Fear of Appreciation and Current Account Adjustment

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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 about 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 this asymmetry is associated with a one-sided muting of exchange rate appreciations. A multi-country DSGE model embodying fear of appreciation can explain greater persistence of current account surpluses.

Keywords: Current account, Exchange rate regime, Local projection, Fear of appreciation
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1. Introduction

Do flexible exchange rates help facilitate the 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 counties 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 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 strong

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

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 exchange rates have significantly faster current account convergence than countries with pegs; in contrast, for cases of current account surpluses, the speeds of convergence are the same for floaters and peggers. For our full sample and benchmark specification, the half-life of current account adjustment rises five-fold from 0.70 years for the case of current account deficits to 3.48 years for surpluses.

Our second empirical analysis studies the role of exchange rate dynamics in the asymmetric adjustment of current account by estimating the joint dynamics of the exchange rate and current account in response to a current account shock 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 are classified as having low levels of capital account openness. These empirical findings help guide our theoretical exploration.

We develop a three-country dynamic stochastic general equilibrium model to explore how fear of appreciation and limited capital account openness could explain slower adjustment in current account surpluses compared to deficits. A key feature is that the model embodies an asymmetric response to exchange rate appreciations and depreciations. We believe this is the first application of fear of appreciation to a multi-country setting. Stochastic simulations of the parameterized model are able to reproduce the empirical findings, and indicate that essential ingredients include some degree of capital control and a willingness by a government to accumulate and hold foreign reserves for an extended period. The model also makes clear that, even though, at the aggregate world level, total current account surpluses must equal current account deficits at any point in time, it is entirely possible in a multi-country setting for the dynamics of current account deficits to differ from that of surpluses on average.

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 that 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 consensus and provide mixed findings.

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 different 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

[2] They argue that nominal exchange regime does not guarantee change in "real" exchange rate to promote current account adjustment.
[3] Hermann (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 and focuses more on closure of the current account gap depending on exchange rate flexibility.

(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 formal 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 significantly 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 (Hermann 2009), or distinguishing between the many bilateral exchange rate pairings of a country (Ghosh *et al*. 2013). Adding to this list, our findings indicate 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

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[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 deprecation 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

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 (Levey-Yeyati *et al*., 2013). While there is 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. In 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

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.

[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.

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) 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.

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[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/

For robustness, we also report full results when using the exchange regime classification from Ilzetzki, Reinhardt, 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 fluctuated outside a 5% band. The narrative account comes from a variety of sources, including central bank minutes, reports, and statements; the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions, etc. In the appendix, we also 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 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.

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[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.
[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

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, we run a panel regression to examine differences in current account adjustment by (*de facto*) exchange rate regime. Second, we use 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:

$$CA_{it} = \varphi_0 + \varphi_1 CA_{it-1} + \varphi_2 CA_{it-1} \cdot posCA_{it-1} + \varphi_3 posCA_{it-1} + year_t + \varepsilon_{it}, \qquad (1)$$

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. 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:

$$CA_{it} = \varphi_0 + \varphi_1 CA_{it-1} + \varphi_2 CA_{it-1} \cdot posCA_{it-1} + \varphi_3 posCA_{it-1} + Controls_{it}\gamma + year_t + \varepsilon_{it}. \quad (2)$$

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

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

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 counties 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 estimating the following equation on our panel of countries:

$$CA_{it} = \alpha + trend + \varphi_i + quarter_t + u_{it}. \quad (4)$$

By controlling for unobserved country characteristics, φ_i, common quarterly characteristics, $quarter_t$, and a time trend, we extract u_{it} 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.[14] 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. Please see Appendix Table 3 for the number of identified positive and negative current account shocks by year.

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

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

where *i* indexes country, *t* represents quarter, and *h* denotes the period that the current account shocks materialize. RER_{it} is real effective exchange rate. An increase in RER_{it} indicates currency *depreciation* of country *i* at *t*-th quarter. $CA\ Shock_{it}$ is the identified current account shock in equation (4). Z_{it-l} is a vector of control variables; First, we include a lagged RER variable. To consider uncovered interest rate parity, we control for the policy interest rate for a country *i* and a 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 the time fixed effect that captures any seasonal or common quarterly characteristics, and $\varepsilon_{i,t+h}$ is an error term.

[14] Assuming a normal distribution, the 16% tails represent one-standard deviation from the mean of the distribution.

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:

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

where I_t 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 RER_{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 higher 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 highly 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 counties 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.

[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. 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. The difference in convergence speeds is economically as well as statically 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 five times that of current account deficits, 3.48 years versus 0.70 years.[15]

A third observation is that if one sums the coefficients on the interaction term for the positive current account with the coefficient on the lagged current account, this sum is remarkably similar for floaters and peggers. For example, for the full sample of countries using the Shambaugh classification, the ratio of autoregressive terms of floater to peggers goes from a very lopsided 0.374 vs. 0.732 to a much more similar 0.819 vs. 0.752 when the two autoregressive coefficients are added, since the small coefficient on lagged current account for floaters is compensated by a large coefficient on the interaction term. The ratios are similar for the IRR classification and for other country samples in Table 2. This finding implies that the speed of convergence for floaters and peggers, conditional on positive current account, is about the same as each other. We also implement statistical tests of the hypothesis that the sum of the two autoregressive coefficients for floaters is the same as for peggers. The tests do not reject the null in most cases except for columns (7)-(10) in Table 2. (Even columns (7)-(10) show that the sum of two coefficients for floaters is not less than that for peggers.)

The overall picture implied by these findings is that floating promotes faster convergence,

[15] Computed as ln(0.5)/ln(0.3740+0.4452) and ln(0.5)/ln(0.3740), respectively.

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 counties, 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 oil exporters, suggesting it is driven by information from 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).[16] Thus, the 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 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, results are similar to our benchmark case.

[Insert Table 5 about here]

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

[16] 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).

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 non-industrial counties, once sub-Saharan Africa and the Caribbean countries are excluded.[17]

[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 exchange rate (RER) in response to different types of shocks to the current account balance. The main question in the study is whether responses of RER to the CA shock are state-dependent, especially whether positive or negative CA shocks have different effects on RER adjustment and vice versa. (Here, an increase in RER 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 RER to a positive CA shock (solid blue line) are not significantly different from zero at the 5% level at any period after the shock. However, the RER significantly increases (real depreciation) in response to the negative CA shocks, and it is significantly different from zero

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

starting from the period of shock impact through the first year afterward, and the effect reaches its peak around three quarters after the shock. 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 RER appreciation, we consider a country's policy characteristics that influence RER 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 using the 84-16 split 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 RER depreciation significantly, but a positive CA shock doesn't lead to a significant RER response. It thus shows a more distinct asymmetric RER responses 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 RER responses (even if it takes nine quarters for this effect to become significant).

[Insert Figure 2 about here]

This evidence informs our theoretical work below, suggesting 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 counties 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 in the presence of capital controls.[18] 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 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:

[18] 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.

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

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_{1t} is the price of the traded good in terms of the domestic consumption bundle (so q_{1t} 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, $AC_{Bit} = \psi_B B_{it}^{*2} / \left(2Y_{Tit}\right)$ is a small bond holding adjustment cost to ensure stationarity. The term $\tau_{it} = \psi_{\tau i} B_{it}^{*2} / \left(2Y_{Tit}\right)$ 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:

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

and an uncovered interest rate parity condition:

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

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*}:

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

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

For the case of country 1's government holdings of the international bond, we specify a rule:

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

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, 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 real exchange rate depreciates as a result of the shock. But to deal with experiments involving stochastic simulations, where shocks occur in both directions, we introduce an exponential function transformation into the rule. This implies that reserve purchases will be positive for cases of real exchange rate appreciation, and close to zero for cases of deprecation. Parameters χ , ξ , and ζ control the speed, strength, and asymmetry of the foreign exchange intervention, respectively, and will be chosen to optimize the fit of the model simulation to empirical results.

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 follow Korinek and Serven (2016) in specifying that a portion of debt claims in reserves will be forgiven. 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 much less demanding, as it requires fewer state variables to be tracked in simulations. Following balance of payments conventions, these asset transfers enter the government budget constraints and the capital accounts of both countries (see the discussion of balance of payments in the next section).

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:

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

Bond market clearing for internationally traded bond requires:

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

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

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

where the first set of brackets specifies the current account, the second is the financial account, and the third is the capital account. Following 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:

$$CA_{it} = Y_{Tit} - C_{Tit} + r_{t-1}^{*}B_{it-1}^{*} + r_{t-1}^{*}B_{it-1}^{G*}\,. \tag{21}$$

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 equtions (6)–(21).[19]

4.4. Shock Processes

Endowments follow a stochastic process, assumed for simplicity to be independent across countries and sectors:

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

The benchmark version of the model will focus on shocks to the endowment of the traded goods sector in the three countries, but robustness will show results when also including shocks to the nontraded sector.

4.5. Numerical Solution

The model is solved by perturbation methods, as a third-order approximation around the steady state, in order to preserve a degree of asymmetry in the response of the policy rule (15) to exchange rate rises versus falls. Stochastic simulations include a burn-in period of 100 years, after which we collect current account data on the three countries for an additional 100 years, and then use this simulated data to estimate a panel autoregression identical to empirical regression (1). We repeat this process 100 times and report the means of regression coefficients. Impulse responses are reported as deviations from the ergodic mean, as discussed in Fernandez-Villaverde *et al.* (2011). Impulse responses are based on 500 replications and employ recommended pruning.

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

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 $\beta = 0.96$. 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). The bond holding cost is set to a standard small value, $\psi_B = 1\times10^{-5}$.

[Insert Table 7 about here]

Regarding supply shocks in the rest of the world (RoW), the annual autoregressive parameter is $\rho_T = 0.84$, and the standard deviation set to $\sigma_{3T} = 0.032$, 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 chapter 4 of Uribe and Schmitt-Grohé (2017), and are set to $\sigma_{i,T} = 0.01$.

The five government policy parameters are chosen in a moment matching exercise to fit the regression coefficients from our empirical results above.[20] The value $\chi = 0.685$ indicates significant smoothing when the government adjusts reserves in equation (15). The value $\xi = 0.0184$ determines how strongly reserves are increased in response to the measure of expected future currency appreciation in (15), while $\zeta = 15.8$ indicates substantial asymmetry in the policy response between appreciations and depreciations. We note that a value $\zeta > 1$ rescales arguments

[20] We employ a Newton-based algorithm to search over the five policy parameters to minimize the distance measure defined as: $\Omega = 0.01\left(\varphi_1^{\text{mod}}/\hat{\varphi}_1 - 1\right)^2 + \left(\varphi_2^{\text{mod}}/\hat{\varphi}_2 - 1\right)^2$, 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 (1) on simulated data, averaged over 100 stochastic simulations.

to more effectively use the nonlinearity of the exponential function, so that policy responses to RER deviations are closer to zero while responses to appreciations remain large. (See Appendix 1 for a discussion of this point.) The value ψ_x = 0.136 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, $\psi_{\tau 1}$ =4.66×10^{-7}, indicating that substantial capital controls are not necessary for our result.[21]

5. Model Simulation Results

This section reports the model's success in replicating the main empirical fact above, that current account surpluses are more persistent than deficits, and explores the mechanism by sensitivity analysis and impulse responses.

5.1. Stochastic Simulation Results

The objective of the theoretical model is to replicate the estimated autoregressive coefficients in equation (1) and provide insight into the mechanism. Of primary interest is φ_2, the coefficient on the interaction term for a positive current account, where φ_2>0 indicates greater persistence for current account surpluses compared to deficits. We re-estimate the empirical regression specification (1), but this time using the artificial data produced by stochastic simulations of the theoretical model, and report the model estimate of φ_2 in Table 8 (Recall that

[21] Given that government intervention in our model is not sterilized, capital controls are not necessary for the government to influence the real exchange rate. This is similar to the case discussed in Korinek and Serven (2016), where an undervalued real exchange rate is maintained by reserve accumulation, involving a loan to foreigners finaced by domestic lump sum tax; this lowers the home supply of traded goods and depresses the real exchange rate. In our model the asset transfer rule from government 1 to 2 implies such a rise in the lump sum tax on agents in country 1 and fall in country 2.

the model's government policy parameters were calibrated in order to optimize the model's fit to this empirical moment in particular.) The first row of the table recalls the empirical target for φ_2, 0.445, and the second row the value implied by the model, 0.406. While the theoretical model was not able to achieve an exact match to the empirical value, it nonetheless succeeds in implying a substantial jump in persistence of surpluses compared to deficits. Additionally, the stochastic simulations also report unconditional means of variables: most notably, the mean of the current account in country 1 is not zero, but instead is a positive value (0.0595), while that in country 2 is negative (-0.0666), and that for the rest of world is close to zero (0.0018).

[Insert Table 8 about here]

The next several rows of Table 8 conduct sensitivity analysis to identify the key parameters and drivers of the benchmark result. Row (3) sets to zero four key policy parameters ($\xi = \chi = \psi_\tau = \psi_x = 0$). The implied value of the regression coefficient now is close to zero, showing that our main result of higher persistence of current account surplus is fully neutralized without these government policies. The next row (4) sets to zero just the parameter ξ, which governs the strength of the foreign exchange intervention to purchase foreign currency reserves to counter domestic appreciation. Eliminating this response produces a result similar to that above, where all four policy parameters are zeroed out, indicating that ξ is a central parameter for generating the benchmark result.

Eliminating a different parameter in this policy rule, χ, which controls smoothing of the policy response, produces an even more strongly negative effect on the persistence of current account surpluses (φ_2 becomes negative, as seen in row (5)). 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 (6) shows the implications of eliminating the rescaling of the policy response inside the exponential function ($\zeta = 1$), while keeping the other parameters in this policy rule at their benchmark values. 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 significantly reduces the ability of the model to explain the greater persistence of surpluses, lowering the estimate φ_2 of compared to the benchmark value.

The asset transfer rule in equation (16) is motivated by the technical need to prevent unbounded accumulation of reserves and violation Blanchard-Kahn conditions for model solution. However, the parameterization of this rule plays a role in generating the persistence in our result. Though we cannot set $\psi_x = 0$ without also setting $\xi = 0$ (as done in row (3)), we can experiment with alternative positive values of this parameter in isolation, which modulates how quickly the rebate responds to rising holdings of international bonds. Row (7) of Table 8 shows that the asset transfer rule does contribute to our result: when setting ψ_x to 0.05 (the lowest value that still satisfies dynamic stability), φ_2 turns sharply negative.

The remaining four rows of Table 8 explore the contribution of various shocks to our result. Row (8) shows that limiting shocks just to country 3 (RoW) implies a large positive value of φ_2, larger even than the benchmark model. This cannot be said of the other two shocks in isolation (rows (9) and (10)). This suggests that endowment shocks to the traded sector of country 3 are the most important for driving our result. This fact will inform our choice of shocks when reporting impulse responses in the next section.

As explained earlier, 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, given our benchmark parameterization where intertemporal and intratemporal substitution effects are equal and offsetting ($\eta = 1/\sigma$). But the last row (11) 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 the 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 sensitivity analysis 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. In brief, the impulse responses in Figure 3 show a highly persistent current account surplus for country 1 that, after several periods of faster 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 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 an extremely slow rate.[22] This

[22] The highly persistent current account surplus in country 1 (and deficit in country 2) is linked in a subtle way to the persistent asset transfers from country 1 to country 2; in fact the two take very similar magnitudes as the simulation approaches its steady state in later periods, as shown in Figure 3. The logic is as follows. The expectation of future transfers in present value terms 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) that we see in Figure 3. The usual case in similar models without such foreign exchange intervention and such a transfer is that in steady state country 1 should run a trade deficit exactly equal to the interest income from its holding of foreign assets, which cancel each other when computing the current account. However, in the present model, the asset transfers of a portion of net foreign assets of country 1 lowers consumption and the trade deficit somewhat, and the difference between this trade deficit and the net interest income implies the persistent current account surplus. We note two things. First, such transfers are mandated by the need for so satisfy Blancard-Kahn conditions. Second, the resulting current account imbalances do not depend crucially on the timing of when these transfers are realized. The same 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 for the case where asset transfers are deferred

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 county 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 the accounting of how this set of responses explains why current account surpluses are more persistent than deficits in our regression analysis above. By estimating equation (1) for the data plotted here as impulse responses, we find that the coefficient values are determined mainly by the observations in periods 10–50, indicating the importance of the very slow adjustment in the long run observed in the figure. The two shocks in Figure 3 and three countries imply six data series in total for the current account. Two data series are predominantly surpluses (country 1 for the CA surplus shock and country 3 for the CA deficit shock), while four are predominantly deficits (countries 1 and 2 in the CA deficit shock, and countries 2 and 3 in the CA surplus shock). One out of two in the first group is highly persistent (country 1's CA for the CA surplus shock), while the other is not; in the second group, one out of four is highly persistent (country 2's CA for

until the very end of the sample period in year 49. This makes the point that there is not a simple mechanical linkage on a period-by-period basis between the asset transfers and the current account surplus.

the CA surplus shock), while the others are not. Hence the average persistence among current account surpluses is higher than that among current account deficits. This accounting also makes clear the need for a multi-country setting, rather than just two countries, one with a persistent surplus and the other with an offsetting persistent deficit.

The logic above also applies in principle to shocks to the traded goods sectors of the other two countries. (For impulse responses, see Appendix Figures 1 and 2.) In both 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 in the case of that shock) are associated with a real exchange rate appreciations of country 1, thus triggering the fear of appreciation mechanism that makes the current account surplus persistent. We conclude that the logic driving our result is quite durable to alternative shocks to tradable goods, though numerical results are sensitive to parameter values. We further find that this logic potentially can apply to shocks impacting the nontraded goods sector, depending on the parameterization of elasticities. In particular, the elasticity of substitution between sectors needs 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.

To gain further insight into the stochastic simulation results, we also report impulse responses from a third-order approximation of the model.[23] 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

[23] 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 steady-state.

size 0.75 of a standard deviation, as we found this best illustrates results from the full 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. 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, to facilitate comparison of the two cases, 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. Figure 4 shows a less stark contrast between the CA-surplus and CA-deficit lines than was the case in the first-order approximation. A key reason is that a third-order approximation only imperfectly preserves the asymmetry of the exponential function within the fear of appreciation rule that distinguishes the responses to positive or negative exchange rate fluctuations. Nonetheless, Figure 4 does show greater persistence in the current account surplus in country 1 in the solid (red) line, compared to the response to a shock implying a deficit in the dashed (black line). In particular, as in Figure 3, we again see a small but very persistent long-run component to the current account surplus. This last feature becomes even more prominent once one accounts for the fact that the impulse responses are reported as deviations from the ergodic mean, which, as noted in the previous section discussing stochastic simulations, was positive. If we were to adjust the impulse responses by adding this ergodic mean, it serves to augment this persistent long-run current account surplus.

In addition, Figure 4 also shows that an exchange rate appreciation in country 1 in the solid red line is smaller (less than 0.3%) compared to the degree of exchange rate depreciation in the dashed black line (greater than 0.3%). This indicates that the fear of appreciation rule has the intended asymmetric effect on exchange rates in the third-order approximation. Overall, the impulse responses are similar in character to those for the first-order approximation, and they continue to support the logic developed for the mechanism driving the result in the stochastic simulations.

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.

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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[I,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[I,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[I,S]	2011-2014	Uruguay	1979-2014	Switzerland*	1996-2014
Cameroon	1978-2014	Guatemala	1978-2014	Maldives	1982-2014	Samoa[I,S]	2005-2014	Vanuatu[I,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, Reinhardt 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)	0.3740*	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	2.5271**	1.2835***	0.4366*	0.4829**	2.6706**	1.0201**	2.6827***	1.1138**	-0.1998	1.0250*
	(1.067)	(0.411)	(0.219)	(0.217)	(1.122)	(0.485)	(0.694)	(0.508)	(0.237)	(0.560)
Constant	-2.3102**	-1.6590**	0.1911	-2.0557***	-4.6249***	-1.3459	-5.7864***	-0.4544	-2.6830***	-1.3025***
	(1.155)	(0.726)	(0.365)	(0.209)	(1.112)	(0.857)	(0.773)	(0.804)	(0.326)	(0.303)
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	0.67 (0.4117)		0.55 (0.4590)		0.33 (0.5685)		10.61*** (0.0011)		7.11*** (0.0077)	
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	2.6045**	1.0100**	0.3401	0.4564*	2.7474**	0.6578	2.8705***	1.0650*	0.0045	0.7687
	(1.131)	(0.419)	(0.200)	(0.242)	(1.153)	(0.501)	(0.671)	(0.576)	(0.201)	(0.548)
Constant	-3.9517***	-0.4055	-0.7993	0.2251	-4.7684***	-0.9338	-5.8757***	-0.8517	-2.1283***	-2.0780***
	(1.317)	(0.550)	(0.904)	(0.506)	(1.305)	(1.078)	(1.045)	(1.052)	(0.483)	(0.334)
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	0.21 (0.6494)		2.20 (0.1378)		0.47 (0.4912)		1.50 (0.2199)		0.08 (0.7708)	
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 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, Reinhardt, 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)	0.5707***	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	0.0009**	-0.0001	-0.0008	-0.0014*	0.0012***	0.0001	0.0009***	0.0000	-0.0002	0.0005
	(0.000)	(0.001)	(0.002)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
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	1.8959***	1.3662***	0.1821	0.4343*	1.5634***	1.2183**	1.7817***	1.1589*	-0.1920	1.0806
	(0.482)	(0.425)	(0.161)	(0.232)	(0.454)	(0.565)	(0.455)	(0.680)	(0.276)	(0.647)
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	-0.0086	0.9519**	1.3148***	-0.5294	-1.2750*	0.7039	-0.6294	-0.0156	0.2853	-0.2439
	(0.526)	(0.461)	(0.376)	(0.946)	(0.719)	(0.618)	(0.848)	(0.800)	(0.287)	(0.493)
Constant	-1.5857**	-1.9328**	-0.7626	-1.6715*	-3.2906***	-1.3668	-4.4549***	-0.3006	-2.9070***	-1.7569**
	(0.686)	(0.902)	(0.543)	(0.819)	(0.503)	(0.943)	(0.569)	(1.149)	(0.259)	(0.763)
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 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 (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)	0.5571***	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	0.0012***	-0.0003	-0.0004	-0.0014**	0.0014***	-0.0001	0.0014***	0.0004	0.0003	-0.0001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
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	2.1175***	0.7076	0.1962	0.3424	1.7629***	0.4775	1.8424***	1.0371	0.2869	0.7044
	(0.376)	(0.452)	(0.183)	(0.235)	(0.423)	(0.539)	(0.372)	(0.664)	(0.314)	(0.611)
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	-0.1542	1.3762***	1.1383***	0.4179	-1.3831**	1.1003**	-1.0377	-0.1479	0.2409	-0.4053
	(0.516)	(0.464)	(0.349)	(0.492)	(0.669)	(0.538)	(0.690)	(0.508)	(0.275)	(0.480)
Constant	-2.9447***	-0.8791	-2.2304**	-0.0165	-3.4947***	-1.2230	-4.6066***	-0.7553	-2.5822***	-2.0746***
	(0.689)	(0.545)	(0.779)	(0.434)	(0.435)	(0.900)	(0.556)	(0.998)	(0.484)	(0.410)
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 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, Reinhardt, 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)	0.6664***	0.7531***	0.6498***	1.0366***	0.6493***	0.7578***	0.3987**	1.0286***	0.6414***	0.8062***
	(0.135)	(0.151)	(0.201)	(0.181)	(0.146)	(0.161)	(0.172)	(0.285)	(0.064)	(0.145)
CA(-1) × Pos CA	0.5647***	0.0410	-0.2692	0.1184**	0.5514**	0.1126	0.7741***	-0.0109	0.4168***	-0.1022
	(0.199)	(0.071)	(0.207)	(0.052)	(0.229)	(0.104)	(0.112)	(0.112)	(0.112)	(0.134)
CA(-1) × trade openness	-0.0008	-0.0009	-0.0004	-0.0015**	-0.0004	-0.0009	-0.0007	-0.0010	-0.0012	0.0003
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
CA(-1) × financial openness	-0.3874***	0.0642	0.5197**	-0.0491	-0.4350***	-0.0197	-0.2572***	-0.1588	0.2292**	-0.0980
	(0.123)	(0.088)	(0.194)	(0.196)	(0.107)	(0.105)	(0.079)	(0.176)	(0.102)	(0.138)
Pos CA	2.0127***	1.7354***	0.0260	0.4903*	1.8150***	1.3268	1.9012***	0.0169	-0.1409	1.2823*
	(0.551)	(0.607)	(0.375)	(0.245)	(0.582)	(0.992)	(0.565)	(1.242)	(0.287)	(0.700)
trade openness	-0.0190**	-0.0223*	0.0150**	0.0034	-0.0160*	-0.0263*	-0.0172***	-0.0214	-0.0112*	-0.0036
	(0.008)	(0.013)	(0.006)	(0.003)	(0.008)	(0.016)	(0.006)	(0.021)	(0.006)	(0.006)
financial openness	0.2218	0.4380	1.1559***	-0.8034	-0.8804	-0.3832	-0.2307	-1.0863	0.6604*	-0.5960
	(0.601)	(0.576)	(0.309)	(1.079)	(0.852)	(0.817)	(0.838)	(1.112)	(0.341)	(0.705)
Constant	0.0060	2.9177*	-0.7497	-3.4824***	2.7125**	3.3708*	1.1661	3.8085	2.9827***	4.3734***
	(1.077)	(1.696)	(0.675)	(0.530)	(1.037)	(1.760)	(1.079)	(2.673)	(1.045)	(0.916)
Observations	1,816	1,441	376	230	1,440	1,211	972	537	914	488
R-squared	0.616	0.458	0.832	0.935	0.604	0.439	0.685	0.436	0.666	0.736

Note: Clustered 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	-1.3186	-0.4596*	-1.6143	-2.1506***	0.3028
	(1.126)	(0.237)	(1.206)	(0.566)	(0.266)
Pos CA	1.3332***	0.1906	1.0404**	0.9650*	0.8392
	(0.401)	(0.230)	(0.483)	(0.506)	(0.578)
Float × Pos CA	1.1287	0.3031	1.5850	1.7228	-1.0085
	(1.279)	(0.289)	(1.432)	(1.111)	(0.695)
Constant	-1.2246**	0.2162	-2.0263***	-2.0695**	-2.4303***
	(0.580)	(0.540)	(0.658)	(0.917)	(0.509)
Observations	4,893	756	4,137	2,165	1,909
R-squared	0.523	0.850	0.507	0.490	0.688

Note: Clustered 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

Preferences	
Risk aversion	$\sigma = 2$
Time preference	$\beta = 0.96$
Traded goods share	$\nu = 0.5$
Substitution elasticity between sectors	$\eta = 0.5$
Technology	
Bond holding cost	$\psi_B = 10^{-5}$
Policy parameters for country 1	
Exchange rate intervention rule:	
Smoothing parameter	$\chi = 0.6847$
Linear response parameter	$\xi = 0.01844$
Assymetry parameter	$\zeta = 15.83$
Asset transfer rule	$\psi_x = 0.1360$
Capital control rule	$\psi_{\tau 1} = 4.655\times10^{-7}$
Shocks:	
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

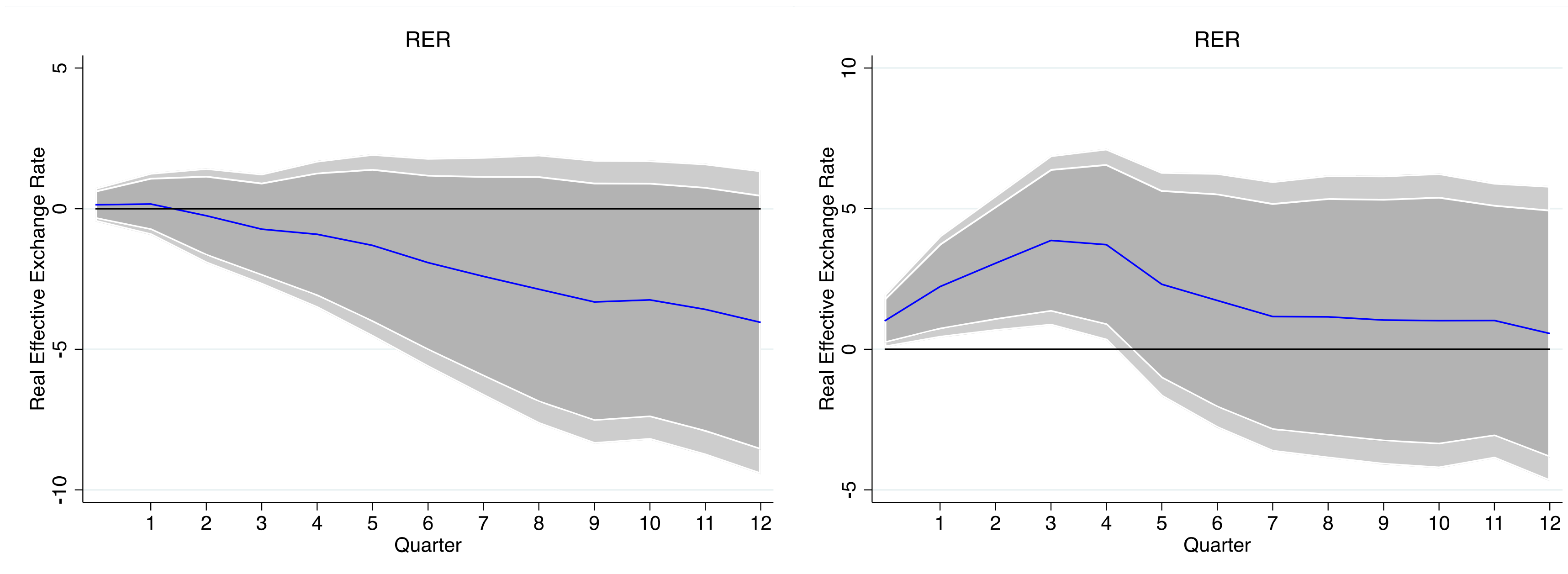
Model specification	regression coefficient φ_2
(1) Data	0.4452
(2) Benchmark model	0.4068
(3) No policies ($\xi = 0, \chi = 0, \psi_\tau = 0, \psi_x = 0$)	0.0036
(4) No foreign exch. intervention ($\xi = 0$)	0.0037
(5) No lag in intervention rule ($\chi = 0$)	-0.0867
(6) No rescaling of exchange rate rule ($\zeta = 1$)	0.0297
(7) Small asset transfer ($\psi_x = 0.05$)	-0.0988
(8) Just shock to Y_{T3}	0.4725
(9) Just shock to Y_{T2}	-0.0096
(10) Just shock to Y_{T1}	-0.0755
(11) Shocks to all traded and nontraded goods*	0.0484

Note: Optimized parameters: ξ = 0.01844, ψ_x = 0.1360, χ = 0.6847, ζ =15.8333, ψ_τ =4.655x10^{-7}.

*Parameter re-optimized for this set of shocks: ξ = 0.02106, ψ_x = 0.1204, χ = 0.6733, ζ =5.3761, ψ_τ =0.

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

A. Positive CA shock (84%) B. Negative CA shock (16%)

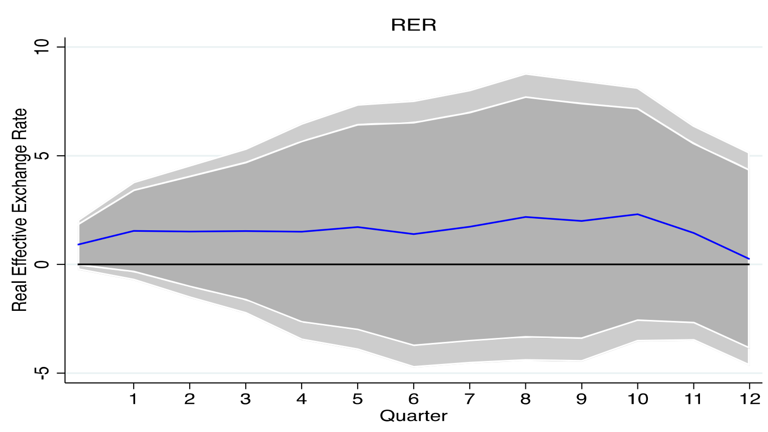


Note: We include lagged real exchange rate, a base country interest rate, a country's policy interest rate, country and quarter fixed effects. RER = real (effective) exchange rate, an increase in RER indicated currency depreciation. Light and thick grey areas indicate 90% and 95% confidence interval, respectively.

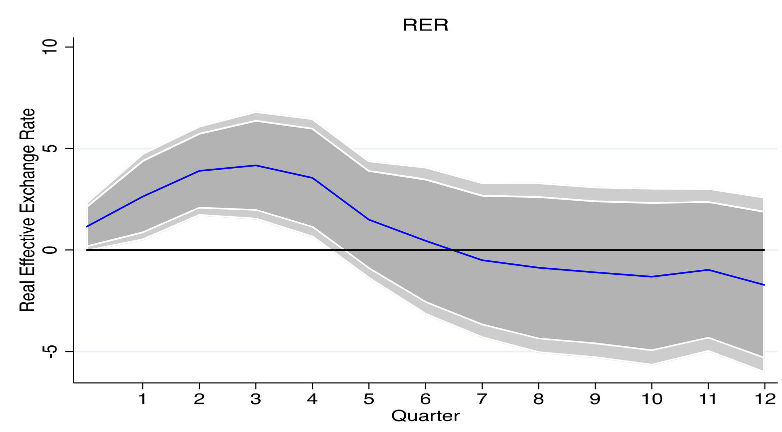
Figure 2. REER response to positive and negative CA shocks with respect to capital controls

A. KA Low countries

Positive CA shock (84%)

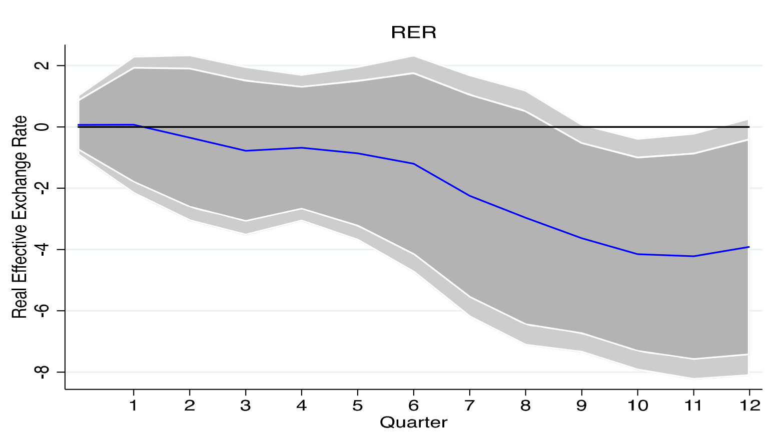


Negative CA shock (16%)

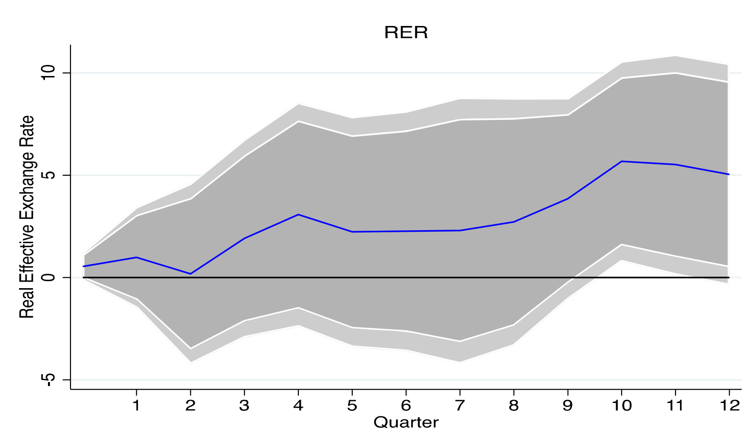


B. KA High countries

Positive CA shock (84%)

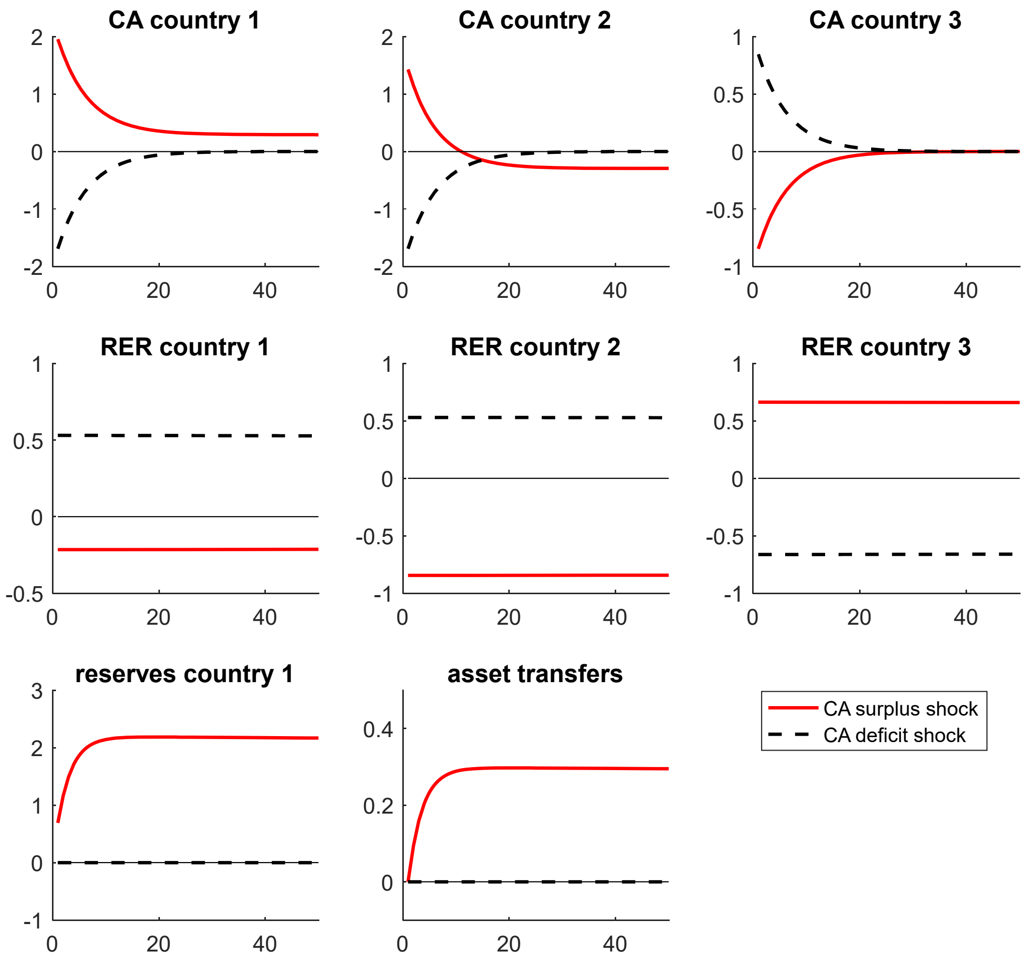


Negative CA shock (16%)



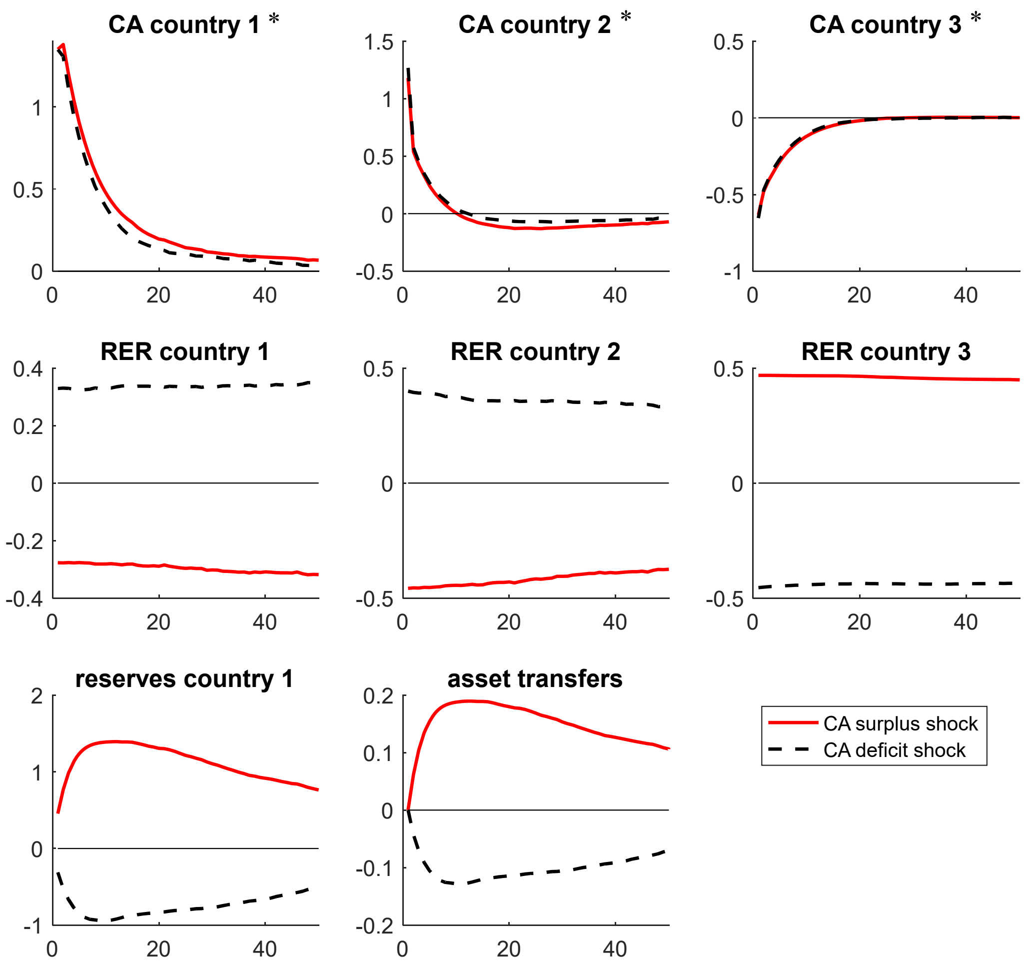
Note: We include lagged real exchange rate, a base country interest rate, a country's policy interest rate, country and quarter fixed effects. RER = real (effective) exchange rate, an increase in RER indicated currency depreciation. Light and thick grey areas indicate 90% and 95% confidence interval, respectively.

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 (0.75 shock)



*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).

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

In this section we explain the purpose of the additioinal scaling parameter (ζ) in the fear of appreciation rule, equation (15). The objective is to improve the ability of a third-order approximating 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 fit to empirical moments.

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	World Bank
	Capital Account Openness (KA_{it})	Chinn-Ito Index
Local Projection with quarterly data		
RER_{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		-2.541	7.728	-65.029	54.671	-23.579	-14.225	-5.855	-2.460	0.379	9.154	22.488
Floating	Trade openness	2,499	70.106	47.147	0.167	437.327	12.801	20.110	42.973	60.270	85.373	139.676	313.416
	Financial openness		0.467	0.358	0	1	0	0	0.166	0.416	0.820	1	1
	CA		-3.711	11.298	-240.521	56.704	-29.546	-19.574	-8.364	-3.866	1.151	12.221	26.140
Peg	Trade openness	2,015	90.538	52.320	6.320	442.62	18.325	33.351	55.016	83.639	111.537	168.032	326.841
	Financial openness		0.479	0.366	0	1	0	0	0.166	0.416	1	1	1
B. Industrial countries													
	CA		-0.384	4.761	-24.229	16.179	-13.739	-6.074	-3.073	-1.002	1.442	8.202	14.701
Floating	Trade openness	481	53.115	20.130	10.757	122.496	16.049	19.815	39.600	52.118	67.234	86.355	106.930
	Financial openness		0.746	0.318	0	1	0	0.166	0.416	1	1	1	1
	CA		0.146	5.052	-14.472	14.291	-11.904	-10.109	-2.202	0.797	3.137	8.525	11.572
Peg	Trade openness	236	81.235	35.851	33.878	201.990	39.905	42.984	54.815	68.493	103.146	157.851	189.422
	Financial openness		0.942	0.163	0.416	1	0.416	0.416	1	1	1	1	1
C. Non-Industrial countries													
	CA		-3.056	8.197	-65.029	54.671	-24.597	-15.289	-6.569	-2.994	0.029	9.231	24.302
Floating	Trade openness	2,018	74.156	50.707	0.167	437.327	12.585	20.982	45.426	63.213	92.007	152.217	325.039
	Financial openness		0.400	0.334	0	1	0	0	0.166	0.240	0.699	1	1
	CA		-4.223	11.789	-240.521	56.705	-30.503	-20.835	-8.947	-4.596	0.298	13.052	28.430
Peg	Trade openness	1,779	91.772	54.017	6.320	442.62	17.628	32.425	55.173	85.631	113.063	171.931	334.602
	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		-1.301	7.585	-46.262	54.671	-16.814	-10.506	-4.944	-2.042	0.780	11.059	28.483
Floating	Trade openness	1,300	75.083	57.694	0.167	437.327	11.882	18.661	43.605	61.456	90.459	162.315	360.167
	Financial openness		0.401	0.326	0	1	0	0	0.166	0.251	0.699	1	1
	CA		-0.835	13.754	-240.521	56.705	-25.752	-14.242	-6.272	-1.976	3.250	19.515	39.901
Peg	trade openness	783	100.664	68.517	11.315	442.62	17.678	28.210	55.282	86.145	126.364	225.759	375.010
	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		-1.987	6.567	-46.262	42.227	-16.936	-10.623	-5.208	-2.312	0.257	8.003	22.219
Floating	Trade openness	1,215	76.101	59.236	0.167	437.327	11.546	18.009	42.259	62.715	90.812	164.484	360.467
	Financial openness		0.400	0.324	0	1	0	0	0.166	0.251	0.699	1	1
	CA		-3.062	7.563	-41.847	29.114	-25.752	-14.885	-6.692	-2.979	0.936	9.050	16.493
Peg	Trade openness	625	105.415	74.666	11.315	442.62	17.019	26.105	53.714	89.756	133.140	285.356	376.657
	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 shock	Number of Positive CA shock	Number of Observations
1987	4	8	31
1988	4	11	32
1989	3	2	32
1990	3	4	32
1991	4	5	36
1992	1	2	36
1993	5	2	40
1994	6	1	40
1995	9	4	64
1996	14	5	83
1997	13	5	84
1998	5	10	88
1999	11	6	100
2000	8	10	104
2001	8	18	104
2002	2	14	112
2003	5	11	127
2004	4	19	136
2005	10	16	144
2006	21	31	152
2007	25	20	152
2008	46	17	152
2009	7	11	152
2010	12	7	152
2011	17	2	152
2012	19	10	152
2013	30	21	152
2014	18	20	152

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

Country	Number of Negative CA shock	Number of Positive CA shock	Capital Account Openness	Reserves (excl. gold, % of GDP)	Average % change in reserves (excl. gold)
A. KA Low countries (12)					
South Africa	16	15	0.151	28.416	16.285
India	9	8	0.166	35.201	13.643
Argentina	2	7	0.167	37.913	7.426
Turkey	13	12	0.282	35.911	14.438
Brazil	1	14	0.351	43.126	13.417
South Korea	19	14	0.425	44.341	16.190
Poland	3	2	0.449	78.894	16.810
Russia	5	9	0.517	52.534	18.200
Indonesia	7	8	0.597	39.632	11.167
Costa Rica	4	2	0.770	66.504	9.331
Hungary	14	8	0.782	92.037	9.184
Israel	14	10	0.786	91.277	10.232
Average	8.9	9.1	0.454	53.816	13.027
B. KA High countries (11)					
Australia	3	0	0.828	17.203	6.145
Czech Republic	12	2	0.831	67.178	12.859
Norway	16	20	0.832	40.884	5.253
Chile	8	8	0.860	63.634	9.652
Sweden	7	10	0.973	25.818	7.262
Japan	2	0	0.987	47.461	11.559
New Zealand	16	9	0.998	35.220	4.691
Germany	16	8	1.000	11.160	0.424
United Kingdom	5	5	1.000	21.220	6.932
Canada	4	20	1.000	14.450	11.032
Switzerland	10	11	1.000	68.039	11.238
Average	9	8.5	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 values of each variable for a country are reported. Standard deviations are in parenthesis.

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)	0.5761***	0.7235***	0.6219***	1.2503***	0.5915***	0.7199***	0.3818***	0.8047***	0.6655***	0.7042***
	(0.099)	(0.086)	(0.117)	(0.360)	(0.104)	(0.089)	(0.108)	(0.219)	(0.038)	(0.123)
CA(-1) × Pos CA	0.4376**	0.0461	-0.0580	0.0238	0.4277*	0.0738	0.6363***	0.0689	0.2308**	0.0094
	(0.212)	(0.054)	(0.073)	(0.060)	(0.238)	(0.064)	(0.158)	(0.074)	(0.087)	(0.103)
CA(-1) × trade openness	0.0010**	-0.0001	-0.0008	-0.0006	0.0012***	0.0000	0.0010***	0.0001	-0.0001	0.0005
	(0.000)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
CA(-1) × financial openness	-0.4219***	-0.0024	0.3838***	-0.2697	-0.4905***	-0.0362	-0.3751***	-0.1195	0.1318	-0.0217
	(0.134)	(0.078)	(0.074)	(0.370)	(0.106)	(0.088)	(0.068)	(0.184)	(0.079)	(0.109)
Pos CA	1.9409***	1.3409***	0.2492	-0.0843	1.5182***	1.1785**	1.7787***	0.8265	-0.1841	0.9726
	(0.478)	(0.436)	(0.206)	(0.280)	(0.454)	(0.591)	(0.450)	(0.862)	(0.289)	(0.693)
trade openness	-0.0032	-0.0060	0.0101	0.0074**	0.0006	-0.0060	-0.0007	-0.0021	0.0012	0.0030
	(0.006)	(0.004)	(0.006)	(0.003)	(0.006)	(0.005)	(0.005)	(0.004)	(0.003)	(0.002)
financial openness	-0.2272	1.0158**	1.1268***	-0.0147	-1.4714**	0.6899	-0.6811	-0.1802	0.3669	-0.2918
	(0.510)	(0.479)	(0.318)	(0.714)	(0.641)	(0.683)	(0.791)	(0.812)	(0.244)	(0.489)
Constant	-2.0459***	-1.5932***	-1.4915***	-0.4611	-1.9248***	-1.5497**	-2.1975***	-0.7370	-0.9154***	-1.3659***
	(0.544)	(0.549)	(0.393)	(0.631)	(0.577)	(0.605)	(0.529)	(0.828)	(0.241)	(0.384)
Observations	2,499	2,015	481	236	2,018	1,779	1,300	783	1,215	625
R-squared	0.597	0.493	0.798	0.902	0.586	0.476	0.651	0.388	0.659	0.692

Note: Clustered standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Country and year fixed effects are excluded. 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)	0.5067***	0.6111***	0.7035**	1.1552***	0.5171***	0.6087***	0.5000***	0.6718**	0.6121***	0.5337***
	(0.068)	(0.151)	(0.323)	(0.123)	(0.069)	(0.155)	(0.073)	(0.253)	(0.064)	(0.170)
CA(-1) × Pos CA	0.2279**	0.2212*	-0.0576	0.1526	0.1581	0.2335*	0.2545***	0.2518**	0.2857***	0.1707
	(0.111)	(0.130)	(0.173)	(0.104)	(0.117)	(0.133)	(0.072)	(0.120)	(0.071)	(0.249)
CA(-1) × trade openness	0.0011***	-0.0001	-0.0022	-0.0024**	0.0014***	-0.0001	0.0014***	-0.0004	-0.0000	0.0005
	(0.000)	(0.001)	(0.004)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
CA(-1) × financial openness	-0.4481***	-0.0350	0.3212	-0.1958	-0.4948***	-0.0557	-0.5290***	-0.0392	-0.0188	0.0461
	(0.103)	(0.100)	(0.187)	(0.124)	(0.097)	(0.104)	(0.064)	(0.188)	(0.090)	(0.168)
Pos CA	1.1999***	0.2158	-0.1263	0.4069	1.0227**	0.1223	0.7688*	0.0889	-0.4095	0.7258
	(0.440)	(0.681)	(0.165)	(0.338)	(0.514)	(0.799)	(0.457)	(1.055)	(0.397)	(0.993)
trade openness	-0.0056	-0.0384	0.0558***	0.0229	-0.0059	-0.0392	0.0011	-0.0658	-0.0082	-0.0265**
	(0.013)	(0.033)	(0.019)	(0.030)	(0.013)	(0.033)	(0.017)	(0.051)	(0.017)	(0.012)
financial openness	-0.7865	-0.5587	1.6957*	-1.2137	-1.3334*	-0.8171	-1.2015**	-2.6283	-0.0259	-0.4036
	(0.729)	(0.915)	(0.965)	(1.071)	(0.713)	(0.974)	(0.537)	(1.872)	(0.522)	(1.051)
Constant	-1.7509**	5.0979	-1.4850	-3.2903	-1.7583	11.7988	-3.0768	22.3147	-1.2392	0.6007
	(0.839)	(4.001)	(0.918)	(1.975)	(2.117)	(9.363)	(3.026)	(14.446)	(2.930)	(3.052)
Observations	2,499	2,015	481	236	2,018	1,779	1,300	783	1,215	625
R-squared	0.701	0.543	0.832	0.940	0.698	0.530	0.745	0.491	0.708	0.753

Note: Clustered 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)	0.6351***	0.7684***	0.7015***	1.0366***	0.6286***	0.7749***	0.4704***	0.9166***	0.7146***	0.7537***
	(0.151)	(0.132)	(0.157)	(0.181)	(0.157)	(0.140)	(0.161)	(0.271)	(0.051)	(0.136)
CA(-1) × Pos CA	0.5044**	0.0130	-0.0513	0.1184**	0.4871**	0.0817	0.7119***	0.0214	0.2889***	-0.0699
	(0.213)	(0.070)	(0.109)	(0.052)	(0.242)	(0.102)	(0.145)	(0.109)	(0.095)	(0.126)
CA(-1) × trade	0.0001	-0.0008	-0.0003	-0.0015**	0.0005	-0.0007	-0.0006	-0.0008	-0.0009	0.0004
openness	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)
CA(-1) × financial	-0.4170***	0.0615	0.2729*	-0.0491	-0.4753***	-0.0213	-0.3278***	-0.0862	0.1473*	-0.0445
openness	(0.130)	(0.080)	(0.138)	(0.196)	(0.107)	(0.095)	(0.079)	(0.161)	(0.087)	(0.130)
CA(-1) × currency	-0.0056	-0.2154*	-0.2847*	-	0.0331	-0.2030	-0.0187	-0.1680	-0.1585*	-0.0657
crisis(-1)	(0.095)	(0.121)	(0.156)	-	(0.096)	(0.127)	(0.121)	(0.334)	(0.084)	(0.359)
Pos CA	1.8422***	1.4307**	0.1421	0.4903*	1.5431***	0.9758	1.4406***	-0.0113	-0.4729*	1.2948*
	(0.524)	(0.588)	(0.232)	(0.245)	(0.517)	(0.940)	(0.502)	(1.442)	(0.257)	(0.702)
trade openness	-0.0144*	-0.0190	0.0150**	0.0034	-0.0115	-0.0222	-0.0101*	-0.0202	-0.0034	-0.0039
	(0.007)	(0.012)	(0.006)	(0.003)	(0.008)	(0.014)	(0.006)	(0.018)	(0.005)	(0.006)
financial openness	0.0816	0.4228	1.3957***	-0.8034	-1.0652	-0.4245	-0.4904	-1.1148	0.3297	-0.2748
	(0.570)	(0.558)	(0.343)	(1.079)	(0.779)	(0.788)	(0.825)	(1.281)	(0.293)	(0.600)
currency crisis(-1)	0.6912	-0.4640	-0.0464	-	0.7853	-0.5146	1.0572	-0.1608	0.5329	-1.8561
	(0.533)	(1.825)	(1.060)	-	(0.577)	(1.859)	(0.675)	(2.023)	(0.568)	(1.756)
Constant	0.0348	2.8784*	-1.1553*	-3.4824***	2.6006**	3.3144*	1.3622	3.4988	3.2064***	4.0374***
	(1.000)	(1.659)	(0.564)	(0.530)	(1.035)	(1.691)	(1.025)	(2.667)	(0.990)	(0.887)
Observations	2,244	1,573	413	230	1,831	1,343	1,217	592	1,134	530
R-squared	0.598	0.462	0.824	0.935	0.585	0.443	0.642	0.412	0.629	0.729

Note: Clustered 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)	0.7640***	0.7200***	0.8190***	1.1340***	0.7501***	0.7143***	0.6788***	0.7747***	0.6889***	0.8048***
	(0.046)	(0.041)	(0.049)	(0.125)	(0.052)	(0.042)	(0.060)	(0.059)	(0.061)	(0.061)
CA(-1) × CA Pos	0.0933	0.0418	0.2044***	-0.2446*	0.1012	0.0512	0.1983**	0.1255	0.2046*	0.1130
	(0.067)	(0.076)	(0.063)	(0.130)	(0.081)	(0.077)	(0.083)	(0.081)	(0.105)	(0.097)
CA Pos	0.4600	1.4263***	0.3011	0.1831	0.2239	1.3018**	0.4654	0.3258	0.1959	-0.0523
	(0.290)	(0.494)	(0.200)	(0.409)	(0.382)	(0.531)	(0.355)	(0.675)	(0.276)	(0.681)
Constant	-1.1769***	-2.1807***	-0.5939*	1.4345***	-1.6057**	-2.1957***	-1.3155*	-1.8125**	-0.8136	-1.5418**
	(0.411)	(0.665)	(0.301)	(0.433)	(0.666)	(0.669)	(0.660)	(0.760)	(0.532)	(0.720)
H0: CA(-1) in Floating = CA(-1) in Peg	0.69		-		0.26		0.94		1.22	
	(0.4073)		-		(0.6086)		(0.3325)		(0.2684)	
Observations	2,200	1,885	513	117	1,687	1,768	1,226	622	1,166	492
R-squared	0.653	0.638	0.867	0.868	0.616	0.630	0.681	0.734	0.638	0.746

Note: Note: : Clustered 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.

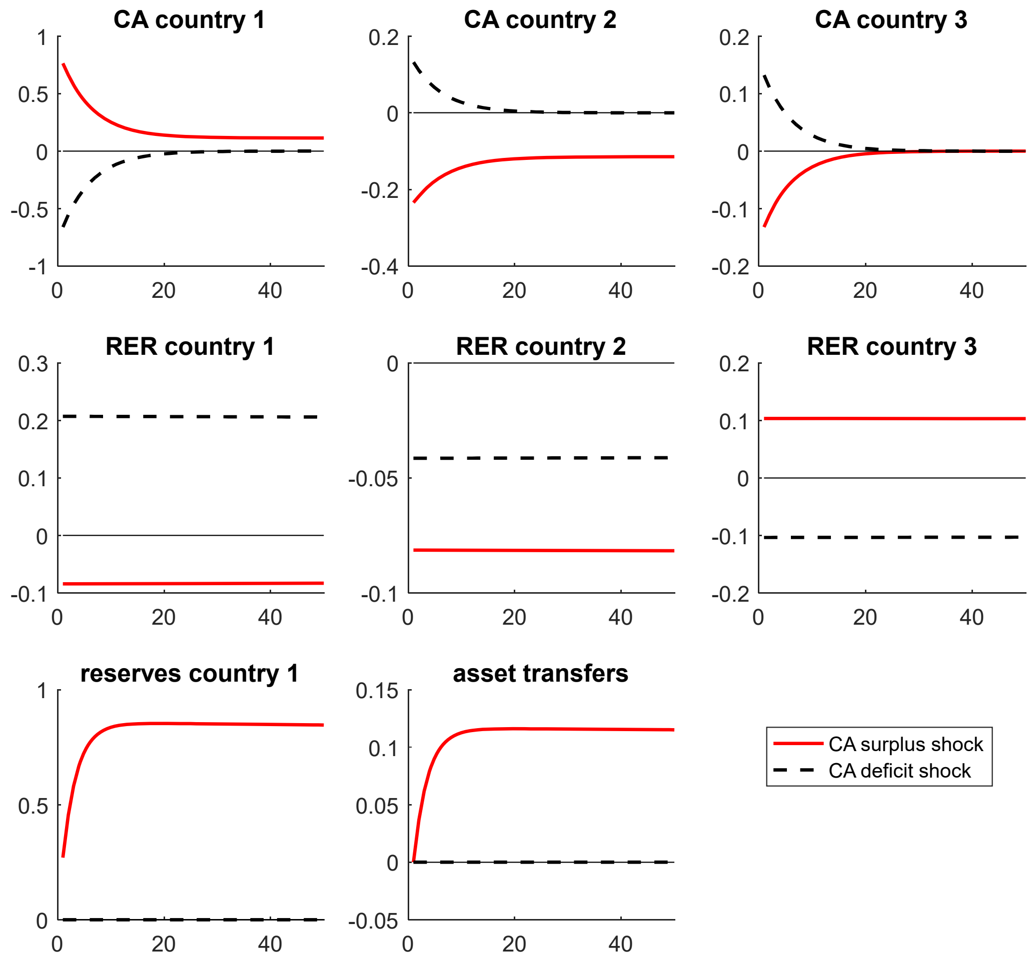
Source: LYS (2016)

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)	0.6594***	0.6723***	0.6182***	1.5141***	0.6590***	0.6686***	0.5769***	0.6683***	0.5868***	0.7985***
	(0.070)	(0.062)	(0.065)	(0.353)	(0.080)	(0.063)	(0.071)	(0.144)	(0.068)	(0.133)
CA(-1) × Pos CA	0.0698	0.1145*	0.1170*	-0.4224*	0.0804	0.1261*	0.1795**	0.1773	0.1464	0.0004
	(0.073)	(0.066)	(0.060)	(0.229)	(0.087)	(0.068)	(0.085)	(0.111)	(0.157)	(0.108)
CA(-1) × trade openness	0.0001	0.0003	0.0002	-0.0093**	0.0002	0.0004	0.0002	0.0005	0.0001	0.0006*
	(0.000)	(0.000)	(0.001)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CA(-1) × financial openness	0.1793**	0.0280	0.2584***	0.5070*	0.1326	0.0072	0.1282	0.0394	0.1691	-0.0848
	(0.083)	(0.076)	(0.052)	(0.277)	(0.106)	(0.079)	(0.089)	(0.102)	(0.111)	(0.128)
Pos CA	0.4557	0.9424*	0.1680	-0.4288	0.4272	0.8588	0.6489*	-0.0404	0.4718*	-0.3274
	(0.298)	(0.525)	(0.205)	(0.699)	(0.407)	(0.573)	(0.338)	(0.721)	(0.273)	(0.659)
trade openness	0.0002	-0.0025	0.0071**	0.0036	0.0003	-0.0017	-0.0008	0.0014	-0.0001	0.0090**
	(0.002)	(0.003)	(0.003)	(0.014)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
financial openness	0.7092**	1.3250***	1.0511**	2.2623	0.2907	1.0841**	-0.0357	-0.8322*	0.4144	-1.7109***
	(0.306)	(0.461)	(0.481)	(1.796)	(0.479)	(0.486)	(0.425)	(0.492)	(0.409)	(0.610)
Constant	-2.7509***	15.0376	-2.5557***	0.5011	-4.0831***	15.2325	-4.0950***	26.9472***	-4.2212***	0.1164
	(0.623)	(9.608)	(0.691)	(1.240)	(0.987)	(9.694)	(1.036)	(6.687)	(1.060)	(0.621)
Observations	2,093	1,696	476	116	1,617	1,580	1,189	598	1,131	475
R-squared	0.674	0.663	0.871	0.890	0.646	0.654	0.689	0.765	0.647	0.749

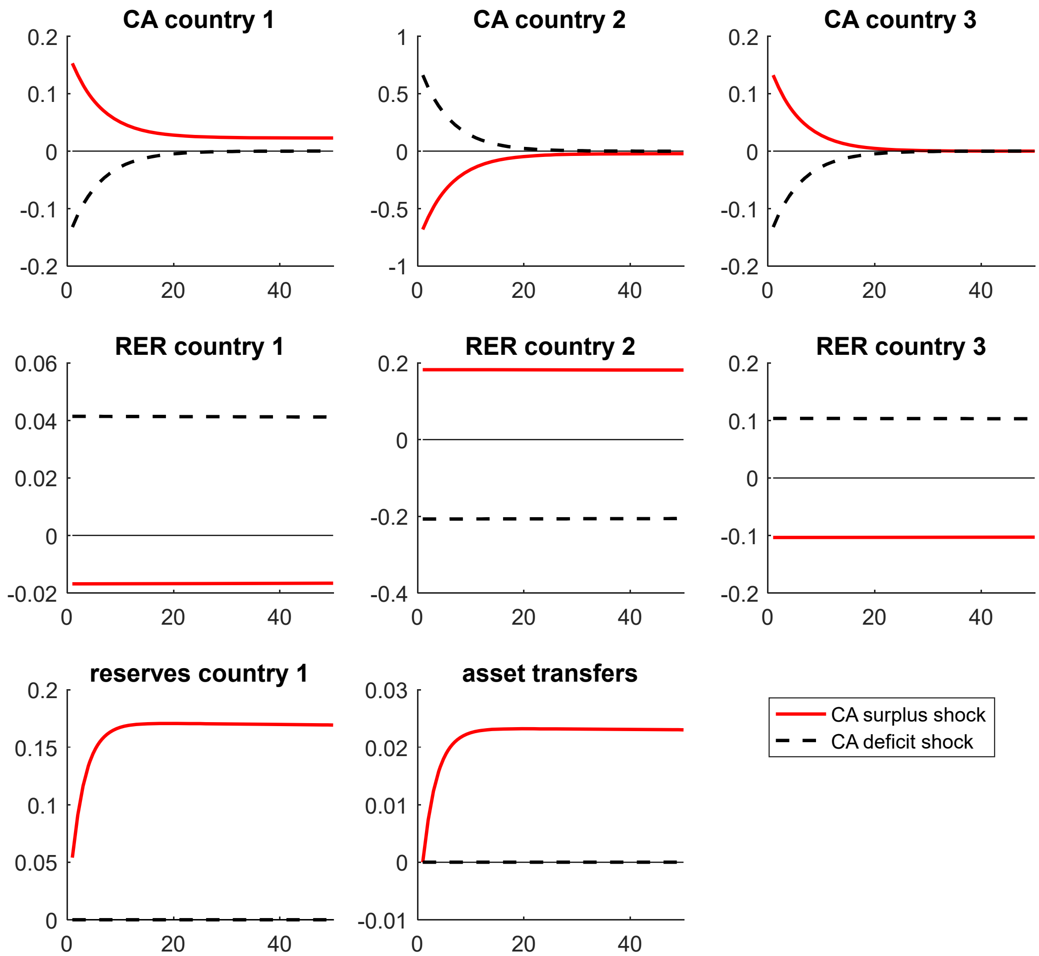
Note: Clustered standard errors at country-level in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Year fixed effects are included but not reported. Pos CA indicate CA>0 dummy at t-1.
Source: LYS (2016)

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



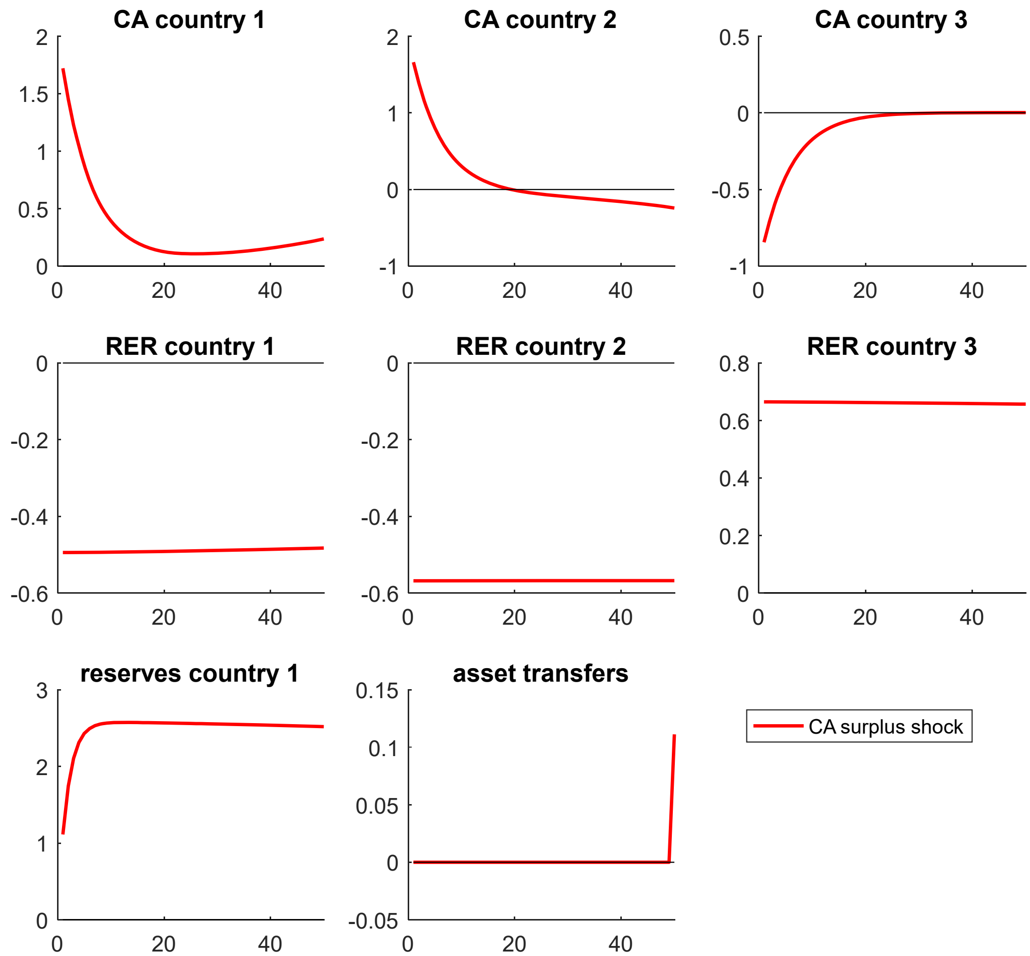
Note: Solid (red) line shows case of a shock raising country 1 endowment of traded good (CA surplus shock); dashed (black) line shows case of a shock lowering the endowment (CA deficit shock). Bottom axes measure time since shock in years. Current account and other quantity variables (top row and bottom 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).