NBER WORKING PAPER SERIES

FEAR OF APPRECIATION AND CURRENT ACCOUNT ADJUSTMENT

Paul Bergin
Kyunghun Kim
Ju H. Pyun

Working Paper 30281
http://www.nber.org/papers/w30281

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
July 2022

The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

NBER working papers are circulated for discussion and comment purposes. They have not been peer-reviewed or been subject to the review by the NBER Board of Directors that accompanies official NBER publications.

© 2022 by Paul Bergin, Kyunghun Kim, and Ju H. Pyun. All rights reserved. Short sections of text, not to exceed two paragraphs, may be quoted without explicit permission provided that full credit, including © notice, is given to the source.

Fear of Appreciation and Current Account Adjustment
Paul Bergin, Kyunghun Kim, and Ju H. Pyun
NBER Working Paper No. 30281
July 2022
JEL No. F31,F33,F44

ABSTRACT

This paper finds that limited exchange rate flexibility in the form of "fear of appreciation" significantly slows adjustment of current account imbalances, providing novel support for Friedman's conjecture regarding exchange-rate flexibility. We present a new stylized fact: floaters have faster convergence than peggers for current account deficits, but not so for surpluses. A striking implication is that current account surpluses are more persistent than deficits on average. We provide evidence that this asymmetry is associated with a one-sided muting of exchange rate appreciations. We develop a multi-country DSGE model augmented with an asymmetric exchange rate policy to represent fear of appreciation; when solved to a third-order approximation, it can explain greater persistence of current account surpluses compared to deficits.

Paul Bergin
Department of Economics
University of California, Davis
One Shields Ave.
Davis, CA 95616
and NBER
prbergin@ucdavis.edu

Kyunghun Kim
School of Economics
Hongik University
94 Wausan-ro, Mapo-gu
Seoul 04066
Korea
khkim@hongik.ac.kr

Ju H. Pyun
Korea University
Business School
145 Anam-Ro
Seongbuk-Gu
Seoul 02841
Korea
jhpyun@korea.ac.kr

1. Introduction

Do flexible exchange rates help facilitate adjustment of current account imbalances? This idea has been prevalent in economics since Friedman (1953), and it has been the basis for policy recommendations made by the IMF and the G20 that emerging economies move to a more flexible exchange rate regime to deal with global imbalances. The U.S., in particular, has put pressure on countries with large trade surpluses against the U.S. to eschew currency manipulation. However, the academic literature has not offered clear empirical support for the idea that floating exchange rates promote current account adjustment. Most notably, Chinn and Wei (2013) find no evidence in autoregressions that the speed of current account adjustment differs by exchange rate regime. Gervais *et al*. (2016) find a similar result with an event-study analysis. Other papers find mixed evidence, some more supportive than others.[1]

This paper finds strongly supportive evidence for faster current account adjustment for countries with flexible exchange rates—but only conditional on the sign of the current account imbalance. In particular, we find that countries with a floating exchange rate regime exhibit faster convergence of current account deficits toward balance than countries with a pegged regime, but they exhibit no faster convergence in the case of current account surpluses. Failure to adequately account for this conditional response of current account adjustment may have contributed to the lack of empirical support for Friedman's conjecture in past research. We present additional evidence pointing to a "fear of appreciation" in exchange rate policies as a key mechanism driving this asymmetric speed of current account adjustment. Finally, we develop an innovative dynamic stochastic general equilibrium (DSGE) model embodying fear of appreciation, and use stochastic simulations to demonstrate that asymmetric exchange rate responses in a multi-country environment can explain the asymmetry in current account adjustment of surpluses and deficits.

Our empirical analysis is twofold. First, we estimate autoregressions for the current account on annual data for 159 countries from 1971 to 2014, distinguishing between countries with a *de facto* flexible or fixed exchange rate regime. We include an indicator for current accounts of a positive sign as well as an interaction of this indicator variable with the autoregressive parameter. By doing so, we estimate not only the different speed of current account adjustment according to exchange rate regime, but also according to whether the current account balance is in surplus or deficit. Our results indicate that for cases of current account deficits, countries with floating

[1] See Ghosh *et al*. (2010, 2013, 2019), Herrmann (2009), and Martin (2016).

exchange rates have significantly faster current account convergence than countries with pegs; in contrast, for cases of current account surpluses, the speeds of convergence for floaters are the same as, or slower than for peggers. For our full sample and benchmark specification, the half-life of current account adjustment rises from 0.80 years for deficits to 11.36 years for surpluses.

Our second empirical analysis studies the role of exchange rate dynamics in asymmetric current account adjustment by estimating the joint dynamics of the exchange rate and current account using local projections for a narrower set of countries for which quarterly data are available. Local projection allows us to distinguish between current account surplus and deficit shocks. An asymmetry by sign of current account is again observed for exchange rate dynamics: while a negative shock to the current account leads to a feedback loop of real exchange rate depreciation, a positive shock to the current account does not lead to significant real exchange rate appreciation. This result suggests that the mechanism driving the asymmetric response of ostensibly flexible exchange rates to current account deficits and surpluses may be related to a "fear of appreciation," as discussed in Levy-Yeyati *et al*. (2013). Further, we also find that this asymmetric behavior in exchange rates for current account surpluses is specific to floaters that have less capital account openness and higher reserves accumulation. These empirical findings help guide our theoretical exploration.

We develop a three-country DSGE model to explore how fear of appreciation could explain slower adjustment in current account surpluses compared to deficits. An innovation in the model is a foreign exchange policy rule that embodies an asymmetric response to exchange rate appreciations and depreciations. Stochastic simulations of the model based on a third-order approximation to preserve this policy asymmetry are found to broadly reproduce the empirical findings. The main condition needed for this mechanism is that a shock must raise the country's current account at the same time as appreciating its real exchange rate, which is true for a variety of shocks. Such a shock triggers the country's fear of appreciation mechanism, by which it accumulates foreign exchange reserves to put downward pressure on the value of its currency. The purchase of foreign assets motivated by this policy implies a financial account deficit and hence a current account surplus in the balance of payments, which reinforces and propagates the initial current account surplus prompted by the shock. Aside from uncovering a particular mechanism that could drive our empirical result, the model demonstrates the more general point that, even though at an aggregate world level total current account surpluses must equal current account deficits at each point in time, the dynamics of current account surpluses nonetheless can differ from that of deficits on average in a multi-country setting. This occurs as the exchange rate policy and current account surplus in one country forces the complementary current account deficit to shift between the other two countries at varying horizons after a shock.

Our results contribute most directly to the literature estimating the effect of exchange rate regimes on current account dynamics. Foremost, Chinn and Wei (2013) show using autoregressions that the effect of exchange rate regime changes on the adjustment of the current account balance is nonlinear: the transition from a fixed exchange rate to an intermediate level of exchange rate flexibility does not necessarily contribute to improving the current account balance. Gervais *et al*. (2016) examine whether a flexible nominal exchange rate facilitates real exchange rate adjustment and the maintenance of current account balances. Using an event-study analysis for a large set of emerging economies over the 1975–2008 period, they show that current account reversions are typically accompanied by large real exchange rate movements, regardless of the exchange rate regime. These two studies do not find a significant distinction in the speed of current account reversion between floating and fixed exchange regimes.[2]

However, other studies such as Herrmann (2009), Martin (2016), and Ghosh *et al*. (2013, 2019) support Friedman's hypothesis that flexible exchange rate arrangements deliver a faster current account adjustment by using different measures for exchange rate regime classifications.[3] Similar to the method applied in Chinn and Wei (2013), Ghosh *et al*. (2013, 2019) examine the relationship between exchange rate flexibility and the current account adjustment using a bilateral classification of exchange rate flexibility between pairs of countries (or bilateral exchange rate volatility measure). Lane and Milesi-Ferretti (2012) find that countries that had an excess current account gap in the pre-crisis period, 2005-2008, had the largest contractions in their external balance in 2010. They find that among countries opting for the peg, those with large negative current account gaps have experienced real exchange rate appreciation instead of depreciation, which implies the real exchange rate had a very modest effect on the external adjustment process after the crisis.[4] In sum, previous studies do not reach a consensus and provide mixed findings.

[2] They argue that nominal exchange regime does not guarantee change in "real" exchange rate to promote current account adjustment.

[3] Herrmann (2009) uses the degree of exchange rate volatility. Martin (2016) employs *de facto* exchange regime classification proposed by Ilzetzki *et al*. (2018).

[4] While they examine the role of exchange rate regime together with initial current account gap in the current account adjustment between before and after the global financial crisis, our analysis is not limited to the financial crisis period

Relative to this literature, our paper makes three contributions. First, we find evidence of a new stylized fact, *asymmetric* current account adjustment across different exchange rate regimes and the sign of current account positions. This finding may help explain why some previous findings in the literature tended to be inconclusive: a flexible exchange rate seems to be working well to balance a current account deficit, whereas it does not help clear a current account surplus (by allowing for appreciation).[5] Second, we provide empirical evidence suggesting that this asymmetric response is related to "fear of appreciation." Third, we provide a theoretical model demonstrating the conditions under which fear of appreciation can generate the empirical results we uncover. More broadly, the paper highlights an implication of the recently identified phenomenon of fear of appreciation: namely, that it can prolong global financial imbalances.

Our findings support calls in several papers in the current account literature for a more refined classification of exchange rate regimes, such as distinguishing among varying degrees of exchange rate flexibility (Herrmann 2009) or distinguishing between the many bilateral exchange rate pairings of a country (Ghosh *et al*. 2013). Adding to this list, we find it is particularly important to distinguish between cases based on the signs of exchange rate movement and the current account.

Our work is also related to the recent literature discussing various implications of "fear appreciation." Foremost, Levy-Yeyati *et al*. (2013) find that the policy stance of many emerging market countries, even those opting for the flexible exchange rate regime, indicates a reluctance to let their currency appreciate. This behavior might be driven by a desire to use a depreciated exchange rate to promote competitiveness to foster growth (e.g., Rodrik, 2008, Hausmann *et al*., 2005, labeled as the "development" view of exchange rate policies, Daude *et al*., 2016).[6] Or it might reflect an aim to accumulate reserves (Korinek and Serven, 2016; Choi and Taylor, 2017; and Benigno et al., 2021) or to foster domestic saving (Levy-Yeyati *et al*., 2013). While there is

and focuses more on closure of the current account gap depending on exchange rate flexibility.

[5] This asymmetric pattern of closing current account balance is also related to Ghosh *et al*. (2010), which finds nonlinearities in the adjustment of the current account in relation to the size of current account imbalances. They show that current account surpluses and deficits are much more persistent in fixed and intermediate regimes than in floating regimes. However, a floating regime does not exhibit the lowest persistence, but instead an intermediate regime does so for the case of large deficits.

[6] Another view of intervention is that it postpones or limits a devaluation (as in the "fear of floating" view, see Hausmann *et al*. (2001) and in Calvo and Reinhart (2002)). An interesting finding on real exchange rate depreciation and growth is that Choi and Pyun (2018), using Korean firm level data, provide an ambivalent view on the role of exchange rate depreciation in shaping productivity. They show that while in the short run, real exchange rate depreciation helps increase productivity, a persistent depreciation rather decreases productivity. In particular, a favorable price condition driven by depreciation deprives firms of the incentive for innovation. Indeed, the negative effect of persistent depreciation on productivity was more pronounced in an industry with negative R&D growth.

growing evidence of the existence of this behavior, there is not yet consensus on its motivation, and resolving this question is beyond the scope of the current paper. From a more macroeconomic perspective, Han and Wei (2018) also find evidence of fear of appreciation from the monetary policy viewpoint: when the center country such as the United States loosens its monetary policy, the periphery emerging countries often pursue similarly expansionary monetary policy even though the domestic Taylor rule suggests otherwise, in order to avoid appreciation of their currencies relative to center currency. Han and Wei (2018) argue that while a flexible exchange rate and capital mobility do not offer full insulation from foreign monetary policy shocks, capital controls offer a buffer from the foreign policy shocks regardless of exchange rate regimes.[7]

Finally, our findings are also related to recent work by Corsetti *et al*. (2021), discussing the related claim of Friedman that exchange rate flexibility promotes macroeconomic adjustment and insulation in the face of foreign shocks. Our paper provides illustration of their general argument, that exchange rate flexibility does not guarantee adjustment automatically, but only provides a necessary precondition in terms of freedom of macroeconomic policies; the degree to which the benefits of flexibility are realized depends crucially upon the macroeconomic policy choices made.

The remainder of this paper is organized as follows. In Section 2, we provide the data used and our empirical methodology. Section 3 presents the main empirical results of a current account autoregression and local projection. A theoretical model is presented in Section 4, with model simulation results reported in Section 5. Concluding remarks follow in Section 6.

2. Empirical Models and Data

2.1. Data

Annual data for the current account (as a share of GDP) are obtained from the World Development Indicators of the World Bank for 159 countries from 1971 to 2014. In addition to reporting results for the full sample, we also divide the sample into subsamples for industrial and non-industrial countries, and for the latter, we present subsamples that separate out three sub-groups: sub-Saharan African (SSA) countries, the Caribbean and South Pacific island (CSP)

[7] Kim and Pyun (2018) also focus on the role of capital controls among peggers (fixed exchange rate) in buffering international transmission of business cycles (via independent monetary policy), which supports the trilemma in international economics.

countries, and oil exporters.[8] The list of the sample countries and their subsample classifications are presented in Table 1.

[Insert Table 1 about here]

To measure exchange rate flexibility, we consider alternative classification schemes common in the literature. One is the *de facto* exchange rate regime of Shambaugh (2004) and Klein and Shambaugh (2008)[9], hereafter Shambaugh (classification). Shambaugh provides *de facto* "peg" definition for a country year observation based on either staying within 2% bands against the base currency or zero volatility in all months except for a one-off devaluation. Four types of peg are provided; i) a zero change, ii) 1% band, iii) 2% band, and iv) one-time devaluation or revaluation. Also, it includes an additional criterion that countries must be pegged for two consecutive years (to be counted as a peg) to avoid spuriously classifying observations.

For robustness, we also report full results when using the exchange regime classification from Ilzetzki, Reinhart, and Rogoff (2018, henceforth IRR).[10] IRR provides a narrative classification that separates freely floating currencies from managed floats, which is only conducted for country-years where a currency fluctuates outside a 5% band. The narrative account comes from central bank minutes, reports, and statements; the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions, etc. In the appendix, we report results for a third classification, by Levy-Yeyati and Sturzenegger (2001),[11] hereafter LYS.[12]

To compare these three *de facto* classification measures, we report a percentage of different codings from the other two for each classification: For the period 1974-2013 (common for all three classifications), Shambaugh shows 2.7%, IRR shows 6.3%, and LYS shows 12%. Thus, LYS shows a significant discrepancy from the other two. We report the correlation of the three

[8] SSA countries were found by Chinn and Prasad (2003) to have distinctive current account behavior from other non-industrial countries. Many CSP countries that relied heavily on the tourism industry exhibited chronic current account deficits (Alleyne *et al*., 2011). When checking the current account position for the CSP sample in our data, about 85% of current account observations show the deficits. Many oil exporters tend to show persistent current account surplus, as discussed in Chinn and Wei (2013).
[9] https://iiep.gwu.edu/jay-c-shambaugh/data/
[10] https://www.ilzetzki.com/irr-data
[11] https://www.hks.harvard.edu/centers/cid/publications/faculty-working-papers/classifying-exchange-rate-regimes
[12] LYS (2001) first identifies *de facto* classification by accounting for the relative behavior of three classification variables: changes in the nominal exchange rate, the volatility of those changes, and the volatility of international reserve changes. They use cluster analysis to identify the regime groups, which is a multivariate procedure according to similarities (distances) along certain quantitative dimensions. LYS (2016) also update their classification up to 2014. We find a significantly different coding between LYS and the other two. For example, Korea has opted for *de jure* floating regime since 1997, and Shambaugh and IRR both coded Korea as non-peg in the years after 1999. However, LYS (2016) showed a different coding that Korea was a pegger (de-facto, hard-fixer) in 2004, 2009, and 2011.

measures: the correlation between Shambaugh and IRR is 0.7512, that between Shambaugh and LYS is 0.6382, and that between IRR and LYS is 0.5641.[13] We also collect trade openness (total trade over GDP) and financial openness from Chinn and Ito (2006). The data sources and descriptive statistics for variables used in the analysis are reported in Appendix Tables 1 and 2.

When we turn our attention to the study of current account and real exchange rate dynamics, which calls for higher frequency data than the annual data in the World Bank data set above, we use quarterly data for current account balances collected from the OECD. We believe that some price adjustment likely would occur within an annual period, so we turn to data sources with a higher frequency to address real exchange rate changes in response to the shocks on the current account. Among countries with floating exchange rate regimes in Table 1, we use the subset of 23 countries with quarterly data available for the period 1987Q1-2014Q4. Quarterly real effective exchange rates are sourced from BIS, and we modify it to make an increase in real exchange rate denote real depreciation.

2.2. Empirical Model

We estimate two empirical models to investigate the role of exchange rates in current account adjustment. First, is a panel regression to examine differences in current account adjustment by (*de facto*) exchange rate regime. Second, is a local projection model to investigate how real exchange rate levels respond to a current account shock. In both estimation methods, we distinguish between cases of current account deficit and surplus.

2.2.1 Differences in Autoregression by Exchange Rate Regime

Our initial regression specification is an autoregression:

$$CA_{it} = \varphi_0 + \varphi_1 CA_{it-1} + \varphi_2 CA_{it-1} \cdot posCA_{it-1} + year_t + \varepsilon_{it}, \tag{1}$$

[13] Correlation table among the three *de facto* classifications is as follows:

	Shambaugh (2004)	IRR (2018)	LYS (2016)
Shambaugh (2004)	1.000		
IRR (2018)	0.7512	1.000	
LYS (2016)	0.6382	0.5641	1.000

where CA_{it} is the current account relative to GDP for country *i* in year *t*, and $posCA_{it-1}$ is an indicator for cases where current account was in surplus (coded as 1 if CA>0 at t-1 and 0 otherwise). The regression also features a term interacting the lagged current account with the indicator of positive current account. To determine how the autoregressive coefficient varies with the exchange rate regime, we classify the exchange rate regimes by (*de facto*) degree of flexibility using two classifications common in the literature.[14] Our main specification estimates equation (1) separately for floaters and peggers as two distinct subsamples.

A second regression specification expands upon the first by including controls such as trade and financial openness common in the literature:

$$CA_{it} = \varphi_0 + \varphi_1 CA_{it-1} + \varphi_2 CA_{it-1} \cdot posCA_{it-1} + Controls_{it}\gamma + year_t + \varepsilon_{it}. \quad (2)$$

A third approach estimates over a sample combining floaters and peggers:

$$CA_{it} = \rho_0 + \rho_1 CA_{it-1} + \rho_2 CA_{it-1} \cdot Floating_{it} + \rho_3 CA_{it-1} \cdot Floating_{it} \cdot posCA_{it-1} + \rho_4 Floating_{it} + \rho_5 posCA_{it-1} + year_t + e_{it}, \quad (3)$$

where $Floating_{it}$ is a binary indicator coded as 1 if country *i* was classified as non-pegger at year *t*. Equation (3) includes three-way interaction among $Floating_{it}$, CA_{it-1} and the indicator of positive current account, $posCA_{it-1}$.

2.2.2. Local Projection Estimating Real Exchange Rate Channel

Given that the estimation in Section 2.2.1 tests for differences in current account adjustment by exchange rate regime, we next investigate further the role of exchange movements in the countries with a flexible regime by estimating impulse responses of the real exchange rate to current account shocks using the local projection method of Jorda (2005). We use a quarterly panel that consists of 23 countries for which quarterly data are available from 1987Q1 to 2014Q4. We focus analysis on the dynamic feedback relationship between the real exchange rate and current account balance that arises after a current account shock.

To identify current account shocks, we follow an idea by Morgan *et al.* (2004) by

[14] Our benchmark specification does not include the indicator of positive CA as a separate regressor, but only interacted with CA_{it-1}, since a separate indicator regressor would imply that cases with positive and negative current accounts would converge to different steady states. Our specification can be viewed as an application of the threshold autoregression (TAR) approach. Nonetheless, we show in the appendix that our conclusions are entirely robust to using a specification that does include the positive CA indicator as a separate regressor (see Appendix Tables 11 to 13).

estimating the following equation on our panel of countries:[15]

$$CA_{it} = \alpha + \mu_i + q_t + tr_{it} + u_{it}. \quad (4)$$

To control for unobserved country characteristics, we include country fixed effect, μ_i. This country fixed effect allows for countries that run persistent current account deficits or surpluses. We also include a quarter-time fixed effect, q_t to control for common quarterly shocks on CA of sample countries.[16] tr_{it} is a country-specific linear time trend computed by a country dummy multiplied by a time trend to capture a specific CA trend (e.g., Germany's widened CA surplus during the sample period). u_{it} is an error term that we extract from CA_{it}. According to distributional information of u_{it}, we define a one-standard-deviation of u_{it} from zero as a positive and negative current account shock, respectively: upper 16% of u_{it} as a positive attribute to the current account and lower 16% of u_{it} as a negative attribute on the current account.[17] In addition, we pool u_{it} for the all-country sample and check their upper and lower 16%. Then, we finally identify a positive (negative) shock on the current account if the value of u_{it} belongs to the upper (lower) 16% in not only country *i* but also the pooled sample. Lastly, we exclude cases where the current account shock is positive (negative) but where the current account itself is not positive (negative).[18] Please see Appendix Table 3 for the number of identified positive and negative current account shocks by year and quarter.

The local projection method requires estimation of the following regression for each horizon *h* for each variable:

$$REER_{it+h} - REER_{it-1} = \alpha_h + \rho_h \cdot CA\ Shock_{it} + \sum_{l=1}^{r} \gamma_{lh}' Z_{it-l} + \mu_i + q_t + \varepsilon_{it+h},$$
$$for\ \ h = 0,1,..., \quad (5)$$

where *i* indexes country, *t* represents quarter, and *h* denotes the period that the current account shocks materialize. $REER_{it}$ is real effective exchange rate. But we modify the definition so that an increase in $REER_{it}$ indicates currency *depreciation* of country *i* at *t*-th quarter. $CA\ Shock_{it}$ is

[15] For seasonal adjustment of CA, we also include quarter dummy, which is distinct from quarter time fixed effects.
[16] One may argue that the average CA in the world needs to be zero by identity, so residualizing the current account from its average across countries is economically meaningless. But our sample in this analysis focuses on selective countries, thus their average CA would not be zero. Also the quarterly time fixed effect can capture a common shock in a specific time period, such as Great trade collapse in 2008, that influences the degree of CA.
[17] Assuming a normal distribution, the 16% tails represent one-standard deviation from the mean of the distribution.
[18] The purpose is to help avoid conflating shocks causing a current account imbalance from changes in current account that are correcting a current account imbalance. (Our results are robust to whether or not we exclude such cases.)

the identified current account shock in equation (4). Z_{it-l} is a vector of control variables; First, we include a lagged REER variable. To consider uncovered interest rate parity, we control for the policy interest rate for a country i and its base country j (Shambaugh, 2004) collected from BIS. Lagged variables up to 4 quarters ($r = 4$) are included. In the specification, μ_i is country fixed effect and q_t is time fixed effect that captures any seasonal or common quarterly characteristics, and $\varepsilon_{i,t+h}$ is an error term.

Since we are interested in the asymmetric nature of the current account shock, we adapt the local projection method to estimate a state-dependent model as follows:

$$REER_{it+h} - REER_{it-1} = I_{it}\left[\alpha_{Ph} + \rho_{Ph} \cdot CA\ Shock_{it} + \sum_{l=1}^{r} \gamma_{lPh}^{\prime} Z_{it-l}\right] + (1 - I_{it})\left[\alpha_{Nh} + \rho_{Nh} \cdot CA\ Shock_{it} + \sum_{l=1}^{r} \gamma_{lNh}^{\prime} Z_{it-l}\right] + \mu_i + q_t + \varepsilon_{it+h}, \quad for\ \ h = 0,1,\ldots, \tag{5'}$$

where I_{it} is a dummy variable that indicates the state where either positive CA shock or negative CA shock hits. We allow all of the coefficients to vary according to the state, so the forecast of $REER_{it+h}$ differs according to the state when the shock hits. To take into account serial correlation in the error term induced by the successive leading of the dependent variable, we employ robust standard errors clustered at the country level.

We also implement a sub-sample analysis by dividing our full sample into two groups—high capital control and low capital control countries—by considering capital controls and reserves accumulation. (Please see Appendix Table 4 for the list of countries.) Appendix Table 5 also shows the descriptive statistics for our sub-sample analysis according to the level of capital account openness (KA) and reserves accumulation. By doing so, we examine whether countries with high capital controls and relatively high reserves accumulation (low capital account openness) are expected to show current account adjustment correlated with real exchange rate movements.

3. Empirical Results

3.1. Differences in Autoregression by Exchange Rate Regime

This section presents empirical evidence for our new stylized fact, that countries with floating exchange rates tend to have significantly faster convergence than peggers for the case of current account deficits, but that this is not true for current account surpluses. It also presents evidence for the related finding that surpluses are more persistent than deficits in the current accounts of floaters on average.

We begin with results from the simplest regression, equation (1), as shown in Table 2. A first observation is that the coefficient on the interaction term indicating a positive current account (second row of coefficients in the table) is positive and significant. This result implies that current account surpluses are more persistent than current account deficits for flexible exchange rate countries. The interaction term is significant at the 1%-5% significance level for floaters in all subsamples of countries when floating is determined under the IRR classification; it is at least marginally significant (5%-10% significance level) for floaters in all subsamples of countries under the Shambaugh classification. We note that significance is at the 1% level for both classifications for the subsample of industrial countries and also the complementary subsample of non-industrial countries once sub-Saharan African countries and small Caribbean countries are excluded. We conclude that the sign of the current account is a determinant of the speed of current account convergence for countries with flexible exchange rates. The difference in convergence speeds is economically as well as statistically significant. Applying the standard formula for half-lives for an autoregression, the estimates from our full sample and benchmark specification imply a half-life for current account surpluses that is fourteen times that of current account deficits, 11.36 years versus 0.80 years.[19]

[Insert Table 2 about here]

The second observation is that the coefficient on lagged current account (first row in Table 2) is much smaller for floaters than peggers in most country subsamples, indicating faster convergence of current account imbalances for floaters, conditional on the current account imbalances being deficits. Table 2 also provides a formal statistical test of the hypothesis that the coefficient on lagged current account for floaters is the same as that for peggers, and statistically rejects this hypothesis in most cases reported in the table. Statistical significance is strong both for the industrial countries subsample and the complementary sample of non-industrial countries once sub-Saharan African and Caribbean countries are excluded. This result is supportive of Friedman's claim that flexible exchange rates can help promote international adjustment. The estimates from our full sample and benchmark specification imply a half-life for current account deficits of 2.61

[19] Computed as ln(0.5)/ln(0.4183+0.5225) and ln(0.5)/ln(0.4183), respectively.

years for pegs, compared to the value of 0.80 noted above for floaters. However, the fact that the result is conditional on the sign of the current account imbalance, a distinction not included in the standard Friedman mechanism, motivates the need for further investigation of the mechanism below.

A third observation is that if one sums the coefficients on the interaction term with the coefficient on the lagged current account, the larger value of the interaction term for surpluses more than compensates for the smaller coefficient on the lagged current account. In other words, while floaters adjust faster for current account deficits, this advantage in adjustment speed is fully eliminated for current account surpluses. For example, the estimates from our full sample and benchmark specification imply a half-life for current account surpluses of 3.02 years for pegs, which now is smaller than the value of 11.36 years noted above for floating exchange rate countries. The result is similar for the IRR classification and for other country samples in Table 2. We also implement statistical tests of the hypothesis that the sum of the two autoregressive coefficients (on lagged current account and on the interaction term) for floaters is not less than the sum for peggers. Table 2 shows the tests do not reject the null in all cases.

The overall picture implied by these findings is that floating promotes faster convergence, specifically in the case of deficits, but not in the case of surpluses. This result suggests one potential reason why many past estimates in the literature, which did not make this distinction based on the sign of the current account, did not find evidence that flexible exchange rates promoted faster current account corrections.

To check the robustness of these results, we estimate several additional versions of the regression. Tables 3 and 4 report results from equation (2), including controls common in the literature for trade and financial openness. Results support the earlier conclusions, and statistical significance is stronger in some respects. First, the interaction term for a positive current account for floaters now is significant at the 5% for the full sample for both regime classifications. While this coefficient is not significant for industrial countries with the additional controls, it is strongly significant for non-industrial countries, excluding sub-Saharan African countries and small Caribbean countries. Second, conditional on a current account balance that is negative, the coefficient on lagged current account is still smaller for floaters than peggers, indicating faster convergence of current account deficits with flexible exchange rates. And third, the difference in speeds of convergence disappears or even is flipped when conditioned on a positive current account balance by adding the autoregressive coefficient with that on the interaction term for positive current account. Tables 3 and 4 provide additional information, in that the interaction of financial openness with lagged current account indicates that floaters with more financial openness have a lower sum of coefficients, indicating a faster speed of convergence than floaters with less financial openness. This last conclusion applies to all country samples except that excluding industrial countries and oil exporters, suggesting it is driven by information from industrial and oil-exporting countries classified as having flexible exchange rates.

[Insert Table 3 about here]

[Insert Table 4 about here]

While the regressions in Tables 3 and 4 include year fixed effects, the Appendix also reports results from a regression specification that excludes this like Chinn and Wei (2013) (see Appendix Table 6), and also from one which includes both year fixed effects and country fixed effects (Appendix Table 7). Results in both cases are similar to those in Tables 3 and 4.

A potential explanation for our finding of faster convergence conditional on a negative sign for the current account is the presence of currency crises, in which a current account deficit and external imbalance due to a peg of an overvalued currency prompts a switch to a float and a currency devaluation, along with a sudden stop of capital flows which forces balancing of the current account. We check for the role of this mechanism by estimating our equation on a sample of countries that excludes those experiencing a currency crisis identified by Laeven and Valencia (2020).[20] This is because we are interested in cases where the current account imbalance is large, not where a large change in the current account is most likely to occur driven by a crisis shock. Our sample of countries decreases from 159 to 130, and our observations for floating and peg exchange rate regime countries shrink from 2,499 and 2,015 to 1,816 and 1,441, respectively. Table 5 shows that the results are very similar to the main results in Tables 3 and 4. Appendix Table 8 also shows results for a regression that retains currency crisis observations but includes an indicator variable for them along with an interaction term of this indicator with lagged current account. Again, the results are similar to our benchmark case.

[Insert Table 5 about here]

[20] The currency crises were built based on Frankel and Rose's (1996) approach, which indicates a nominal depreciation of the currency vis-a-vis the U.S. dollar of at least 30 percent that is also at least 10 percentage points higher than the rate of depreciation in the year before (see Laeven and Valencia, 2020).

To provide a more precise way to estimate the effect of current account sign on the difference in autoregressive parameter between floaters and peggers, we consider an expanded regression equation, including a three-way interaction of lagged current account, indicators of positive current account, and an indicator for floating regime (equation (3)). While the interpretation of the proliferation of coefficients can be subtle, the main point for our purposes is that the triple-interaction term is statistically significant at the 1% level both for the sample of industrial countries and for the complementary sample of non-industrial countries, once sub-Saharan Africa and the Caribbean countries are excluded.[21]

[Insert Table 6 about here]

3.2. Local Projection: Estimating Real Exchange Rate Channel

This section presents estimates of our local projections model, aimed at investigating how exchange rates among ostensibly flexible exchange rate countries actually respond to current account shocks. Figure 1 shows impulse response functions for the real effective exchange rate (REER) in response to different types of shocks to the current account balance. The main question in the study is whether responses of REER to the CA shock are state-dependent, especially whether positive or negative CA shocks have different effects on REER adjustment and vice versa. (Here, an increase in REER indicates a real depreciation.)

The impulse response functions in the state-dependent cases are derived from the estimates, ρ_{Ph} and ρ_{Nh} in equation (5'). Panel (A) of Figure 1 shows the impulse responses of the positive CA shocks identified at the upper 16 percentiles, and Panel (B) of Figure 1 illustrates the case for negative CA shocks at the lower 16 percentiles (from one standard deviation). We find that responses of the REER to a positive CA shock (solid blue line) are not significantly different from zero at the 10% level at any period after the shock. However, the REER significantly increases (real depreciation) in response to the negative CA shocks, and it is significantly different from zero starting from the period of shock impact through the first year afterward. This suggests that real exchange rates move in the right direction to promote the adjustment of current account deficits, but they do not move to promote the adjustment of current account surpluses.

[Insert Figure 1 about here]

To further examine why the current account surplus did not bring about real exchange rate

[21] We also provide more robustness checks using LYS (2016) *de facto* classification in Appendix Tables 9 and 10.

appreciation, we consider a country's policy characteristics that influence REER and CA adjustments, such as individual countries' capital account openness (inverse of capital controls) and reserves accumulation in Figure 2. See also Appendix Tables 4 and 5 for descriptive statistics of the variables used in the local projection method.

Figure 2 shows sub-sample regressions regarding capital account openness (KA). Panel (A) and Panel (B) show KA-low countries (countries with capital controls) and KA-high countries, respectively. First, the results in Panel (A) show that a negative CA shock leads to real exchange rate depreciation significantly, but a positive CA shock doesn't lead to a significant REER response. It thus shows a more distinct asymmetric REER response to negative CA shocks, which is similar to those in Figure 1. However, when looking at Panel (B) for KA-high countries in Figure 2, there is no longer asymmetry; we show that CA positive and negative shocks lead to the right direction of REER responses (even if it takes six or seven quarters for this effect to become significant).

[Insert Figure 2 about here]

This evidence indicates that we focus on countries that employ some degree of capital controls on international asset flows, as a mechanism to help avoid undesired currency appreciations. Examination of the group of countries identified in Appendix Table 5 suggests candidates for the countries that fit our profile for driving the earlier result of persistent current account surpluses. It suggests that we not focus just on noted cases of current account surplus like China, but other countries like Indonesia, Korea, and Russia.

4. Theoretical Model

In this section, we develop a simple three-country dynamic stochastic general equilibrium model to explore conditions under which fear of appreciation can explain our empirical results. Following Jeanne (2013) and Korinek and Serven (2016), we use a real model of real exchange rate determination.[22] This approach is especially suitable for our study of exchange rate policy's implications for current account persistence, rather than a nominal model where real effects of the nominal exchange rate depend on short-run price rigidities. The economic environment includes a

[22] The general structure of goods and asset markets are drawn from Jeanne (2013), with modifications for a stochastic environment and for three countries. The specification of government policy rules embodying fear of appreciation is unique to our model, developed to facilitate stochastic simulation and comparison to our empirical results.

goods market with stochastic endowments of traded and nontraded goods. Government policy includes rules governing reserves accumulation and capital controls, which one of the three countries employs to selectively dampen real appreciations. In the notation below, the three countries will be indexed by i = 1, 2, 3.

4.1. Household Behavior

Households in country i maximize the discounted stream of expected utility from consumption: $E_0 \sum_{t=0}^{\infty} \beta^t C_{it}^{1-\sigma} / (1-\sigma)$, where the consumption index, C_{it}, includes traded goods, C_{Tit}, and nontradeds, C_{Nit} as $C_{it} \equiv \left(\nu^{\frac{1}{\eta}} C_{T,it}^{\frac{\eta-1}{\eta}} + (1-\nu)^{\frac{1}{\eta}} C_{N,it}^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}$, subject to the budget constraint:

$$C_{it} + \left(B_{it} - B_{it-1} \right) + q_{it} \left(B_{it}^* - B_{it-1}^* \right) = q_{it} \left(Y_{Tit} + p_{it} Y_{Nit} \right) + r_{it-1} B_{it-1} + r_{t-1}^* q_{it} B_{it-1}^* + T_{it} - q_{it} AC_{Bit} - q_{it} \tau_{it} \,. \quad (6)$$

B_{it} is household holdings of the domestic bond in country i, in units of the domestic consumption index, with interest rate r_{it-1}. B_{it}^* is holding of the international bond in units of the traded good, with interest rate r_{t-1}^*. Here q_{it} is the price of the traded good in terms of the domestic consumption bundle (so q_{it} is the reciprocal of the consumer price index in units of the numeraire traded good), and p_{it} is the price of the nontraded good in terms of the traded good. T_{it} is a lump sum transfer from the government. The term, $AC_{Bit} = \psi_B B_{it}^{*2} / (2Y_{Tit})$ is a small bond holding adjustment cost to ensure stationarity. The term $\tau_{it} = \psi_{\tau i} B_{it}^{*2} / (2Y_{Tit})$ is a capital control tax, scaled by the parameter $\psi_{\tau i}$: for $\psi_{\tau i}$ =0 capital is internationally mobile, and as $\psi_{\tau i} \to \infty$ the capital market approaches being fully closed.

The first order conditions imply an intertemporal Euler equation:

$$C_{1t}^{-\sigma} = \beta \left(1 + r_{1t} \right) E_t \left[C_{1t+1}^{-\sigma} \right], \quad (7)$$

and a real uncovered interest rate parity condition:

$$\left(1 + r_t \right) E_t \left[C_{1t+1}^{-\sigma} \right] = \left(1 + r_t^* \right) E_t \left[C_{1t+1}^{-\sigma} \frac{q_{t+1}}{q_{t1}} \right] \left(1 + \frac{\left(\psi_B + \psi_{\tau i} \right) B_{it}^*}{Y_{Tit}} \right)^{-1}. \quad (8)$$

Intra-temporal optimization (maximizing consumption index for a given expenditure) implies the usual allocation condition between the two types of goods: $\frac{C_{Nit}}{C_{Tit}} = \frac{1-\nu}{\nu} p_{it}^{-\eta}$.

Combined with the consumption index, this implies the following demands, and price index (where the price of traded goods is equal in all countries, and normalized to 1).

$$C_{Tit} = \nu q_{it}^{-\eta} C_{it}, \tag{9}$$

$$C_{Nit} = (1-\nu)\left(p_{it} q_{it}\right)^{-\eta} C_{it}, \tag{10}$$

$$q_{it}^{-1} = \left(\nu + (1-\nu)\, p_{it}^{1-\eta}\right)^{\frac{1}{1-\eta}}. \tag{11}$$

4.2. Government Policies

The government budget constraint is:

$$\left(B_{it}^{G} - B_{it-1}^{G}\right) + q_{it}\left(B_{it}^{G*} - B_{it-1}^{G*}\right) = r_{it-1} B_{it-1}^{G} + q_{it} r_{t-1}^{*} B_{it-1}^{G*} - T_{it} + q_{it}\tau_{it} - \sum_{j\neq i, j=1}^{3} X_{ijt} + \sum_{j\neq i, j=1}^{3} X_{jit}, \tag{12}$$

where B_{it}^{G} and B_{it}^{G*} are government holdings of domestic and international bonds, respectively, and X_{ijt} represent intergovernmental asset transfers from country *i* to country *j*, to be defined below.

Government policy rules specify paths for B_{it}^{G} and B_{it}^{G*}:

$$B_{it}^{G} = 0 \text{ for } i = 1, 2, 3, \tag{13}$$

$$B_{it}^{G*} = 0 \text{ for } i = 2, 3, \tag{14}$$

To describe the holding of foreign bonds as reserves by the government of country 1, we specify a foreign exchange intervention rule:

$$B_{1t}^{G*} = \chi B_{1t-1}^{G*} + \xi\left(\exp\left(\zeta \sum_{n=0}^{10}\left(1 - E_t RER_{1t+n}\right)\right) - 1\right). \tag{15}$$

In this policy rule, RER_{it} measures the real exchange rate of a country, defined as the relative consumer price index to the geometric average of the other two countries: $RER_{it} = q_{it} \Big/ \prod_{j\neq i} q_{jt}^{0.5}$ (a rise in *RER* is a real exchange rate depreciation). This rule summarizes fear of appreciation in the following sense. If country 1 expects to experience a prolonged (over a range of 10 years) real exchange rate appreciation relative to the steady-state value of 1, the government will purchase foreign reserves, which puts downward pressure on the value of the domestic real exchange rate. To capture fear of appreciation in particular, rather than fear of floating more broadly, we must reflect an asymmetric response to appreciations and depreciations. In experiments involving a single shock, we can control this by setting $\chi = \xi = 0$ in cases where the shock implies a real exchange rate depreciation.

However, to deal with experiments involving stochastic simulations, where shocks occur in both directions, we introduce an exponential function transformation into the rule. This rule implies that reserve purchases will tend to be large for the case of real exchange rate appreciations: $\sum_{n=0}^{10}\left(1 - E_t RER_{1t+n}\right) > 0$ and the term $\exp\left(\zeta \sum_{n=0}^{10}\left(1 - E_t RER_{1t+n}\right)\right) - 1$ will be positive and grow exponentially and unboundedly with a larger size of the appreciation. Conversely, the rule implies reserve sales will tend to be small for the case of real exchange rate depreciations: $\sum_{n=0}^{10}\left(1 - E_t RER_{1t+n}\right)$ < 0, and while the term $\exp\left(\zeta \sum_{n=0}^{10}\left(1 - E_t RER_{1t+n}\right)\right) - 1$ will be negative, it will be bounded below by the value -1. The nonlinearity has more bite for larger arguments in the exponential function, so the rule above includes a parameter scaling this argument, ζ. Values for this parameter will be determined by moment matching in a stochastic simulation (See Appendix 1 and Section 4.6 below for more details.) The reserves rule also includes a linear scaling parameter, ξ, to rescale the overall magnitude of the reserves purchases after the parameter ζ is chosen to scale the degree of nonlinearity. The parameter χ determines the speed of reserves accumulation by scaling the autoregressive term in the intervention rule.

Given that government policy in country 1 implies accumulation of reserves indefinitely to control the exchange rate, a mechanism must be specified to ensure stationarity of reserves levels in order to satisfy Blanchard-Kahn conditions for model solution. We assume that at some point in time a sufficient portion of debt claims will be forgiven to prevent explosive growth in reserves. The scenario we study in our simulations designates country 1 as the country that accumulates foreign assets to influence its exchange rate, and designates country 2 as the recipient of any asset transfers from country 1 needed to maintain stationarity. We specify the following rule, indicating asset transfers rise with the accumulation of government reserves in country 1:

$$X_{12t} = \overline{X} + \psi_x q_t B^{*}_{G1t-1}, \tag{16}$$

$$X_{i,j,t} = 0 \quad \forall i \neq 1, j \neq 2 .$$

We show in later sensitivity analysis that our results are robust to alternative specifications of this rule, such as transfers fully deferred to a distant future period. But the present rule with only one lag is computationally less demanding, as it requires tracking fewer state variables in simulation.

4.3. Market Clearing

Market clearing for nontraded goods requires:

$$C_{Nit} = Y_{Nit} . \tag{17}$$

Clearing of the global market for traded goods is:

$$C_{T1t} + C_{T2t} + C_{T3t} = Y_{T1t} + Y_{T2t} + Y_{T3t} . \tag{18}$$

If we assume national domestic bonds cannot be traded internationally, then the market clearing condition for domestic bonds is:

$$B_{it} + B^{G}_{it} = 0 . \tag{19}$$

Bond market clearing for internationally traded bond requires:

$$B^{*}_{1t} + B^{G*}_{1t} + B^{*}_{2t} + B^{G*}_{2t} + B^{*}_{3t} + B^{G*}_{3t} = 0 . \tag{20}$$

By combining budget constraints for households and governments with the goods market-clearing conditions, we can write the countries' balance of payments constraints:

$$\left[Y_{Tit} - C_{Tit} + r^{*}_{t-1} B^{*}_{it-1} + r^{*}_{t-1} B^{G*}_{it-1} - AC_{Bit} \right] + \left[-\left(B^{G*}_{it} - B^{G*}_{it-1} \right) - \left(B^{*}_{it} - B^{*}_{it-1} \right) \right] + \left[\sum_{j \neq i, j=1}^{3} X_{jit} - \sum_{j \neq i, j=1}^{3} X_{ijt} \right] = 0$$

where the first set of brackets specifies the current account, the second is the financial account, and the third is the capital account. Following balance of payments conventions, debt forgiveness is tracked in the capital account. Following empirical convention used in our empirical section above, our simulation data tracking current account dynamics will abstract from the quantitatively tiny bond holding cost, and define the current account as:

$$CA_{it} = Y_{Tit} - C_{Tit} + r^{*}_{t-1} B^{*}_{it-1} + r^{*}_{t-1} B^{G*}_{it-1} . \tag{21}$$

Equilibrium values of 38 endogenous variables (C_{it} , C_{Tit} , C_{Nit} , B_{it} , B_{it}^{*} , p_{it} , q_{it} , r_{it} , B_{it}^{G} , B_{it}^{G*} , T_{it} and CA_{it} for i = 1,2,3, and r_t^{*} , $X_{1,2,t}$) satisfy equations (6)–(21).[23]

4.4. Shock Processes

Endowments follow a stochastic process with log-normal shocks, assumed for simplicity to be independent across countries and sectors:

$$\left(\ln Y_{kit} - \ln \overline{Y}_{ki}\right) = \rho\left(\ln Y_{kit} - \ln \overline{Y}_{ki}\right) + \varepsilon_{kit}, \ \varepsilon_{kit} \sim N\left(0, \sigma_{ki}\right), \text{ for } i \in \{1,2,3\}, \ k \in \{T, N\}.$$

4.5. Model Solution and Simulation Specification

The model is solved by perturbation methods, as a third-order approximation around the deterministic steady state. A third-order approximation is needed to preserve asymmetry in the response of the government exchange rate policy rule (15) that is the essence of “fear of appreciation”; a second-order approximation would not allow for an asymmetric response to real exchange rate appreciations compared to depreciations. Fernández-Villaverde et al. (2011) show that perturbation methods provide a fast and accurate solution method for a third-order approximation to a small open economy model.[24]

The states of the model are ($\widehat{B}_{it}$, $\widehat{B}_{it}^{*}$, $\widehat{B}_{it}^{G}$, $\widehat{B}_{it}^{G*}$ and $\widehat{X}_{i,j,t}$) for countries i,j = 1,2,3, measured as deviations from steady-state as percentages of steady-state traded goods endowment. Innovations are $\{\varepsilon_{Tit}, \varepsilon_{Nit}\}$ for i = 1,2,3. Stochastic simulations include a burn-in period of 1000 years, after which we collect current account data on the three countries for an additional 44 years, reflecting the length of our empirical dataset. To prevent explosive behavior, stochastic simulations employ pruning of higher-order terms that arise when iteratively computing simulations of the solution (see Andreasen et al., 2018 and Kim et al., 2008).[25] We replicate each simulation 300 times, and report moments as the average over these replications.[26] Impulse

[23] We drop the version of equation (6) for country 3 due to Walras’ Law.

[24] See also Kollmann (2005) for an early discussion of perturbation methods applied to third-order approximations of rational expectations models.

[25] We confirmed that results are not sensitive to a longer burn-in. To help the simulation reach its ergodic mean within the burn-in period, we increased the calibration of bond holding costs to ψ_B = 1×10^{-3}, which prevents wide swings in bond holding. Examination of simulated data indicates the ergodic mean is reached by the end of the burn-in period under this calibration.

[26] We confirmed that results are not sensitive to increasing the number of replications.

responses for the third-order approximated model are reported as deviations from the ergodic mean, as discussed in Fernández-Villaverde et al. (2011), and are based on 500 replications.

The simulation moments of interest are the autoregressive parameters in the empirical equation (1), especially the coefficient on the interaction term for a positive current account, φ_2. For each stochastic simulation, we conduct a panel estimation of regression equation (1) on the simulated data, where the cross-section consists of the three countries in our model, and the time dimension is the 44 years of our simulation period.

We also conduct a moment-matching exercise to choose values for some policy parameters, as detailed in the following section. We employ a Newton-based algorithm to minimize the distance measure defined as: $\Omega = \omega_1\left(\varphi_1^{\text{mod}}/\hat{\varphi}_1 - 1\right)^2 + \omega_2\left(\varphi_2^{\text{mod}}/\hat{\varphi}_2 - 1\right)^2$, where $\hat{\varphi}_1$ and. $\hat{\varphi}_2$ are empirical estimates of the coefficients on the autoregressive term and interaction term from equation (1), and φ_1^{mod} and φ_2^{mod} are the model counterparts, computed from estimating regression specification (1) on simulated data, averaged over 100 stochastic simulations.[27]

4.6. Calibration

Parameter values are listed in Table 7. Some parameters are calibrated to standard values from the macroeconomic literature or outside evidence. Risk aversion (inverse of intertemporal elasticity) is set to the standard value of $\sigma = 2$. Consistent with annual frequency, time discounting is set to β = 0.96. The traded goods share is set to $\nu = 0.5$, and the elasticity of substitution between traded and nontraded goods is set to $\eta = 0.5$, as in chapter 8 of Uribe and Schmitt-Grohé (2017).

[Insert Table 7 about here]

Regarding supply shocks in the rest of the world (RoW), the annual autoregressive parameter is ρ_T = 0.84, and the standard deviation set to σ_{3T} = 0.032, both taken from estimates for emerging markets in chapter 5 of Uribe and Schmitt-Grohé (2017). For countries *i* = 1 and 2, standard deviations are derived from estimates of output variability for a developed country in

[27] The number of replications is reduced to 100 in the moment-matching exercise to save computation time, given the large number simulations required in the Newton-based algorithm. Nonetheless, when final stochastic simulation results are reported, we re-run the final simulation using the full number of 300 replications. In the objective, ω_1 and ω_2 are weights to reflect the greater importance we place on the interaction term indicating the effect of a current account sign: ω_1 =0.01 and ω_2 =1.

chapter 4 of Uribe and Schmitt-Grohé (2017), and are set to $\sigma_{i,T}$ = 0.01. The benchmark simulation will focus on shocks to the traded goods endowment of the rest of world (country 3), but robustness checks will extend simulations to shocks of the other countries and the nontraded sector.

The five government policy parameters are chosen in a moment-matching exercise to fit the regression coefficients from our empirical results, as explained in the previous section. The value χ = 0.648 indicates significant smoothing when the government adjusts reserves in equation (15). The values ξ = 0.0119 and ζ = 27.7 together determine how strongly reserves are increased in response to expected currency appreciation in (15): ξ determines the linear scaling of the reserves response; $\zeta > 1$ rescales arguments to amplify the nonlinearity of the exponential function in the response rule, as explained in the model section 4.2 above. The value ψ_x = 0.110 indicates the share of accumulated reserves written off each year by country 1 in equation (16). The optimized value of the capital control parameter is very small, $\psi_{\tau 1} = 2.58\times10^{-7}$; this reflects the fact that in the presence of the reserves write-off above, capital control restrictions are not strictly necessary for the government's reserves policy to affect the real exchange rate in this model.[28]

5. Model Simulation Results

Model simulations are conducted with several objectives. First, simulated model impulse responses are helpful in illustrating the implications of our exchange rate policy rule embodying fear of appreciation, and in particular, how this policy rule links exchange rate management to current account dynamics. Second, the model illustrates how it is possible in a multi-country setting that common measures of current account persistence can differ between surpluses and deficits, even though at each point in time global current account balances must sum to zero. And third, stochastic simulations are used to gauge the degree to which our model mechanism can reproduce quantitatively the degree of asymmetry in the persistence of current account surpluses and deficits found in our earlier empirical estimations.

---

[28] This is similar to the case discussed in section 5 of Korinek and Serven (2016), where an accumulation of reserves that depreciates the real exchange rate is viewed as a loan to foreigners to purchase tradable goods, and this loan is financed by lump-sum taxes on domestic households. This reserve accumulation directly affects the real exchange rate by lowering the home supply of the traded good and raising its relative price. Similarly, in our model, equation (16) requires that an accumulation of reserves imply an asset transfer from government 1 to 2, which in turn implies a rise in the lump-sum tax on agents in country 1 and a cut in the lump-sum tax in country 2. See further details in the discussion of impulse responses below.

5.1. Stochastic Simulation Results

Table 8 reports results from stochastic simulations, where simulated data are used to estimate autoregressive regression equation (1). Of primary interest is φ_2, the coefficient on the interaction term for a positive current account, where $\varphi_2 > 0$ indicates greater persistence for current account surpluses compared to deficits. The benchmark calibration of the model (row 1) implies an estimate of φ_2 = 0.35.[29] This value does not fully replicate the estimate of φ_2 for the full sample empirical regression in panel A of Table 1 (0.52), but it does compare well with estimates in that table for the subsample of industrial countries (0.24) and also the subsample of non-industrial countries that excludes oil exporters (0.26). Further, it is clear that the estimate from the simulated data implies a substantial degree of asymmetry in the persistence of current account surpluses compared to deficits; together with the estimate of φ_1=0.56, the estimate of φ_2=0.35 implies the half-life of surpluses that is 6.4 times that of deficits.[30]

Stochastic simulations also provide an estimate for ergodic means of variables, computed as the average of the 44 year sample period after the completion of the 1000 period burn-in, averaged again over the 300 replications. The resulting ergodic mean of current account in country 1 is 0.57% as a share of its steady-state traded goods endowment, and that for country 2 is -0.28%; this implies an asymmetry where country 1, on average, has current account surpluses while country 2 on average has deficits.

[Insert Table 8 about here]

The next several rows of Table 8 report sensitivity analysis, to identify the key parameters and drivers of the benchmark result. Row (2) eliminates the reserve policy response countering exchange rate changes in country 1 by setting the parameter ξ near to zero. Eliminating this policy response largely eliminates the main result of greater persistence of current account surpluses (φ_2 becomes small), which speaks to the essential importance of foreign exchange intervention for our benchmark result.

Eliminating a different parameter in the foreign exchange policy rule, χ, which controls

[29] The benchmark panel estimation on simulated data includes country fixed effects. Results are largely robust to estimating without fixed effects: φ_2=0.2460 and φ_1=0.7105.

[30] Computed as ln(0.5)/ln(0.5579+0.3549) = 7.597 versus ln(0.5)/ln(0.5579) = 1.188.

smoothing of the policy response, also eliminates our main results (φ_2 becomes close to zero, as seen in row (3)). Eliminating this parameter forces the purchases of reserves in the foreign exchange intervention to occur much more quickly. Since the purchase of reserves implies a rise in the current account, this action augments the initial rise in the current account surplus relative to its later values, hence reducing our measure of persistence in terms of an autoregressive coefficient.

Row (4) shows the implications of eliminating the rescaling of the policy response inside the exponential function (ζ =1). A value $\zeta >1$ amplifies the policy response to RER appreciations compared to depreciations implied by the exponential function, to better reflect the idea of fear of appreciation. Eliminating this rescaling dampens the ability of the model to explain the greater persistence of surpluses, implying a smaller value of φ_2 than the benchmark model.

The asset transfer rule in equation (16) is motivated by the technical need to prevent unbounded accumulation of reserves and violation of Blanchard-Kahn conditions. However, row (5) of Table 8 shows that the asset transfer rule does contribute to our result: when setting ψ_x to 0.06 (the lowest value satisfying dynamic stability), φ_2 is much smaller than the benchmark value.

A third-order approximation to the model is essential to retaining the key asymmetry in the policy responses to currency appreciations versus depreciations. This claim is supported by conducting stochastic simulations on a second-order approximation to the model, and finding that the estimate of φ_2 is very small (row 6).

The last couple rows of Table 8 explore robustness to alternative shocks. Row (7) shows that the main result is largely robust considering shocks to the traded sectors of all three countries together, with an estimate of φ_2 =0.21. These results indicate that RoW shocks are the most potent in generating the result of substantially higher persistence in positive current accounts in country 1, which is why we chose this as the benchmark case. Impulse responses below will further explore the mechanism for selected shocks.

Our main analysis focuses on shocks to the traded goods sector, since the nontraded shocks contribute zero to the variance decomposition of the current account. This follows from our benchmark parameterization where intertemporal and intratemporal substitution effects are equal and offsetting ($\eta = 1/\sigma$). But row (8) of Table 8 shows that our result of higher persistence of surpluses continues in a muted form under this more general set of shocks, though we needed to re-optimize the parameters to accommodate the new shock specification.

5.2. Impulse Responses

This section reports impulse responses tracing the effects over time of a single shock draw, to develop intuition for the mechanism driving current account persistence in the model. Given that simulations above found that endowment shocks to the traded good sector of country 3 (RoW) were by far the most important for deriving our main result, we focus on this case, with the cases of other shocks reported in the Appendix. In brief, the impulse responses in Figure 3 show a highly persistent current account surplus for country 1 that, after several initial periods of adjustment, decays toward zero at a very slow rate. In addition, the figure illustrates the essential condition needed to generate this result: increases in the current account of country 1 tend to coincide with an exchange rate appreciation, which triggers foreign exchange intervention to curb the appreciation that will also prolong the current account surplus.

Now consider the mechanism in more detail. Figure 3 plots responses to both a positive and a negative shock. Begin by considering the logic of a shock that lowers the endowment of traded goods in RoW, for which impulse responses are depicted by the solid (red) line in Figure 3. (We denote this shock as *CA surplus shock* from country 1's perspective.) The households in RoW smooth consumption by lowering consumption of the traded goods by a smaller amount than the fall in endowment, implying an initial current account deficit for RoW and current account surpluses for countries 1 and 2. The fall in the relative supply of traded goods compared to nontraded goods in RoW implies a rise in the relative price of traded goods in terms of the consumption bundle, and hence a real exchange rate depreciation (rise) for RoW and an appreciation (fall) in the real exchange rates of countries 1 and 2.

[Insert Figure 3 about here]

The appreciation of real exchange rate in country 1 triggers its fear of appreciation response, by which it purchases international assets as foreign exchange reserves. This dampens the real appreciation of country 1, which is visibly smaller in magnitude than that of country 2, which does not intervene. This accumulation of foreign assets implies a deficit in the financial account of country 1, and an accompanying improvement in its current account. Given that the exchange rate rule specifies a response spread over time, the effect on the current account is quite persistent. At the same time, the purchases of reserve assets by country 1 imply eventual asset transfers to country 2. The expectation of future transfers leads to a rise in consumption in country 2 and hence, a current account that eventually falls below zero and remains at a persistent current account deficit. While the current account imbalances appear in Figure 3 to be essentially permanent, simulations of further periods show that they do all converge back to zero, but at a slow rate.[31] This story arguably could be interpreted in more concrete terms as reflecting the financial relationship between China and the US in recent decades, in which Chinese (country 1) purchases of foreign reserves contribute to a persistent current account surplus there and a persistent current account deficit in the US (country 2).

Next, consider briefly the complementary case of a shock raising endowment in RoW (*CA deficit shock*), depicted in Figure 3 with dashed (black) lines. The sign of impulse response movements, of course, is reversed from the previous shock. Because the real exchange rate of country 1 now depreciates, the fear of appreciation policy is suspended, and there is no purchase of foreign reserves ($\xi = 0$). As a result, impulse responses in Figure 3 show that the currency movement in country 1 now is of the same magnitude as in country 2. More importantly, the current account deficit in country 1 now converges to zero at about the same rate as current account convergence in the other two countries.

Now consider how this set of model impulse responses can provide some intuition for why current account surpluses were found in the preceding section to be more persistent than deficits in our regressions on data from stochastic simulations. The first observation is that due to the high persistence of the current account surplus in country 1, its pair of impulse responses for the positive and negative shocks do not cross each other within the sample period. In terms of a standard autoregression estimation, this implies a slow rate of convergence to the sample mean.[32] In

[31] The highly persistent current account surplus in country 1 (and deficit in country 2) is related in a subtle way to the asset transfers from country 1 to country 2. In the particular case of Figure 3, the two variables clearly take very similar magnitudes as the simulation approaches its steady-state. The logic is as follows: the present value of expected future transfers leads to a fall in consumption in country 1 (and rise in country 2) relative to national income, leading to the current account surplus for country 1 (and deficit in country 2). We note, however, that the responses in consumption and current account are robust to the particular timing of these transfers; qualitatively similar responses would apply in a parameterization of the model where the asset transfers are all deferred to some arbitrarily far point in the future but have the same present value. Appendix figure 3 demonstrates this claim, where there is a persistent current account surplus in country 1 for all periods of the simulation, even though asset transfers are set at zero until the final period of the plot.

[32] The autoregression $CA_t = \overline{C} + \rho CA_{t-1} + \varepsilon_t$ can be written as $\left(CA_t - \overline{CA}\right) = \rho\left(CA_{t-1} - \overline{CA}\right) + \varepsilon_t$, where ρ indicates the rate of convergence to the mean $\overline{CA} = \overline{C}/(1-\rho)$.

contrast, for country 2, due to the fact the initial current account surplus flips sign to deficit, we see that the two impulse responses for this country cross each other during the sample period. So the impulse responses fully reach their sample mean during the sample period, implying a faster rate of convergence when estimating an autoregression. The second observation is that the persistent surplus in country 1 for the positive shock, combined with a less persistent deficit for the negative shock, implies a positive mean level of current account for a sample aggregating both shocks. In country 2, the fact that the initial surplus crosses to deficit implies the mean level of current account is negative over a sample aggregating both shocks. Putting the two observations together, the impulse responses imply that slower current account convergence is associated with the country that tends to have surpluses, while faster convergence is associated with the country that tends to have deficits. This suggests a channel by which the model can imply a greater estimate of persistence for surpluses compared to deficits in an autoregression.

We note that the mechanism described above requires a multi-country setting of more than two countries. In a two-country environment, the fact that the global current account must sum to zero in each period implies that the current account balance in country 2 in each period necessarily would equal the inverse of that in country 1. So the impulse responses for country 2 would be symmetric around zero to those for country 1, and there would be no way that the impulse responses for country 2 with respect to the positive and negative shocks could cross each other without the same applying to the impulse responses for country 1. Our argument for slower convergence in country 1 could not apply in such a case. In contrast, in the three country setting faster convergence is possible in country 2 in the case of a shock to RoW endowment since the country 2 current account can start out as positive at the same time as country 1 is in surplus, since the combined surplus is balanced by the current account deficit in RoW; then the current account in country 2 can move quickly to deficit as the RoW deficit moves to a zero balance, even as the current account in country 1 remains in surplus. The essential asymmetry between countries 1 and 2 is made possible by the presence of a third country.

While our analysis has focused on the shock to traded endowment in RoW, part of the logic above also applies to the counterpart shocks to traded endowments of the other two countries. For impulse responses for these two shocks, see Appendix Figures 1 and 2. On one hand, shocks to the traded goods sector of any of the three counties can generate an asymmetrically persistent current account surplus in country 1. This is because in all three cases shocks that push the current account of country 1 into surplus (a rise in endowment in the case of a shock to country 1, or a fall in endowment of country 2) are associated with a real exchange rate appreciation of country 1, thus triggering the fear of appreciation mechanism that makes the current account surplus persistent. On the other hand, the positive and negative impulse responses do not cross each other for either country in these cases, limiting our ability to gauge different rates of convergence across countries.

We further find that the applicability of this logic to shocks to the nontraded sector is highly dependent on the parameterization of elasticities. In particular, the elasticity of substitution between sectors would need to be sufficiently high in order for a current account surplus in country 1 to be associated with a real exchange rate appreciation (rise in the relative price of nontraded goods); this is not true of our benchmark calibration, in which the intratemporal elasticity equals the intertemporal elasticity. This provides some intuition for the finding in the preceding section that our stochastic simulations generate a substantial asymmetry in current account persistence for surpluses primarily for the case of shocks to the traded goods endowment of RoW.

To gain further insight into the stochastic simulation results, we also report impulse responses from a third-order approximation of the model.[33] Since the impulse response to a single shock in a third-order approximation will differ with the size of the shock draw, we choose a shock draw of one-half standard deviation in size, as we found this best illustrates results from the stochastic simulations above (this scaling produces impulse responses with a visible asymmetry between positive and negative shock draws). Figure 4 reports the average of 500 replications of impulse responses to a shock to the endowment of traded goods in country 3 (RoW) in the context of the full stochastic environment. The impulse responses are computed as deviations from the ergodic mean. As in the previous figures, we report both a positive and negative draw of the shock, where the latter implies a current account surplus for country 1 (solid red line) and the former a deficit (dashed black line). However, now the same exchange rate policy rule (15) is used consistently in evaluating the effects of both shocks, and it is hoped that the third-order approximation will preserve the asymmetry inherent in this policy rule. To facilitate comparison

[33] Interpretation of such impulse responses is complicated by several factors. First, the effect of a shock will vary depending on its size, so the scaling of the shock used to generate the impulse responses will matter. Second, the impulse responses will study the effect of a single shock in the context of a stochastic simulation of shocks in the background, requiring multiple replications and taking an average. Third, in this stochastic environment, the mean of variables can differ from the deterministic steady state, and impulse responses are reported as deviations from the ergodic mean rather than from the steady-state.

of the two shocks, Figure 4 inverts the sign of the current account values in the case of deficit, so that all current account values are reported together as positive.

[Insert Figure 4 about here]

The overall shape of impulse responses for a CA-surplus shock in Figure 4 is broadly similar to those for the first-order approximation in Figure 3. For example, Figure 4 shows some degree of asymmetry between the positive and negative current account shocks, with greater persistence for the positive current account case. This is reassuring, in that the third-order approximation of our reserve policy rule retains some of the asymmetry needed to capture the fear of appreciation. This asymmetry favoring a rise in the current account also offers some intuition for why country 1 was found in stochastic simulation to have a positive ergodic mean for this variable. In addition, Figure 4 also shows that an exchange rate appreciation in country 1 in the solid red line is smaller (around 0.2%) compared to the degree of exchange rate depreciation in the dashed black line (around 0.3%). In contrast, for the shock leading to currency deprecation in both countries, the figure shows that both countries depreciate the same amount. This further supports that our third-order approximation of the exchange rate policy rule indeed is consistent with the type of asymmetric exchange rate response we would characterize as fear of appreciation.

These impulse responses are also consistent with the two key observations from Figure 3 used to provide intuition for the main regression finding. First, country 1 has a slower rate of convergence to its ergodic mean than country 2 since the impulse responses for country 1 do not cross each other, while the impulse responses for country 2 do cross when its current account surplus eventually turns to deficit. Second, the persistent surplus in country 1 helps explain why the ergodic mean in the full stochastic simulation was positive as discussed above, while the flip in current account sign for country 2 helps explain why its ergodic mean was negative. Further, comparing the magnitude of that ergodic mean for current account of country 1 (0.57% of traded goods endowment) to the magnitude of the impulse responses indicates that even for the negative shock lowering the current account of country 1 below its ergodic mean, the current account still takes a positive value in absolute terms for most of the sample period. Likewise, the negative ergodic mean of country 2 found in stochastic simulations (-0.28%) implies that most of the impulse response for country 2, including the time while its current account is above its ergodic mean, is still in deficit in absolute terms. This supports the intuition that a slow rate of current account converges to the ergodic mean is associated with a current account surplus in absolute terms (country 1), while a slower rate of convergence to the ergodic mean is associated with a current account deficit in absolute terms (country 2), as was found when estimating the autoregression on data from the full stochastic simulation.

6. Conclusion

This study investigates the long-standing question of whether exchange rate flexibility can facilitate the closure of current account imbalances. In particular, we provide new empirical results and theoretical insights into the implications of "fear of appreciation" for this international adjustment. Empirically, we provide a new stylized fact that, for countries with ostensibly flexible exchange rates, current account surpluses are more persistent on average than deficits. In particular, we find that countries with a floating exchange rate regime exhibit faster convergence of current account deficits toward balance than countries with a pegged regime, but they exhibit no faster convergence in the case of current account surpluses. Our evidence indicates that this asymmetric current account adjustment is associated with an asymmetric exchange rate response indicative of a fear of appreciation. We provide a theoretical model showing how fear of appreciation can explain these empirical findings.

Our findings provide a new source of support for Friedman's conjecture that exchange rate flexibility should facilitate international financial adjustment. However, our results suggest this ability to facilitate adjustment must be viewed as conditional on the sign of the current account imbalance. The lack of such conditioning may have contributed to inconclusive results in some past research on this question. Our work also has implications for how to understand the current state of global imbalances, suggesting one mechanism by which cases of stubbornly persistent current account surpluses may be policy-induced, the result of asymmetric policy toward currency appreciation.

References

Alleyne, D., Lugay, B., & Dookie, M. (2011). The relationship between fiscal and current account balances in the Caribbean, ECLAC.

Andreasen, M. M., Jesús Fernández-Villaverde, J, Rubio-Ramírez, J. (2018). The pruned statespace system for non-linear DSGE models: theory and empirical applications. *Review of Economic Studies* 85(1), 1-49.

Benigno, G., Fornaro, L., Wolf, M. (2021). Reserve accumulation, growth and financial crises, Working Papers 1279, Barcelona Graduate School of Economics.

Calvo, G.A., Reinhart, C.M. (2002). Fear of floating. *Quarterly Journal of Economics* 117 (2), 379–408.

Chinn, M. D., Ito, H. (2006). What matters for financial development? capital controls, institutions, and interactions. *Journal of Development Economics,* 81(1), 163-192.

Chinn, M. D., Prasad, E. S. (2003). Medium-term determinants of current accounts in industrial and developing countries: an empirical exploration. *Journal of International Economics*, *59*(1), 47-76.

Chinn, M.D., Wei, S.J. (2013). A faith-based initiative meets the evidence: does a flexible exchange rate regime really facilitate current account adjustment? *Review of Economics and Statistics* 95 (1), 168-184.

Choi, B. Y., Pyun, J. H. (2018). Does real exchange rate depreciation increase productivity? Analysis using Korean firm-level data. *The World Economy*, *41*(2), 604-633.

Choi, W. J., Taylor, A. M. (2017). Precaution Versus Mercantilism: Reserve Accumulation, Capital Controls, and the Real Exchange Rate (No. w23341). National Bureau of Economic Research.

Corsetti, G., Müller, G. J., K. Kuester (2021). The exchange rate insulation puzzle, CEPR Discussion Paper DP15689.

Daude, C., Yeyati, E. L., Nagengast, A. J. (2016). On the effectiveness of exchange rate interventions in emerging markets. *Journal of International Money and Finance 64*, 239-261.

Fernández-Villaverde, J., Guerrón-Quintana, P., Rubio-Ramírez, J.F., Uribe, M. (2011). Risk matters: the real effects of volatility shocks. *American Economic Review* 101 (6), 2530-2561.

Frankel, J. A., Rose, A. K. (1996). Currency crashes in emerging markets: An empirical treatment. *Journal of International Economics*, *41*(3-4), 351-366.

Friedman, M. (1953). The case for flexible exchange rates. In: Friedman, M. (Ed.), Essays in Positive Economics. The University of Chicago Press, Chicago, pp. 157–203.

Gervais, O., Schembri, L., Suchanek, L. (2016). Current account dynamics, real exchange rate adjustment, and the exchange rate regime in emerging-market economies. *Journal of Development Economics*, *119*, 86-99.

Ghosh, R.A., Terrones, M., Zettelmeyer, J. (2010). Exchange rate regimes and external adjustment: new answers to an old debate. In: Wyplosz, C. (Ed.), The New International Monetary System: Essays in Honor of Alexander Swoboda. Routledge.

Ghosh, R.A., Qureshi, M.S., Tsangarides, C.G. (2013). Is the exchange rate regime really irrelevant for external adjustment? *Economic Letters*. 1181, 104–109.

Ghosh, A. R., Qureshi, M. S., Tsangarides, C. G. (2019). Friedman Redux: External Adjustment and Exchange Rate Flexibility. *The Economic Journal 129*(617), 408-438.

Han, X., Wei, S. J. (2018). International transmissions of monetary shocks: Between a trilemma and a dilemma. *Journal of International Economics*, *110*, 205-219.

Hausmann, R., Panizza, U., Stein, E. (2001). Why do countries float the way they float? *Journal of Development Economics* 66 (2), 387–414.

Hausmann, R., Pritchett, L., Rodrik, D. (2005). Growth accelerations. *Journal of Economic Growth* 10, 303–329.

Herrmann, S. (2009). Do we really know that flexible exchange rates facilitate current account adjustment? *Applied Economics Quarterly, Deutsche Bundesbank Discussion Paper Series, 1*.

Ilzetzki, E., Reinhart, C.M., Rogoff, K.S. (2018). Exchange rate arrangements entering the 21st century: which anchor will hold? Mimeo.

Jeanne, O. (2013). Capital account policies and the real exchange rate. In *NBER International Seminar on Macroeconomics*, 9:pp. 7–42. University of Chicago Press Chicago, IL.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review 95*(1), 161-182.

Kim, J., Kim, S.H., Schaumburg, E., Sims, C.A. (2008). Calculating and using second-order accurate solutions of discrete time dynamic equilibrium models. *Journal of Economic*

Dynamics and Control 32(11), 3397–3414.

Kim, K., Pyun, J. H. (2018). Exchange rate regimes and the international transmission of business cycles: Capital account openness matters. *Journal of International Money and Finance 87*, 44-61.

Klein, M. W., & Shambaugh, J. C. (2008). The dynamics of exchange rate regimes: Fixes, floats, and flips. *Journal of International Economics 75*(1), 70-92.

Kollmann, R. (2005). Solving Non-Linear Rational Expectations Models: Approximations based on Taylor Expansions, working paper, https://www.robertkollmann.com/KOLLMANN_manuscript_APPROX_2005.pdf.

Korinek, A., Serven, L. (2016). Undervaluation through foreign reserve accumulation: Static losses, dynamic gains. *Journal of International Money and Finance 64*, 104-136.

Lane, P. R., Milesi-Ferretti, G. M. (2012). External adjustment and the global crisis. *Journal of International Economics 88*(2), 252-265.

Laeven, L. and F. Valencia, F. (2020). Systemic banking crises database II, *IMF Economic Review*, 2020, vol. 68, issue 2, No 1, 307-361.

Levy-Yeyati, E., Sturzenegger, F., Gluzmann, P. A. (2013). Fear of appreciation. *Journal of Development Economics 101*, 233-247.

Levy-Yeyati, E., & Sturzenegger, F. (2001). Exchange rate regimes and economic performance. *IMF Staff Papers*, *47*, 62.

Martin, F. E. (2016). Exchange rate regimes and current account adjustment: An empirical investigation. *Journal of International Money and Finance 65*, 69-93.

Morgan, D.P., Rime, B., Strahan, P.E. (2004). Bank integration and state business cycles. *Quarterly Journal of Economics* 119, 1555–1584.

Rodrik, D., 2008. The real exchange rate and economic growth: theory and evidence. *Brookings Pap. Econ. Act.* 365–412.

Shambaugh, J.C. (2004). The effect of fixed exchange rates on monetary policy. *Quarterly Journal of Economics* 119, 301–352.

Uribe, M. Schmitt-Grohé, S. (2017). *Open Economy Macroeconomics*: Princeton University Press, Princeton New Jersey.

Table 1. List of 159 countries

Country	Availability	Country	Availability	Country	Availability	Country	Availability	Country	Availability	Country	Availability
Albania	1995-2014	Chile*	1976-2014	Haiti	1988-2014	Mauritania	1976-2014	Seychelles	1981-2014	Zambia	1998-2014
Algeria[ex, I, S]	1978-2014	China	1984-2014	Honduras	1975-2014	Mauritius	1977-2014	Sierra Leone	1978-2014	Zimbabwe	1984-2014
Angola[ex]	2000-2014	Colombia	1971-2014	Hong Kong, China	1999-2014	Mexico	1980-2014	Singapore	1973-2014		
Antigua and Barbuda	1985-2009	Comoros	1981-2014	Hungary*	1992-2014	Micronesia	2010-2014	Slovak Republic	1996-2014	**Industrial countries**	
Argentina*	1977-2014	Congo, Rep.	1979-2014	India*	1976-2014	Moldova	1996-2014	Slovenia	1996-2014	Australia*	1990-2014
Armenia	1996-2014	Costa Rica*	1978-2014	Indonesia*	1982-2014	Morocco	1976-2014	Solomon Islands[L,S]	1982-2014	Austria	2006-2014
Aruba[I, L]	1987-2013	Cote d'Ivoire[L, S]	2006-2014	Iran[ex]	1977-2000	Mozambique	2006-2014	South Africa*	1971-2014	Belgium	2003-2014
Azerbaijan	1996-2014	Croatia	1996-2014	Israel*	1971-2014	Myanmar	2001-2014	Sri Lanka	1976-2014	Canada*	1971-2014
Bahamas	1977-2014	Cyprus	1977-2014	Jamaica	1977-2014	Namibia	1994-2014	St. Kitts and Nevis	1988-2014	Denmark	1976-2014
Bahrain	1981-2014	Czech Rep.*	1996-2014	Jordan	1976-2014	Nepal	1977-2014	St. Lucia	1983-2014	Finland	1976-2014
Bangladesh	1977-2014	Djibouti	2013-2014	Kazakhstan	1996-2014	Nicaragua	1978-2014	St. Vincent & the Grenadines	1983-2014	France	1976-2014
Barbados	1975-2013	Dominica	1982-2014	Kenya	1976-2014	Niger	1975-2014	Sudan	1978-2014	Germany*	1972-2014
Belarus	1996-2014	Dominican Rep.	1971-2014	Kiribati	1990-1994	Nigeria[ex]	1978-2014	Suriname	2006-2010	Greece	1977-2014
Belize	1985-2014	Ecuador[I, L]	1977-2014	Korea, Rep.*	1977-2014	Oman[ex]	1977-2014	Syrian Arab Rep.[I, L]	1986-2007	Iceland	1977-2014
Benin	1979-2014	Egypt	1978-2014	Kuwait[ex]	1976-2014	Pakistan	1977-2014	Tanzania	1990-2014	Ireland	2006-2014
Bolivia	1977-2014	El Salvador	1977-2014	Lao PDR	1985-2014	Panama	1978-2014	Thailand	1976-2014	Italy	1971-2014
Bosnia and Herzegovina	1999-2014	Estonia	1996-2014	Latvia	1996-2014	Papua New Guinea	1979-2004	Togo	1975-2014	Japan*	1995-2014
Botswana	1976-2014	Eswatini	1975-2014	Lebanon	2003-2014	Paraguay[L, S]	1976-2014	Tonga	1989-2014	Netherlands	1971-2014
Brazil*	1976-2014	Ethiopia[L, S]	2011-2014	Lesotho	1976-2014	Peru	1978-2014	Tunisia	1977-2014	New Zealand*	2001-2014
Bulgaria	1994-2014	Gabon	1979-2014	Libya	1991-2014	Philippines	1978-2014	Turkey*	1975-2014	Norway*	1976-2014
Burkina Faso	2006-2014	Gambia	1979-2014	Lithuania	1996-2014	Poland*	1995-2014	Uganda	1981-2014	Portugal	1976-2014
Burundi	1986-2014	Georgia	1998-2014	Madagascar	1975-2014	Qatar[ex]	2012-2014	Ukraine	1996-2014	Spain	1976-2014
Cabo Verde	1982-2014	Ghana	1976-2014	Malawi	1978-2014	Russia[ex]*	1996-2014	United Arab Emirates[ex]	2001-2014	Sweden*	1971-2014
Cambodia[I, L]	1995-2014	Grenada	1979-2014	Malaysia	1975-2014	Rwanda[L, S]	2011-2014	Uruguay	1979-2014	Switzerland*	1996-2014
Cameroon	1978-2014	Guatemala	1978-2014	Maldives	1982-2014	Samoa[L, S]	2005-2014	Vanuatu[L, S]	1985-2000	United Kingdom*	1971-2014
C. African Rep.	1978-1994	Guinea	1987-2014	Mali	1976-2014	Saudi Arabia[ex]	1972-2014	Venezuela[ex]	1971-2014		
Chad	1978-1994	Guyana	1978-2014	Malta	1972-2014	Senegal	1975-2014	Vietnam	1997-2014	United States	1971-2014

Note: [ex] indicates oil exporting countries (by a rank of the volume of oil exports). [I] indicates countries that Ilzetzki, Reinhart and Rogoff's classification is only available. [L] indicates countries that LYS's classification is only available. [S] indicates countries that Shambaugh's are only available. SSA indicates 38 sub-Saharan Africa in red, CSP does 24 Caribbean and South Pacific island countries in blue. * 23 countries used in the local projection.

Table 2. CA persistence and asymmetry between floating and fixed regimes

Panel A. Shambaugh classification, 155 countries, 1971~2014

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.4183**	0.7664***	0.7659***	0.9558***	0.3905*	0.7468***	0.1752	0.7952***	0.6921***	0.8056***
	(0.200)	(0.032)	(0.031)	(0.024)	(0.199)	(0.033)	(0.134)	(0.045)	(0.042)	(0.039)
CA(-1) × CA Pos	0.5225*	0.0284	0.2403***	0.0158	0.5420*	0.0498	0.8363***	0.0114	0.2554***	0.0100
	(0.270)	(0.048)	(0.061)	(0.046)	(0.277)	(0.049)	(0.139)	(0.057)	(0.070)	(0.093)
Constant	-0.0084	-0.0120**	0.0053*	-0.0159***	-0.0440***	-0.0121	-0.0559***	-0.0026	-0.0273***	-0.0107***
	(0.009)	(0.006)	(0.003)	(0.000)	(0.011)	(0.008)	(0.008)	(0.007)	(0.003)	(0.003)
H0: CA(-1) in Floating = CA(-1) in Peg	3.02* (0.0824)		29.97*** (0.0000)		3.23* (0.0722)		18.98*** (0.0000)		3.52* (0.0607)	
H0: CA(-1) + CA(-1)× CA Pos in Floating ≥ CA(-1) + CA(-1) × CA Pos in Peg	(0.936)		(0.809)		(0.907)		(0.999)		(0.983)	
Observations	2661	2232	500	256	2161	1976	1356	809	1268	641
R-squared	0.524	0.526	0.809	0.928	0.508	0.514	0.626	0.469	0.676	0.723

Panel B. Ilzetzki, Reinhart and Rogoff's (2018) classification, 157 countries, 1971~2014

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CA(-1)	0.4456**	0.7401***	0.7753***	0.9602***	0.4181**	0.7162***	0.2090	0.7574***	0.7541***	0.7672***
	(0.195)	(0.039)	(0.030)	(0.024)	(0.194)	(0.040)	(0.154)	(0.046)	(0.027)	(0.043)
CA(-1) × CA Pos	0.4535**	0.1187*	0.2311***	0.0005	0.4770**	0.1476**	0.6832***	0.1749**	0.1382**	0.1882**
	(0.193)	(0.066)	(0.061)	(0.049)	(0.199)	(0.069)	(0.127)	(0.073)	(0.065)	(0.070)
Constant	-0.0275**	0.0012	-0.0047	0.0055	-0.0449***	-0.0087	-0.0562***	-0.0071	-0.0213***	-0.0195***
	(0.012)	(0.005)	(0.009)	(0.004)	(0.013)	(0.010)	(0.011)	(0.010)	(0.005)	(0.003)
H0: CA(-1) in Floating = CA(-1) in Peg	2.35 (0.1254)		31.15*** (0.000)		2.42 (0.1199)		12.66*** (0.0004)		0.08 (0.7793)	
H0: CA(-1) + CA(-1)× CA Pos in Floating ≥ CA(-1) + CA(-1) × CA Pos in Peg	(0.740)		(0.890)		(0.689)		(0.309)		(0.167)	
Observations	2657	1959	499	250	2158	1709	1369	672	1270	532
R-squared	0.409	0.659	0.813	0.924	0.392	0.646	0.337	0.773	0.691	0.722

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year-fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1. Statistical tests are presented to compare coefficients across two different exchange rate regimes (Non-peg vs. Peg), and p-values are in parentheses.

Source: Shambaugh (2004), Klein and Shambaugh (2008), and Ilzetzki, Reinhart, and Rogoff (2016).

Table 3. CA persistence and asymmetry with more controls (Shambaugh classification, 155 countries, 1971~2014)

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.6406***	0.7695***	0.6494***	1.0603***	0.6341***	0.7534***	0.4504***	0.8281***	0.6542***	0.7654***
	(0.086)	(0.080)	(0.131)	(0.198)	(0.095)	(0.078)	(0.095)	(0.168)	(0.038)	(0.103)
CA(-1) × Pos CA	0.5280**	0.0585	0.0191	0.1128*	0.4978**	0.0980*	0.6893***	0.0345	0.2387***	-0.0165
	(0.210)	(0.052)	(0.099)	(0.054)	(0.235)	(0.059)	(0.159)	(0.084)	(0.084)	(0.096)
CA(-1) × trade openness	0.0773*	-0.0118	-0.1023	-0.1408**	0.1104***	0.0044	0.0873***	-0.0010	-0.0126	0.0390
	(0.041)	(0.049)	(0.154)	(0.059)	(0.036)	(0.050)	(0.025)	(0.057)	(0.032)	(0.031)
CA(-1) × financial openness	-0.4494***	-0.0037	0.3484***	-0.0420	-0.5152***	-0.0529	-0.4258***	-0.0572	0.1405*	-0.0196
	(0.160)	(0.082)	(0.097)	(0.211)	(0.122)	(0.089)	(0.070)	(0.136)	(0.079)	(0.118)
trade openness	-0.0017	-0.0062	0.0132**	0.0041	0.0015	-0.0063	0.0007	-0.0027	0.0011	0.0045**
	(0.006)	(0.005)	(0.006)	(0.003)	(0.006)	(0.005)	(0.005)	(0.004)	(0.003)	(0.002)
financial openness	0.0002	0.0101*	0.0133***	-0.0031	-0.0143**	0.0059	-0.0080	-0.0011	0.0027	-0.0035
	(0.006)	(0.005)	(0.004)	(0.009)	(0.007)	(0.006)	(0.009)	(0.008)	(0.003)	(0.005)
Constant	-0.0050	-0.0151**	-0.0065	-0.0150	-0.0305***	-0.0121	-0.0408***	-0.0003	-0.0295***	-0.0141**
	(0.007)	(0.008)	(0.005)	(0.009)	(0.005)	(0.009)	(0.005)	(0.010)	(0.002)	(0.007)
Observations	2499	2015	481	236	2018	1779	1300	783	1215	625
R-squared	0.604	0.513	0.819	0.934	0.600	0.501	0.666	0.463	0.686	0.718

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.

Source: Shambaugh (2004), Klein and Shambaugh (2008)

Table 4. Robustness 1: Ilzetzki, Reinhart and Rogoff's (2016) classification, 157 countries, 1971~2014

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.6369***	0.7440***	0.6576***	0.7603***	0.6282***	0.7291***	0.4418***	0.7720***	0.6748***	0.7924***
	(0.054)	(0.066)	(0.115)	(0.175)	(0.059)	(0.068)	(0.084)	(0.086)	(0.042)	(0.077)
CA(-1) × Pos CA	0.4612**	0.1680***	0.0167	0.0805	0.4497**	0.2009***	0.5736***	0.2115**	0.1047*	0.1723**
	(0.185)	(0.063)	(0.110)	(0.055)	(0.206)	(0.067)	(0.161)	(0.082)	(0.055)	(0.085)
CA(-1) × trade openness	0.1084***	-0.0277	-0.0708	-0.1420***	0.1311***	-0.0108	0.1403***	0.0419	0.0228	-0.0147
	(0.032)	(0.059)	(0.133)	(0.048)	(0.025)	(0.063)	(0.033)	(0.042)	(0.020)	(0.049)
CA(-1) × financial openness	-0.4726***	0.0305	0.3239***	0.2717	-0.5259***	-0.0141	-0.4552***	-0.1057	0.1074	-0.0183
	(0.173)	(0.091)	(0.096)	(0.192)	(0.134)	(0.099)	(0.086)	(0.071)	(0.070)	(0.091)
trade openness	-0.0053	-0.0029	0.0124**	0.0041	-0.0016	-0.0028	-0.0027	0.0011	0.0019	0.0047
	(0.007)	(0.003)	(0.006)	(0.003)	(0.007)	(0.003)	(0.007)	(0.003)	(0.003)	(0.003)
financial openness	-0.0025	0.0146***	0.0115***	0.0064	-0.0166**	0.0109*	-0.0130*	-0.0016	0.0024	-0.0040
	(0.006)	(0.005)	(0.004)	(0.005)	(0.007)	(0.005)	(0.008)	(0.005)	(0.003)	(0.005)
Constant	-0.0186**	-0.0058	-0.0207**	0.0007	-0.0316***	-0.0121	-0.0415***	-0.0065	-0.0249***	-0.0199***
	(0.009)	(0.005)	(0.008)	(0.004)	(0.004)	(0.009)	(0.005)	(0.009)	(0.005)	(0.004)
Observations	2529	1764	475	235	2054	1529	1345	644	1248	513
R-squared	0.444	0.682	0.821	0.929	0.434	0.670	0.363	0.788	0.696	0.717

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.

Source: Ilzetzki, Reinhart, and Rogoff (2018)

Table 5. Robustness 2: Excluding currency crises, 130 countries, 1971~2014

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.7830***	0.8198***	0.6553***	1.1022***	0.7411***	0.8058***	0.5420***	1.0298***	0.6320***	0.8805***
	(0.114)	(0.140)	(0.173)	(0.199)	(0.125)	(0.136)	(0.157)	(0.218)	(0.061)	(0.122)
CA(-1) × Pos CA	0.6212***	0.0445	-0.2693	0.1190**	0.5927**	0.1309	0.8021***	-0.0111	0.4149***	-0.0959
	(0.200)	(0.066)	(0.206)	(0.054)	(0.230)	(0.092)	(0.120)	(0.116)	(0.111)	(0.130)
CA(-1) × trade openness	-0.1496	-0.1085	-0.0474	-0.1458**	-0.0816	-0.0982	-0.1476	-0.1052	-0.1134	0.0187
	(0.125)	(0.106)	(0.226)	(0.059)	(0.124)	(0.113)	(0.172)	(0.146)	(0.102)	(0.051)
CA(-1) × financial openness	-0.4213***	0.0747	0.5185**	-0.0825	-0.4767***	-0.0374	-0.3189***	-0.1593	0.2265**	-0.1195
	(0.142)	(0.100)	(0.198)	(0.212)	(0.116)	(0.102)	(0.084)	(0.163)	(0.100)	(0.134)
trade openness	-0.0207**	-0.0210	0.0151**	0.0042	-0.0167*	-0.0253	-0.0177**	-0.0214	-0.0112*	-0.0031
	(0.008)	(0.013)	(0.007)	(0.003)	(0.009)	(0.016)	(0.007)	(0.021)	(0.006)	(0.007)
financial openness	0.0024	0.0046	0.0116***	-0.0046	-0.0110	-0.0068	-0.0041	-0.0109	0.0065*	-0.0086
	(0.006)	(0.007)	(0.003)	(0.010)	(0.008)	(0.007)	(0.009)	(0.010)	(0.003)	(0.007)
Constant	0.0138	0.0317*	-0.0074	-0.0339***	0.0322***	0.0365**	0.0188*	0.0381	0.0293***	0.0491***
	(0.008)	(0.018)	(0.006)	(0.006)	(0.009)	(0.017)	(0.010)	(0.025)	(0.010)	(0.008)
Observations	1816	1441	376	230	1440	1211	972	537	914	488
R-squared	0.608	0.456	0.832	0.934	0.599	0.438	0.677	0.436	0.666	0.733

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.

Source: Shambaugh (2004), Klein and Shambaugh (2008)

Table 6. Three-way interaction

Sample, Exchange rate regime	(1) All	(2) Industrial Countries	(3) Non-ind Countries	(4) Non-ind Countries excl. SSA & CSP	(5) Non-ind Countries excl. SSA & CSP & Oil exporters
CA(-1)	0.7217***	0.9312***	0.7131***	0.7429***	0.7725***
	(0.036)	(0.025)	(0.037)	(0.043)	(0.037)
CA(-1) × Float	-0.3415*	-0.1887***	-0.3557*	-0.6003***	-0.0683
	(0.203)	(0.028)	(0.201)	(0.127)	(0.065)
CA(-1) × Pos CA	0.0303	0.0316	0.0498	0.0326	0.0022
	(0.050)	(0.041)	(0.052)	(0.046)	(0.097)
CA(-1) × Float × Pos CA	0.4113*	0.1844***	0.4102*	0.7326***	0.2546***
	(0.236)	(0.052)	(0.240)	(0.124)	(0.094)
Float	-0.0132	-0.0046*	-0.0161	-0.0215***	0.0030
	(0.011)	(0.002)	(0.012)	(0.006)	(0.003)
Pos CA	0.0133***	0.0019	0.0104**	0.0097*	0.0084
	(0.004)	(0.002)	(0.005)	(0.005)	(0.006)
Float × Pos CA	0.0113	0.0030	0.0158	0.0172	-0.0101
	(0.013)	(0.003)	(0.014)	(0.011)	(0.007)
Constant	-0.0122**	0.0022	-0.0203***	-0.0207**	-0.0243***
	(0.006)	(0.005)	(0.007)	(0.009)	(0.005)
Observations	4,893	756	4,137	2,165	1,909
R-squared	0.523	0.850	0.507	0.490	0.688

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.
Source: Shambaugh (2004), Klein and Shambaugh (2008)

Table 7. Benchmark parameter values for model simulation

<u>Preferences</u>	
Risk aversion	$\sigma = 2$
Time preference	$\beta = 0.96$
Traded goods share	$\nu = 0.5$
Substitution elasticity between sectors	$\eta = 0.5$
<u>Technology</u>	
Bond holding cost	$\psi_B = 10^{-5}$
<u>Policy parameters for country 1</u>	
Exchange rate intervention rule:	
Smoothing parameter	$\chi = 0.6478$
Linear response parameter	$\xi = 0.0119$
Asymmetry parameter	$\zeta = 27.74$
Asset transfer rule	$\psi_x = 0.1101$
Capital control rule	$\psi_{\tau 1} = 2.580\times10^{-7}$
<u>Shocks</u>	
Persistence	$\rho_T = 0.84$, $\rho_N = 0.84$
Standard deviation	$\sigma_{i,T} = 0.01$ for i=1,2; $\sigma_{i,T} = 0.032$ for i = 3

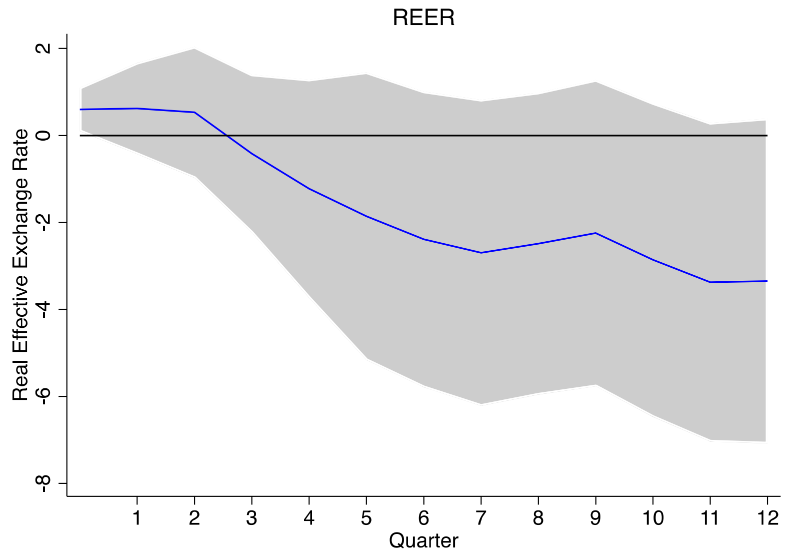
Table 8. Stochastic simulation results

Model specification	regression coefficient on interaction term (φ_2)	regression coefficient on lagged CA (φ_1)
(1) Benchmark model	0.3549	0.5579
(2) No foreign exchange intervention ($\xi = 0.0001$)	0.0319	0.6404
(3) No lag in intervention rule ($\chi = 0$)	0.0020	0.7621
(4) No rescaling of exchange rate rule ($\zeta = 1$)	0.1343	0.5356
(5) Small asset transfer ($\psi_x = 0.06$)	0.0981	0.7362
(6) Second-order approximation	0.0153	0.7330
(7) Shock to traded sector of all three countries	0.2143	0.6760
(8) Shocks to all traded and nontraded goods*	0.0992	0.7539

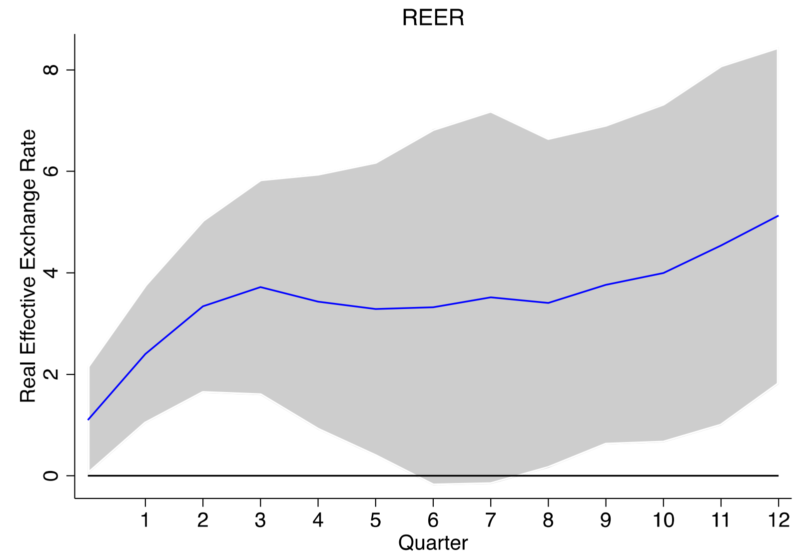
Table reports average coefficients from applying regression equation (1) to 300 replications of simulated data.
*using re-optimized parameter values: $\xi = 0.2063$, $\psi_x = 0.0615$, $\chi = 0.9433$, $\zeta = 15.56$, $\psi_\tau = 0$.

Figure 1. REER response to one-standard-deviation positive (84%) and negative (16%) CA Shocks

A. Positive CA shock (84%)



B. Negative CA shock (16%)

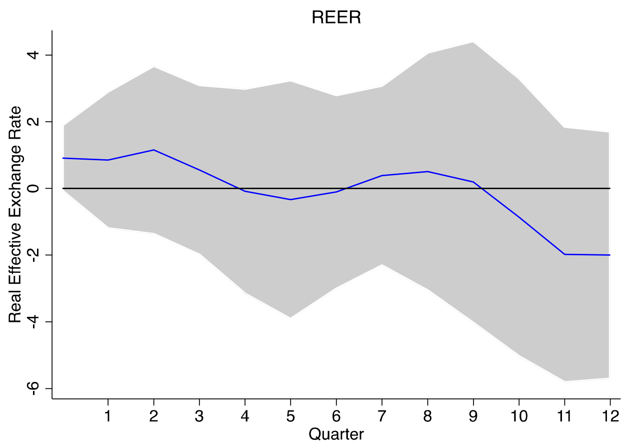


Note: We include lagged real effective exchange rate, a base country interest rate, a country's policy interest rate, a country specific time trend, country and quarter fixed effects. REER = real effective exchange rate, an increase in REER indicated home currency depreciation. Grey areas indicate 90% confidence interval.

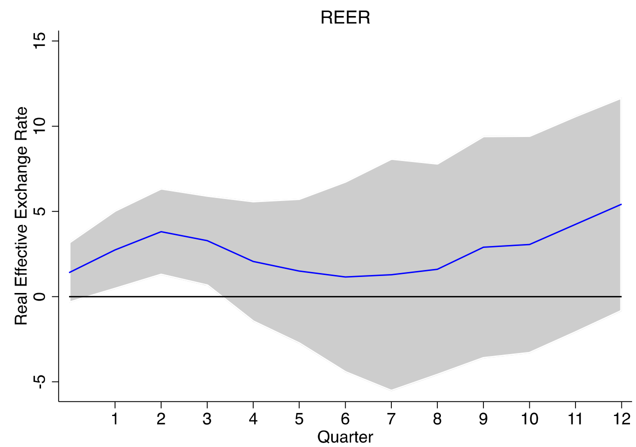
Figure 2. REER response to positive and negative CA shocks with respect to capital controls

A. KA Low countries

Positive CA shock (84%)

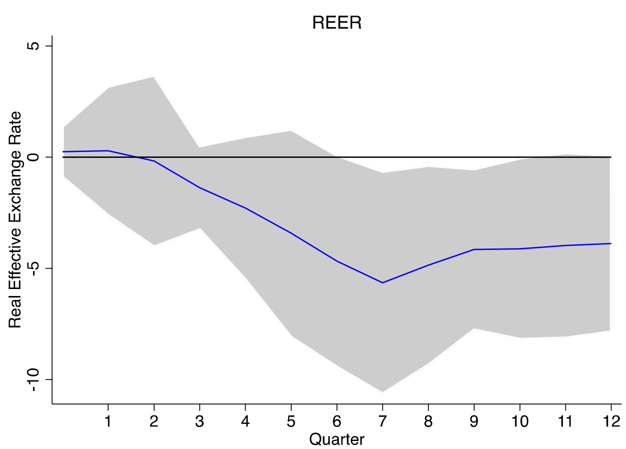


Negative CA shock (16%)

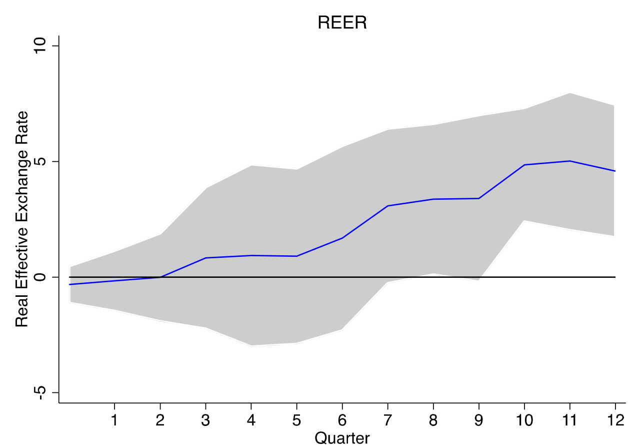


B. KA High countries

Positive CA shock (84%)

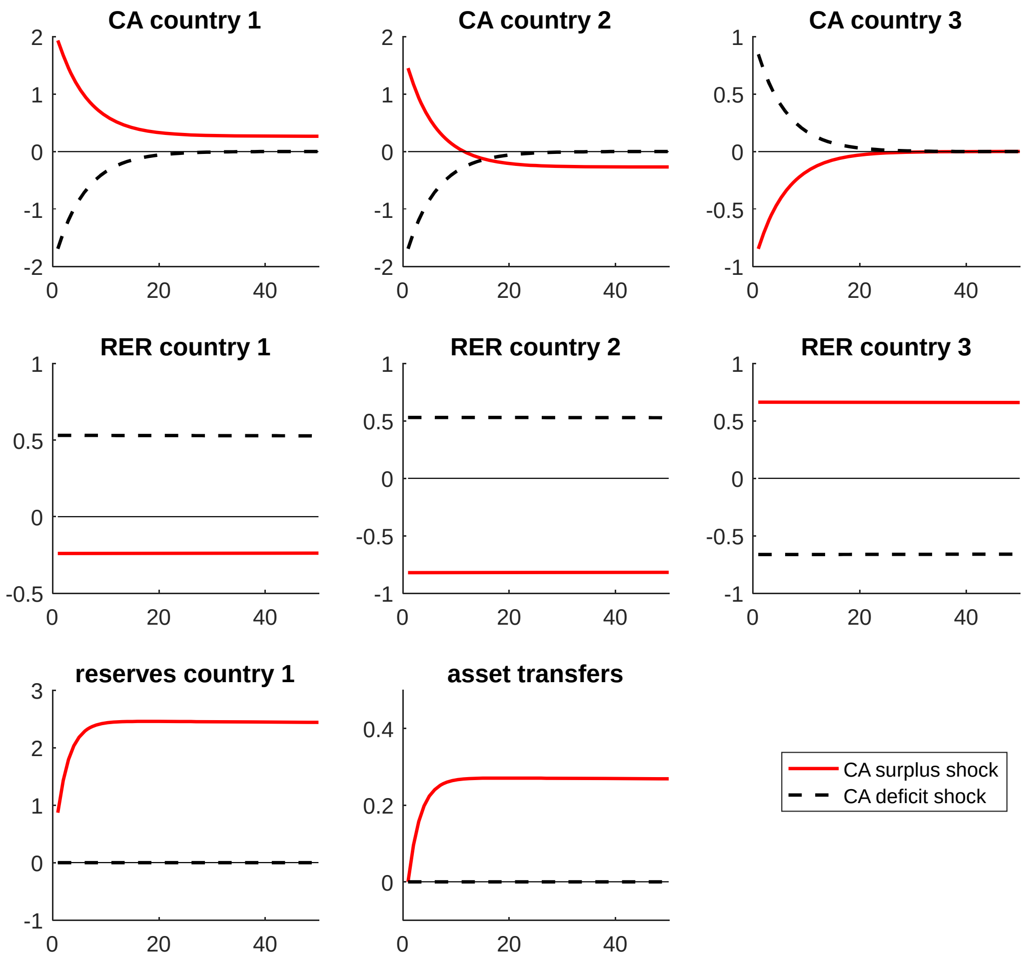


Negative CA shock (16%)



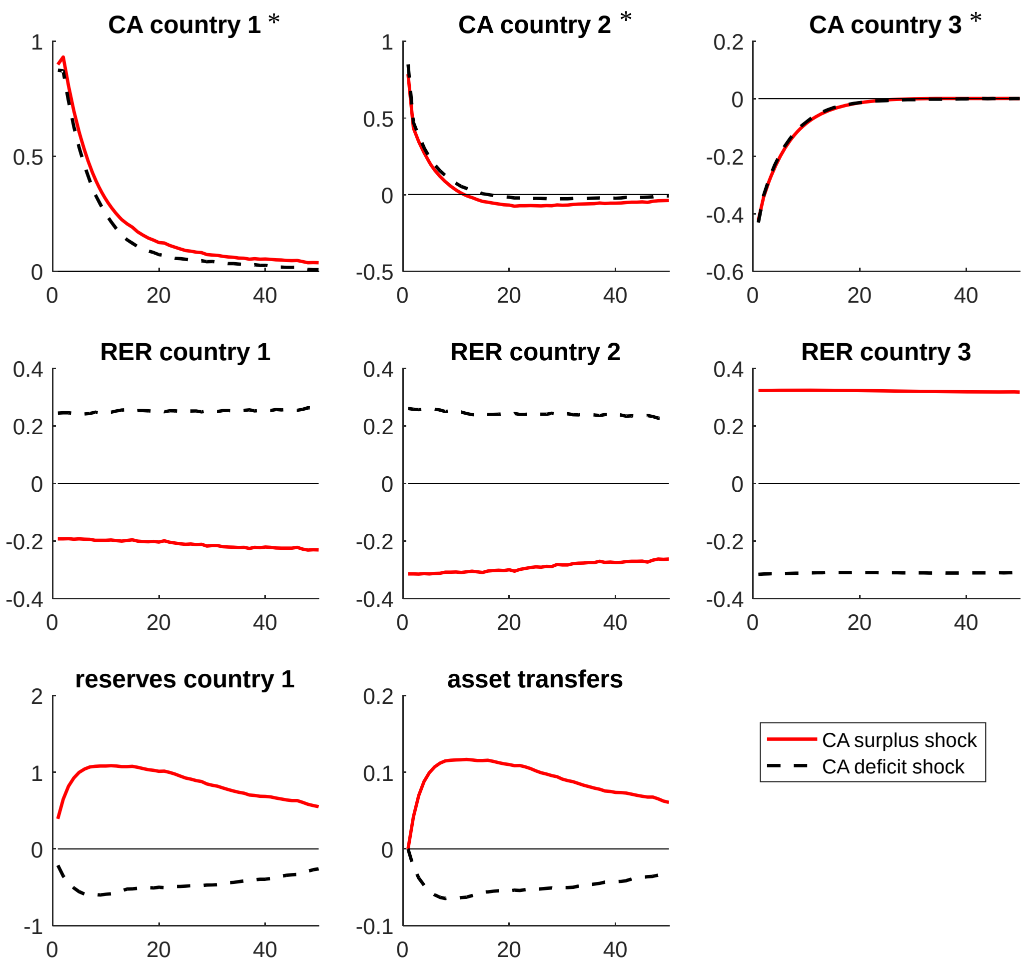
Note: We include lagged real effective exchange rate, a base country interest rate, a country's policy interest rate, a country specific time trend, country and quarter fixed effects. REER = real effective exchange rate, an increase in REER indicated currency depreciation. Grey areas indicate 90% confidence interval.

Figure 3. Impulse responses to shocks to Country 3 (RoW) endowment of traded good, first order approximation



Note: Solid (red) line shows the case of a shock lowering country 3 endowment of traded good (CA surplus shock); dashed (black) line shows the case of a shock raising the endowment (CA deficit shock). Bottom axes measure time since shock in years. Current account and other quantity variables (top row and bottom row) measured as deviations in variable as a percentage of steady-state traded endowment (multiplied by 100). Real exchange rate (middle row) measured as percent deviation from steady-state value (multiplied by 100).

Figure 4. Impulse responses to shocks to Country 3 (RoW) endowment of traded good, third-order approximation (shock of 0.5 standard deviation)



*Dashed lines showing current account have been inverted in sign, so that current account deficits in this case can be compared easily to current account surpluses in the solid line.

Note: Solid (red) line shows the case of a shock raising country 1 endowment of traded good (CA surplus shock); dashed (black) line shows the case of a shock lowering the endowment (CA deficit shock). Bottom axes measure time since shock in years. Current account and other quantity variables (top row and bottom row) measured as deviations in variable as a percentage of steady state traded endowment (multiplied by 100). Real exchange rate (middle row) measured as percent deviation from steady state value (multiplied by 100).

***** This material intended for supplementary online appendix *****

Appendix 1. Scaling of the exponential function in fear of appreciation rule

In this section, we explain the parameterization of the additional scaling parameter (ζ) in the fear of appreciation rule, equation (15). The objective is to improve the ability of a third-order approximation to the exponential function to reflect the asymmetry between positive versus negative values of its argument, that is, exchange rate depreciations versus appreciations. The exponential function, of course, assigns positive output greater than 1 for a positive argument, and values between 0 and 1 for negative arguments. The larger the scaling of the argument inside the exponential function, the closer to zero will be the output for negative arguments. However, a third-order approximation introduces a tradeoff, since the approximation of the original exponential function breaks down for larger arguments. To explore this tradeoff, we simulated the model with approximate values of policy parameters to determine the standard deviation of exchange rate fluctuations. We then considered a range of alternative values of the scaling factor modifying the exponential function (ζ), and computed, in turn, the output from the third-order approximation for both a positive and negative exchange rate deviation of one standard deviation. We found that a scaling factor of 10 maximized the difference between these two values. We used 10 as the initial value for ζ in the algorithm choosing parameter values to optimize the model's overall fit to empirical moments, as explained in section 4.6 of the text.

Appendix Table 1. Variables and data sources

Variable	Definition	Source
CA Autoregression with annual data		
Exchange Rate Regime	Peg vs Non-peg exchange rate regime classification	Shambaugh (2004), Klein and Shambaugh (2008)
CA_{it}	Current Account Balance (of GDP)	External Balance Assessment (EBA), IMF.
X'_{it}	Trade Openness (TI_{it}) = (export + import)/GDP	WDI, World Bank
	Capital Account Openness (KA_{it})	Chinn-Ito Index
Local Projection with quarterly data		
$REER_{it}$	Real Effective Exchange Rate	BIS
$CA\ Shock_{it}$	CA surplus and deficit shocks	OECD and Authors' calculation
Z_{it-l}	Policy Rates	Shambaugh (2004) and BIS

Appendix Table 2. Descriptive statistics for autoregression model

		N	Mean	SD	Min	Max	p1	p5	p25	p50	p75	p95	p99
A. All countries													
	CA		-0.025	0.077	-0.650	0.547	-0.236	-0.142	-0.059	-0.025	0.004	0.092	0.225
Floating	Trade openness	2,499	0.701	0.471	0.002	4.373	0.128	0.201	0.430	0.603	0.854	1.397	3.134
	Financial openness		0.467	0.358	0	1	0	0	0.166	0.416	0.820	1	1
	CA		-0.037	0.113	-2.405	0.567	-0.295	-0.196	-0.084	-0.039	0.012	0.122	0.261
Peg	Trade openness	2,015	0.905	0.523	0.063	4.426	0.183	0.334	0.550	0.836	1.115	1.680	3.268
	Financial openness		0.479	0.366	0	1	0	0	0.166	0.416	1	1	1
B. Industrial countries													
	CA		-0.004	0.048	-0.242	0.162	-0.137	-0.061	-0.031	-0.010	0.014	0.082	0.147
Floating	Trade openness	481	0.531	0.201	0.108	1.225	0.160	0.198	0.396	0.521	0.672	0.864	1.069
	Financial openness		0.746	0.318	0	1	0	0.166	0.416	1	1	1	1
	CA		0.001	0.051	-0.145	0.143	-0.119	-0.101	-0.022	0.008	0.031	0.085	0.116
Peg	Trade openness	236	0.812	0.359	0.339	2.020	0.399	0.430	0.548	0.685	1.031	1.579	1.894
	Financial openness		0.942	0.163	0.416	1	0.416	0.416	1	1	1	1	1
C. Non-Industrial countries													
	CA		-0.031	0.082	-0.650	0.547	-0.246	-0.153	-0.066	-0.030	0.000	0.092	0.243
Floating	Trade openness	2,018	0.742	0.507	0.002	4.373	0.126	0.210	0.454	0.632	0.920	1.522	3.250
	Financial openness		0.400	0.334	0	1	0	0	0.166	0.240	0.699	1	1
	CA		-0.042	0.118	-2.405	0.567	-0.305	-0.208	-0.089	-0.046	0.003	0.131	0.284
Peg	Trade openness	1,779	0.918	0.540	0.063	4.426	0.176	0.324	0.552	0.856	1.131	1.719	3.346
	Financial openness		0.418	0.341	0	1	0	0	0.166	0.251	0.699	1	1
D. Non-Industrial countries w/o SSA&CSP													
	CA		-0.013	0.076	-0.463	0.547	-0.168	-0.105	-0.049	-0.020	0.008	0.111	0.285
Floating	Trade openness	1,300	0.751	0.577	0.002	4.373	0.119	0.187	0.436	0.615	0.905	1.623	3.602
	Financial openness		0.401	0.326	0	1	0	0	0.166	0.251	0.699	1	1
	CA		-0.008	0.138	-2.405	0.567	-0.258	-0.142	-0.063	-0.020	0.033	0.195	0.399
Peg	trade openness	783	1.007	0.685	0.113	4.426	0.177	0.282	0.553	0.861	1.264	2.258	3.750
	Financial openness		0.604	0.373	0	1	0	0	0.166	0.699	1	1	1
E. Non-Industrial countries w/o SSA&CSP & Oil exporters													
	CA		-0.020	0.066	-0.463	0.422	-0.169	-0.106	-0.052	-0.023	0.003	0.080	0.222
Floating	Trade openness	1,215	0.761	0.592	0.002	4.373	0.115	0.180	0.423	0.627	0.908	1.645	3.605
	Financial openness		0.400	0.324	0	1	0	0	0.166	0.251	0.699	1	1
	CA		-0.031	0.076	-0.418	0.291	-0.258	-0.149	-0.067	-0.030	0.009	0.091	0.165
Peg	Trade openness	625	1.054	0.747	0.113	4.426	0.170	0.261	0.537	0.898	1.331	2.854	3.767
	Financial openness		0.562	0.375	0	1	0	0	0.166	0.477	1	1	1

Appendix Table 3. Identified CA shocks by year and annual observations (1987~2014)

Year	Number of Negative CA shocks	Number of Positive CA shocks	Number of Observations
1987	3	6	31
1988	5	7	32
1989	3	1	32
1990	1	1	32
1991	4	2	36
1992	3	0	36
1993	4	0	40
1994	0	0	40
1995	8	0	64
1996	10	3	83
1997	9	2	84
1998	9	6	88
1999	6	4	100
2000	9	8	104
2001	11	15	104
2002	8	9	112
2003	9	5	127
2004	16	13	136
2005	18	16	144
2006	27	29	152
2007	21	33	152
2008	25	28	152
2009	8	14	152
2010	17	10	152
2011	11	2	152
2012	11	8	152
2013	16	14	152
2014	9	12	152

Appendix Table 4. Number of identified CA shocks in terms of capital account openness

Country	Number of Negative CA shocks	Number of Positive CA shocks	Capital Account Openness	Reserves (excl. gold, % of GDP)	Average % change in reserves (excl. gold)
A. KA Low countries (12)					
South Africa	14	5	0.151	28.416	16.285
India	9	5	0.166	35.201	13.643
Argentina	1	3	0.167	37.913	7.426
Turkey	13	6	0.282	35.911	14.438
Brazil	13	14	0.351	43.126	13.417
South Korea	20	15	0.425	44.341	16.190
Poland	3	0	0.449	78.894	16.810
Russia	0	5	0.517	52.534	18.200
Indonesia	5	2	0.597	39.632	11.167
Costa Rica	7	0	0.770	66.504	9.331
Hungary	14	4	0.782	92.037	9.184
Israel	7	11	0.786	91.277	10.232
Average	8.8	5.8	0.454	53.816	13.027
B. KA High countries (11)		B. KA High countries (11)			
Australia	6	0	0.828	17.203	6.145
Czech Republic	15	2	0.831	67.178	12.859
Norway	6	20	0.832	40.884	5.253
Chile	7	8	0.860	63.634	9.652
Sweden	4	14	0.973	25.818	7.262
Japan	1	5	0.987	47.461	11.559
New Zealand	19	5	0.998	35.220	4.691
Germany	13	19	1.000	11.160	0.424
United Kingdom	3	10	1.000	21.220	6.932
Canada	8	7	1.000	14.450	11.032
Switzerland	8	1	1.000	68.039	11.238
Average	8.2	8.3	0.937	37.479	7.913

Note: Average annual percentage changes in reserves (excluding gold, current US$) are calculated based on the sample period from 1987 to 2014.

Appendix Table 5. Descriptive statistics for local projection model

	N	Mean	SD	Min	Max	p1	p5	p25	p50	p75	p95	p99
A. KA Low Countries												
REER	544	99.711	15.497	48.899	132.091	61.424	74.280	89.137	99.173	111.591	123.313	130.399
CA/GDP (%)		-0.394	3.460	-9.281	11.681	-7.256	-5.702	-2.963	-0.528	1.652	5.537	9.986
Policy Rate		9.775	5.990	0.25	44	0.75	2.417	5.75	8.25	12.75	19.667	30.667
Policy Rate (base country)		2.365	2.373	0.125	9.708	0.125	0.125	0.125	1.5	5	6.333	8.25
B. KA High Countries												
REER	404	93.616	15.527	69.035	141.185	70.689	72.876	81.331	92.177	100.319	126.054	136.088
CA/GDP (%)		-2.225	3.089	-8.961	7.561	-7.596	-6.600	-4.240	-3.029	0.307	3.096	4.701
Policy Rate		5.175	3.605	0.05	18.117	0.05	0.25	2.583	4.917	6.633	13.017	16.83
Policy Rate (base country)		4.003	3.239	0.125	18.117	0.125	0.125	1	4.583	5.5	8.833	15.817

Note: The mean and standard deviations of two groups of countries are reported

Appendix Table 6. Panel OLS without year fixed effects

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.6488***	0.7643***	0.6643***	1.2368***	0.6459***	0.7529***	0.4672***	0.8554***	0.6567***	0.7477***
	(0.084)	(0.080)	(0.110)	(0.366)	(0.091)	(0.080)	(0.096)	(0.177)	(0.035)	(0.102)
CA(-1) × Pos CA	0.4965**	0.0577	-0.0538	0.0224	0.4678*	0.0933	0.6622***	0.0585	0.2274**	0.0293
	(0.212)	(0.050)	(0.077)	(0.057)	(0.236)	(0.058)	(0.162)	(0.074)	(0.087)	(0.099)
CA(-1) × trade openness	0.0822**	-0.0118	-0.1121	-0.0575	0.1147***	0.0008	0.0931***	0.0067	-0.0076	0.0425
	(0.041)	(0.049)	(0.138)	(0.054)	(0.037)	(0.051)	(0.024)	(0.059)	(0.031)	(0.026)
CA(-1) × financial openness	-0.4561***	-0.0001	0.3827***	-0.2632	-0.5271***	-0.0466	-0.4449***	-0.1386	0.1275	-0.0287
	(0.159)	(0.081)	(0.070)	(0.374)	(0.120)	(0.087)	(0.064)	(0.168)	(0.078)	(0.104)
trade openness	-0.0023	-0.0050	0.0104	0.0073**	0.0016	-0.0048	0.0008	-0.0013	0.0012	0.0036*
	(0.006)	(0.005)	(0.007)	(0.003)	(0.006)	(0.005)	(0.005)	(0.004)	(0.003)	(0.002)
financial openness	-0.0019	0.0108**	0.0114***	-0.0004	-0.0161**	0.0058	-0.0084	-0.0025	0.0035	-0.0037
	(0.006)	(0.005)	(0.003)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.002)	(0.005)
Constant	-0.0154***	-0.0121**	-0.0141***	-0.0048	-0.0151***	-0.0122**	-0.0166***	-0.0039	-0.0097***	-0.0103***
	(0.005)	(0.005)	(0.004)	(0.006)	(0.005)	(0.006)	(0.004)	(0.006)	(0.002)	(0.003)
Observations	2499	2015	481	236	2018	1779	1300	783	1215	625
R-squared	0.589	0.492	0.798	0.902	0.582	0.475	0.644	0.387	0.659	0.690

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Country and year fixed effects are NOT included. Pos CA indicate CA>0 dummy at t-1.

Source: Shambaugh (2004), Klein and Shambaugh (2008)

Appendix Table 7. Including country and year fixed effects, 155 countries, 1971~2014

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.5443***	0.6171***	0.6798**	1.2089***	0.5470***	0.6120***	0.5324***	0.6770***	0.5932***	0.5661***
	(0.064)	(0.138)	(0.313)	(0.117)	(0.067)	(0.139)	(0.064)	(0.210)	(0.061)	(0.135)
CA(-1) × Pos CA	0.2708***	0.2249*	-0.0600	0.1579	0.1905*	0.2355*	0.2625***	0.2505**	0.2810***	0.1921
	(0.100)	(0.121)	(0.170)	(0.105)	(0.101)	(0.123)	(0.067)	(0.124)	(0.075)	(0.225)
CA(-1) × trade openness	0.1032**	-0.0144	-0.1990	-0.2350**	0.1346***	-0.0070	0.1394***	-0.0388	0.0053	0.0407
	(0.044)	(0.110)	(0.386)	(0.095)	(0.042)	(0.112)	(0.026)	(0.132)	(0.031)	(0.044)
CA(-1) × financial openness	-0.4679***	-0.0351	0.3252	-0.2322*	-0.5136***	-0.0563	-0.5559***	-0.0406	-0.0319	0.0456
	(0.110)	(0.100)	(0.189)	(0.114)	(0.101)	(0.103)	(0.060)	(0.183)	(0.090)	(0.163)
trade openness	-0.0061	-0.0383	0.0542**	0.0258	-0.0068	-0.0392	-0.0001	-0.0657	-0.0073	-0.0260**
	(0.013)	(0.033)	(0.019)	(0.031)	(0.013)	(0.034)	(0.017)	(0.051)	(0.017)	(0.012)
financial openness	-0.0085	-0.0055	0.0165	-0.0080	-0.0144*	-0.0082	-0.0126**	-0.0264	-0.0004	-0.0046
	(0.007)	(0.009)	(0.010)	(0.008)	(0.007)	(0.010)	(0.006)	(0.018)	(0.005)	(0.011)
Constant	-0.0121	0.0528	-0.0152	-0.0315	-0.0130	0.1180	-0.0258	0.2229	-0.0153	0.0090
	(0.009)	(0.037)	(0.009)	(0.021)	(0.021)	(0.094)	(0.029)	(0.146)	(0.028)	(0.027)
Observations	2499	2015	481	236	2018	1779	1300	783	1215	625
R-squared	0.699	0.543	0.832	0.940	0.697	0.530	0.744	0.491	0.707	0.752

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Country and year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.

Source: Shambaugh (2004), Klein and Shambaugh (2008)

Appendix Table 8. Robustness: Including the interaction term of CA and currency crisis

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.7314***	0.8228***	0.7258***	1.1022***	0.7015***	0.8096***	0.5789***	0.9158***	0.6846***	0.8282***
	(0.131)	(0.120)	(0.142)	(0.199)	(0.138)	(0.115)	(0.138)	(0.191)	(0.050)	(0.112)
CA(-1) × Pos CA	0.5628***	0.0198	-0.0482	0.1190**	0.5287**	0.0977	0.7371***	0.0216	0.2780***	-0.0602
	(0.212)	(0.064)	(0.114)	(0.054)	(0.240)	(0.090)	(0.150)	(0.114)	(0.093)	(0.121)
CA(-1) × trade	-0.0485	-0.0919	-0.0500	-0.1458**	0.0119	-0.0814	-0.1176	-0.0800	-0.0665	0.0238
openness	(0.126)	(0.094)	(0.191)	(0.059)	(0.122)	(0.100)	(0.125)	(0.135)	(0.073)	(0.044)
CA(-1) × financial	-0.4435***	0.0685	0.2704*	-0.0825	-0.5069***	-0.0355	-0.3722***	-0.0859	0.1363	-0.0667
openness	(0.148)	(0.089)	(0.137)	(0.212)	(0.116)	(0.092)	(0.078)	(0.145)	(0.086)	(0.127)
CA(-1) × currency	0.0169	-0.2211*	-0.2904*	--	0.0588	-0.2047	0.0002	-0.1683	-0.1612*	-0.0473
crisis(-1)	(0.106)	(0.119)	(0.149)		(0.106)	(0.127)	(0.127)	(0.327)	(0.081)	(0.362)
trade openness	-0.0162**	-0.0178	0.0154**	0.0042	-0.0123	-0.0214	-0.0108	-0.0202	-0.0032	-0.0033
	(0.008)	(0.012)	(0.006)	(0.003)	(0.008)	(0.014)	(0.007)	(0.019)	(0.005)	(0.006)
financial openness	0.0012	0.0043	0.0141***	-0.0046	-0.0120	-0.0065	-0.0059	-0.0111	0.0028	-0.0052
	(0.006)	(0.006)	(0.003)	(0.010)	(0.008)	(0.007)	(0.008)	(0.010)	(0.003)	(0.006)
currency crisis(-1)	0.0082	-0.0044	-0.0009	--	0.0094	-0.0051	0.0121*	-0.0016	0.0050	-0.0189
	(0.006)	(0.018)	(0.010)		(0.006)	(0.018)	(0.007)	(0.020)	(0.006)	(0.018)
Constant	0.0127	0.0308*	-0.0108*	-0.0339***	0.0301***	0.0352**	0.0190**	0.0350	0.0304***	0.0456***
	(0.008)	(0.017)	(0.005)	(0.006)	(0.010)	(0.016)	(0.009)	(0.024)	(0.010)	(0.008)
Observations	2244	1573	413	230	1831	1343	1217	592	1134	530
R-squared	0.591	0.460	0.824	0.934	0.581	0.442	0.637	0.412	0.628	0.726

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.

Source: Shambaugh (2004), Klein and Shambaugh (2008). For currency crisis dummy, we use the currency crisis event from Laeven and Valencia (2020)

Appendix Table 9. Simple regression with LYS classification, 154 countries, 1974~2013

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CA(-1)	0.7805***	0.7514***	0.8384***	1.1569***	0.7567***	0.7408***	0.6982***	0.7763***	0.6964***	0.8034***
	(0.042)	(0.038)	(0.045)	(0.097)	(0.047)	(0.038)	(0.053)	(0.055)	(0.056)	(0.055)
CA(-1) × CA Pos	0.1051	0.0619	0.2135***	-0.2617**	0.1083	0.0713	0.2012**	0.1457*	0.2108*	0.1121
	(0.065)	(0.072)	(0.071)	(0.118)	(0.079)	(0.074)	(0.082)	(0.083)	(0.110)	(0.096)
Constant	-0.0197***	0.1145	-0.0141**	0.0151***	-0.0315***	0.1145	-0.0325***	0.2624***	-0.0325***	0.0011
	(0.006)	(0.088)	(0.006)	(0.003)	(0.010)	(0.088)	(0.010)	(0.067)	(0.010)	(0.004)
H0: CA(-1) in Floating = CA(-1) in Peg	0.22		-		0.06		0.83		-	
	(0.6404)		-		(0.8121)		(0.3631)		-	
Observations	2200	1885	513	117	1687	1768	1226	622	1166	492
R-squared	0.654	0.640	0.869	0.868	0.620	0.633	0.684	0.761	0.641	0.747

Note: Note: : Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1. Statistical tests are presented to compare coefficients across two different exchange rate regimes (Non-peg vs. Peg) and p-values are in parentheses.

Source: LYS (2016)

Appendix Table 10. Full regression with LYS classification, 154 countries, 1974~2013

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.6786***	0.6992***	0.6339***	1.4369***	0.6772***	0.6922***	0.6142***	0.6662***	0.6103***	0.7852***
	(0.067)	(0.056)	(0.054)	(0.354)	(0.074)	(0.056)	(0.068)	(0.123)	(0.074)	(0.123)
CA(-1) × Pos CA	0.0804	0.1307**	0.1258**	-0.3974	0.0903	0.1428**	0.1831**	0.1779	0.1784	-0.0009
	(0.069)	(0.063)	(0.060)	(0.231)	(0.084)	(0.064)	(0.082)	(0.109)	(0.150)	(0.109)
CA(-1) × trade openness	-0.0013	0.0254	0.0027	-0.8914**	0.0123	0.0338	0.0178	0.0489	0.0017	0.0672*
	(0.024)	(0.036)	(0.051)	(0.344)	(0.028)	(0.037)	(0.027)	(0.031)	(0.035)	(0.033)
CA(-1) × financial openness	0.1862**	0.0329	0.2621***	0.5197	0.1301	0.0076	0.1180	0.0394	0.1704	-0.0917
	(0.083)	(0.074)	(0.052)	(0.295)	(0.106)	(0.077)	(0.089)	(0.102)	(0.111)	(0.129)
trade openness	0.0003	-0.0015	0.0072**	-0.0013	0.0005	-0.0006	-0.0004	0.0013	-0.0003	0.0084**
	(0.002)	(0.003)	(0.003)	(0.012)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)
financial openness	0.0075**	0.0137***	0.0108**	0.0215	0.0027	0.0106**	-0.0009	-0.0083*	0.0042	-0.0166***
	(0.003)	(0.005)	(0.005)	(0.018)	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)	(0.006)
Constant	-0.0259***	0.1529	-0.0249***	0.0065	-0.0406***	0.1551	-0.0404***	0.2692***	-0.0417***	0.0007
	(0.006)	(0.097)	(0.007)	(0.011)	(0.010)	(0.098)	(0.010)	(0.068)	(0.010)	(0.006)
Observations	2093	1696	476	116	1617	1580	1189	598	1131	475
R-squared	0.674	0.662	0.871	0.890	0.646	0.654	0.688	0.765	0.647	0.749

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.

Source: LYS (2016)

Appendix Table 11. Table 2 with CA positive dummy

Panel A. Shambaugh classification, 155 countries, 1971~2014

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.3740*	0.7319***	0.7346***	0.9192***	0.3499*	0.7226***	0.1401	0.7558***	0.7007***	0.7788***
	(0.201)	(0.036)	(0.020)	(0.021)	(0.198)	(0.036)	(0.120)	(0.047)	(0.047)	(0.035)
CA(-1) × CA Pos	0.4452*	0.0197	0.2391***	0.0182	0.4640*	0.0403	0.7662***	0.0201	0.2559***	-0.0225
	(0.244)	(0.049)	(0.051)	(0.042)	(0.252)	(0.050)	(0.120)	(0.052)	(0.071)	(0.098)
CA Pos	0.0253**	0.0128***	0.0044*	0.0048**	0.0267**	0.0102**	0.0268***	0.0111**	-0.0020	0.0103*
	(0.011)	(0.004)	(0.002)	(0.002)	(0.011)	(0.005)	(0.007)	(0.005)	(0.002)	(0.006)
Constant	-0.0231**	-0.0166**	0.0019	-0.0206***	-0.0462***	-0.0135	-0.0579***	-0.0045	-0.0268***	-0.0130***
	(0.012)	(0.007)	(0.004)	(0.002)	(0.011)	(0.009)	(0.008)	(0.008)	(0.003)	(0.003)
H0: CA(-1) in Floating = CA(-1) in Peg	3.04* (0.0813)		51.34*** (0.0000)		3.39* (0.0655)		21.47*** (0.0000)		1.59 (0.2070)	
H0: CA(-1) + CA(-1)× CA Pos in Floating ≥ CA(-1) + CA(-1) × CA Pos in Peg	(0.794)		(0.771)		(0.716)		(0.999)		(0.996)	
Observations	2,661	2,232	500	256	2,161	1,976	1,356	809	1,268	641
R-squared	0.537	0.528	0.810	0.928	0.520	0.515	0.643	0.470	0.676	0.725

Panel B. Ilzetzki, Reinhart and Rogoff's (2018) classification, 157 countries, 1971~2014

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
CA(-1)	0.3986**	0.7124***	0.7499***	0.9280***	0.3752*	0.7007***	0.1695	0.7215***	0.7540***	0.7486***
	(0.199)	(0.043)	(0.019)	(0.029)	(0.196)	(0.044)	(0.138)	(0.050)	(0.029)	(0.048)
CA(-1) × CA Pos	0.3837**	0.1119	0.2323***	-0.0037	0.4048**	0.1410*	0.6182***	0.1796**	0.1382**	0.1625**
	(0.173)	(0.069)	(0.050)	(0.045)	(0.178)	(0.072)	(0.111)	(0.077)	(0.065)	(0.069)
CA Pos	0.0260**	0.0101**	0.0034	0.0046*	0.0275**	0.0066	0.0287***	0.0107*	0.0000	0.0077
	(0.011)	(0.004)	(0.002)	(0.002)	(0.012)	(0.005)	(0.007)	(0.006)	(0.002)	(0.005)
Constant	-0.0395***	-0.0041	-0.0080	0.0023	-0.0477***	-0.0093	-0.0588***	-0.0085	-0.0213***	-0.0208***
	(0.013)	(0.005)	(0.009)	(0.005)	(0.013)	(0.011)	(0.010)	(0.011)	(0.005)	(0.003)
H0: CA(-1) in Floating = CA(-1) in Peg	2.43 (0.1190)		33.04*** (0.000)		2.69* (0.10)		14.37*** (0.0001)		0.01 (0.9164)	
H0: CA(-1) + CA(-1)× CA Pos in Floating ≥ CA(-1) + CA(-1) × CA Pos in Peg	(0.325)		(0.931)		(0.246)		(0.110)		(0.385)	
Observations	2,657	1,959	499	250	2,158	1,709	1,369	672	1,270	532
R-squared	0.419	0.660	0.814	0.925	0.402	0.646	0.349	0.774	0.691	0.722

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year-fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1. Statistical tests are presented to compare coefficients across two different exchange rate regimes (Non-peg vs. Peg), and p-values are in parentheses.

Source: Shambaugh (2004), Klein and Shambaugh (2008) , and Ilzetzki, Reinhart, and Rogoff (2016).

Appendix Table 12. CA positive dummy with more controls (Shambaugh classification, 155 countries, 1971~2014)

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.5707***	0.7272***	0.6198***	0.9885***	0.5787***	0.7189***	0.3672***	0.7593***	0.6633***	0.7204***
	(0.101)	(0.086)	(0.138)	(0.180)	(0.107)	(0.087)	(0.107)	(0.193)	(0.038)	(0.120)
CA(-1) × Pos CA	0.4696**	0.0464	0.0180	0.1112**	0.4561*	0.0777	0.6636***	0.0484	0.2419***	-0.0394
	(0.210)	(0.054)	(0.096)	(0.052)	(0.238)	(0.063)	(0.155)	(0.084)	(0.085)	(0.101)
CA(-1) × trade openness	0.0937**	-0.0050	-0.0767	-0.1401*	0.1172***	0.0067	0.0907***	0.0037	-0.0157	0.0463
	(0.038)	(0.051)	(0.159)	(0.066)	(0.036)	(0.051)	(0.026)	(0.059)	(0.033)	(0.034)
CA(-1) × financial openness	-0.4167***	-0.0074	0.3479***	0.0003	-0.4779***	-0.0431	-0.3583***	-0.0335	0.1446*	-0.0172
	(0.135)	(0.079)	(0.099)	(0.196)	(0.109)	(0.089)	(0.072)	(0.143)	(0.081)	(0.119)
Pos CA	0.0190***	0.0137***	0.0018	0.0043*	0.0156***	0.0122**	0.0178***	0.0116*	-0.0019	0.0108
	(0.005)	(0.004)	(0.002)	(0.002)	(0.005)	(0.006)	(0.005)	(0.007)	(0.003)	(0.006)
trade openness	-0.0026	-0.0071	0.0128**	0.0033	0.0005	-0.0074	-0.0008	-0.0036	0.0011	0.0038*
	(0.006)	(0.005)	(0.006)	(0.003)	(0.006)	(0.005)	(0.005)	(0.004)	(0.003)	(0.002)
financial openness	-0.0001	0.0095**	0.0131***	-0.0053	-0.0128*	0.0070	-0.0063	-0.0002	0.0029	-0.0024
	(0.005)	(0.005)	(0.004)	(0.009)	(0.007)	(0.006)	(0.008)	(0.008)	(0.003)	(0.005)
Constant	-0.0159**	-0.0193**	-0.0076	-0.0167*	-0.0329***	-0.0137	-0.0445***	-0.0030	-0.0291***	-0.0176**
	(0.007)	(0.009)	(0.005)	(0.008)	(0.005)	(0.009)	(0.006)	(0.011)	(0.003)	(0.008)
Observations	2,499	2,015	481	236	2,018	1,779	1,300	783	1,215	625
R-squared	0.611	0.515	0.819	0.935	0.603	0.502	0.672	0.464	0.686	0.721

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.

Source: Shambaugh (2004), Klein and Shambaugh (2008)

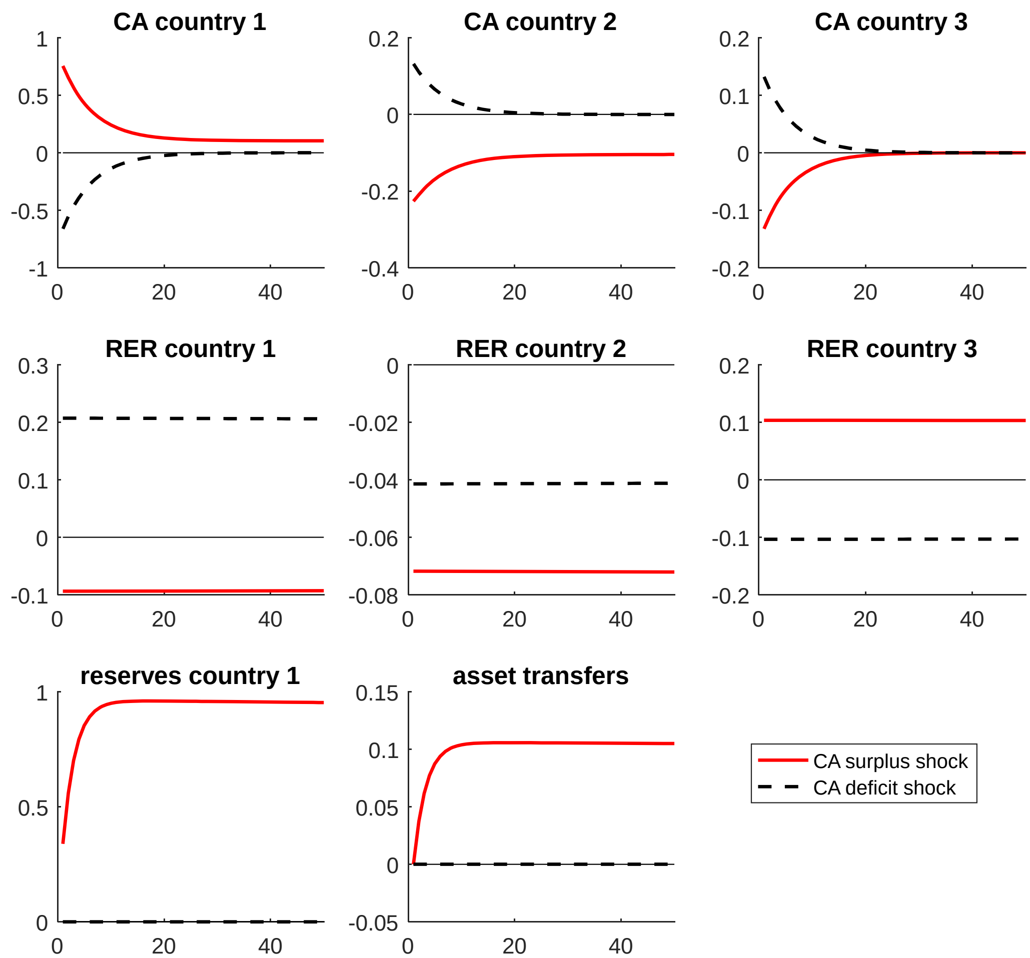
Appendix Table 13. CA positive dummy with more controls (Ilzetzki, Reinhart and Rogoff, 2016, 157 countries, 1971~2014)

Sample, Exchange rate regime	(1) All, Floating	(2) All, Peg	(3) Industrial Countries, Floating	(4) Industrial Countries, Peg	(5) Non-ind Countries, Floating	(6) Non-ind Countries, Peg	(7) Non-ind Countries excl. SSA & CSP, Floating	(8) Non-ind Countries excl. SSA & CSP, Peg	(9) Non-ind Countries excl. SSA & CSP & Oil exporter, Floating	(10) Non-ind Countries excl. SSA & CSP & Oil exporter, Peg
CA(-1)	0.5571***	0.7271***	0.6244***	0.7222***	0.5652***	0.7191***	0.3445***	0.7373***	0.6590***	0.7770***
	(0.064)	(0.071)	(0.122)	(0.184)	(0.064)	(0.073)	(0.080)	(0.095)	(0.047)	(0.081)
CA(-1) × Pos CA	0.4027**	0.1602**	0.0161	0.0699	0.4037*	0.1921***	0.5487***	0.2178**	0.1012*	0.1532*
	(0.188)	(0.068)	(0.106)	(0.055)	(0.212)	(0.072)	(0.156)	(0.087)	(0.060)	(0.085)
CA(-1) × trade openness	0.1219***	-0.0266	-0.0428	-0.1383**	0.1372***	-0.0120	0.1429***	0.0373	0.0269	-0.0135
	(0.027)	(0.060)	(0.139)	(0.054)	(0.023)	(0.063)	(0.034)	(0.043)	(0.024)	(0.051)
CA(-1) × financial openness	-0.4295***	0.0250	0.3239***	0.2862	-0.4815***	-0.0119	-0.3744***	-0.1020	0.1044	-0.0259
	(0.146)	(0.092)	(0.099)	(0.200)	(0.123)	(0.100)	(0.079)	(0.069)	(0.073)	(0.085)
Pos CA	0.0212***	0.0071	0.0020	0.0034	0.0176***	0.0048	0.0184***	0.0104	0.0029	0.0070
	(0.004)	(0.005)	(0.002)	(0.002)	(0.004)	(0.005)	(0.004)	(0.007)	(0.003)	(0.006)
trade openness	-0.0058	-0.0037	0.0121**	0.0036	-0.0025	-0.0034	-0.0040	0.0002	0.0019	0.0040
	(0.007)	(0.003)	(0.005)	(0.003)	(0.007)	(0.004)	(0.007)	(0.004)	(0.003)	(0.003)
financial openness	-0.0015	0.0138***	0.0114***	0.0042	-0.0138**	0.0110**	-0.0104	-0.0015	0.0024	-0.0041
	(0.005)	(0.005)	(0.003)	(0.005)	(0.007)	(0.005)	(0.007)	(0.005)	(0.003)	(0.005)
Constant	-0.0294***	-0.0088	-0.0223**	-0.0002	-0.0349***	-0.0122	-0.0461***	-0.0076	-0.0258***	-0.0207***
	(0.007)	(0.005)	(0.008)	(0.004)	(0.004)	(0.009)	(0.006)	(0.010)	(0.005)	(0.004)
Observations	2,529	1,764	475	235	2,054	1,529	1,345	644	1,248	513
R-squared	0.450	0.683	0.821	0.929	0.437	0.670	0.367	0.789	0.696	0.718

Note: Clustered robust standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.

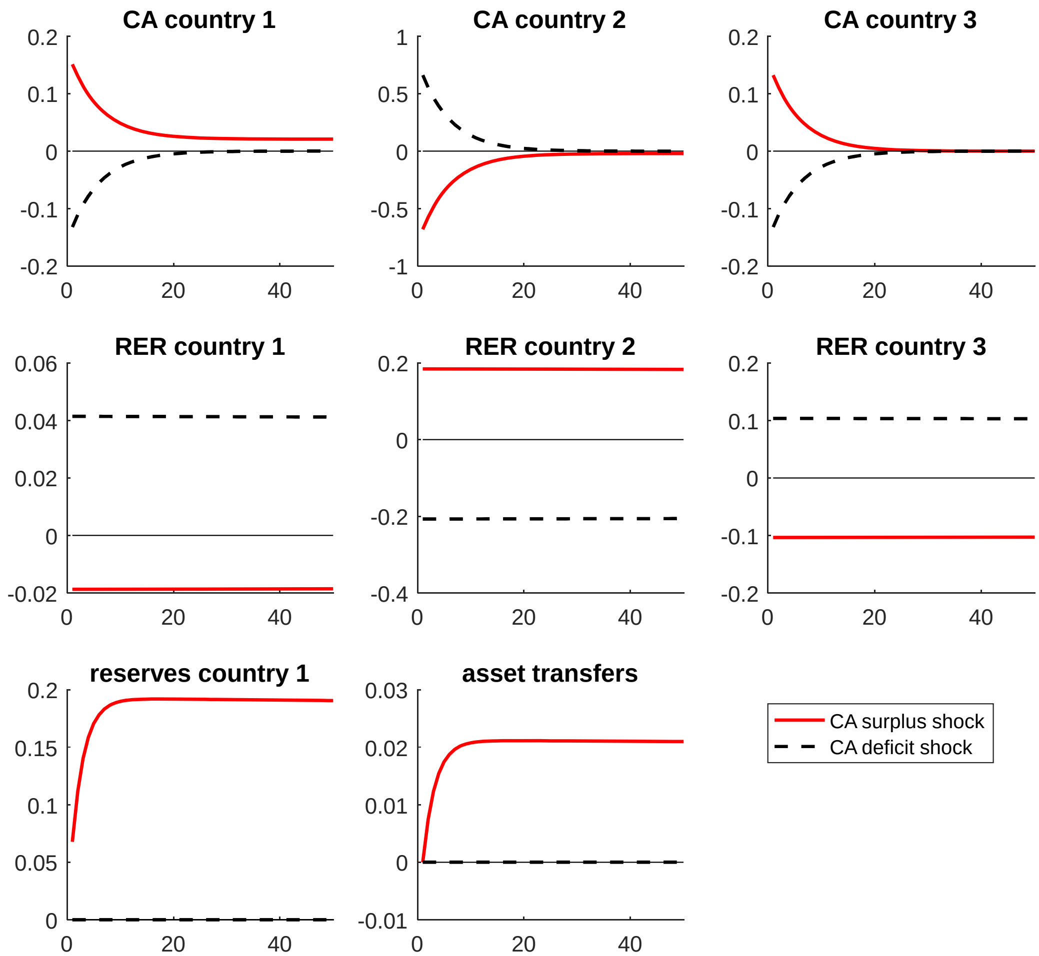
Source: Ilzetzki, Reinhart, and Rogoff (2018)

Appendix Figure 1. Impulse responses for shocks to country 1 endowment of traded good, first order approximation



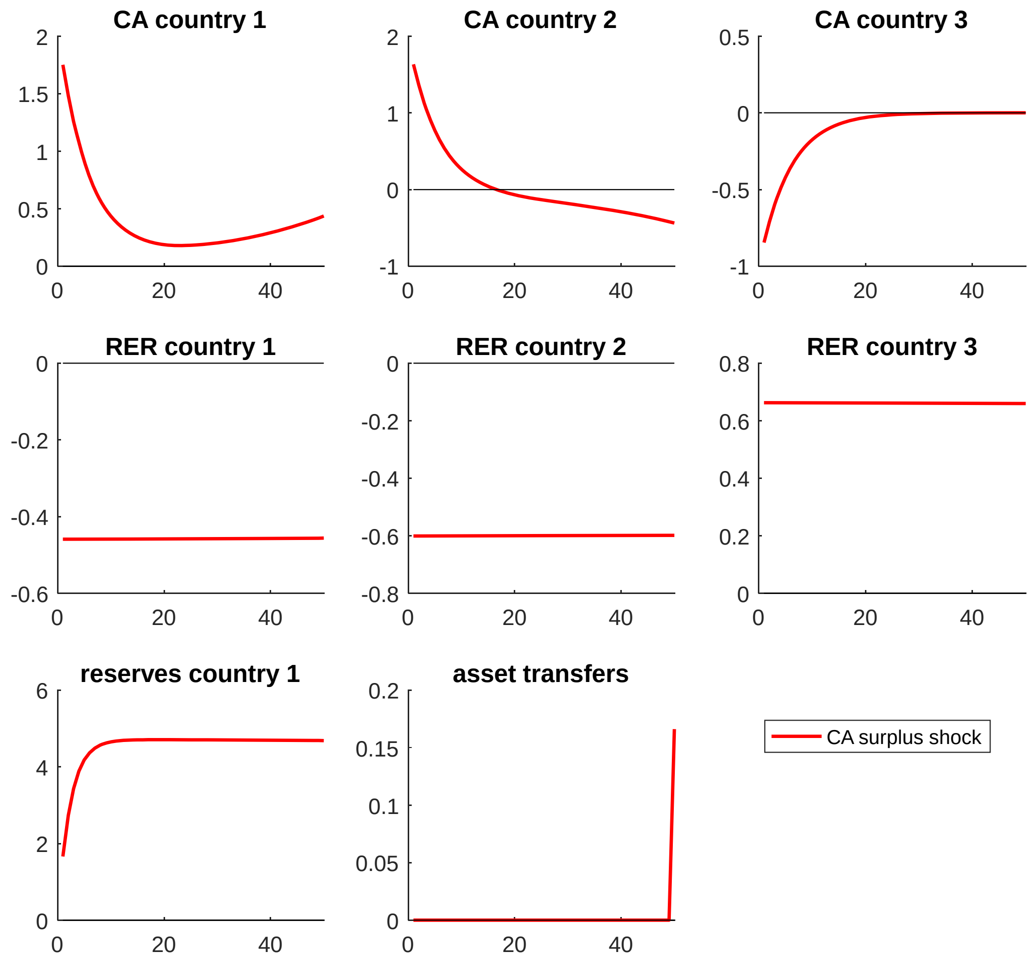
Note: Solid (red) line shows case of a shock raising country 1 endowment of traded good (CA surplus shock); dashed (black) line shows case of a shock lowering the endowment (CA deficit shock). Bottom axes measure time since shock in years. Current account and other quantity variables (top row and bottom row) measured as deviations in variable as a percentage of steady state traded endowment (multiplied by 100). Real exchange rate (middle row) measured as percent deviation from steady state value multiplied by 100).

Appendix Figure 2. Impulse responses for shocks to country 2 endowment of traded good, first order approximation



Note: Solid (red) line shows case of a shock lowering country 2 endowment of traded good (CA surplus shock); dashed (black) line shows case of a shock raising the endowment (CA deficit shock). Bottom axes measure time since shock in years. Current account and other quantity variables (top row and bottom row) measured as deviations in variable as a percentage of steady state traded endowment (multiplied by 100). Real exchange rate (middle row) measured as percent deviation from steady state value (multiplied by 100).

Appendix Figure 3. Impulse responses for shocks to country 3 endowment of traded good, first order approximation, with delayed asset transfer rule



Note: Asset transfer rule specifies transfers begin in period 49 rather than period 2. Bottom axes measure time since shock in years. Current account and other quantity variables (top row and bottom row) measured as deviations in variable as a percentage of steady state traded endowment (multiplied by 100). Real exchange rate (middle row) measured as percent deviation from steady state value multiplied by 100).