as follows. Section 2 provides an overview of the empirical methodology employed. Section 3 offers a description of the data set used. In Sect. 4, we present linear panel specification results, while in Sect. 5 we report findings when asymmetric current account movement is permitted across relatively appreciated and depreciated real exchange rate scenarios. Section 6 covers the analysis on country-specific current account persistence. Section 7 concludes.

2 Analytical Framework

2.1 Linear Dynamic Panel Approach

To study the empirical relation between the current account and real exchange rate conditional on nominal exchange rate variability, we employ a single equation dynamic panel model. The cross-section dimension is particularly relevant in the presence of greater variation in nominal exchange rate volatility across countries than over time for a single country. For instance, member nations of the African currency unions observe virtually zero nominal exchange rate volatility over time. Thus, a panel analysis may provide an advantage in discerning whether more flexible nominal exchange rates facilitate greater adjustment between external imbalances and the real exchange rate. As discussed in Sect. 3, our variables are characterized as stationary.

We first estimate the following linear baseline level-log specification via pooled OLS, fixed effects, the difference generalized method of moments (GMM) à la Arellano and Bond (1991), and system GMM à la Blundell and Bond (1998)

$$ca_{i,t} = \alpha_i + \alpha_t + \sum_{j=1}^{p} \beta_j ca_{i,t-j} + \sum_{k=0}^{q} \gamma_k rer_{i,t-k} + \varepsilon_{i,t} \tag{1}$$

where *ca* is the current account to GDP ratio, *rer* is the natural logarithm of either the real effective exchange rate (REER) or the U.S.-based bilateral real exchange rate

(BRER), α_i and α_t are country and time fixed effects, and $p \geq 1$, $q \geq 0$.[7,8] An increase in *rer* indicates real currency appreciation. Alternatively, one can re-parameterize Eq. (1) as

$$\Delta ca_{i,t} = \alpha_i + \alpha_t + \tau_1 ca_{i,t-1} + \sum_{j=1}^{p-1} \tau_{2j} \Delta ca_{i,t-j} + \tau_3 rer_{i,t} + \sum_{k=0}^{q-1} \tau_{4k} \Delta rer_{i,t-k} + \varepsilon_{i,t} \quad (2)$$

where

$$\tau_1 = -\left(1 - \sum_{j=1}^{p} \beta_j\right) \quad (3)$$

$$\tau_{2j} = -\sum_{l=j+1}^{p} \beta_l \quad (4)$$

$$\tau_3 = \sum_{k=0}^{q} \gamma_k \quad (5)$$

$$\tau_{4k} = -\sum_{m=k+1}^{q} \gamma_m. \quad (6)$$

The parameters in Eqs. (3) and (5) are of particular interest as the figure $-\tau_3/\tau_1$ gives the long-run or cumulative impact of a change in the real exchange rate provided that the stability condition $\sum_j \beta_j < 1$ holds.[9] A standard error for the long-run coefficient is obtained via the delta method (Davidson and MacKinnon 2004). $\sum_j \beta_j$ offers, ceteris paribus, a measure of current account inertia.

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[7] It is well documented that dynamic panel regressions with a lagged dependent variable and fixed effects can result in inconsistent estimates i.e. dynamic panel bias or Nickell bias. This problem typically erodes away as T increases. However, simulation studies have shown that the bias in the coefficient estimate of interest can be as large as 20 percent even when T=30. The GMM approach helps to gauge the extent of this problem. Difference GMM uses additional lags of the dependent variable as instruments in the differenced equation. The results are always reported for the original levels model even though mechanically the first difference model is fitted. According to the Monte Carlo simulations of Judson and Owen (1999), differences in efficiency and bias across the Anderson and Hsiao (1981) and Arellano and Bond (1991) estimators (the former of which uses only one further lag of the dependent variable as an instrument) become quite small for larger N and T. System GMM employs additional moment conditions to obtain an estimator with improved precision and better finite-sample properties. Moreover, Blundell and Bond (1998) demonstrate that if the dependent variable is close to a random walk, past changes (as instruments) may be more predictive of current levels. The method estimates a two-equation system of regressions in first differences and levels, using lags of levels as instruments for the first differences and first differences as well as further lags of first differences as instruments for the levels. Given model overidentification, more efficient two-step estimation is used for both difference and system GMM. Good GMM estimates should lie in the range of the pooled OLS (without α_i) and fixed effects estimates, or at least lie close to this interval.

[8] Information criteria (Akaike and Bayesian) and data frequency considerations determine lag length choices of p and q. Our analysis employs $p = q = 2$ with annual data.

[9] Strictly speaking, this is not the sole stationarity condition since one cannot expect *ca* to be stationary without imposing further conditions on *rer*. It is apparent nevertheless that if this condition is violated,

Studies by Debelle and Faruqee (1996), Chinn and Prasad (2003), Lee et al. (2008) and Auer (2014) examine the current account in a panel setting using only pooled OLS and fixed effects estimation. Dynamic panel bias and endogeneity of regressors can invalidate such estimation procedures. We therefore supplement the standard methodology with the GMM approach. To assess the effect of nominal exchange rate flexibility on the strength of the relation between the current account and real exchange rate, we augment Eq. (1) with nominal exchange rate volatility (continuous measure) or regime (discrete measure) interaction terms. Namely, we estimate

$$ca_{i,t} = \alpha_i + \alpha_t + \sum_{j=1}^{p} \beta_j ca_{i,t-j} + \sum_{j=1}^{p} \phi_j \left(ca_{i,t-j} \times nervol_{i,t-j} \right) + \sum_{k=0}^{q} \gamma_k rer_{i,t-k} + \\ + \sum_{k=0}^{q} \psi_k \left(rer_{i,t-k} \times nervol_{i,t-k} \right) + \sum_{k=0}^{r} \theta_k nervol_{i,t-k} + \varepsilon_{i,t} \tag{7}$$

and

$$ca_{i,t} = \alpha_i + \alpha_t + \sum_{j=1}^{p} \beta_j ca_{i,t-j} + \sum_{j=1}^{p} \delta_j \left(ca_{i,t-j} \times ierr_{i,t-j} \right) + \sum_{j=1}^{p} \rho_j \left(ca_{i,t-j} \times flerr_{i,t-j} \right) + \\ + \sum_{k=0}^{q} \gamma_k rer_{i,t-k} + \sum_{k=0}^{q} \lambda_k \left(rer_{i,t-k} \times ierr_{i,t-k} \right) + \sum_{k=0}^{q} \pi_k \left(rer_{i,t-k} \times flerr_{i,t-k} \right) + \\ + \sum_{k=0}^{r} \varphi_k ierr_{i,t-k} + \sum_{k=0}^{r} \omega_k flerr_{i,t-k} + \varepsilon_{i,t} \tag{8}$$

where *nervol* is the natural logarithm of either effective or bilateral nominal exchange rate volatility, *flerr* (*ierr*) is a binary variable that equals 1 whenever a country is characterized by a (an) flexible (intermediate) nominal exchange rate regime and 0 otherwise, and $r = \max[p;q]$.[10]

Footnote 9 (continued)

ca becomes characterized by random walk or explosive behavior. As a result, in order for the long-run multiplier definition to make sense, the convergence requirement must be satisfied.

[10] Only employing contemporaneous nominal exchange rate volatility ($nervol_{i,t}$) and exchange rate regime ($ierr_{i,t}$, $flerr_{i,t}$) variables in our models does not significantly alter results. The same applies to only using the first lag of flexibility measures. Information criteria indicate a preference for specifications used in our paper. The inclusion of varying lags of nominal exchange rate flexibility variables implies that we are concerned with the degree of flexibility over the period $t - r$ to t for an observation at time t. This decision reflects the fact that export and import contracts can be set for future periods and thus adjust with a lag upon expiry in response to price and exchange rate changes today i.e. previously agreed contracts are sticky (where the degree of stickiness may depend on exchange rate variability). Thus nominal exchange rate flexibility at different points over the entire period $t - r$ to t, and not just over t, should a priori matter for corresponding *rer* and *ca* coefficients in models, and so current account adjustment or dynamics more generally.

2.2 Incorporating Nonlinear Transitional Dynamics

There are few reasons a priori to believe that the dynamics of the current account should be symmetric across episodes of relatively appreciated and depreciated real exchange rates. For instance, if the current account is initially in deficit and the real exchange rate overvalued, then under a fixed exchange rate regime, barring an adjustment through output compression, an improvement in the external balance will necessitate a fall in the price level. However, this may be more difficult to achieve if prices or wages are less flexible downward, in turn implying a more persistent deficit. Consequently, nominal exchange rate flexibility may impart a differential effect in such states than in the opposite scenario in which upward price adjustment is relatively easier.

We examine whether nonlinear adjustment in the current account can be attributed to asymmetries in the relation between the current account and the real exchange rate by estimating the following dynamic panel smooth transition regression (DPSTR) model with nonlinear least squares (NLS)

$$
\begin{aligned}
ca_{i,t} = {} & \alpha_i + \alpha_t + \sum_{j=1}^{p} \beta_j ca_{i,t-j} + \sum_{j=1}^{p} \phi_j \left(ca_{i,t-j} \times nervol_{i,t-j} \right) + \sum_{k=0}^{q} \gamma_k rer_{i,t-k} + \\
& + \sum_{k=0}^{q} \psi_k \left(rer_{i,t-k} \times nervol_{i,t-k} \right) + \sum_{k=0}^{r} \theta_k nervol_{i,t-k} + \\
& + \left(\alpha_i^* + \alpha_t^* + \sum_{j=1}^{p} \beta_j^* ca_{i,t-j} + \sum_{j=1}^{p} \phi_j^* \left(ca_{i,t-j} \times nervol_{i,t-j} \right) + \sum_{k=0}^{q} \gamma_k^* rer_{i,t-k} + \right. \\
& \left. + \sum_{k=0}^{q} \psi_k^* \left(rer_{i,t-k} \times nervol_{i,t-k} \right) + \sum_{k=0}^{r} \theta_k^* nervol_{i,t-k} \right) G\left(rer_{i,t-d}; \sigma, c \right) + \varepsilon_{i,t}
\end{aligned}
\tag{9}
$$

where $G\left(rer_{i,t-d};\sigma,c\right) = \left[1 + \exp\left(-\sigma \prod_{s=1}^{z} \left(rer_{i,t-d} - c_s\right)\right)\right]^{-1}$.[11,12] Prior to estimating this equation, the nominal exchange rate volatility augmented DPSTR, we also inspect its baseline version. That is, Eq. (9) is first estimated without the volatility and interaction terms. Taking a closer look at Eq. (9), $G(.)$ is a (continuous) transition function of the logistic variety that governs the nonlinear behavior of the current account. The slope/smoothness parameter $\sigma > 0$ determines the speed of

[11] Hansen (1999) introduced the panel threshold regression model that over time allows discrete shifts in coefficients across regimes. Building on this work, González et al. (2017) formulated the panel smooth transition regression model which instead facilitates a smooth and gradual transition of coefficients between regimes. We adopt the latter more general smooth transition approach since we are analyzing a wide range of countries with different historical experiences. With aggregated series and heterogeneous agents there is also a good chance that responses will not be simultaneous, thus resulting in a smoother change in the adjustment coefficients.

[12] Estimation of the DPSTR model with GMM, including instruments, produces similar results. NLS is equivalent to maximum likelihood estimation under the assumption that the errors $\varepsilon_{i,t}$ are normally distributed. NLS estimates otherwise may be interpreted as quasi-maximum likelihood estimates.

transition between "states" or "regimes", with higher values of σ indicating faster transition. $rer_{i,t-d}$ is the transition variable with delay parameter d, while the c_s are corresponding threshold parameters with $c_1 \leq c_2 \leq \ldots \leq c_z$. For the purposes of discussion, we denote the coefficients in the linear (without $G(.)$) and nonlinear (with $G(.)$) components of the DPSTR by the vectors $\boldsymbol{\mu}$ and $\boldsymbol{\mu}^*$ respectively. Given annual data, the only plausible value for d is 1. From an empirical perspective, González et al. (2017) note that considering $z = 1, 2$ is generally sufficient for capturing nonlinearities arising from regime switching. In our analysis, tests suggest that $z = 1$ is appropriate resulting in $G(.) \in [0, 1]$. This implies that the two extreme lower and upper regimes at $G(.) = 0$ and $G(.) = 1$ are associated with low and high values of $rer_{i,t-d}$ respectively, with a single monotonic transition of coefficients from $\boldsymbol{\mu}$ to $\boldsymbol{\mu} + \boldsymbol{\mu}^*$ as $rer_{i,t-d}$ rises where the change is centered around c_1. More generally, an observation has effective regression coefficients $\boldsymbol{\mu} + \boldsymbol{\mu}^* G(.)$ and is assigned to the low (high) regime when $G(.) < (>)\ 0.5$. The dynamics of the current account can therefore be viewed as a weighted average of dynamics across the two extreme regimes i.e. $(1 - G(.))\boldsymbol{\mu} + G(.)(\boldsymbol{\mu} + \boldsymbol{\mu}^*)$.

As $\sigma \rightarrow \infty$ in the limit, $G(.)$ becomes an indicator function and the DPSTR reduces to a discrete transition dynamic panel threshold model. Conversely, as $\sigma \rightarrow 0$, $G(.)$ tends to a constant (0.5) and the DPSTR specification dwindles down to a homogeneous or linear dynamic panel regression model with fixed effects. As suggested by Teräsvirta (1994), when necessary, we re-parameterize the transition function as

$$G\left(rer_{i,t-d}; \sigma, c\right) = \left[1 + \exp\left(\frac{-\sigma(rer_{i,t-d} - c_1)}{\hat{s}(rer_{i,t-d})}\right)\right]^{-1} \tag{10}$$

where $\hat{s}(rer_{i,t-d})$ is the sample standard deviation of the transition variable. Such an adjustment speeds the convergence and improves the stability of parameter estimates.

2.3 Cross-Section Approach

This sub-section takes a different perspective and turns attention to obtaining country-specific scalar measures of current account inertia, which are subsequently related to individual country levels of real exchange rate persistence and nominal exchange rate variability over the time period of study. The intertemporal approach can be employed to formalize the trajectory of the current account (Taylor 2002; Christopoulos and León-Ledesma 2010). Within this framework, it can be shown that current account stationarity is a sufficient, but not necessary, condition for compliance with the open economy long-run budget constraint. The current account in this case is said to be "strongly sustainable". However, these are not the only dynamics of the current account that will avoid violation of the intertemporal budget constraint. As Bohn (2007) demonstrates, theoretically the budget constraint can be met even if the current account is integrated of some finite order. Such instances fall under the category of "weak sustainability". We concentrate on the "strong sustainability" hypothesis given the more rigorous economic policy implications and results of preliminary panel unit root tests provided in Sect. 3.[13]

To gauge the persistence of the current account for each country, we estimate linear autoregressive (AR) specifications, and employ the concept of the half-life as our measure of the degree of mean-reversion.[14] Specifically, for each country we consider AR(1) and augmented AR models

$$\Delta ca_t = \varrho_0 + \varrho_1 ca_{t-1} + \varepsilon_t \tag{11}$$

and

$$\Delta ca_t = \varrho_0 + \beta t + \varrho_1 ca_{t-1} + \sum_{j=1}^{p-1} \vartheta_j \Delta ca_{t-j} + \varepsilon_t. \tag{12}$$

Equivalent specifications for the real exchange rate are also estimated following Curran and Velic (2019). In turn, we retrieve the half-life, defined as the number of years required for a deviation from equilibrium to dissipate permanently by 50 percent, from

$$\hat{hl} = \frac{\ln(0.5)}{\ln(1 + \hat{\varrho}_1)}. \tag{13}$$

Using these estimates, we non-parametrically and graphically inspect the cross-section gross relation between 1) current account persistence and real exchange rate persistence, and 2) current account or real exchange rate persistence and nominal exchange rate volatility. We next parametrically relate current account inertia to nominal exchange rate variability and a set of other control factors, detailed in the data section, via the reduced-form cross-section equation

$$\begin{aligned} hl_i^{ca} = \kappa_0 + \kappa_1 nerv_i + \kappa_2 NFA_i + \kappa_3 GBB_i + \kappa_4 to_i + \kappa_5 ifi_i + \kappa_6 res_i + \\ + \kappa_7 ydr_i + \kappa_8 odr_i + \kappa_9 fdev_i + \kappa_{10} pci_i + \kappa_{11} PG_i + \kappa_{12} cas_i + \varepsilon_i \end{aligned} \tag{14}$$

where lowercase-letter variables are in logarithms, hl^{ca} is the current account half-life, *nerv* is nominal exchange rate volatility (or alternatively exchange rate regime *ERR* is used), *NFA* is net foreign assets, *GBB* is the government budget balance, *to* is trade openness, *ifi* is international financial integration, *res* is international reserves, *ydr* is the youth dependency ratio, *odr* is the old dependency ratio, *fdev* is financial development, *pci* is per capita income, *PG* is productivity growth, and *cas* is current account size. The additional determinants of current account persistence are collected as averages over the sample period for each country *i*. Estimation of Eq. (14) is by ordinary least squares (OLS).

[13] In a growing economy persistent non-"relative to GDP" current account deficits are strongly sustainable if their expected value does not grow at a rate faster than that of output, implying that ca_t is stationary.

[14] Estimation of more elaborate nonlinear models is not feasible as we employ lower frequency data.

3 Data

Our study is conducted for 73 economies using annual data over the post Bretton Woods period 1973-2011.[15] The countries used, consistent with the selection criteria of Lane and Milesi-Ferretti (2012), are listed and categorized in Appendix 1. We discard all countries with nominal GDP below $20 billion in 2007 and in the process eliminate very low-income nations (i.e. those with per capita nominal GDP less than $500).[16] We exclude oil-dominated countries as their current account dynamics are highly dictated by the price of petroleum. The omission of small and very low-income nations is justified by the fact that small countries can experience outsized current account volatility, while the external balances of very poor economies are typically influenced by external aid and debt reduction agreements following episodes of large deficits. These factors could potentially impede a meaningful assessment of the relation between the current account, real exchange rate, and nominal exchange rate flexibility.

Our panel regressions focus on current account balances that are in absolute terms greater than 3 percent of GDP since large external imbalances are the ones of greatest concern to the global community (Cline and Williamson 2008; Obstfeld 2012).[17] Annual nominal exchange rate volatility measures in panel specifications are constructed using monthly exchange rate data. We drop observations in years prior to 1996 for Central and Eastern European economies as these were times of great structural change and volatility in these nations. The study overall is left with an unbalanced panel data set. In the cross-section examination of persistence, nevertheless, we use the full sample of current account observations in order to mitigate the inadequate power issue. Appendix 2 lists the full set of variables employed in this study, as well as their mnemonics, definitions, and sources.

Tables 1, 2, 3, 4, 5 and 6 present the results of panel unit root tests for the two main variables in the cases of cross-sectional independence and dependence respectively. An overwhelming majority of the tests strongly reject the null of non-stationary panels. As shown later in Sect. 6, the current account tends to display relatively fast mean-reversion for most individual country cases. While one can reject the unit root hypothesis for both bilateral and multilateral real exchange rates at the annual frequency, we note that these series exhibit higher levels of

[15] Data availability governs the sample time period. Annual observations are more relevant for the analysis of external adjustment and allow for superior country coverage.

[16] We varied the nominal GDP threshold (as well as the year) accordingly and found no significant change in the results. Employing a 1 million population threshold instead has no qualitative impact on our findings. Results are insensitive to the exclusion of Kenya and Bangladesh, the only two nations with per capita nominal GDP less than $1000 in 2007.

[17] Findings are qualitatively similar when imbalances greater than 5 percent in absolute value are analyzed. On the other hand, results are generally weaker when imbalances less than 3 percent in absolute terms are included in the study. See Cline and Williamson (2008) on the 3 percent rule for current account sustainability.

Table 1 Current Account Panel Unit Root Tests: Unbalanced Panel of 73 countries, all CA balances, 1973-2011

Panel Unit Root Test	Full Sample	Advanced Economies	Emerging Economies	Developing Economies	High Income	Middle & Low Income
PP-Fisher, chi-squared, no lags	0.00	0.00	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, 1 lag	0.00	0.00	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, no lags, demeaned	0.00	0.02	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, 1 lag, demeaned	0.00	0.01	0.00	0.00	0.00	0.00
Pesaran CADF, no lags	0.00	0.01	0.00	0.00	0.00	0.00
Pesaran CADF, 1 lag	0.00	0.07	0.00	0.00	0.00	0.00

Current account to GDP ratio is employed. P-values are displayed. Null hypothesis is that all panels contain unit roots. In tests where the demeaned option is specified cross-sectional averages are removed from the data to help mitigate the impact of cross-sectional dependence. Pesaran's cross-section augmented Dickey-Fuller (CADF) test is robust to cross-sectional dependence. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) versions of Fisher test produce same results. Inverse chi-squared (used), inverse normal, inverse logit and modified inverse chi-squared statistics generally yield consistent conclusions in Fisher tests, particularly in the case of null rejection

persistence than the current account.[18] Given these results, a cointegration framework is not appropriate.[19] Average absolute cross-section correlation coefficients tend to be low (< 0.30) across variables in our sample. Pesaran (2021) in this instance suggests using the assumption of cross-section independence. Moreover, the use of time dummies in regressions attenuates cross-section dependence issues that are driven by common shocks.

Table 7 shows the de facto fine and coarse nominal exchange rate regime classification codes of Ilzetzki et al. (2017), while Table 8 indicates how we re-categorize these codes for the purposes of our study. Using the new classification scheme and data corresponding to relatively large external imbalances, Tables 9 and 10 indicate

[18] Multilateral and U.S.-based bilateral rates are highly correlated. We employ both since the former is theoretically the correct measure for our purposes while the latter offers greater country coverage and plays a highly significant role in emerging market and euro area effective exchange rates (Lane and Milesi-Ferretti 2012; Schmitz et al. 2013). We note that real exchange rates can be non-stationary over shorter time periods e.g. Galstyan and Velic (2017).

[19] Even with near-unit root variables, Hjalmarsson and Österholm (2007, 2010) show that the risk of erroneously finding cointegration is substantially higher. They contend that standard inferential procedures based on the assumption of unit root data are generally not robust to even small deviations from this assumption.

Table 2 Current Account Panel Unit Root Tests: Unbalanced Panel of 73 countries, $|CA| > 3\%$, 1973-2011

Panel Unit Root Test	Full Sample	Advanced Economies	Emerging Economies	Developing Economies	High Income	Middle & Low Income
PP-Fisher, chi-squared, no lags	0.00	0.00	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, 1 lag	0.00	0.00	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, no lags, demeaned	0.09	0.19	0.53	0.18	0.02	0.43
PP-Fisher, chi-squared, 1 lag, demeaned	0.03	0.19	0.33	0.20	0.00	0.39
Pesaran CADF, no lags	0.10	0.09	0.10	0.10	0.06	0.05

Current account to GDP ratio is employed. $|CA| > 3\%$ refers to the sample of current account balances that are in absolute terms greater than 3 percent of GDP. P-values are displayed. Null hypothesis is that all panels contain unit roots. In tests where the demeaned option is specified cross-sectional averages are removed from the data to help mitigate the impact of cross-sectional dependence. Pesaran's cross-section augmented Dickey-Fuller (CADF) test is robust to cross-sectional dependence. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) versions of Fisher test produce same results. Inverse chi-squared (used), inverse normal, inverse logit and modified inverse chi-squared statistics generally yield consistent conclusions in Fisher tests, particularly in the case of null rejection

that the majority of the observations in our samples fall under the fixed exchange rate arrangement. For the sample of bilateral (multilateral) real exchange rate countries, Table 9 (10) shows across regimes and country groups the spread of observations and levels of average annual bilateral (multilateral) nominal exchange rate volatility corresponding to current account balances that are in absolute terms greater than 3 percent of GDP. Advanced and developing economies have the largest shares of fixed exchange rate regime observations. Conversely, emerging market economies have larger shares of the more flexible regime observations. Tables 9 and 10 reveal that less flexible regimes are associated with lower nominal exchange rate volatility, a trend consistent with the findings of Mussa (1986).

Regime rigidity according to the discrete measure may not always be associated with low volatility, and similarly for the opposite scenario. For instance, although classified as fixed exchange rate regime countries in the year 1994, the CFA Franc users of Central and West Africa observed significant nominal exchange rate volatility at this time as the currency was sharply devalued in an attempt to aid exports in the region. In this case, volatility changes while the binary variables reflecting flexibility do not. Consequently, de facto nominal exchange rate volatility captures more precisely the actual behavior or flexibility of the nominal exchange rate than the discrete measure. It may moreover be argued that the classification of binary variables can be quite arbitrary for intermediate regimes. We thus bolster the analysis with the continuous (volatility) variable. Clower and Ito (2012) and Chinn and Wei

Table 3 ln(REER) Panel Unit Root Tests: Unbalanced Panel of 51 countries, full sample, 1973-2011

Panel Unit Root Test	Full Sample	Advanced Economies	Emerging Economies	Developing Economies	High Income	Middle & Low Income
PP-Fisher, chi-squared, no lags	0.00	0.02	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, 1 lag	0.00	0.00	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, no lags, demeaned	0.00	0.00	0.00	0.05	0.00	0.07
PP-Fisher, chi-squared, 1 lag, demeaned	0.00	0.00	0.00	0.04	0.00	0.04
Pesaran CADF, no lags	0.00	0.28	0.10	0.00	0.05	0.00
Pesaran CADF, 1 lag	0.00	0.03	0.00	0.01	0.00	0.00

ln(REER) denotes the natural logarithm of the real effective exchange rate. P-values are displayed. Null hypothesis is that all panels contain unit roots. In tests where the demeaned option is specified cross-sectional averages are removed from the data to help mitigate the impact of cross-sectional dependence. Pesaran's cross-section augmented Dickey-Fuller (CADF) test is robust to cross-sectional dependence. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) versions of Fisher test produce same results. Inverse chi-squared (used), inverse normal, inverse logit and modified inverse chi-squared statistics generally yield consistent conclusions in Fisher tests, particularly in the case of null rejection

(2013) amongst others, in contrast, solely focus on discrete variables as measures of exchange rate flexibility.

4 Linear Panel Analysis

Tables 11 and 12 present the findings for the baseline linear "current account"-"real exchange rate" specification under the different estimation procedures.[20,21] The overriding message is that the current account on average has a persistence coefficient of around 0.70 (i.e. based on $\sum \beta_j$), and a negative contemporaneous and long-run relation with the real exchange rate. The former indicates that, controlling for the

[20] We check whether instrument proliferation is driving our difference and system GMM results by collapsing the instrument set or limiting its lag length. The findings do not change notably in these tests. Instrument proliferation however does inflate the p-value of the test for overidentifying restricitions (SH) toward 1. This p-value is generally smaller in our instrument proliferation robustness checks, but still sufficiently large to fail to reject the null of valid overidentifying restrictions (or that the population moment conditions hold). See Roodman (2009a, b) for further information.

[21] Standard errors produced using the usual textbook formulas for the two-step GMM estimator are downward biased in finite samples. Windmeijer (2005) provides a correction for this issue. We err on the side of caution and employ the Windmeijer-corrected cluster-robust standard errors in GMM regressions.

Table 4 ln(REER) Panel Unit Root Tests: Unbalanced Panel of 51 countries, when $|CA| > 3\%$, 1973-2011

Panel Unit Root Test	Full Sample	Advanced Economies	Emerging Economies	Developing Economies	High Income	Middle & Low Income
PP-Fisher, chi-squared, no lags	0.00	0.45	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, 1 lag	0.00	0.34	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, no lags, demeaned	0.00	0.10	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, 1 lag, demeaned	0.00	0.09	0.00	0.00	0.00	0.00
Pesaran CADF, no lags	0.07	0.64	0.43	0.03	0.54	0.10

ln(REER) denotes the natural logarithm of the real effective exchange rate. $|CA| > 3\%$ refers to the sample of observations corresponding to current account balances that are greater than 3 percent of GDP in absolute terms. P-values are displayed. Null hypothesis is that all panels contain unit roots. In tests where the demeaned option is specified cross-sectional averages are removed from the data to help mitigate the impact of cross-sectional dependence. Pesaran's cross-section augmented Dickey-Fuller (CADF) test is robust to cross-sectional dependence. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) versions of Fisher test produce same results. Inverse chi-squared (used), inverse normal, inverse logit and modified inverse chi-squared statistics generally yield consistent conclusions in Fisher tests, particularly in the case of null rejection

real exchange rate, the current account exhibits relatively high inertia, while the latter suggests that price and nominal exchange rate movements can, at least partly, allow for external adjustment through the expenditure-switching channel. The average long-run real exchange rate coefficient across the two tables is weakly negative and stands at approximately -0.01, with five of the nine negative estimates reported as statistically insignificant. This implies that a 10 percent real currency appreciation is associated with a 0.001 decline in the current account, that is, a 0.10 percentage point fall which is a relatively small multiplier.[22,23]

Pooling over disparate exchange rate regimes however may blur the lines of analysis by biasing the sum of the real exchange rate coefficients toward zero. This can occur if the correlations across the different exchange rate arrangements offset each

[22] A 10 percent real currency appreciation refers to a +10 percent change in the real exchange rate.

[23] Krugman (1989) contends that a small expenditure-switching effect may amplify nominal exchange rate volatility. He notes that the smaller the impact of exchange rate changes on relative prices, and thus on relative demands, the larger the required exchange rate change for achieving equilibrium (Devereux and Engel (2002) further discuss this argument and its limitations in the context of new open economy macroeconomic models). However, the expenditure-switching effect of a given real exchange rate movement may also change at higher nominal exchange rate variability levels if firm pricing strategies or the frequency with which import and export volume contracts are reset change with volatility.

Table 5 ln(BRER) Panel Unit Root Tests: Unbalanced Panel of 72 countries, full sample, 1973-2011

Panel Unit Root Test	Full Sample	Advanced Economies	Emerging Economies	Developing Economies	High Income	Middle & Low Income
PP-Fisher, chi-squared, no lags	0.00	0.24	0.00	0.00	0.09	0.00
PP-Fisher, chi-squared, 1 lag	0.00	0.01	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, no lags, demeaned	0.00	0.01	0.00	0.00	0.81	0.00
PP-Fisher, chi-squared, 1 lag, demeaned	0.00	0.00	0.00	0.00	0.62	0.00
Pesaran CADF, no lags	0.00	0.12	0.54	0.01	0.59	0.00
Pesaran CADF, 1 lag	0.10	0.09	0.98	0.25	0.00	0.12

ln(BRER) denotes the natural logarithm of the bilateral real exchange rate. P-values are displayed. Null hypothesis is that all panels contain unit roots. In tests where the demeaned option is specified cross-sectional averages are removed from the data to help mitigate the impact of cross-sectional dependence. Pesaran's cross-section augmented Dickey-Fuller (CADF) test is robust to cross-sectional dependence. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) versions of Fisher test produce same results. Inverse chi-squared (used), inverse normal, inverse logit and modified inverse chi-squared statistics generally yield consistent conclusions in Fisher tests, particularly in the case of null rejection

other. One might anticipate that in the presence of low nominal exchange rate flexibility and high price or wage rigidities, equating to a real rigidity, effective expenditure switching will be prevented thus leading to pressure on demand adjustment in order to correct large external imbalances. The latter may only provide a temporary solution if output is moving away from potential output. Here, we are concerned with whether higher exchange rate flexibility can accommodate easier current account adjustment by commanding the dynamics of the real exchange rate (namely by inducing faster and smoother real exchange rate adjustment).

Tables 13 and 14 display the augmented linear specification results in the cases of continuous and discrete measures of nominal exchange rate flexibility. For large imbalances, we find that the degree of flexibility plays a significant role in the "current account"-"real exchange rate" relation as well as the average persistence of the current account itself. With respect to the latter, regardless of the flexibility measure employed, the estimates unequivocally indicate that less rigid nominal exchange rates are connected to less persistent external imbalances. Figure 1 graphically illustrates this point in the case of Table 13. It shows that the sum of the current account coefficients, representing the rate of own-"current account" adjustment, typically declines toward lower positive values as nominal exchange rate volatility in the sample increases. For example, the first graph of the figure indicates that, after controlling for relative prices multilaterally, current account persistence coefficients across

Table 6 ln(BRER) Panel Unit Root Tests: Unbalanced Panel of 72 countries, when $|CA| > 3\%$, 1973-2011

Panel Unit Root Test	Full Sample	Advanced Economies	Emerging Economies	Developing Economies	High Income	Middle & Low Income
PP-Fisher, chi-squared, no lags	0.04	0.96	0.00	0.92	0.91	0.00
PP-Fisher, chi-squared, 1 lag	0.03	0.00	0.00	0.91	0.00	0.04
PP-Fisher, chi-squared, no lags, demeaned	0.00	0.10	0.00	0.00	0.00	0.00
PP-Fisher, chi-squared, 1 lag, demeaned	0.00	0.10	0.00	0.00	0.00	0.00
Pesaran CADF, no lags	0.04	0.78	0.43	0.43	0.79	0.05

ln(BRER) denotes the natural logarithm of the bilateral real exchange rate. $|CA| > 3\%$ refers to the sample of observations corresponding to current account balances that are greater than 3 percent of GDP in absolute terms. P-values are displayed. Null hypothesis is that all panels contain unit roots. In tests where the demeaned option is specified cross-sectional averages are removed from the data to help mitigate the impact of cross-sectional dependence. Pesaran's cross-section augmented Dickey-Fuller (CADF) test is robust to cross-sectional dependence. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) versions of Fisher test produce same results. Inverse chi-squared (used), inverse normal, inverse logit and modified inverse chi-squared statistics generally yield consistent conclusions in Fisher tests, particularly in the case of null rejection

the different estimators can rise above 1 (non-convergence) at the lowest levels of nominal effective exchange rate volatility, and fall below 0.60 at the highest levels of such variability. In Table 14, consider $\sum \rho_j$ from Eq. (8) to see the negative effect of the flexible exchange rate arrangement (*flerr*) on current account inertia. One potential explanation for this is that under more variable or flexible exchange rates, relatively larger and more frequent interest rate changes may arise in anticipation of exchange rate movement, thus leading to output-shifting-based external adjustment.

The suggestions of a contemporaneous inverse relation from Eq. (1) are less prevalent under more inflexible nominal exchange rates in Table 13, with the pattern in values of real exchange rate coefficients reminiscent of a J-curve effect in some specifications e.g. column (8).[24] The BRER case in Table 14 similarly suggests a breakdown of the contemporaneous link between the two core variables under a fixed regime. Focusing on system GMM output in Tables 13 and 14, as exchange rate flexibility rises, it either gradually reintroduces the negative contemporaneous relation between the current account and real exchange rate while attenuating any negative correlations with lags of the real exchange rate, or has no effect on the contemporaneous link but induces an inverse relation with lags.

[24] See, for instance, Leonard and Stockman (2002) for a formal definition of the J-curve.

Table 7 Nominal Exchange Rate Regime Classification: Ilzetzki, Reinhart, and Rogoff (IRR) (2017)

Natural Classification	Fine Class. Codes	Coarse Class. Codes
No separate legal tender	1	1
Pre-announced peg or currency board arrangement	2	1
Pre-announced horizontal band that is narrower than or equal to +/ − 2%	3	1
De facto peg	4	1
Pre-announced crawling peg	5	2
Pre-announced crawling band that is narrower than or equal to +/−2%	6	2
De facto crawling peg	7	2
De facto crawling band that is narrower than or equal to +/−2%	8	2
Pre-announced crawling band that is wider than +/−2%	9	3
De facto crawling band that is narrower than or equal to +/−5%	10	3
Moving band that is narrower than or equal to +/−2%	11	3
Managed floating	12	3
Freely floating	13	4
Freely falling	14	5
Dual market in which parallel market data is missing	15	6

Notably, the long-run real exchange rate coefficients reported at the bottom of Tables 13 and 14 indicate that a negative comovement between the current account and real exchange rate is established at greater nominal exchange rate flexibility levels. This result tends to hold across almost all estimation procedures. For Table 13, Fig. 2 graphically depicts the link between the sum of the real exchange rate coefficient estimates and nominal exchange rate variability, while Fig. 3 does the same for the link between the long-run real exchange rate coefficient and nominal exchange rate variability. Both figures normally show an inverse correlation, with less variable exchange rates being associated with less negative or more positive (summed or long-run) real exchange rate coefficients.

Table 13 gives the long-run real exchange rate effects at low, moderate and high nominal exchange rate volatility levels whenever the calculation is possible. Low volatility represents volatility levels that are effectively zero and therefore base estimates are employed in the computation of the long-run coefficient; moderate volatility denotes the average, which is approximately equal to the median, level of volatility in the sample of concern; and high volatility reflects the maximum value of

Table 8 Aggregated Nominal Exchange Rate Regime Classification

Classification Employed	IRR Fine Class. Codes	IRR Coarse Class. Codes
Fixed Exchange Rate Regime (FERR)	1, 2, 3, 4, 5, 6, 7, 8	1, 2
Intermediate Exchange Rate Regime (IERR)	9, 10, 11, 12	3
Flexible Exchange Rate Regime (FLERR)	13, 14	4, 5

IRR stands for Ilzetzki et al. (2017)

Table 9 Nominal Bilateral Exchange Rate Volatility by Nominal Exchange Rate Regime (NERR) across country groups, 1973-2011 BRER and $|CA| > 3\%$ sample (72 countries)

NERR	Advanced Economies			Emerging Economies			Developing Economies			High Income			Middle Income			Low Income			All Countries		
	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$
FERR	230	61	0.02	265	57	0.02	210	76	0.02	335	61	0.02	357	66	0.02	13	57	0.02	705	63	0.02
IERR	104	28	0.03	160	35	0.02	50	18	0.02	167	30	0.02	138	26	0.02	9	39	0.03	314	28	0.02
FLERR	41	11	0.03	39	8	0.08	18	6	0.06	52	9	0.03	45	8	0.08	1	4	0.08	98	9	0.05
Total	375	100	0.02	464	100	0.02	278	100	0.02	554	100	0.02	540	100	0.02	23	100	0.02	1117	100	0.02

"BRER and $|CA| > 3\%$ sample" refers to the bilateral real exchange rate sample of countries and observations for which the absolute value of the current account balance is greater than 3 percent of GDP. FERR, IERR and FLERR denote the fixed, intermediate and flexible nominal exchange rate regimes respectively. Nominal bilateral exchange rate volatility for year t is calculated as the standard deviation of the change in the natural logarithm of the monthly nominal bilateral exchange rate during year t. $\bar{v}$ is the sample average annual bilateral nominal exchange rate volatility. The trend in volatility across regimes also holds for median values

Table 10 Nominal Effective Exchange Rate Volatility by Nominal Exchange Rate Regime (NERR) across country groups, 1973-2011 REER and $|CA| > 3\%$ sample (51 countries)

NERR	Advanced Economies			Emerging Economies			Developing Economies			High Income			Middle Income			All Countries		
	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$	Ob.	%	$\bar{v}$
FERR	224	59	0.01	168	53	0.02	107	68	0.01	293	57	0.01	206	62	0.02	499	59	0.01
IERR	103	27	0.02	112	36	0.02	32	20	0.02	161	31	0.01	86	26	0.03	247	29	0.02
FLERR	54	14	0.02	34	11	0.14	18	12	0.10	64	12	0.02	42	12	0.15	106	12	0.07
Total	381	100	0.01	314	100	0.03	157	100	0.03	518	100	0.01	334	100	0.04	852	100	0.02

"REER and $|CA| > 3\%$ sample" refers to the real effective exchange rate sample of countries and observations for which the absolute value of the current account balance is greater than 3 percent of GDP. FERR, IERR and FLERR denote the fixed, intermediate and flexible nominal exchange rate regimes respectively. Nominal effective exchange rate volatility for year t is calculated as the standard deviation of the change in the natural logarithm of the monthly nominal effective exchange rate during year t. $\bar{v}$ is the sample average annual nominal effective/multilateral exchange rate volatility. The trend in volatility across regimes also holds for median values (median statistics for emerging, developing, and middle income countries in the case of the flexible exchange rate regime are 0.04, 0.03, and 0.04 respectively)

Table 11 Baseline linear CA-REER specification results (Eq. (1) estimates)

$\|ca\| > 0.03$	Pooled OLS	Fixed Effects I	Fixed Effects II	two-step difference-GMM I	two-step difference-GMM II	two-step system-GMM I	two-step system-GMM II
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$ca_{i,t-1}$	0.892***	0.777***	0.762***	0.510***	0.571*	0.892***	0.894***
	(0.043)	(0.049)	(0.044)	(0.092)	(0.342)	(0.062)	(0.049)
$ca_{i,t-2}$	0.069	0.011	-0.001	−0.236***	-0.454	0.071	-0.001
	(0.052)	(0.058)	(0.057)	(0.080)	(0.309)	(0.053)	(0.077)
$reer_{i,t}$	−0.077***	−0.066***	−0.060***	−0.051*	0.062	−0.086**	−0.225***
	(0.015)	(0.018)	(0.015)	(0.030)	(0.097)	(0.034)	(0.081)
$reer_{i,t-1}$	0.040*	0.026	0.019	-0.019	-0.090	0.058	0.207**
	(0.021)	(0.024)	(0.022)	(0.049)	(0.075)	(0.053)	(0.086)
$reer_{i,t-2}$	0.038**	0.035*	0.039**	−0.056**	-0.076	0.042	0.024
	(0.018)	(0.019)	(0.018)	(0.024)	(0.154)	(0.037)	(0.031)
Observations	733	733	733	705	705	733	733
Country FEs	No	Yes	Yes				
Time FEs	No	No	Yes	No	Yes	No	Yes
SH test				0.91	1.00	1.00	0.10
AB(1)				0.01	0.06	0.00	0.00
AB(2)				0.23	0.23	0.60	0.89
AB(3)				0.77	0.51	0.53	0.85
Overall R^2	0.84	0.84	0.85				
Long-run coefficient							
reer	0.035	-0.024	-0.006	−0.173***	-0.117	0.396	0.051
	(0.095)	(0.045)	(0.035)	(0.055)	(0.146)	(0.530)	(0.358)

Cluster-robust standard errors in parentheses with Windmeijer-corrected cluster-robust standard errors in the case of generalised method of moments (GMM) regressions. Dependent variable is the current account to GDP ratio. $|ca| > 0.03$ indicates that the analysis is executed for the sample of current account balances that are greater than 3 percent in absolute value. FEs denotes fixed effects. SH test is the Sargan/Hansen test of valid overidentifying restrictions. AB(m) is the Arellano-Bond test for zero m^{th}-order autocorrelation in the first-differenced residuals. P-values are reported for both the SH and AB(m) tests. The long-run real effective exchange rate coefficient (reer) is calculated as the sum of the contemporaneous and lagged real effective exchange rate coefficient estimates divided by one minus the sum of the lagged current account coefficient estimates, provided that the current account does not exhibit explosive dynamics. Standard errors for long-run real exchange rate coefficients are computed using the delta method. Analysis reported for 50 countries common to both REER (real effective exchange rate) and BRER (bilateral real exchange rate) series. Results are similar for respective full country samples

* significant at 10%; ** significant at 5%; *** significant at 1%

volatility found in the sample. For nominal exchange rate volatility levels close to zero, the current account typically exhibits explosive dynamics, thus violating the condition required for the calculation of the long-run coefficient. Based on the cases where the computation is feasible in this instance, statistically insignificant positive coefficients are reported. For moderate volatility levels, the average long-run

Table 12 Baseline linear CA-BRER specification results (Eq. (1) estimates)

$\lvert ca \rvert > 0.03$	Pooled OLS	Fixed Effects I	Fixed Effects II	two-step difference-GMM I	two-step difference-GMM II	two-step system-GMM I	two-step system-GMM II
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$ca_{i,t-1}$	0.894***	0.758***	0.741***	0.284***	0.416***	0.882***	0.825***
	(0.045)	(0.046)	(0.040)	(0.077)	(0.138)	(0.089)	(0.170)
$ca_{i,t-2}$	0.062	0.011	0.011	-0.074	-0.084	0.030	-0.196
	(0.053)	(0.061)	(0.057)	(0.058)	(0.069)	(0.096)	(0.272)
$brer_{i,t}$	−0.036**	−0.038***	−0.050**	−0.052**	−0.165*	−0.036*	-0.087
	(0.014)	(0.015)	(0.020)	(0.023)	(0.094)	(0.022)	(0.076)
$brer_{i,t-1}$	-0.006	-0.009	-0.006	-0.003	0.061	-0.004	0.052
	(0.025)	(0.024)	(0.024)	(0.033)	(0.072)	(0.038)	(0.135)
$brer_{i,t-2}$	0.042**	0.030**	0.054***	-0.027	0.009	0.030	0.093
	(0.017)	(0.014)	(0.017)	(0.018)	(0.022)	(0.020)	(0.104)
Observations	753	753	753	727	727	753	753
Country FEs	No	Yes	Yes				
Time FEs	No	No	Yes	No	Yes	No	Yes
SH test				1.00	0.49	1.00	1.00
AB(1)				0.02	0.00	0.01	0.02
AB(2)				0.88	0.53	0.75	0.55
AB(3)				0.41	0.31	0.67	0.74
Overall R^2	0.84	0.83	0.85				
Long-run coefficient							
brer	0.015	−0.074***	-0.010	−0.104***	−0.142*	-0.115	0.156
	(0.110)	(0.024)	(0.035)	(0.026)	(0.078)	(0.100)	(0.234)

Cluster-robust standard errors in parentheses with Windmeijer-corrected cluster-robust standard errors in the case of generalised method of moments (GMM) regressions. Dependent variable is the current account to GDP ratio. $\lvert ca \rvert > 0.03$ indicates that the analysis is executed for the sample of current account balances that are greater than 3 percent in absolute value. FEs denotes fixed effects. SH test is the Sargan/Hansen test of valid overidentifying restrictions. AB(m) is the Arellano-Bond test for zero m^{th}-order autocorrelation in the first-differenced residuals. P-values are reported for both the SH and AB(m) tests. The long-run bilateral real exchange rate coefficient (brer) is calculated as the sum of the contemporaneous and lagged bilateral real exchange rate coefficient estimates divided by one minus the sum of the lagged current account coefficient estimates, provided that the current account does not exhibit explosive dynamics. Standard errors for long-run real exchange rate coefficients are computed using the delta method. Analysis reported for 50 countries common to both REER (real effective exchange rate) and BRER (bilateral real exchange rate) series. Results are similar for respective full country samples

* significant at 10%; ** significant at 5%; *** significant at 1%

real exchange rate coefficient across the different specifications is -0.13 implying that a 10 percent real currency appreciation is associated with approximately a 0.01, or 1 percentage point, decline in the current account. Examining the high volatility scenario, the average coefficient is -0.33 suggesting that a 10 percent real currency

Table 13 Nominal exchange rate volatility augmented linear specification results (Eq. (7) estimates)

	REER-based analysis (1-4)				BRER-based analysis (5-8)			
$\lvert ca\rvert > 0.03$	Pooled OLS	Fixed Effects	two-step difference-GMM	two-step system-GMM	Pooled OLS	Fixed Effects	two-step difference-GMM	two-step system-GMM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ca_{i,t-1}$	1.255***	1.126***	0.935***	1.369***	2.068***	2.162***	1.430	1.122
	(0.129)	(0.119)	(0.274)	(0.234)	(0.525)	(0.510)	(1.064)	(1.012)
$ca_{i,t-2}$	-0.043	-0.057	−0.502*	-0.108	-0.121	0.084	0.368	-0.789
	(0.184)	(0.191)	(0.259)	(0.265)	(0.582)	(0.551)	(0.683)	(0.562)
$ca_{i,t-1} \times nervol_{i,t-1}$	−0.076***	−0.075***	−0.110**	−0.108**	−0.152**	−0.185***	-0.149	-0.039
	(0.028)	(0.027)	(0.053)	(0.047)	(0.067)	(0.066)	(0.134)	(0.131)
$ca_{i,t-2} \times nervol_{i,t-2}$	0.021	0.012	0.075*	0.009	0.023	-0.009	-0.046	0.097
	(0.039)	(0.039)	(0.045)	(0.055)	(0.073)	(0.067)	(0.091)	(0.071)
$rer_{i,t}$	−0.098***	−0.117***	0.121	0.093	0.141	0.127	0.271*	0.685**
	(0.023)	(0.026)	(0.138)	(0.149)	(0.112)	(0.105)	(0.155)	(0.311)
$rer_{i,t-1}$	0.081	0.053	0.175	0.431***	-0.231	-0.188	0.014	−0.553**
	(0.073)	(0.078)	(0.166)	(0.159)	(0.148)	(0.140)	(0.201)	(0.241)
$rer_{i,t-2}$	0.066	0.037	-0.036	0.047	0.100	0.079	0.211	-0.008
	(0.083)	(0.077)	(0.097)	(0.146)	(0.098)	(0.085)	(0.146)	(0.270)
$rer_{i,t} \times nervol_{i,t}$	0.004*	0.008***	-0.035	-0.030	-0.022	-0.021	−0.039*	−0.096**
	(0.002)	(0.002)	(0.031)	(0.023)	(0.015)	(0.014)	(0.021)	(0.039)
$rer_{i,t-1} \times nervol_{i,t-1}$	-0.008	-0.004	-0.033	−0.074**	0.029	0.024	-0.006	0.067**
	(0.013)	(0.014)	(0.032)	(0.032)	(0.020)	(0.018)	(0.025)	(0.031)
$rer_{i,t-2} \times nervol_{i,t-2}$	-0.007	-0.002	-0.000	-0.002	-0.007	-0.007	-0.028	0.008
	(0.014)	(0.013)	(0.018)	(0.025)	(0.013)	(0.011)	(0.018)	(0.032)
Observations	733	733	705	733	714	714	681	714
Country FEs	No	Yes			No	Yes		
Time FEs	No	No	No	No	No	No	No	No
SH test			1.00	1.00			1.00	1.00
AB(1)			0.00	0.00			0.05	0.00
AB(2)			0.72	0.71			0.43	0.97
AB(3)			0.84	0.42			0.58	0.90
Overall R^2	0.84	0.84			0.84	0.83		
Long-run coefficients								
rer (low nervol)			0.459					0.184
			(0.646)					(0.630)
rer (mod. nervol)	-0.116	−0.051*	−0.190*	−0.200*	0.046	-0.118	−0.121***	−0.242**
	(0.107)	(0.032)	(0.102)	(0.120)	(0.074)	(0.088)	(0.036)	(0.114)
rer (high nervol)	-0.179	-0.014	−0.500*	−0.674*	0.008	−0.058**	−0.208***	-1.006
	(0.163)	(0.080)	(0.300)	(0.402)	(0.066)	(0.023)	(0.076)	(3.499)

Table 13 (continued)

Cluster-robust standard errors in parentheses with Windmeijer-corrected cluster-robust standard errors in the case of generalised method of moments (GMM) regressions. Dependent variable is the current account to GDP ratio. $|ca| > 0.03$ indicates that the analysis is executed for the sample of current account balances that are greater than 3 percent in absolute value. *nervol* is multilateral/effective nominal exchange rate volatility in the case of regressions that employ the real effective exchange rate (REER), and bilateral nominal exchange rate volatility in the case of regressions that employ the bilateral real exchange rate (BRER). FEs denotes fixed effects. SH test is the Sargan/Hansen test of valid overidentifying restrictions. AB(m) is the Arellano-Bond test for zero m^{th}-order autocorrelation in the first-differenced residuals. P-values are reported for both the SH and AB(m) tests. At each of the nominal exchange rate volatility levels, low, moderate, and high, the long-run real exchange rate coefficient (rer) is calculated as the sum of the relevant contemporaneous and lagged real exchange rate coefficient estimates divided by one minus the sum of the relevant lagged current account coefficient estimates, provided that the current account does not exhibit explosive dynamics at the given volatility level. Standard errors for long-run real exchange rate coefficients are computed using the delta method. Analysis reported for 50 countries common to both REER and BRER series. Results are similar for respective full country samples

* significant at 10%; ** significant at 5%; *** significant at 1%

appreciation is correlated with roughly a 0.03, or 3 percentage point, attenuation of the current account balance.

Using de facto exchange rate regime indicators, the long-run coefficients in Table 14 suggest a similar trend, with intermediate regimes diplaying the strongest inverse “current account”-“real exchange rate” relations. Under fixed exchange rate arrangements, the average long-run real exchange rate impact across the columns is -0.03. On the other hand, in the case of the intermediate exchange rate regime the average coefficient drops to -0.42, while under the flexible regime it drops to -0.07. Overall, higher exchange rate flexibility acts to facilitate a stabilizing relation between the real exchange rate and current account, in the sense that it helps to induce a stronger inverse relation between the two variables, thus accommodating any required adjustments.[25]

5 Nonlinear Panel Analysis

We now turn to examining whether differential results exist across relatively appreciated and relatively depreciated real exchange rate scenarios. Table 15 shows results for the baseline nonlinear specification. We note again, from a theoretical standpoint, that relatively high (low) values of rer_{t-1} are associated with current account deterioration (improvement) due to competitiveness losses (gains) and that in this upper (lower) regime the relevant regressor coefficients are approximately $\boldsymbol{\mu} + \boldsymbol{\mu}^*$ ($\boldsymbol{\mu}$), representing the sum of the linear and nonlinear coefficients (linear coefficient) as the transition function tends to one (zero). To facilitate interpretation, we focus on

[25] Results for different country groups are broadly commensurate with aggregate results. One salient feature of these findings is that, ceteris paribus, non-advanced economies tend to have lower current account inertia. This could be due to the fact that advanced economies have better access to international capital markets and therefore are able to sustain imbalances for longer. An exception has been the tightening of external financing conditions for euro area economies carrying high external liabilities. Such economies observed sharp current account adjustment post 2007.

Table 14 Nominal exchange rate regime augmented linear specification results (Eq. (8) estimates)

	REER-based analysis (1-4)				BRER-based analysis (5-8)			
$\lvert ca\rvert > 0.03$	Pooled OLS	Fixed Effects	two-step difference-GMM	two-step system-GMM	Pooled OLS	Fixed Effects	two-step difference-GMM	two-step system-GMM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$ca_{i,t-1}$	0.855***	0.708***	0.376***	0.867***	0.886***	0.732***	0.394***	0.834***
	(0.045)	(0.056)	(0.137)	(0.063)	(0.049)	(0.054)	(0.089)	(0.079)
$ca_{i,t-2}$	0.100*	0.030	-0.124	0.078	0.076	-0.004	-0.060	0.083
	(0.055)	(0.059)	(0.140)	(0.099)	(0.059)	(0.059)	(0.064)	(0.095)
$ca_{i,t-1} \times ierr_{i,t-1}$	0.029	0.070	-0.021	-0.002	-0.014	0.022	-0.145	0.046
	(0.049)	(0.052)	(0.157)	(0.105)	(0.053)	(0.049)	(0.137)	(0.121)
$ca_{i,t-1} \times flerr_{i,t-1}$	0.218*	0.200**	-0.094	0.109	0.208*	0.169*	0.122	-0.086
	(0.115)	(0.101)	(0.245)	(0.190)	(0.109)	(0.101)	(0.139)	(0.243)
$ca_{i,t-2} \times ierr_{i,t-2}$	-0.001	0.023	0.145	-0.095	0.015	0.058	-0.068	0.020
	(0.063)	(0.069)	(0.178)	(0.133)	(0.061)	(0.071)	(0.117)	(0.136)
$ca_{i,t-2} \times flerr_{i,t-2}$	−0.288***	−0.291***	−0.314**	−0.345*	−0.266***	−0.274***	−0.312*	−0.708***
	(0.088)	(0.069)	(0.131)	(0.201)	(0.073)	(0.057)	(0.174)	(0.240)
$rer_{i,t}$	−0.088***	−0.091***	−0.097*	−0.127*	-0.018	-0.023	-0.048	-0.055
	(0.022)	(0.026)	(0.050)	(0.072)	(0.017)	(0.019)	(0.034)	(0.056)
$rer_{i,t-1}$	0.035	0.021	0.025	0.084	-0.022	-0.024	0.005	-0.071
	(0.027)	(0.029)	(0.056)	(0.058)	(0.029)	(0.028)	(0.047)	(0.061)
$rer_{i,t-2}$	0.059***	0.057***	-0.029	0.047**	0.043***	0.030**	-0.012	0.109**
	(0.019)	(0.020)	(0.043)	(0.019)	(0.016)	(0.015)	(0.034)	(0.047)
$rer_{i,t} \times ierr_{i,t}$	0.010	0.007	-0.010	0.073	-0.018	-0.015	0.044	0.017
	(0.021)	(0.021)	(0.044)	(0.065)	(0.015)	(0.016)	(0.042)	(0.060)
$rer_{i,t} \times flerr_{i,t}$	0.013	0.018	0.015	0.034	−0.066**	−0.056**	-0.014	0.041
	(0.024)	(0.024)	(0.070)	(0.066)	(0.032)	(0.027)	(0.046)	(0.092)
$rer_{i,t-1} \times ierr_{i,t-1}$	-0.039	-0.029	-0.007	−0.101*	-0.001	0.003	−0.159**	-0.026
	(0.031)	(0.027)	(0.055)	(0.055)	(0.026)	(0.023)	(0.067)	(0.073)
$rer_{i,t-1} \times flerr_{i,t-1}$	0.037*	0.045**	0.064	0.028	0.027	0.028	-0.040	0.105
	(0.019)	(0.019)	(0.054)	(0.050)	(0.027)	(0.026)	(0.064)	(0.076)
$rer_{i,t-2} \times ierr_{i,t-2}$	0.011	-0.004	-0.010	0.013	0.020	0.010	0.051	-0.008
	(0.025)	(0.024)	(0.051)	(0.042)	(0.023)	(0.019)	(0.048)	(0.043)
$rer_{i,t-2} \times flerr_{i,t-2}$	−0.060***	−0.048**	-0.027	−0.057***	-0.001	0.010	0.047	−0.122**
	(0.023)	(0.022)	(0.046)	(0.022)	(0.018)	(0.013)	(0.053)	(0.052)
Observations	733	733	705	733	753	753	727	753
Country FEs	No	Yes			No	Yes		
Time FEs	No	No	No	No	No	No	No	No
SH test			1.00	1.00			1.00	0.99
AB(1)			0.03	0.00			0.00	0.00
AB(2)			0.84	0.90			0.32	0.72
AB(3)			0.49	0.68			0.27	0.99
Overall R^2	0.84	0.84			0.84	0.83		
Long-run coefficients								

Table 14 (continued)

	REER-based analysis (1-4)				BRER-based analysis (5-8)			
rer (fixed)	0.124	-0.052	-0.134^{**}	0.059	0.098	-0.061^{**}	-0.083^{**}	-0.206
	(0.136)	(0.048)	(0.067)	(1.018)	(0.137)	(0.031)	(0.039)	(0.377)
rer (intermediate)	-0.723	-0.232^{*}	-0.203^{***}	-0.078	0.125	-0.100^{*}	-0.136^{***}	-2.030
	(0.957)	(0.123)	(0.080)	(0.299)	(0.373)	(0.060)	(0.050)	(15.110)
rer (flexible)	-0.039	0.004	-0.042	0.031	-0.385	-0.091	-0.073^{*}	0.009
	(0.055)	(0.022)	(0.055)	(0.097)	(0.461)	(0.076)	(0.045)	(0.056)

Cluster-robust standard errors in parentheses with Windmeijer-corrected cluster-robust standard errors in the case of generalised method of moments (GMM) regressions. Dependent variable is the current account to GDP ratio. $|ca| > 0.03$ indicates that the analysis is executed for the sample of current account balances that are greater than 3 percent in absolute value. *ierr* (*flerr*) is a dummy variable that equals 1 for an (a) intermediate (flexible) nominal exchange rate regime, and 0 otherwise. FEs denotes fixed effects. SH test is the Sargan/Hansen test of valid overidentifying restrictions. AB(m) is the Arellano-Bond test for zero m^{th}-order autocorrelation in the first-differenced residuals. P-values are reported for both the SH and AB(m) tests. For each nominal exchange rate regime, fixed, intermediate, and flexible, the long-run real exchange rate coefficient (rer) is calculated as the sum of the relevant contemporaneous and lagged real exchange rate coefficient estimates divided by one minus the sum of the relevant lagged current account coefficient estimates, provided that the current account does not exhibit explosive dynamics in the given regime. Standard errors for long-run real exchange rate coefficients are computed using the delta method. Analysis reported for 50 countries common to both REER (real effective exchange rate) and BRER (bilateral real exchange rate) series. Results are similar for respective full country samples

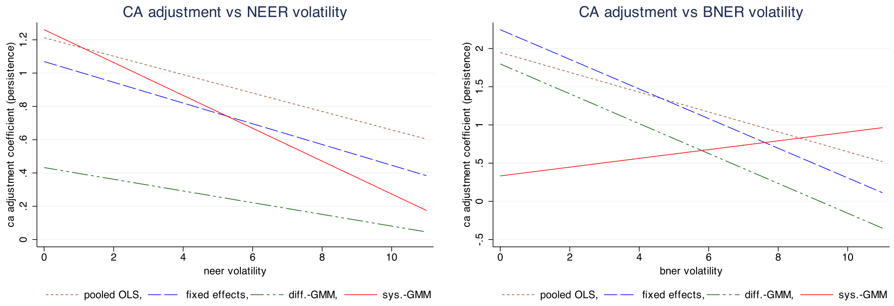
* significant at 10%; ** significant at 5%; *** significant at 1%

the regression coefficients corresponding to the extreme lower and upper regimes at $G(rer_{i,t-1};\sigma, c) = 0$ and 1 respectively.

Baseline results indicate significant differences in the dynamics of the "current account"-"real exchange rate" relation across the upper and lower regimes of current account movement. The results also vary somewhat over multilateral and bilateral exchange rates. The transition or smoothness parameter (σ) is statistically significant in all samples except one, namely the full BRER-based sample in column (2), thus providing support for the adopted nonlinear approach.[26] Columns (3) and (4) provide comparable samples of the same 50 countries. Focusing on the respective full sample and sub-sample cases, it is evident that the results are not greatly altered by the exclusion of the U.S. in column (3), and the exclusion of the Baltic countries, some developing countries, and other Eastern European nations in column (4).

From Table 15, one can arrive at current account persistence coefficients of around 0.33 and 0.78 when $G(.) = 0$ in the case of REER- and BRER-based samples respectively. On the other hand, the typical coefficients for these samples are 0.85 and 0.59 when $G(.) = 1$. The REER-based results suggest that the current account

[26] Statistical insignificance of σ is not necessarily evidence against the smooth transition-type nonlinearities considered. A relatively large transition parameter can be difficult to precisely estimate as in such cases the shape of the (logistic) transition function changes little. Thus, to retrieve an accurate estimate of σ, many observations in the proximate local neighborhood of the threshold c are required. As this is normally not the situation, the estimated transition parameter quite often is statistically insignifcant even when the true population parameter suggests differently.

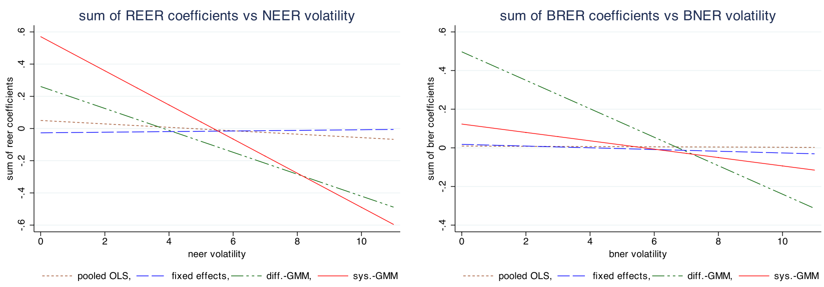


Notes: Estimates from linear model. ca adjustment coefficient is the sum of the current account coefficients at the given level of nominal exchange rate volatility, and, holding the real exchange rate constant, is a measure of current account persistence. NEER and BNER denote nominal effective exchange rate and bilateral nominal exchange rate respectively. Nominal (effective or bilateral) exchange rate volatility within a given year is defined as the standard deviation of the change in the natural logarithm of the monthly nominal exchange rate. Nominal exchange rate volatility is rescaled so that it lies between 0 and 11.

Fig. 1 Own-"Current Account" Adjustment Coefficient vs. Nominal Exchange Rate Volatility

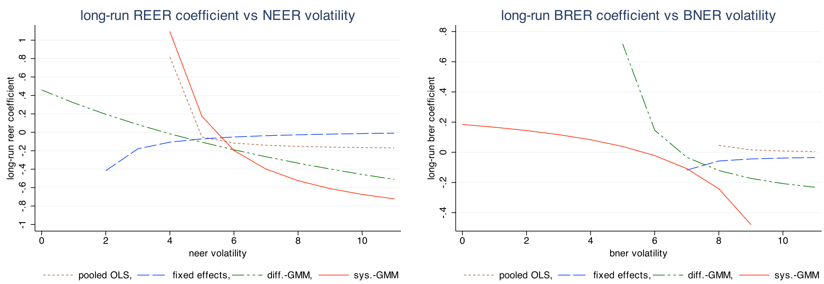
on average is less persistent in the lower regime associated with current account improvement (i.e. falling deficits or rising surpluses) than in the upper regime, while the reverse holds in the BRER-based sample. This discrepancy across the correlated multilateral and U.S.-based bilateral real exchange rates is likely due to differences in estimated real exchange rate threshold parameters (c).

However, the implications of the real exchange rate coefficients are qualitatively the same across REER and BRER samples. The baseline regressions reveal that contemporaneous real exchange rate appreciation is connected to a worsening of the current account in the lower regime, whereas past real exchange rate appreciation shows signs of a link to improving current account balances in the same regime. In contrast, there is some evidence that the contemporaneous negative relation between the current account and real exchange rate is attenuated in the upper regime (turning positive in column (4)), while an inverse relation with the second lag of the real exchange rate develops as one moves toward this regime. These dynamics are therefore suggestive of a J-curve effect in the upper regime.



Notes: Estimates from linear model. R(N)EER and BR(N)ER denote real (nominal) effective exchange rate and bilateral real (nominal) exchange rate respectively. Nominal (effective or bilateral) exchange rate volatility within a given year is defined as the standard deviation of the change in the natural logarithm of the monthly nominal exchange rate. Nominal exchange rate volatility is rescaled so that it lies between 0 and 11.

Fig. 2 Sum of Real Exchange Rate Coefficients vs. Nominal Exchange Rate Volatility



Notes: Estimates from linear model. R(N)EER and BR(N)ER denote real (nominal) effective exchange rate and bilateral real (nominal) exchange rate respectively. The long-run real exchange rate coefficient is the sum of the contemporaneous and lagged real exchange rate coefficient estimates divided by one minus the sum of the current account coefficient estimates at the given nominal exchange rate volatility level, provided that the current account does not exhibit explosive dynamics at that volatility level. Nominal (effective or bilateral) exchange rate volatility within a given year is defined as the standard deviation of the change in the natural logarithm of the monthly nominal exchange rate. Nominal exchange rate volatility is rescaled so that it lies between 0 and 11.

Fig. 3 Long-Run Real Exchange Rate Coefficient vs. Nominal Exchange Rate Volatility

The bottom of Table 15 shows that the long-run real exchange rate coefficient in the lower regime across the four columns is always negative and around -0.04 on average. Conversely, this coefficient turns positive in the upper regime in the case of multilateral exchange rates, with the average estimate across the different samples standing at -0.00, perhaps reflecting greater downward price stickiness. We investigate these baseline results further by decomposing our samples into high and middle to low income country groups. In particular, significant discrepancies in dynamics and real exchange rate thresholds across the two groups could be skewing results at the aggregate level. Table 16 reports the baseline estimates for these two country groups and offers some evidence of heterogeneity. Across the samples, there is more consistent support for faster current account convergence in the lower regime after controlling for the real exchange rate. Middle-low income economies are characterized by a negative long-run coefficient in each of the two regimes, with a much stronger negative and significant estimate in the lower regime. The results are reversed for high income nations with almost no evidence of a negative long-run relation between the current account and real exchange rate in either regime.

Table 17 reports the augmented nonlinear panel estimates and casts doubt over the baseline specification results by showing that the “current account”-“real exchange rate” relation varies across differing degrees of nominal exchange rate variability. Across all samples we observe that the transition parameter is statistically significant. Results also appear to be more consistent qualitatively across REER and BRER samples.

For relatively fixed exchange rates, as proxied by low nominal exchange rate volatility, the estimates suggest that the current account is more persistent in the upper regime, and in fact becomes explosive. This evidence coincides with the highly persistent current account deficits and expansion of net external liabilities in the peripheral euro area economies and Baltics (from around 1998), which are considered to have had overvalued real exchange rates. Interestingly, there is some evidence that the rate of current account persistence tends to decline with nominal exchange rate flexibility in both regimes, but typically by more in the upper regime when prices

Table 15 Baseline nonlinear CA-RER specification results

$\lvert ca \rvert > 0.03$	Full REER-based sample	Full BRER-based sample	REER-based sub-sample	BRER-based sub-sample
	(1)	(2)	(3)	(4)
$ca_{i,t-1}$	0.482***	0.734***	0.481***	0.737***
	(0.091)	(0.038)	(0.092)	(0.037)
$ca_{i,t-2}$	−0.149*	0.063	−0.151*	0.033
	(0.091)	(0.042)	(0.092)	(0.037)
$rer_{i,t}$	−0.099***	−0.055***	−0.099***	−0.044***
	(0.037)	(0.013)	(0.038)	(0.012)
$rer_{i,t-1}$	0.035	0.013	0.036	-0.008
	(0.051)	(0.017)	(0.051)	(0.018)
$rer_{i,t-2}$	0.046	0.033***	0.046	0.034***
	(0.029)	(0.011)	(0.029)	(0.012)
$ca^{NL}_{i,t-1}$	0.302***	-0.007	0.303***	0.459
	(0.110)	(0.083)	(0.112)	(0.297)
$ca^{NL}_{i,t-2}$	0.216**	−0.256***	0.217*	−0.576*
	(0.111)	(0.093)	(0.113)	(0.339)
$rer^{NL}_{i,t}$	0.044	0.008	0.043	0.160*
	(0.045)	(0.018)	(0.046)	(0.097)
$rer^{NL}_{i,t-1}$	0.043	0.016	0.045	0.492*
	(0.063)	(0.035)	(0.064)	(0.273)
$rer^{NL}_{i,t-2}$	−0.064*	−0.052*	−0.066*	−0.636**
	(0.039)	(0.030)	(0.040)	(0.309)
sigma	23.641***	22.118	23.206***	23.861*
	(6.215)	(16.377)	(6.168)	(14.159)
c	−0.077***	0.202***	−0.077***	0.549***
	(0.022)	(0.042)	(0.023)	(0.064)
Observations	746	1013	733	753
No. of countries	51	72	50	50
Country FEs	Yes	Yes	Yes	Yes
Time FEs	No	No	No	No
R^2	0.78	0.83	0.78	0.87
Adjusted-R^2	0.74	0.82	0.74	0.86
Regression SE	0.03	0.03	0.03	0.03
Lower Regime, $G(.) = 0$: Long-Run coefficient				
rer	−0.027*	−0.044*	−0.025*	−0.078**
Upper Regime, $G(.) = 1$: Long-Run coefficient				
rer	0.034	−0.079*	0.033	-0.006

Dynamic panel smooth transition regression (DPSTR) estimation via nonlinear least squares. Robust standard errors in parentheses. Dependent variable is the current account to GDP ratio. $\lvert ca \rvert > 0.03$ indicates that the analysis is executed for the sample of current account balances that are greater than 3 percent in absolute value. REER denotes the real effective exchange rate, while BRER denotes the bilateral real exchange rate. Current account and real exchange rate variables with superscript *NL* give estimates from the nonlinear component of the DPSTR model (these estimates represent the difference between

Table 15 (continued)

coefficient estimates of the extreme lower regime and those of the extreme upper regime). sigma is the estimated smoothness parameter that determines the speed of transition between regimes. c is the estimated (real exchange rate) threshold parameter. FEs denotes fixed effects. Regression SE is the regression standard error. In the extreme lower and upper regimes of current account adjustment associated with the transition function values of $G(.) = 0$ and $G(.) = 1$ respectively, the long-run real exchange rate coefficient (rer) is calculated as the sum of the relevant contemporaneous and lagged real exchange rate coefficient estimates divided by one minus the sum of the relevant lagged current account coefficient estimates, provided that the current account does not exhibit explosive dynamics in the given extreme regime of current account movement. Statistical significance of long-run real exchange rate coefficients determined by the delta method

* significant at 10%; ** significant at 5%; *** significant at 1%

need to come down in order to improve the current account via expenditure switching. More broadly, higher volatility can entail greater economic uncertainty, which has macroeconomic implications (Jurado et al. 2015; Baker et al. 2016; Leduc and Liu 2016). Such uncertainty stimulates capital outflows thereby forcing current account adjustment as the private funds for running deficits dry up.[27] As Fernández-Villaverde et al. (2011) and Curran and Velic (2020a) point out, higher real interest rate volatility can raise the cost of debt by increasing the uncertainty pertaining to repayment burdens. Volatility may thus be associated with a lower persistence of current account deficits as financing becomes more expensive.

Nominal exchange rate rigidity further implies no significant connection or at the very most a positive relation between the current account and real exchange rate in the lower regime based on the individual base contemporaneous and lagged real exchange rate coefficients. The cumulative real exchange rate impact at the low volatility level is positive, but insignificant, indicating that "exchange rate"-driven external adjustment is difficult to achieve in such an environment. However, increasing nominal exchange rate volatility in the lower regime of current account movement tends to engender a negative link between the current account and real exchange rate. In particular, the average long-run real exchange rate coefficients across the samples at the moderate and high levels of volatility are -0.06 and -0.21 respectively.

In the upper regime, most of the base correlations between the current account and real exchange rate, contemporaneous and lagged, are negative or less positive when compared to those of the opposite regime. In fact, the sum of the upper regime base real exchange rate coefficients is negative in all cases in Table 17. This provides broad evidence in favor of the idea that for large deteriorating imbalances, associated with high real exchange rate appreciation under a fixed exchange rate arrangement, a threshold may eventually be reached that prompts downward price or wage flexibility and hence a reversal. Some of the euro peripheral economies (GIIPS) certainly observed substantial current account deficit reversals from 2008 onwards when unit

[27] In the euro area, in the presence of uncertainty coupled with high risk aversion, private capital flows effectively collapsed during the crisis and in the initial years were partly replaced by TARGET 2 imbalances (ECB liquidity) which allowed the deficits to persist a little longer in the euro area periphery.

Table 16 Baseline nonlinear CA-RER specification results by income group

$\lvert ca \rvert > 0.03$	REER-based, Full sample, High Income	REER-based, Full sample, Mid-Low Income	BRER-based, Full sample, High Income	BRER-based, Full sample, Mid-Low Income
	(1)	(2)	(3)	(4)
$ca_{i,t-1}$	0.469***	0.494***	0.551***	0.540***
	(0.096)	(0.142)	(0.167)	(0.074)
$ca_{i,t-2}$	-0.089	-0.190	-0.079	0.012
	(0.097)	(0.129)	(0.128)	(0.076)
$rer_{i,t}$	-0.060	−0.141***	-0.012	−0.100***
	(0.045)	(0.043)	(0.047)	(0.022)
$rer_{i,t-1}$	0.062	0.028	0.024	0.024
	(0.068)	(0.055)	(0.089)	(0.029)
$rer_{i,t-2}$	0.008	0.023	0.019	0.023
	(0.035)	(0.034)	(0.066)	(0.017)
$ca^{NL}_{i,t-1}$	0.336***	0.256	0.234	0.016
	(0.128)	(0.162)	(0.181)	(0.148)
$ca^{NL}_{i,t-2}$	0.208*	0.267*	0.140	-0.130
	(0.128)	(0.152)	(0.144)	(0.160)
$rer^{NL}_{i,t}$	0.079	0.053	-0.005	0.097***
	(0.066)	(0.050)	(0.053)	(0.029)
$rer^{NL}_{i,t-1}$	-0.045	0.042	-0.028	-0.002
	(0.091)	(0.071)	(0.096)	(0.049)
$rer^{NL}_{i,t-2}$	-0.028	-0.008	-0.017	-0.054
	(0.055)	(0.046)	(0.071)	(0.044)
sigma	3.402**	23.199	3.829	2.547***
	(1.505)	(14.882)	(3.497)	(0.954)
c	−0.080***	-0.001	−0.300***	0.217***
	(0.021)	(0.009)	(0.063)	(0.056)
Observations	467	279	507	506
No. of countries	31	20	34	38
Country FEs	Yes	Yes	Yes	Yes
Time FEs	No	No	No	No
R^2	0.90	0.78	0.89	0.73
Adjusted-R^2	0.89	0.73	0.88	0.68
Regression SE	0.03	0.03	0.03	0.03
Lower Regime, $G(.) = 0$: Long-Run coefficient				
rer	0.016	−0.129*	0.059	−0.118**
Upper Regime, $G(.) = 1$: Long-Run coefficient				
rer	0.211*	-0.017	−0.123*	-0.021

Dynamic panel smooth transition regression (DPSTR) estimation via nonlinear least squares. Robust standard errors in parentheses. Dependent variable is the current account to GDP ratio. $\lvert ca \rvert > 0.03$ indi-

Table 16 (continued)

cates that the analysis is executed for the sample of current account balances that are greater than 3 percent in absolute value. REER denotes the real effective exchange rate, while BRER denotes the bilateral real exchange rate. Current account and real exchange rate variables with superscript *NL* give estimates from the nonlinear component of the DPSTR model (these estimates represent the difference between coefficient estimates of the extreme lower regime and those of the extreme upper regime). sigma is the estimated smoothness parameter that determines the speed of transition between regimes. c is the estimated (real exchange rate) threshold parameter. FEs denotes fixed effects. Regression SE is the regression standard error. In the extreme lower and upper regimes of current account adjustment associated with the transition function values of $G(.) = 0$ and $G(.) = 1$ respectively, the long-run real exchange rate coefficient (rer) is calculated as the sum of the relevant contemporaneous and lagged real exchange rate coefficient estimates divided by one minus the sum of the relevant lagged current account coefficient estimates, provided that the current account does not exhibit explosive dynamics in the given extreme regime of current account movement. Statistical significance of long-run real exchange rate coefficients determined by the delta method

* significant at 10%; ** significant at 5%; *** significant at 1%

labor costs were decreasing.[28] Strikingly, the long-run relation between the current account and real exchange rate in the upper regime of current account movement is positive, and thus destabilizing, at higher degrees of nominal exchange rate variability. Specifically, the average long-run coefficients for moderate and high volatility are 0.17 and 0.37 respectively. A possible interpretation of this result in the upper regime is that most of the adjustment under greater volatility occurs directly through expenditure reduction (rather than expenditure switching), as reflected by the current account coefficients, given capital outflows due to the uncertainty. Alternatively, the finding could be the product of sufficiently heterogeneous country groups within the overall samples.

With the latter point in mind, we also present the augmented nonlinear specification estimates by country income levels in Table 18. The results suggest that the high-income cohort of nations, characterized by less variable nominal exchange rates (Tables 9 and 10), is the driver of the earlier upper regime findings in Table 17. These economies generally display positive long-run real exchange rate coefficients in both regimes when nominal exchange rate variability is higher. Moreover, ceteris paribus, they tend to exhibit lower current account persistence with higher nominal exchange rate volatility in either regime. On the other hand, an inverse link between the cumulative real exchange rate effect and volatility is reported in the lower and upper regimes for middle-low income nations, with typically stronger negative long-run coefficients in the former regime. Evidence for an inverse relation between current account persistence and volatility in both regimes meanwhile is weaker in this case. A negative link between the two can only be observed in the REER-based

[28] GIIPS is an abbreviation used for the countries Greece, Ireland, Italy, Portugal and Spain. However, Ireland was the only country to see a real fall in unit labor costs. For example, unit labor cost declines in Spain were to a certain extent prompted by emigration and a reduction in the labour force. Examining the last three decades as a whole, Ordóñez et al. (2015) find that the GIIPS succeeded in reducing their real unit labour costs by more than their northern partners. The authors report that, with the exception of Ireland, technological progress was weak and that capital intensification was the underlying reason for gains in efficiency and competitiveness in peripheral economies.

Table 17 Nominal exchange rate volatility augmented nonlinear specification results

$\lvert ca \rvert > 0.03$	Full REER-based sample	Full BRER-based sample	REER-based sub-sample	BRER-based sub-sample
	(1)	(2)	(3)	(4)
$ca_{i,t-1}$	0.568**	1.375***	0.584**	2.145***
	(0.237)	(0.370)	(0.239)	(0.831)
$ca_{i,t-2}$	0.074	0.476	0.060	-0.286
	(0.237)	(0.376)	(0.239)	(0.923)
$ca_{i,t-1} \times nervol_{i,t-1}$	-0.005	−0.087*	-0.007	−0.202**
	(0.043)	(0.047)	(0.043)	(0.103)
$ca_{i,t-2} \times nervol_{i,t-2}$	-0.025	-0.051	-0.023	0.018
	(0.042)	(0.048)	(0.042)	(0.114)
$rer_{i,t}$	0.081	-0.040	0.078	-0.521
	(0.109)	(0.157)	(0.110)	(0.488)
$rer_{i,t-1}$	0.095	-0.029	0.094	-0.022
	(0.116)	(0.172)	(0.117)	(0.505)
$rer_{i,t-2}$	0.017	0.172	0.015	1.056***
	(0.074)	(0.115)	(0.075)	(0.353)
$rer_{i,t} \times nervol_{i,t}$	−0.032*	-0.001	−0.032*	0.068
	(0.019)	(0.020)	(0.019)	(0.062)
$rer_{i,t-1} \times nervol_{i,t-1}$	-0.011	0.005	-0.010	-0.006
	(0.020)	(0.021)	(0.020)	(0.063)
$rer_{i,t-2} \times nervol_{i,t-2}$	0.002	-0.018	0.002	−0.126***
	(0.013)	(0.014)	(0.013)	(0.044)
$ca^{NL}_{i,t-1}$	0.515*	1.968**	0.481*	-0.661
	(0.296)	(0.810)	(0.297)	(0.962)
$ca^{NL}_{i,t-2}$	0.005	0.062	0.062	-0.197
	(0.299)	(1.056)	(0.301)	(1.051)
$(ca_{i,t-1} \times nervol_{i,t-1})^{NL}$	-0.049	−0.261**	-0.043	0.104
	(0.056)	(0.107)	(0.056)	(0.121)
$(ca_{i,t-2} \times nervol_{i,t-2})^{NL}$	0.024	-0.052	0.013	0.053
	(0.056)	(0.141)	(0.056)	(0.132)
$rer^{NL}_{i,t}$	−0.218*	0.162	−0.215*	0.581
	(0.115)	(0.238)	(0.116)	(0.512)
$rer^{NL}_{i,t-1}$	-0.094	0.418	-0.095	-0.271
	(0.135)	(0.323)	(0.136)	(0.532)
$rer^{NL}_{i,t-2}$	-0.125	−0.698***	-0.113	−1.039***
	(0.095)	(0.237)	(0.096)	(0.382)
$(rer_{i,t} \times nervol_{i,t})^{NL}$	0.051**	-0.019	0.050**	-0.082
	(0.020)	(0.029)	(0.020)	(0.065)
$(rer_{i,t-1} \times nervol_{i,t-1})^{NL}$	0.020	-0.045	0.020	0.051
	(0.023)	(0.041)	(0.023)	(0.067)
$(rer_{i,t-2} \times nervol_{i,t-2})^{NL}$	0.020	0.081***	0.018	0.123***
	(0.017)	(0.030)	(0.017)	(0.048)

Table 17 (continued)

$\lvert ca \rvert > 0.03$	Full REER-based sample	Full BRER-based sample	REER-based sub-sample	BRER-based sub-sample
sigma	15.719***	30.396*	16.054***	11.074**
	(3.508)	(16.389)	(3.590)	(4.549)
c	−0.026***	0.210***	−0.026***	−0.086***
	(0.009)	(0.024)	(0.009)	(0.015)
Observations	746	910	733	714
No. of countries	51	70	50	50
Country FEs	Yes	Yes	Yes	Yes
Time FEs	No	No	No	No
R^2	0.85	0.85	0.85	0.89
Adjusted-R^2	0.83	0.84	0.83	0.86
Regression SE	0.03	0.03	0.03	0.03
Lower Regime, $G(.) = 0$: Long-Run coefficient				
rer (low nervol)	0.539		0.525	
rer (moderate nervol)	−0.099*	-0.036	−0.099*	0.002
rer (high nervol)	−0.330**	-0.070	−0.325**	−0.129*
Upper Regime, $G(.) = 1$: Long-Run coefficient				
rer (low nervol)				
rer (moderate nervol)	0.333*	0.012	0.301*	0.037
rer (high nervol)	0.660*	0.009	0.591*	0.238

Dynamic panel smooth transition regression (DPSTR) estimation via nonlinear least squares. Robust standard errors in parentheses. Dependent variable is the current account to GDP ratio. $\lvert ca \rvert > 0.03$ indicates that the analysis is executed for the sample of current account balances that are greater than 3 percent in absolute value. *nervol* is multilateral nominal exchange rate volatility in the case of regressions that employ the real effective exchange rate (REER), and bilateral nominal exchange rate volatility in the case of regressions that employ the bilateral real exchange rate (BRER). Current account, real exchange rate and interaction term variables with superscript *NL* give estimates from the nonlinear component of the DPSTR model (these estimates represent the difference between coefficient estimates of the extreme lower regime and those of the extreme upper regime). sigma is the estimated smoothness parameter that determines the speed of transition between regimes. c is the estimated (real exchange rate) threshold parameter. FEs denotes fixed effects. Regression SE is the regression standard error. In the extreme lower and upper regimes of current account adjustment associated with the transition function values of $G(.) = 0$ and $G(.) = 1$ respectively, the long-run real exchange rate coefficient (rer) is calculated at each of the nominal exchange rate volatility levels (low, moderate, and high) as the sum of the relevant contemporaneous and lagged real exchange rate coefficient estimates divided by one minus the sum of the relevant lagged current account coefficient estimates, provided that the current account does not exhibit explosive dynamics at the volatility level of concern in the given extreme regime of current account movement. Statistical significance of long-run real exchange rate coefficients determined by the delta method

* significant at 10%; ** significant at 5%; *** significant at 1%

sample when inspecting the upper regime. Focusing on column (2) of Table 18, the implication for non-high income countries under less rigid exchange rates is that both expenditure-switching and output-shifting can contribute to adjustment in the upper regime where a current account improvement may be required. Overall, the

Table 18 Nominal exchange rate volatility augmented nonlinear specification results by income group

$\lvert ca \rvert > 0.03$	REER-based, Full sample, High Income	REER-based, Full sample, Mid-Low Income	BRER-based, Full sample, High Income	BRER-based, Full sample, Mid-Low Income
	(1)	(2)	(3)	(4)
$ca_{i,t-1}$	1.625***	0.155	3.992***	0.126
	(0.371)	(0.552)	(1.045)	(0.585)
$ca_{i,t-2}$	−0.887*	0.009	0.130	0.211
	(0.516)	(0.462)	(1.264)	(0.586)
$ca_{i,t-1} \times nervol_{i,t-1}$	−0.225***	0.054	−0.436***	0.058
	(0.071)	(0.092)	(0.130)	(0.076)
$ca_{i,t-2} \times nervol_{i,t-2}$	0.155	-0.024	-0.027	-0.026
	(0.096)	(0.073)	(0.157)	(0.074)
$rer_{i,t}$	−0.722**	0.392	−1.577***	0.243
	(0.315)	(0.263)	(0.583)	(0.225)
$rer_{i,t-1}$	0.144	-0.039	0.049	-0.159
	(0.301)	(0.242)	(0.696)	(0.244)
$rer_{i,t-2}$	-0.204	0.170	-0.021	0.125
	(0.193)	(0.146)	(0.513)	(0.159)
$rer_{i,t} \times nervol_{i,t}$	0.131**	−0.089**	0.197***	−0.044*
	(0.061)	(0.044)	(0.073)	(0.028)
$rer_{i,t-1} \times nervol_{i,t-1}$	-0.007	0.007	-0.005	0.021
	(0.060)	(0.041)	(0.088)	(0.029)
$rer_{i,t-2} \times nervol_{i,t-2}$	0.042	-0.024	0.003	-0.013
	(0.035)	(0.024)	(0.065)	(0.019)
$ca^{NL}_{i,t-1}$	-0.609	0.335	−2.441**	3.141*
	(0.491)	(0.631)	(1.236)	(1.615)
$ca^{NL}_{i,t-2}$	0.725	1.001*	-0.522	−3.481*
	(0.648)	(0.549)	(1.420)	(1.913)
$(ca_{i,t-1} \times nervol_{i,t-1})^{NL}$	0.184**	0.006	0.336**	−0.427**
	(0.095)	(0.109)	(0.155)	(0.215)
$(ca_{i,t-2} \times nervol_{i,t-2})^{NL}$	-0.092	−0.175*	0.090	0.456*
	(0.123)	(0.095)	(0.178)	(0.260)
$rer^{NL}_{i,t}$	0.314	−0.471*	1.984***	0.100
	(0.343)	(0.266)	(0.722)	(0.331)
$rer^{NL}_{i,t-1}$	0.028	-0.015	-0.074	0.322
	(0.283)	(0.256)	(0.758)	(0.415)
$rer^{NL}_{i,t-2}$	-0.150	0.037	-0.327	0.279
	(0.222)	(0.163)	(0.608)	(0.408)
$(rer_{i,t} \times nervol_{i,t})^{NL}$	-0.051	0.086**	−0.253***	-0.004
	(0.067)	(0.044)	(0.091)	(0.040)
$(rer_{i,t-1} \times nervol_{i,t-1})^{NL}$	-0.007	0.015	0.012	-0.039

Table 18 (continued)

$\lvert ca \rvert > 0.03$	REER-based, Full sample, High Income	REER-based, Full sample, Mid-Low Income	BRER-based, Full sample, High Income	BRER-based, Full sample, Mid-Low Income
	(0.052)	(0.043)	(0.096)	(0.052)
$(rer_{i,t-2} \times nervol_{i,t-2})^{NL}$	0.020	-0.013	0.043	-0.046
	(0.040)	(0.027)	(0.077)	(0.052)
sigma	2.882***	36.004	6.883***	5.474***
	(1.015)	(31.615)	(2.501)	(2.062)
c	−0.055**	-0.003	−0.052***	0.197***
	(0.024)	(0.007)	(0.019)	(0.026)
Observations	467	279	501	409
No. of countries	31	20	34	36
Country FEs	Yes	Yes	Yes	Yes
Time FEs	No	No	No	No
R^2	0.91	0.76	0.91	0.80
Adjusted-R^2	0.89	0.70	0.89	0.75
Regression SE	0.03	0.03	0.03	0.03
Lower Regime, $G(.) = 0$: Long-Run coefficient				
rer (low nervol)	-2.985	0.626		0.315*
rer (moderate nervol)	0.314*	−0.172*	0.019	−0.194*
rer (high nervol)	0.664*	−1.002*	0.197**	−0.440*
Upper Regime, $G(.) = 1$: Long-Run coefficient				
rer (low nervol)	-4.041			0.907*
rer (moderate nervol)	12.714	−0.102*	0.073*	−0.175*
rer (high nervol)		−0.119*	0.040*	−0.865*

Dynamic panel smooth transition regression (DPSTR) estimation via nonlinear least squares. Robust standard errors in parentheses. Dependent variable is the current account to GDP ratio. $\lvert ca \rvert > 0.03$ indicates that the analysis is executed for the sample of current account balances that are greater than 3 percent in absolute value. *nervol* is multilateral nominal exchange rate volatility in the case of regressions that employ the real effective exchange rate (REER), and bilateral nominal exchange rate volatility in the case of regressions that employ the bilateral real exchange rate (BRER). Current account, real exchange rate and interaction term variables with superscript *NL* give estimates from the nonlinear component of the DPSTR model (these estimates represent the difference between coefficient estimates of the extreme lower regime and those of the extreme upper regime). sigma is the estimated smoothness parameter that determines the speed of transition between regimes. c is the estimated (real exchange rate) threshold parameter. FEs denotes fixed effects. Regression SE is the regression standard error. In the extreme lower and upper regimes of current account adjustment associated with the transition function values of $G(.) = 0$ and $G(.) = 1$ respectively, the long-run real exchange rate coefficient (rer) is calculated at each of the nominal exchange rate volatility levels (low, moderate, and high) as the sum of the relevant contemporaneous and lagged real exchange rate coefficient estimates divided by one minus the sum of the relevant lagged current account coefficient estimates, provided that the current account does not exhibit explosive dynamics at the volatility level of concern in the given extreme regime of current account movement. Statistical significance of long-run real exchange rate coefficients determined by the delta method

* significant at 10%; ** significant at 5%; *** significant at 1%

results are in line with the notion that nominal or real exchange rate volatility and faster external adjustment are relatively more notable traits of the developing world.

6 Cross-Section Analysis

Current account balances across countries typically displayed very low persistence over the sample period, with the overall mean and median half-lives from Eq. (12) standing at 1.33 and 0.95 years respectively. Table 19 indicates that advanced economies observed more protracted external imbalances than non-industrial countries perhaps reflecting their relative ease of access to financial markets. Specifically, emerging and developing economies are characterized by a half-life of less than 1 year, roughly half of that of advanced nations. The same general pattern holds for AR(1) estimates, although the half-life is now around 1.50 years for the former cohort of countries according to median values. Consistent with these results, the table also shows that countries classified as "high income" display greater inertia in external imbalances. Categorizing by nominal exchange rate arrangement, Table 19 lastly provides some evidence in favor of slower current account adjustment for economies that largely maintained, or averaged, a fixed exchange rate over the 1973-2011 period. We focus on current account persistence estimates from the more general Eq. (12).[29]

Figure 4 plots current account persistence against REER and BRER persistence. The salient feature of the graphs is the positive and statistically significant bivariate relation in each case, with correlations of 0.31 and 0.48 respectively, suggesting that real exchange rate misalignment durability has an important role to play in the correction of external imbalances. Furthermore, this relation continues to hold across country groups and nominal exchange rate regimes with greater flexibility normally entailing lower inertia in both variables. Noting the dashed reference line designating the 1-year half-life mark on either axis, we can see that pegger countries such as euro area and European ERM (Exchange Rate Mechanism) II members predominantly populate the top right quadrants, though Latvia and Lithuania fall marginally below the 1-year current account persistence level.

Figure 5 reveals that current account and real exchange rate persistence both negatively co-vary with nominal exchange rate volatility. As the graphs illustrate, emerging and developing economies, in particular Latin American and Eastern European regions, experienced the highest rates of volatility and lowest rates of persistence. This preliminary graphical evidence strongly opposes the conclusions of Chinn and Wei (2013) who rely on binary measures of exchange rate flexibility and

[29] Equation (12) reduces to Eq. (11) for a country if the lags and trend are all insignificant. Use of AR(1)-based current account persistence estimates does not change the findings in the cross-section regression analysis that follows.

Table 19 Current account half-lives (in years) by stage of economic development and nominal exchange rate regime

sample	size	simple AR model		augmented AR model	
		CA half-life		CA half-life	
		mean	median	mean	median
		(1)	(2)	(3)	(4)
Whole	69	2.60	1.85	1.33	0.95
Industrial	23	4.35	3.27	2.11	1.57
Emerging	32	1.90	1.80	0.94	0.86
Developing	14	1.30	0.98	0.92	0.90
Test of Equality		0.00	0.00	0.00	0.02
High Income	35	3.47	2.37	1.65	1.04
Middle & Low Income	34	1.70	1.68	1.00	0.91
Test of Equality		0.00	0.02	0.04	0.18
Exchange Rate Regime					
Fixed Regime	29	3.14	2.10	1.68	1.04
Intermediate Regime	30	2.09	1.62	1.02	0.89
Flexible Regime	10	2.53	2.41	1.25	0.98
Test of Equality		0.24	0.18	0.10	0.36

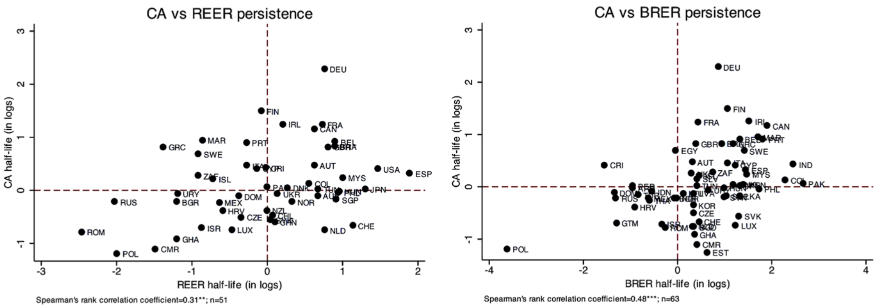
P-values are reported for "Test of Equality" which tests either (i) the null hypothesis of equal group means using the F*-test or (ii) the null hypothesis of equal group medians using the non-parametric Mood's median test (based on Pearson χ^2 statistic). Each country is characterized by the nominal exchange rate regime that accounts for more than 50 percent of its total number of arrangement observations over the period, or alternatively by the average regime prevailing over the period if the former rule does not apply

* significant at 10%; ** significant at 5%; *** significant at 1%

argue that the latter factor has no role in real exchange rate persistence and thus current account adjustment either.

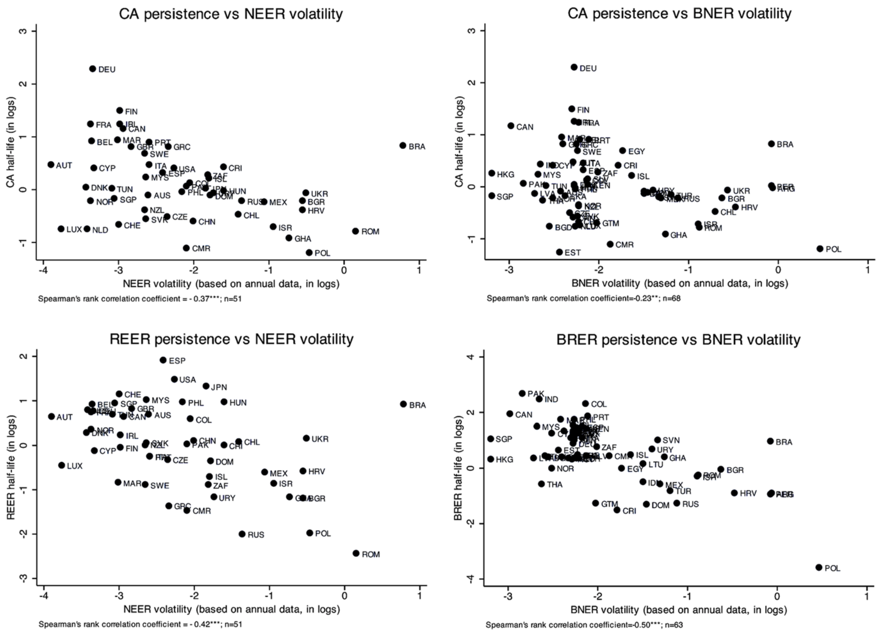
Table 20 reports the OLS results from the cross-section regressions of current account persistence on nominal exchange rate volatility and other potential determinants. Collectively, the regressors explain about 40 percent of the variation in current account half-lives. Corroborating the graphical analysis, the estimates invariably point to a highly statistically significant inverse association between current account persistence and nominal exchange rate volatility. The magnitude of the coefficient on nominal exchange rate volatility is notable at -0.31 on average, implying that a 3 percent increase in exchange rate volatility is associated with approximately a 1 percent decrease in the half-life of the external imbalances.[30] In addition, as shown in columns (5)-(8), employing discrete measures of nominal exchange rate flexibility yields evidence of faster reversion in the current account under intermediate and

[30] This estimate is quite robust to different specifications. We perform a similar parametric exercise for real exchange rate persistence and obtain a negative coefficient on nominal exchange rate volatility.



Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. CA, REER, and BRER denote current account, real effective exchange rate, and bilateral real exchange rate respectively. n is the country sample size. Persistence is gauged by the half-life, given in years. Noting the base $e \approx 2.72$ in the natural logarithm, it is easy to convert the log scales back to original variable scales. With log scale data on the left of the equality and approximate original variable data in inverted commas on the right of the equality: -4 = "0.02", -3 = "0.05" (0.02 x e), -2 = "0.14" (0.05 x e), -1 = "0.37" (0.14 x e), 0 = "1" (0.37 x e), 1 = "2.72" (1 x e), 2 = "7.39" (2.72 x e), 3 = "20.09" (7.39 x e).

Fig. 4 Current Account Persistence vs. Real Exchange Rate Persistence, Cross Section Evidence over 1973-2011



Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. CA, R(N)EER, and BR(N)ER denote current account, real (nominal) effective exchange rate, and bilateral real (nominal) exchange rate respectively. n is the country sample size. Persistence is gauged by the half-life, given in years. Nominal exchange rate volatility is defined as the standard deviation of the change in the natural logarithm of the annual nominal exchange rate over the period of study. Noting the base $e \approx 2.72$ in the natural logarithm, it is easy to convert the log scales back to original variable scales. With log scale data on the left of the equality and approximate original variable data in inverted commas on the right of the equality: -4 = "0.02", -3 = "0.05" (0.02 x e), -2 = "0.14" (0.05 x e), -1 = "0.37" (0.14 x e), 0 = "1" (0.37 x e), 1 = "2.72" (1 x e), 2 = "7.39" (2.72 x e), 3 = "20.09" (7.39 x e).

Fig. 5 Current Account & Real Exchange Rate Persistence vs. Nominal Exchange Rate Volatility, Cross Section Evidence over 1973-2011

Table 20 Cross-section current account persistence regressions

dependent variable:	NEER	BNER	NEER	BNER	NEER	BNER	NEER	BNER
ca persistence (hl^{ca})	full sample	full sample	sub-sample	sub-sample	full sample	full sample	sub-sample	sub-sample
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ner volatility	−0.274**	−0.315***	−0.273**	−0.373***				
(nerv)	(0.131)	(0.095)	(0.130)	(0.118)				
intermediate regime					-0.052	-0.284	-0.050	-0.174
(IERR)					(0.237)	(0.196)	(0.239)	(0.253)
flexible regime					−0.693**	−0.769***	−0.689**	−0.788***
(FLERR)					(0.292)	(0.289)	(0.289)	(0.292)
net foreign assets	−0.008**	−0.006**	−0.008**	−0.009***	−0.007**	−0.005*	−0.007**	−0.008**
(NFA)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
govt. budget balance	-0.009	−0.037*	-0.009	-0.012	0.005	-0.031	0.005	-0.005
(GBB)	(0.027)	(0.021)	(0.027)	(0.022)	(0.027)	(0.023)	(0.028)	(0.026)
trade openness	-0.451	−0.493**	-0.449	-0.326	-0.327	−0.454**	-0.326	-0.309
(to)	(0.320)	(0.244)	(0.321)	(0.359)	(0.254)	(0.208)	(0.257)	(0.267)
financial integration	0.295	0.332*	0.288	0.244	0.222	0.214	0.215	0.128
(ifi)	(0.229)	(0.199)	(0.243)	(0.249)	(0.236)	(0.210)	(0.253)	(0.256)
reserves	0.145	0.141	0.137	-0.000	0.019	0.082	0.010	-0.072
(res)	(0.141)	(0.146)	(0.165)	(0.165)	(0.143)	(0.140)	(0.174)	(0.165)
youth dependency	−1.533**	-0.390	−1.535**	-0.796	−1.479*	-0.516	−1.483*	-0.952
(ydr)	(0.724)	(0.647)	(0.729)	(0.765)	(0.820)	(0.736)	(0.828)	(0.937)
old dependency	−1.164**	-0.478	−1.164**	-0.606	−1.305**	-0.804	−1.306**	−1.030*
(odr)	(0.550)	(0.467)	(0.552)	(0.564)	(0.568)	(0.520)	(0.570)	(0.626)
financial development	-0.006	0.031	-0.000	0.146	0.394*	0.320*	0.399*	0.534**
(fdev)	(0.206)	(0.165)	(0.212)	(0.221)	(0.226)	(0.170)	(0.236)	(0.228)
per capita income	0.105	0.188*	0.106	0.114	0.145	0.214*	0.146	0.173
(pci)	(0.137)	(0.110)	(0.139)	(0.138)	(0.144)	(0.112)	(0.145)	(0.156)
productivity growth	-0.075	−0.089*	-0.075	-0.083	−0.117*	−0.126**	−0.116*	−0.141**
(PG)	(0.069)	(0.052)	(0.069)	(0.062)	(0.061)	(0.058)	(0.061)	(0.067)
absolute ca size	−0.530**	−0.313*	−0.524*	−0.424**	−0.571**	−0.290*	−0.563**	−0.389*
(cas)	(0.257)	(0.175)	(0.270)	(0.212)	(0.232)	(0.180)	(0.245)	(0.220)
Observations	51	68	50	50	51	69	50	50

Table 20 (continued)

dependent variable:	NEER	BNER	NEER	BNER	NEER	BNER	NEER	BNER
ca persistence (hl^{ca})	full	full	sub-	sub-	full	full	sub-	sub-
	sample	sample	sample	sample	sample	sample	sample	sample
R^2	0.42	0.34	0.42	0.41	0.45	0.36	0.45	0.43

"NEER full sample" refers to the full sample of countries for which nominal effective exchange rate data are available. "BNER full sample" refers to the full sample of countries for which bilateral nominal exchange rate data (against the U.S. dollar) are available. "NEER sub-sample" and "BNER sub-sample" use the pool of countries for which both multilateral and bilateral nominal exchange rate data are available. ner volatility is nominal effective exchange rate volatility in the case of NEER samples, and bilateral nominal exchange rate volatility in the case of BNER samples. All variables are in logarithm, except for IERR (dummy), FLERR (dummy), NFA, GBB, and PG. Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

flexible exchange rate regimes. From Table 20, we also see that current account persistence falls with the absolute size of imbalances. This result is in accord with the sharp reversals that sometimes arise at deficit thresholds due to a loss of financing.

An assessment of the remaining coefficients reveals that a number of other statistically significant covariates emerge. For instance, the net foreign asset position, a variable that varies substantially across countries but is relatively more stable within countries over time, has a negative relation with current account persistence. This implies that countries with larger levels of external debt run more persistent imbalances. Financial constraints on international borrowing can mean a country may have to run persistent surpluses to pay off its debt before being able to borrow again. Conversely, external debt may be associated with persistent deficits (as long as threshold is not reached) if the economy is attempting to smooth consumption in anticipation of higher income levels in the future.[31]

The government budget balance, a proxy for public debt, generally comoves negatively with the persistence rate (see column (2) in particular). Thus, budget surpluses tend to be related to less persistent external imbalances. This suggests that durable twin deficits can arise as budget deficits may be related to more persistent current account deficits. In correction and recovery periods, nations may observe an attenuation of current account deficits while the government moves from budget deficit to surplus with an aim of improving the public debt position.

Current account persistence falls with trade openness but rises with international financial integration (volume-based measure) and domestic financial development, as measured by domestic private credit creation. Greater trade openness or

[31] Analysis across country groups indicates that the relation is positive, but insignificant, for emerging economies. China is an example of a transitional economy that has built up its net foreign asset position by maintaining persistently large current account surpluses.

liberalization can result in faster external adjustment by inducing real exchange rate or relative price effects on the trade balance. The implications of heightened capital market openness and development are more equivocal. Improved international financial integration can help delink saving and investment thereby permitting more persistent current account imbalances. At the same time it may attenuate persistence through the transmission of financial shocks across nations. Inadequate domestic financial market conditions can prompt persistent outflows of capital from the home country that are associated with persistent current account surpluses. This capital may in turn provide the recipient country, characterized by more sophisticated capital markets, with the ammunition to run persistent deficits.[32]

Regarding demographic factors, youth and old-age dependency ratios are consistently negatively related to current account inertia. The very old are less likely to borrow or be lent to while the very young (under 15 years of age) generally do not save or officially borrow. These tendencies are likely to be associated with less persistent deficits and surpluses. Finally, current account persistence is positively tied to per capita income and, somewhat counter-intuitively, negatively to productivity growth. In further sub-sample checks (unreported), industrial countries formed the only group with a positive sign for the productivity growth coefficient. This is consistent with the notion that nations characterized by higher economic growth are able to convince markets more easily that loans will be repaid, as they borrow more to smooth the consumption path.

7 Conclusions

Based on a global sample of countries, this paper examines the empirical bivariate relation between large external imbalances and the real exchange rate at different levels of nominal exchange rate flexibility. The study finds that greater nominal exchange rate variability generally acts to stabilize the long-run “current account”-“real exchange rate” relation, in the sense that it engenders more effective expenditure-switching-based adjustment. Under more rigid nominal rates this link is normally weak and current account adjustment is slower. Our results however suggest that the “current account”-“real exchange rate” relation can become destabilizing at high levels of nominal exchange rate volatility when the real exchange rate is sufficiently appreciated. We show that this outcome is driven by high-income countries. Along the cross-section dimension we find a striking positive correlation between current account and real exchange rate persistence. Our results consistently point to an inverse relation between persistence in either of the main variables and nominal exchange rate variability.

[32] We find that greater international financial integration and less developed domestic financial markets are associated with more persistent imbalances in emerging and developing economies. Greater international financial integration can facilitate higher levels of international borrowing by non-industrial economies during the convergence process. Similar results are obtained with alternative measures of international financial integration and financial development.

Although there is a positive link between nominal exchange rate regime flexibility and nominal exchange rate volatility in our study, it is important to stress that flexible regimes are not akin to unstable nominal exchange rates. According to Friedman (1953), instability of the nominal exchange rate arises from instability in the underlying economic structure. In contrast to some of the previously conducted research, our systematic empirical investigation has offered support for the notion that more variable nominal exchange rates can aid in the prevention of explosive or highly persistent global imbalances.

Appendices

Country Lists

Advanced Economies Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Iceland (ISL), Ireland (IRL), Italy (ITA), Japan (JPN), Luxembourg (LUX), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR), United States (USA).

Emerging Economies Argentina (ARG), Brazil (BRA), Bulgaria (BGR), Chile (CHL), China (Mainland) (CHN), Colombia (COL), Croatia (HRV), Cyprus (CYP), Czech Republic (CZE), Egypt, Arab Rep. (EGY), Estonia (EST), Hong Kong S.A.R. (HKG), Hungary (HUN), India (IND), Indonesia (IDN), Israel (ISR), Korea Rep. (KOR), Latvia (LVA), Lithuania (LTU), Malaysia (MYS), Mexico (MEX), Pakistan (PAK), Peru (PER), Philippines (PHL), Poland (POL), Russia (RUS), Singapore (SGP), Slovak Republic (SVK), Slovenia (SVN), South Africa (ZAF), Thailand (THA), Turkey (TUR).

Developing Economies Bangladesh (BGD), Cameroon (CMR), Costa Rica (CRI), Dominican Republic (DOM), El Salvador (SLV), Ghana (GHA), Guatemala (GTM), Kenya (KEN), Lebanon (LBN), Morocco (MAR), Romania (ROM), Serbia (SRB), Sri Lanka (LKA), Sudan (SDN), Tunisia (TUN), Ukraine (UKR), Uruguay (URY), Vietnam (VNM).

High-Income Economies [World Bank 2010 classification] Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Croatia (HRV), Cyprus (CYP), Czech Republic (CZE), Denmark (DNK), Estonia (EST), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hong Kong S.A.R. China (HKG), Hungary (HUN), Iceland (ISL), Ireland (IRL), Israel (ISR), Italy (ITA), Japan (JPN), Korea Rep. (KOR), Luxembourg (LUX), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Poland (POL), Portugal (PRT), Singapore (SGP), Slovak Republic (SVK), Slovenia (SVN), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR), United States (USA).

Middle-Income Economies [World Bank 2010 classification] Argentina (ARG), Brazil (BRA), Bulgaria (BGR), Cameroon (CMR), Chile (CHL), China (Mainland) (CHN), Colombia (COL), Costa Rica (CRI), Dominican Republic (DOM), Egypt, Arab Rep. (EGY), El Salvador (SLV), Ghana (GHA), Guatemala (GTM), India (IND), Indonesia (IDN), Latvia (LVA), Lebanon (LBN), Lithuania (LTU), Malaysia (MYS), Mexico (MEX), Morocco (MAR), Pakistan (PAK), Peru (PER), Philippines (PHL), Romania (ROM), Russian Federation (RUS), Serbia (SRB), South Africa (ZAF), Sri Lanka (LKA), Sudan (SDN), Thailand (THA), Tunisia (TUN), Turkey (TUR), Ukraine (UKR), Uruguay (URY), Vietnam (VNM).

Low-Income Economies [World Bank 2010 classification] Bangladesh (BGD), Kenya (KEN).

BRER Sample of Countries Bilateral real exchange rates (BRERs) against the U.S. are available for all of the above countries (excluding the U.S. since it is used as the reference country).

REER Sample of Countries Australia (AUS), Austria (AUT), Belgium (BEL), Brazil (BRA), Bulgaria (BGR), Cameroon (CMR), Canada (CAN), Chile (CHL), China (Mainland) (CHN), Colombia (COL), Costa Rica (CRI), Croatia (HRV), Cyprus (CYP), Czech Republic (CZE), Denmark (DNK), Dominican Republic (DOM), Finland (FIN), France (FRA), Germany (DEU), Ghana (GHA), Greece (GRC), Hungary (HUN), Iceland (ISL), Ireland (IRL), Israel (ISR), Italy (ITA), Japan (JPN), Luxembourg (LUX), Malaysia (MYS), Mexico (MEX), Morocco (MAR), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Pakistan (PAK), Philippines (PHL), Poland (POL), Portugal (PRT), Romania (ROM), Russian Federation (RUS), Singapore (SGP), Slovak Republic (SVK), South Africa (ZAF), Spain (ESP), Sweden (SWE), Switzerland (CHE), Tunisia (TUN), Ukraine (UKR), United Kingdom (GBR), United States (USA), Uruguay (URY).

Variable Mnemonics, Definitions, and Sources

Current Account (ca) expressed as a fraction of GDP; WB's WDI.[33]

Real Effective Exchange Rate (reer) logarithm of multilateral real exchange rate with 2005 as the base year, constructed as a geometric weighted average of CPI-based bilateral real exchange rates between the home country and its trade partners where the weights imposed are updated discretely and are based on the composition of trade in commodities, manufactures and tourism/non-tourism services

[33] Sources are for the raw data used to construct the series. WB's WDI: World Bank's World Development Indicators; WB's GFDD: World Bank's Global Financial Development Database; IMF's IFS: International Monetary Fund's International Financial Statistics; IRR: Ilzetzki et al. (2017); EWN: External Wealth of Nations database by Lane and Milesi-Ferretti (2007, 2018); PWT: Penn World Tables (6.1.0).

(non-tourism services use the same weights as manufactures), an increase in the series indicates a real currency appreciation; IMF's IFS.

Note: Bank for International Settlements, OECD, Federal Reserve, and Bank of England use chain-linked effective exchange rate series with more frequently updated weights. A statistical disadvantage of chain-linking is that changes in trade weights impart a permanent effect on the level of the effective exchange rate index, even when exchange rates and weights revert to initial levels (see Ellis (2001) and Klau and Fung (2006)).

Bilateral Real Exchange Rate (brer) logarithm of bilateral real exchange rate vis-à-vis the U.S. with 2005 as the base year, constructed using the relevant bilateral nominal exchange rate and consumer price indices, an increase in the series indicates a real currency appreciation; IMF's IFS.

Nominal Effective Exchange Rate Volatility (nervol) logarithm of the standard deviation of the approximate proportionate change in the nominal effective exchange rate, with annual volatility based on monthly data (in the case of annual volatility, the data are rescaled so that they lie in the range 0 to 11), continuous measure; IMF's IFS.

Note: in cross section regressions nominal exchange rate volatility is denoted by nerv.

Bilateral Nominal Exchange Rate Volatility (nervol) logarithm of the standard deviation of the approximate proportionate change in the bilateral nominal exchange rate vis-à-vis the U.S., with annual volatility based on monthly data (in the case of annual volatility, the data are rescaled so that they lie in the range 0 to 11), continuous measure; IMF's IFS.

Note: in cross section regressions nominal exchange rate volatility is denoted by nerv.

Nominal Exchange Rate Regime (err) de facto measure of nominal exchange rate flexibility consisting of fixed, intermediate, and flexible regime variables (ferr, ierr, flerr) each of which equals 1 if the regime in question is realized and 0 otherwise, discrete measure; IRR.

Net Foreign Assets (nfa) total foreign assets minus total foreign liabilities expressed as a fraction of GDP; EWN.

International Financial Integration (ifi) logarithm of total foreign assets plus total foreign liabilities expressed as a fraction of GDP, volume-based de facto measure; EWN.

Financial Development (fdev) logarithm of private credit by deposit money banks and other (non-bank) financial institutions expressed as a fraction of GDP; WB's GFDD.

Trade Openness (to) logarithm of exports plus imports of goods and services expressed as a fraction of GDP (all in current U.S. dollars); WB's WDI.

Old Dependency Ratio (odr) logarithm of population over 64 expressed as a fraction of the working-age population (those between 15 and 64 years of age); WB's WDI.

Youth Dependency Ratio (ydr) logarithm of population under 15 expressed as a fraction of the working-age population (those between 15 and 64 years of age); WB's WDI.

Government Budget Balance (gbb) cash surplus/deficit is revenue (including grants) minus expense, minus net acquisition of non-financial assets expressed as a fraction of GDP; WB's WDI.

International Reserves (res) logarithm of total reserves minus gold holdings expressed as a fraction of GDP; EWN.

Productivity Growth (pg) growth rate of real GDP chain per capita (index, in 2005 constant prices); PWT.

Relative Per Capita Income (pci) logarithm of per capita GDP in current U.S. dollars (i.e. nominal terms) relative to that of the U.S.; WB's WDI.

Current Account Size (cas) absolute value of the "current account" defined above; WB's WDI.

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