WP/14/146

IMF Working Paper

Friedman Redux: External Adjustment and Exchange Rate Flexibility

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INTERNATIONAL MONETARY FUND

 WP/14/146

IMF Working Paper

Research Department

Friedman Redux: External Adjustment and Exchange Rate Flexibility[†]

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August 2014

Abstract

Milton Friedman argued that flexible exchange rates would facilitate external adjustment. Recent studies find surprisingly little robust evidence that they do. We argue that this is because they use composite (or aggregate) exchange rate regime classifications, which often mask very heterogeneous bilateral relationships between countries. Constructing a novel dataset of bilateral exchange rate regimes that differentiates by the degree of exchange rate flexibility, as well as by direct and indirect exchange rate relationships, for 181 countries over 1980–2011, we find a significant and empirically robust relationship between exchange rate flexibility and the speed of external adjustment. Our results are supported by several "natural experiments" of exogenous changes in bilateral exchange rate regimes.

JEL Classification Numbers: F32, F33, F41

Keywords: external dynamics, exchange rate regimes, global imbalances

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[†] We are grateful to Olivier Blanchard, Jeffrey Frankel, Si Guo, Anton Korinek, Andrea Presbitero, Andrew Rose, Hélène Ward, and participants at the NBER IFM Spring 2014 Meeting, SNB-CEPR Conference on Exchange Rates and External Adjustment, Royal Economic Society Annual Conference, CEA Annual Conference, International Panel Data Conference, Bank of England International Finance Seminar, and the Graduate Institute Geneva International Economics Seminar for helpful comments and suggestions. We are also very grateful to Naotaka Sugawara for help with data programming, and to Luis-Diego Barrot for excellent research assistance. Any errors are our responsibility.

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I. INTRODUCTION

Debates on global imbalances as well as the challenges currently confronting many Eurozone periphery countries have rekindled interest in the relationship between exchange rate flexibility and external adjustment. Writing in the heyday of Bretton Woods, Friedman (1953) argued that flexible exchange rates would facilitate external adjustment, helping countries avoid traumatic balance of payments crises by allowing automatic adjustment to incipient imbalances. In deficit countries, the exchange rate would depreciate, restoring competitiveness and narrowing the deficit; in surplus countries, the exchange rate would appreciate, shrinking the surplus. Under fixed exchange rates, by contrast, the burden of adjustment in deficit countries would fall entirely on downwardly rigid goods and factor prices, while surplus countries would face no compelling adjustment mechanism.

The emerging market (EM) financial crises of the 1990s (all of which occurred under some form of pegged regime), the large current account deficits in Eastern European countries in the runup to the global financial crisis, and the ongoing efforts of several Eurozone periphery countries are all testament to the delayed and more difficult external adjustment under fixed exchange rates. Yet formal evidence on the link between exchange rate regimes and external adjustment is scant and surprisingly contradictory. In a recent paper, for example, Chinn and Wei (C&W, 2013) argue that the nominal exchange rate regime does not matter for external adjustment—or more precisely, that they find "no strong, robust, or monotonic relationship between exchange rate regime flexibility and the rate of current account reversion." Similarly, Clower and Ito (2012) find that exchange rate regimes are generally not a robust determinant of current account persistence, but that fixed exchange rate regimes have a significantly higher likelihood of entering a nonstationary current account regime in EMs.

While increasing capital mobility may have weakened the relationship between exchange rate flexibility and external adjustment (since capital flows can sustain imbalances for longer even under flexible exchange rates), such findings are in contrast to a central tenet of open economy macroeconomics that the nominal exchange rate constitutes an important adjustment tool.[1] Although several studies question C&W's results on the grounds that they do not take proper account of threshold effects whereby imbalances are larger, and subsequent adjustment is more abrupt under pegs (Ghosh et al., 2010); their econometric model is misspecified (Tippkötter, 2010); or that they are sample-specific and driven by the discrete nature of the regime classification that does not adequately capture exchange rate flexibility (Herrmann, 2009; Ghosh et al., 2013; Berger and Nitsch, 2014), it is fair to say that the relationship between external adjustment and the exchange rate regime remains unresolved.

[1] In addition to increasing capital mobility, Berka et al. (2012) and Dong (2012) argue that changes in firms' pricing behavior (shift from exporter currency pricing to local currency pricing), and greater stickiness in local currency prices implies lower responsiveness of the trade balance to exchange rate movements.

In this paper, we argue that the main reason existing studies do not find an empirically robust relationship between exchange rate flexibility and external adjustment is because they use standard exchange rate regime classifications that are composite (or aggregate) in nature, and do not differentiate between the degree of exchange rate flexibility across various trading partners. The problem is well illustrated by the example of the United States. Clearly, the US dollar floats—and existing regime classifications categorize it as such. Yet its exchange rate against many of the major trading partners (e.g., China), and that is relevant to the dynamics of (a significant portion) of its trade balance, does not adjust freely. For example, Figure 1[a] plots the volatility of the bilateral nominal exchange rate between the US and some of its top trading partners over the last decade. This volatility—measured as the standard deviation of the monthly percentage change in the bilateral nominal exchange rate—is around 2½-3 percentage points against Canada, Germany, Japan and Mexico, but less than one-half percentage point against China (which accounts for 15 percent of US trade). If exchange rate flexibility does matter, then the behavior of US-China bilateral trade balance should be different from that of other US bilateral relationships. Figure 1[b] suggests that this is indeed the case: US deficits against other countries have tended to fluctuate, while the deficit against China has consistently deteriorated, almost tripling over the past decade.[2]

Similar problems arise in other cases. For instance, Eurozone countries are classified in existing regime classifications as either having floating exchange rates (but around 60 percent of their trade is with each other), or as having fixed exchange rates (but 40 percent of their trade is with countries against which they float).[3] Countries that peg against an anchor currency are classified as a fixed exchange rate, even though their exchange rates may fluctuate against other countries that are important trading partners.[4] Not surprisingly, ignoring the very heterogeneous bilateral relationships and whether most—or even much—of a country's trade is with a partner against which it has a peg (regardless of which country is initiating the peg) can yield misleading conclusions about the relationship between the exchange rate regime and external adjustment.

To test our hypothesis, we examine the regime-external adjustment nexus through the prism of *bilateral* relationships between pairs of countries. To this end, we construct a unique and comprehensive dataset of bilateral exchange rate regimes covering 181 countries over 1980–2011, making use of existing (composite) de jure and de facto regime classifications, together with information on "anchor" currencies, obtained from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Our dataset comprises a three-way bilateral exchange rate regime classification—*fixed*, *intermediate*, and *floating*—

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[2] Likewise, China's trade balance against the US shows much greater persistence than its trade balance with other partners such as Brazil, Germany or Japan, against which its exchange rate is relatively more flexible.

[3] The IMF, for example, classified the Eurozone countries as a fixed exchange rate regime until 2006, but has been classifying them as floats since then. Other commonly used regime classifications, e.g., Levy-Yeyati and Sturzenegger (2003) and Reinhart and Rogoff (2004), classify them as a fixed regime.

[4] In the context of the gold standard, Catão and Solomou (2005) show that swings in nominal exchange rates between gold-pegged countries and their major trading partners with more flexible monetary regimes translated into real exchange rate variations, which was instrumental to international payments adjustment.

against each trading partner. For fixed and intermediate regimes—hereafter referred collectively to as "pegs"—we further differentiate between *direct pegs* (one country pegging to another) and *indirect pegs* (two countries pegging to a common anchor currency; or to separate anchor currencies that are themselves pegged to a common anchor).

Combining the bilateral exchange rate relationships with information on bilateral trade balances, we obtain a much larger and richer dataset than the standard practice of using aggregate balances and regime classifications, which allows us to differentiate across heterogeneous bilateral relationships (so that the US-China exchange rate relationship is treated as a peg, while the US-Germany relationship is a float). Following Friedman, we would expect the speed of mean reversion of the trade balance to be faster under a float than under a peg, and faster when the peg is indirect than when it is direct (as indirect pegs may allow relatively greater exchange rate flexibility).

With our bilateral data, we obtain empirical results strongly consistent with Friedman's hypothesis.[5] Trade imbalances under less flexible exchange rate regimes (regardless of whether the peg is direct or indirect) adjust significantly more slowly than imbalances under floats. The half-life of the bilateral trade balance is thus almost twice as long under a direct peg than under a float (5 years versus 2.5 years) when both cross-sectional and time variation in bilateral exchange rate regimes is allowed (either with or without country fixed effects), and about 0.3 years higher when only the time variation is considered (i.e., when country-pair fixed effects are included in the regression). This pattern generally holds across subsamples comprising different country compositions (advanced, EM, and developing), and also when indirect pegs are taken into account, where as hypothesized, we find the speed of external adjustment for indirect pegs to be faster than that for direct pegs, but significantly slower than that for floats.

These results are supported by several "natural experiments" of exogenous regime changes between trading partners: the CFA Franc zone's peg to all Eurozone countries when France adopted the euro in 1999; Lithuania's switch from the US dollar to the euro as anchor currency for its currency board arrangement in 2002; and the shift from (somewhat) more flexible exchange rates between European countries under European Monetary System/Exchange Rate Mechanism (EMS/ERM) and ERMII to completely rigid rates with euro adoption. In each of these cases, trade balance adjustment against the corresponding partner is significantly slower under the less flexible exchange rate arrangement.

In addition, we find that under floating regimes, large deficits and surpluses—defined as the bottom and top quartiles of the distribution of bilateral trade balances, respectively—adjust significantly faster than smaller imbalances, while pegs (both direct and indirect) show no such tendency. This suggests that the faster mean reversion of imbalances under flexible

[5] This is akin to the literature on trade and exchange rate volatility, which generally finds much sharper results using bilateral data than those typically obtained from looking at aggregate trade volumes and (trade-weighted) real exchange rate volatility (see, e.g., Clark et al., 2004).

exchange rates does not just represent "noise" of small, short-term movements, but also the correction of substantial imbalances. In support of this, we further find that the direction of the exchange rate movement under floats is consistent with the correction of imbalances: countries with bilateral trade deficits experience real depreciations of their bilateral exchange rate, while surplus countries experience real appreciations. Under pegs, however, the response of the bilateral real exchange rate to the trade balance is statistically insignificant. Finally, we find some evidence that greater capital mobility weakens the relationship between exchange rate flexibility and external adjustment. Overall, our findings are robust to a battery of sensitivity tests, including alternate model specifications, estimation methods, samples, measures of bilateral trade balance, and to bilateral regime classifications constructed using other (composite) exchange rate regime classifications.

We make several contributions to the literature. First, we provide an intuitive explanation for why previous studies have had difficulty in establishing a robust relationship between exchange rate flexibility and external adjustment, and propose a novel way of analyzing that relationship. While it is usually the aggregate, rather than bilateral, trade balance that is of interest, a bilateral prism is necessary to examine the flexibility-adjustment nexus—just as, for instance, in analyzing the effect of a currency union on the volume of trade, it is important to examine bilateral trade with partners with which the country actually shares a common currency. Likewise, in analyzing the effect of pegs on external adjustment, it is important to examine the behavior of the trade balance against partners with which the country actually has a pegged exchange rate relationship. Second, to test our hypothesis, we construct a comprehensive, three-way, bilateral exchange rate regime classification, covering almost the entire universe of countries and spanning three decades, which takes into account both direct and indirect exchange rate relationships between countries. Further, by using a variety of existing (composite) exchange rate regime classifications to create the bilateral exchange rate regime measure, we are able to show that our findings are not driven by any particular classification, but rather reflect the underlying heterogeneous bilateral regime relationships across trading partners. Finally, our bilateral dataset allows us to exploit several "natural experiments" of regime change, which help to address potential endogeneity concerns, and provide a robustness check on the panel estimations.

The rest of the paper is organized as follows. Section II discusses the various possible bilateral exchange rate regime relationships, and details the construction of our bilateral exchange rate regime classification. Section III presents key stylized facts about the dynamics of external balance under different bilateral exchange rate regimes. Section IV discusses the estimation strategy and presents our main findings. Section V reports some further results on possible threshold effects in the external adjustment-exchange rate flexibility relationship; the direction of exchange rate movement in the face of trade imbalances under different exchange rate regimes; the impact of financial openness on external dynamics; and robustness checks. Section VI concludes with the key policy implications of our results.

II. Bilateral Exchange Rate Relationships

A. Possible Configurations

Central to examining the relationship between exchange rate flexibility and the speed of external adjustment is how the exchange rate regime is classified.[6] Previous studies (e.g., C&W; Ghosh et al., 2010) use Reinhart and Rogoff's (R&R, 2004) or the IMF's de facto exchange rate regime classification, both of which code a country's regime based on its movements with respect to a *single* anchor currency (or a basket of anchor currencies). But, as argued above, what may be more important for current account adjustment is the behavior of the exchange rate against the currencies of the *major trading partners* (regardless of which country is pegging).

In the case of the US, for instance, what needs to be taken into account is not only whether the dollar floats, but also whether any of US' major trading partners peg to the dollar. Since many countries—including China, which is a major trading partner—de facto peg against the US dollar, US' exchange rate relevant to its external dynamics does not float as freely as, say, the New Zealand dollar (which also floats, but to which almost no major trading partner pegs). The speed of adjustment of US' current account balance should therefore be slower than that of New Zealand—even though any composite exchange rate regime classification would categorize both countries as floating regimes. Figure 2 plots the simple first-order autoregressive (AR) coefficient for the current account balance of the US and New Zealand, and finds support for this argument: the AR coefficient for the US is almost twice as large as that for New Zealand, implying that the half-life of the US external balance (to GDP) is almost four times as long as that of New Zealand (4 years vs. 1 year).[7]

To examine the association between exchange rate flexibility and the speed of external adjustment, we therefore turn to the bilateral exchange rate relationships between countries. Our basic premise is that, with sticky prices and wages, a flexible nominal exchange rate facilitates external adjustment. The rate at which a bilateral imbalance between two countries, *A* and *B*, reverts should thus depend on the degree of exchange rate flexibility between them, which in turn depends on several features (as illustrated in Figure 3). First, and most simply, whether the two countries are *pegged* to each other such that the exchange rate between them does not adjust freely. If pegged, then whether it constitutes a *direct peg* (such that the currency of at least one country in the pair is an anchor for the other; or the two countries share a common currency), or an *indirect peg* (i.e., the two countries peg to a

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[6] An alternative approach to using exchange rate regime classifications would be to use actual exchange rate volatility (Ghosh et al., 2013). In the literature on the effects of exchange rate regimes, however, it is standard practice to use discrete regime classifications—one advantage of which is that they tend to be slow-moving variables, mitigating endogeneity concerns.

[7] Likewise, the degree to which a fixed exchange rate impedes external adjustment depends on the trade share of the partner(s) to which the country pegs: thus the AR coefficient on the trade balance of Greece (about 50 percent of whose trade is with the Eurozone) is 0.9, whereas the corresponding coefficient, say, for Ecuador (which has dollarized since 2000, but its trade with the US constitutes some 35 percent of its total trade) is 0.5.

common anchor; or to different anchors that are themselves pegged to a common anchor). Further, since the peg could take the form of a *fixed* exchange rate regime with no or very limited exchange rate flexibility (e.g., monetary union, dollarization, currency board, single currency peg) or a relatively more flexible *intermediate* regime (e.g., basket peg, target zone, crawling peg), both direct and indirect pegs may be further classified as fixed or intermediate direct and indirect regimes.[8]

Among bilateral floats, a further distinction is also possible if we consider whether the two countries share a *pure float* (i.e., neither country has a peg to another country) or an *impure float* (i.e., at least one country in the trading pair has a pegged regime but no (direct or indirect) peg relationship exists between the pair). In principle, the greater exchange rate flexibility afforded by the float need not translate into faster external adjustment under impure floats. Consider a case where country *A* pegs to country *B*, but has a floating exchange rate against country *C*. Then *A*'s exchange rate dynamics against *C* will be (largely) determined by those of the anchor, *B*, and need not correspond to what is required for adjustment with *C*. Thus, if *A* has a trade surplus against *C*, its exchange rate should appreciate to facilitate adjustment, but whether it will do so depends upon whether *B*'s currency appreciates against *C* (i.e., other things equal, whether *B* also has a trade surplus with *C*). Hence, whether the flexibility implied by *A*'s (impure) float with *C* facilitates adjustment will at least, in part, rely on whether the sign of its trade balance with *C* coincides with the sign of the trade balance between *B* (its anchor country) and *C*.[9]

Among the various bilateral relationships described above, *a priori*, we would expect real exchange rate flexibility to be the lowest when one country directly fixes its exchange rate to the other. Indeed, in our sample, under a direct fixed regime, the standard deviation of the (bilateral) real exchange rate amounts to 3 percent per year, compared to about 6 percent under a direct intermediate regime (Table 1). Similarly, since direct pegs typically imply stabilizing the parity to within a certain range, we would expect indirect pegs to imply somewhat greater exchange rate flexibility (i.e., if direct pegs imply stabilizing the parity within ±1 percent, an indirect peg could move by ±2 percent). This appears to be the case empirically—the standard deviation of the real exchange rate is 7½ and 9 percent under indirect fixed and intermediate exchange rate regimes, respectively.

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[8] Among indirect pegs, several types of indirect relationships are possible depending on the number of links involved. The smallest possible number of links is two such that, e.g., if countries *A* and *C* peg to country *B*, then *A* and *C* could be considered to have a "first generation" indirect peg (see Figure A1 in the Appendix for a graphic illustration). By contrast, if *D* pegs to *A* and *E* pegs to *C*, then *D*'s relationship with *C* and *E* could be considered as a "second generation" indirect peg. In the empirical work below, we allow for both first and second generation indirect pegs collectively—results remain similar if we consider only the former.

[9] While, in principle, there is an equal probability that the signs will coincide, in practice, the probability turns out to be higher: the proportion of bilateral relationships where the sign of the trade balance between a pegged country and its trading partner coincides with the sign of the trade balance between the anchor country and that trading partner is about 60 percent (on a trade-weighted basis) in our dataset. In our empirical analysis below, we find negligible difference in the rate of adjustment between pure and impure floats.

Real exchange rate flexibility is greatest when the two countries have a pure float relationship, with an annual standard deviation of 10 percent per year, with impure floats following closely at 9 percent. Empirically, at least, regimes may therefore be ranked in order of increasing real exchange rate flexibility—direct pegs, indirect pegs, and (impure/pure) floats—with the ranking generally holding across different horizons over which exchange rate flexibility is calculated (Figure 4). The upshot is that, if Friedman's hypothesis holds, then adjustment should be fastest under a float and slowest under a direct fixed regime, with other (bilateral) regimes lying somewhere in between these extremes.

B. Regime Classification

To create the various possible bilateral exchange rate regime relationships, we draw on the IMF's de jure and de facto (composite) exchange rate regime classifications, as documented in the AREAER, for 181 countries over 1980–2011.[10] The de jure classification reflects the officially announced regime, which—as is well known—often differs from the regime actually pursued by the central bank. By contrast, the de facto classification categorizes the regime according to actual exchange rate behavior (supplemented by information on movements in foreign exchange reserves, interest rates, and parallel market exchange rates).

While several de facto classifications have been developed in the literature (e.g., Ghosh et al., 2003; Levy-Yeyati and Sturzenegger, LY&S, 2003; R&R; Shambaugh, 2004), there are several reasons to prefer the IMF's de facto classification. First, it combines (often confidential) information on central bank's foreign exchange intervention and policy framework with actual changes in the nominal exchange rate to arrive at an informed judgment about the exchange rate regime. Thus, by not being based on a purely mechanical algorithm, it tends to avoid some of the occasional idiosyncrasies that any mechanical rule inevitably produces. Second, in most cases where countries peg, it provides explicit information on the anchor currency necessary to pin down bilateral exchange rate relationships. Third, the IMF classification provides up-to-date coverage for all member countries, making it possible to analyze recent trends in external adjustment.[11] While we prefer the IMF's classification for our empirical analysis, we also check the robustness of our results below by using other classifications (R&R and LY&S).

The IMF classification traditionally grouped exchange rate regimes into eight categories: (i) arrangements with no separate legal tender; (ii) currency boards; (iii) conventional pegs (including basket pegs); (iv) pegged exchange rates within horizontal bands; (v) crawling pegs; (vi) crawling bands; (vii) managed floats with no predetermined path for the exchange

[10] See Table A1 in the Appendix for the countries in the sample grouped as advanced, EM and developing. Countries are identified as advanced based on the IMF's World Economic Outlook (WEO) (Czech Republic, Estonia, Korea and Slovak Republic that have recently been classified as advanced countries in the WEO, are considered as EMs in our sample); and as EM based on IMF's Vulnerability Exercise for Emerging Economies.

[11] The IMF adopted the de facto exchange rate regime classification in 1999. Bubula and Ötker-Robe (2003) and Anderson (2008) harmonize the coverage of the de jure and de facto classifications by extending the former up to 2006, and the latter backwards up to the 1970s. See Table A2 for data description and sources.

rate; and (viii) independent floats. The classification categories have been revised since 2008, however, and some additional categories (stabilized, crawl-like, and other managed) have been introduced, while a few (e.g., crawling band) have been abandoned.[12] To construct our bilateral regime classification, we first map the new categories into the old ones to create a consistent composite regime classification for the full sample period (1980–2011).[13] We then group the first three arrangements (excluding basket pegs) as fixed exchange rate regimes, the last arrangement as a float, and the remaining arrangements as intermediate regimes (assigning values of 0, 0.5, and 1 to fixed, intermediate and floating regimes, respectively).[14]

Next, we combine the exchange rate regime information for each country with that of its anchor currency—also obtained from the IMF's AREAER—to generate the (direct) bilateral exchange rate regime variable. The anchors (listed in Table A3) include major international as well as regionally important currencies. We focus on explicit currency anchors, whereby countries serving as anchors of monetary policy are not included. For countries with only one anchor currency, the process of identifying the exchange rate regime with the trading partners is straightforward—e.g., a country that has a "conventional peg" with the US dollar is considered to have a fixed exchange rate regime against the US, but an (impure) float against all other trading partners. Similarly, for currency unions (CU), countries within the CU are considered to have a fixed exchange rate regime with each other (as well as with the anchor country if that exists, e.g., France/Eurozone for the CFA zone countries, and US for the Eastern Caribbean Currency Union), and an (impure) float against all other trading partners.

For countries that peg to a composite of currencies (such as basket pegs) the process of creating bilateral regime relationships is significantly more involved because, typically, the anchor currencies in the basket (or their weights) are not disclosed. To get around this problem, and to avoid any subjectivity in the selection of anchors, for all basket pegs we take the top five trading partners as anchors since countries generally seek to stabilize exchange rates against their major trading partners. For pegs to Special Drawing Rights (SDRs), we consider the currencies in the SDR basket (pre-1999: French franc, German mark, Japanese yen, Pound sterling, and US dollar; post-1999: Euro, Japanese yen, Pound sterling, and US dollar) as anchor currencies; and for (participant and non-participant) countries in the ERM,

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[12] See IMF (2008) for a detailed description of the methodological revisions to the classification.

[13] In mapping the new categories with the earlier ones, we try to minimize subjective judgment. For the category of stabilized arrangement, we classify observations as conventional pegs if they meet the pre-2007 criteria that the exchange rate against the anchor remains in a tight band of ±1 percent for at least 3 months (and code them as managed floats otherwise). We classify crawl-like and crawling band arrangements as crawling pegs, and other managed arrangements as managed floats. In addition, consistent with pre-2007 classification, we classify currency union members (e.g., the Eurozone countries) as a fixed regime rather than a float.

[14] The estimation results presented below are robust to changing the cut-offs, and grouping basket pegs and managed floats with fixed regimes and floats, respectively.

we consider currencies comprising the European Currency Unit (ECU) as anchors before the euro was introduced, and all Eurozone countries as anchors thereafter.[15]

Once we have established the direct exchange rate regimes between trading pairs, we create possible indirect relationships between countries resulting from common anchors. (Thus, e.g., Argentina is considered to form an indirect peg with China during its currency board years as both countries pegged to the US dollar; Lithuania forms an indirect peg with CFA zone countries post-2002 as both have euro as an anchor; and Bhutan forms an indirect peg with the US in the years India is pegged to the US dollar since Bhutan pegs to India; see Figure A1.) We consider the indirect peg as an indirect *fixed* regime (and assign a value of 0) if both countries are linked through fixed exchange rate regime relationships (i.e., if they have a fixed exchange rate against the same anchor, or if they have fixed exchange rates against two separate anchors, which themselves have a fixed exchange rate between them). We consider the indirect peg as an indirect *intermediate* regime (and assign a value of 0.5) if both countries are linked entirely through intermediate regime relationships, or through some combination of fixed and intermediate regimes.[16]

Our final bilateral exchange rate regime classification dataset has about 380,000 observations (instead of (181×180×32)/2=521,280 because of missing data in earlier years). For analytical purposes, we split the full sample into three (mutually exclusive) subsamples based on economic characteristics—Advanced-EMDC: where one country in the trading pair is an advanced country and the other is an EM or developing country; Advanced: where both countries in the trading pair are advanced countries; and EMDC: where both countries in the trading pair are either EMs or developing.

Table 2 presents the distribution of bilateral exchange rate regimes for both the de jure and de facto classifications for the different samples. Direct pegs (fixed and intermediate regimes) constitute about 4 percent of the full sample, while indirect pegs and floats constitute 23 and 73 percent of the sample, respectively. This is in contrast to the aggregate exchange rate regime classifications where generally a much larger proportion of observations (about 70-80 percent) is identified as pegs (e.g., Ghosh et al., 2003; R&R). This bilateral distribution, however, does not take into account the importance of trading relationships between countries—if we restrict the sample to include only the top trading partners, then of course the share of direct fixed and intermediate exchange rate regimes increases (to about 15 percent of the sample), but still remains significantly less than floats.

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[15] In 1998, the ECU comprised 12 currencies with the German mark carrying the largest weight, followed by the French franc, Pound sterling, Dutch guilder, Italian lira, Belgian franc, Spanish peseta, Danish krona, Irish pound, Portugese escudo, Greek drachma, and Luxembourg franc.

[16] For example, in Figure A1, if both countries *A* and *C* have a fixed (intermediate) exchange rate regime against the common anchor, *B*, then the resultant indirect ("first generation") pegged regime between *A* and *C* is fixed (intermediate). If, however, one country has a fixed regime against *B* and the other has an intermediate regime, then the resultant indirect regime between *A* and *C* is coded as intermediate (to reflect relatively greater flexibility in the bilateral exchange rate movement). The same rule applies to "second generation" indirect pegs.

Looking at the trend in regimes over time, we find that the proportion of bilateral (direct) intermediate regimes (de jure or de facto) has fallen in the last decade, but that of fixed regimes has increased—mainly because of Eurozone formation. Since EMDCs mostly peg to currencies of advanced countries, the share of fixed exchange rate regimes between EMDCs is very small (about 1 percent), and has remained fairly stable over the years, while that between EMDCs and advanced countries has increased five-fold from the 1980s to 2000s.

III. Exchange Rate Regimes and External Balances: Some Stylized Facts

To examine Friedman's argument that flexible exchange rates provide a continuous mechanism for external adjustment, a measure of external balance is required. While existing studies commonly use the current account balance for this purpose, such data are not widely available on a bilateral basis. Instead, we use the bilateral trade balance data (taken from the IMFs' *Direction of Trade Statistics*), scaled by the sum of bilateral exports and imports—to preserve symmetry across trading pairs—as our measure of external balance.[17] This does not present any particular difficulties as the bulk of the current account is usually the trade balance, and the postulated relationship between exchange rate flexibility and the external balance in any case pertains mainly to trade rather than to factor incomes or transfers.[18]

We begin the analysis by looking at the (unconditional) transition probabilities of staying in the current state of the external balance under different exchange rate regimes. If the thrust of Friedman's argument holds, then such probabilities should be lower under a float (reflecting lower persistence of the external balance) than under a pegged regime. To provide a benchmark for comparison, we first present the transition probabilities using aggregate data (for trade balances and regime classification), where for consistency with the discussion below on bilateral trade balances, we use a similar measure of external balance (i.e., aggregate trade balance scaled by total trade); results using the current account or trade balance expressed in percent of GDP are very similar (reported in Table A4).

Our measure of trade balance (TB) lies between -1 and 1; to compute the transition probabilities, therefore, we define four ranges of the TB (less than -0.5, -0.5 to 0, 0 to 0.5,

[17] Since the reported export values of country *i* to country *j* are often not identical to the imports reported by *j* from *i* (because of differences in reporting capacities, valuation methods, etc.), we compute bilateral exports and imports by taking the average of *i*'s exports to *j*, and *j*'s imports from *i*, and the average of *i*'s imports from *j*, and *j*'s exports to *i*, respectively. Following Berger and Nitsch (2014), we scale by total bilateral trade rather than GDP since the GDP of the trading partners may be very different. By preserving the symmetry of the bilateral trade relationship, we can also restrict estimation over trade balance between *i* and *j* (the balance between *j* and *i* is simply the mirror image; while the bilateral exchange rate regime between *i* and *j*, and *j* and *i* is also identical). In the sensitivity analysis below, we use alternate definitions of bilateral trade balance, and obtain similar results.

[18] The data obtained from IMF's *Direction of Trade Statistics*, while comprehensive in country and time coverage, pertains to bilateral trade in goods only. In the robustness analysis below, we also use data on bilateral trade in goods and services obtained from the OECD for countries where such information is available.

and greater than 0.5).[19] We compute transition probabilities for each range under fixed, intermediate and floating regimes, but when computing these probabilities, we exclude the years in which the exchange rate regime changes so as not to (incorrectly) attribute the trade balance to regimes when the switch happened later in the year.

The estimated transition probabilities using aggregate balances and the composite regime classification present a mixed picture in terms of persistence across the different regimes (Table 3). Large deficits, for instance, tend to be significantly more persistent under pegs than under floats: the probability of maintaining a large deficit from the current period to the next is about 76 and 82 percent under fixed and intermediate regimes, respectively, but about 50 percent under floats. For more moderate deficits, however, persistence appears to be somewhat similar across regimes; while for surpluses, it is the highest under floats. Based on these probabilities, it seems fair to say that no clear pattern emerges of the behavior of aggregate balances under different exchange rate regimes.

How does the picture look like when using bilateral trade balances and the bilateral regime classification? As above, we divide the bilateral TB data into four ranges (less than -0.5, -0.5 to 0, 0 to 0.5, and greater than 0.5), and estimate transition probabilities using the bilateral classification of direct fixed, intermediate, and floating regimes.[20] Looking at the diagonal elements in Table 4, it is striking that the persistence of TB is statistically significantly greater under pegs relative to floats for *all* ranges. Thus, e.g., for large bilateral trade deficits and surpluses, the probability of staying within the same range from one period to the next is about 4 percentage points higher under pegged regimes than under floats, while for all other deficit and surplus ranges, this probability is about 6-27 percentage points higher for pegs.

Similar results are obtained if we split the sample by decade, and compute transition probabilities over time (Table 5). Pegged regimes appear to have higher persistence than floats across different ranges of the bilateral TB in earlier decades as well as in the 2000s. The persistence of bilateral TB, however, seems to have increased generally over time. For fixed regimes, for instance, the probability of maintaining the same balance has increased by about 2-8 percentage points from the 1980s to 2000s across the different TB ranges, whereas it has increased by about 1-2 percentage points for floats. Formal tests of structural stability of the transition probabilities also reject the hypothesis of equal probabilities over time. This trend of increasing persistence is in line with the pattern of increasing global dispersion in external balances reported in earlier studies (e.g., Faruqee et al., 2009), who argue that it is a consequence of greater financial integration (lower barriers to capital mobility), which allows countries to maintain larger imbalances for longer periods of time.

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[19] While the choice of the cut-offs is inherently arbitrary, we select the threshold of -0.5 to depict large deficits as it corresponds to the bottom 10^{th} percentile of the TB distribution for the full sample.

[20] The floating category here includes pure and impure floats, as well as indirect pegs. Excluding indirect pegs from floats leads to even lower persistence probabilities across different ranges of the TB.

Overall, in sharp contrast to the results using composite classifications, the transition probabilities estimated on bilateral data are much more consistent with Friedman's hypothesis that exchange rate flexibility should promote faster corrections of trade imbalances. In what follows, we investigate these results more formally through the use of panel estimations as well as by exploiting several "natural experiments."

IV. External Dynamics: Estimation Strategy and Results

A. Composite Regime Classifications

To estimate the relationship between exchange rate regimes and external dynamics, as before, we begin by using the composite regime classification to provide a comparative benchmark, and reproduce the results of earlier studies. Following C&W and others (e.g., Herrmann, 2009; Ghosh et al., 2013), we estimate a first-order AR model as follows:

$$TB_{it} = \rho_0 + \rho_1 TB_{it-1} + \rho_2 XRR_{it} + \rho_3 (TB_{it-1} \times XRR_{it}) + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where TB_{it} denotes our trade balance (to total trade) measure in country i and year t; ρ_1 is the AR parameter (with values closer to 1 indicating a more persistent trade balance); *XRR* is the nominal exchange rate regime (with 0, 0.5, and 1 indicating a fixed, intermediate, and floating regime, respectively); *TB×XRR* is an interaction term between the exchange rate regime and lagged trade balance; μ are country-specific fixed effects; λ are time-specific effects to capture common shocks across countries; and ε is the random error term. If flexible regimes imply faster convergence of the trade balance, then the coefficient of the interaction term, ρ_3, should be significantly negative.

We estimate (1) using the IMF, R&R, and LY&S exchange rate regime classifications (with regime switch years excluded from the sample).[21] The results, presented in Table 6, show that contrary to Friedman's hypothesis, and consistent with C&W's findings, the estimated coefficient of the interaction term is statistically insignificant in all specifications. Specifically, when using the IMF's de jure and de facto classifications—where (1) is estimated with pooled Ordinary Least Squares (OLS), country-specific effects (CFE), and country-specific and time effects (CFE/TE)—the coefficient on the AR term for the full sample is statistically significant and in the range of about 0.7-0.9 (cols. [1]-[6]). By contrast, the coefficient of interest—on the interaction term between lagged TB and the exchange rate regime—is negative but wholly statistically insignificant. Among the various subsamples, the interaction term is always statistically insignificant.

The same pattern holds for R&R and LY&S classifications in cols. [7]-[9] and [10]-[12], respectively, where the interaction term is statistically insignificant across all samples. The results remain essentially the same if we use the current account balance to GDP ratio as a measure of external balance instead of the trade balance (Table A5). Overall, these findings

[21] The results are not affected if we include the regime switch observations in the estimations.

are consistent with those obtained in earlier studies, and do not suggest a robust association between exchange rate regimes and external dynamics, implying that exchange rate flexibility does not matter for external adjustment.

B. Bilateral Regime Classification

Next, we turn to bilateral data, and modify (1) to estimate the following model:

$$TB_{ijt} = \gamma_0 + \gamma_1 TB_{ijt-1} + \gamma_2 XRR_{ijt} + \gamma_3 (TB_{ijt-1} \times XRR_{ijt}) + \nu_{ij} + \lambda_t + \eta_{ijt} \tag{2}$$

where TB_{ijt} is the trade balance between countries *i* and *j* in year *t* as a ratio of total bilateral trade (sum of exports and imports) between the two countries in year *t*; *XRR* indicates the (bilateral) exchange rate regime between countries *i* and *j* (with 0, 0.5, and 1 indicating if *i* and *j* have a fixed, intermediate, or floating regime against each other, respectively); *TB×XRR* is an interaction term between the bilateral regime and the lagged trade balance term; ν captures country pair-specific effects (CPFE) that may affect the bilateral trade balance; λ are time-specific effects; and η is the random error term.

As before, we also estimate other versions of (2) such as pooled OLS (without CPFE and time effects), and with individual CFE for both *i* and *j* to control for any country-level time invariant specificities. In the sensitivity analysis below, we augment (2) with several time-varying control variables for the trading partners that could potentially affect their trade balance (such as economic size, age dependency ratio, and fiscal balance), and more generally with country-year fixed effects (i.e., the interaction between individual CFE and time effects) to control for all possible time varying variables of the trading pair. Considering the long time dimension of our dataset, and possible correlation in the error term, we cluster standard errors at the country-pair level in all specifications.[22]

We begin by considering only direct regime relationships so that fixed and intermediate regimes capture direct fixed and direct intermediate relationships, respectively; while the nonpeg/float category includes everything else (i.e., indirect pegs and impure/pure floats). We estimate (2) using both the de jure and de facto bilateral regime classifications for the full sample as well as the subsamples (Advanced-EMDC, Advanced, and EMDC), and find that the results lend strong support to Friedman's hypothesis that more flexible exchange rates are associated with significantly faster mean reversion and less persistent imbalances (Table 7). For the full sample, for instance, the estimated coefficient on the interaction term between lagged TB and the exchange rate regime is negative and statistically significant regardless of the specification used. The results obtained from the pooled OLS specification indicate that

[22] The fixed effects estimation of models with lagged dependent variable can produce biased estimates (the so-called "Nickell bias"). The bias (equal to 1/T) is serious for short panels, but disappears as $T \rightarrow \infty$ (for our sample, T=32; so the fixed effects estimator is likely to perform at least as well as many alternatives; Judson and Owen, 1999). To check the robustness of our results, however, we also apply the GMM estimation method for dynamic panels below.

the half-life of the bilateral TB under a fixed exchange rate is about twice as long as that for floats (5 years versus 2.5 years; cols. [1] and [5]). The result remains similar when CFE are included in the model, and we find that the half-life of the bilateral TB under a fixed exchange rate is about 5 years relative to 2 years for floats (cols. [2] and [6]). The persistence parameter, however, drops with CPFE such that the half-life of the trade balance is reduced to about 1.2 years under a fixed exchange rate compared to 1 year under an intermediate regime or 0.9 years under a float (cols. [3]-[4] and [7]-[8]).[23]

The results obtained from the subsamples present a broadly similar picture. In the Advanced-EMDC subsample, the half-life of the bilateral trade balance under a pegged regime ranges between 1.2-5.0 years depending on whether or not CPFE are included in the model, while that for floats is between 1-3 years. When the sample comprises only EMDC pairs, the half-life of the bilateral trade balance obtained from the pooled OLS specification is about 4 years under pegs compared to 2 years under floats, while that obtained from the CPFE estimation is about 1 year for pegs compared to 0.8 years under floats. By contrast, for the Advanced subsample, the interaction term is statistically significant in the pooled OLS and CFE regressions, but insignificant with CPFE. This may be because exchange rate regime switches between advanced country pairs are relatively rare; hence, most of the statistical power lies in the cross-country pair variation and throwing that out (by the inclusion of CPFE), leaves too little variation in the regime variable to identify its effect.

Indirect pegs and impure floats

What happens if we also take into account *indirect* bilateral exchange rate regime relationships? As discussed in Section II, *a priori*, we would expect such indirect pegged relationships to exhibit lower persistence of the trade balance than direct pegs (because they allow somewhat greater movement of the exchange rate), but to exhibit higher persistence than floats. Including a variable for indirect regimes and its interaction with lagged trade balance in (2), we indeed find this to be the case. While the difference in half-lives of bilateral trade balances between direct fixed and floating regimes obtained through CPFE is 0.3 years, it is about 0.1 years between indirect fixed regimes and floats (Table 8, cols. [2]-[3])). The result remains essentially similar if we also take into account impure floats, though—consistent with the finding above that exchange rate flexibility under impure float is not much lower than under pure floats—the dynamics under impure floats are not statistically different from those of pure floats, at least in the CPFE specifications (cols. [5]-[6]).

From the external adjustment perspective, these results thus imply that the slowest adjustment of imbalances will be under a direct peg. The indirect pegged relationships created as a result of pegging to a common an anchor currency also have non-negligible effects—while their effect is smaller than that of direct pegs, it is significantly larger than

[23] The change in the estimate of the persistence parameter with CPFE is likely because the impact of the exchange rate regime is then identified only through regime changes for the country-pair over time (while between country-pair variation in regimes is ignored), but such regimes changes are infrequent.

that for floats. These findings resonate with the stylized facts documented above on aggregate external balances that the adjustment is slower for the US (to which several partners directly or indirectly peg) than for New Zealand (to which no major trading partner pegs its currency). In fact, looking at the AR coefficients on aggregate external balance across countries, and their (average) trade share with countries to which they directly peg (through a fixed or intermediate regime), we can observe a significantly positive association (Figure A2). This implies that countries with, on average, a greater share of trade with partners against which they have a peg, have a higher persistence in their current accounts.

C. Natural Experiments

As with any study on the properties of exchange rate regimes, a potential concern is that of reverse causality: the possibility that the trade balance dynamics drives exchange rate flexibility. This endogeneity concern, however, may be less relevant in our case for several reasons. First, we measure exchange rate flexibility using exchange rate regimes—which is a slow-moving variable—rather than the *actual* exchange rate movement. Second, the main determinants of the choice of exchange rate regime, as identified in earlier empirical literature, are the optimum currency area criteria, exchange rate-based disinflation strategies, economic size, diversification, or the desire for greater cross-border trade or investment—rather than the trade balance itself (e.g., Levy-Yeyati et al., 2010). Third, the symmetry of the bilateral relationship makes it unlikely that the results could be driven by reverse causality alone (if, e.g., country *A* chooses to peg to country *B* in order to maintain its surplus, then the (peg) regime for *B* against *A* is determined exogenously, so that the effect of the inflexible exchange rate on the persistence of *B*'s deficit with *A* should be estimated correctly). Moreover, it is especially implausible that indirect peg relationships considered here should be driven by bilateral trade imbalances (or their persistence).

Nevertheless, we buttress the results obtained above by looking at some "natural experiments"—instances of clearly exogenous changes in the bilateral exchange rate relationship—afforded by the bilateral nature of our dataset. Such natural experiments help to isolate the effect of exchange rate flexibility on external dynamics and provide deeper insights into external adjustment under different regimes. Exploiting the large cross-sectional and time series dimension of our dataset, we identify several types of experiments (such as switches from pegs to floats, and vice versa), pertaining to advanced, EM and developing countries.

The first experiment relates to the behavior of trade balance of the CFA franc zone countries against their Eurozone trading partners after France adopted the euro in 1999. Historically, the CFA franc had been pegged to the French franc since 1945, but remained flexible against other European currencies (to the extent that the French franc was flexible against these currencies). On France's adoption of the euro, the CFA member countries found their currency pegged to all Eurozone members—but clearly for the CFA countries, this switch was entirely exogenous, and unrelated to their trade balance (or any other economic/political factors). Thus, if the trade balance of CFA countries against their Eurozone counterparts has become more persistent post-1999, then this would provide compelling evidence of the effect of exchange rate flexibility on trade balance dynamics.[24]

The second case we examine is that of Lithuania, which adopted a currency board arrangement in 1994, but shifted its anchor currency from the US dollar to the euro in 2002. This change in the anchor was related to the country joining the ERM in the run up to becoming a member of the EMU, rather than to any developments in its external balance. (While Lithuania maintained strong trade ties with the Eurozone countries, which may have also induced the shift toward the euro, the trade balance between Lithuania and Eurozone countries was not the driving force behind the regime switch.) As a result of this change, the Lithuanian litas shifted to a float against the US dollar, while adopting a direct fixed exchange rate against the Eurozone countries. If exchange rate regime matters for external adjustment, then we should observe a decline in the persistence of Lithuania's trade balance with the US, and an increase in its persistence against the Eurozone trading partners.[25]

The third experiment we consider pertains to the formation of the Eurozone in 1999. Clearly, the decision to form the Eurozone (taken in 1991) was part of a broader historical process of European economic integration, and one that was not influenced by the state of external balances in the Eurozone countries.[26] Before adopting the common currency, the original Eurozone members either pegged their currencies to each other (e.g., Austria with German mark and Luxembourg with Belgian franc) or were part of the ERM (and stabilized their currencies within a tight band against a weighted basket of regional currencies, the ECU). For these countries, adoption of the euro implied moving from exchange rates that had limited flexibility to a completely rigid exchange rate regime. Again, if the degree of exchange rate regime flexibility matters, then the pace of external adjustment between the Eurozone countries would have slowed down since the euro adoption. To the extent that the pre-euro bilateral exchange rates between Eurozone members were already fairly stable, the before-after change in persistence may however be modest—making any observed change all the more compelling as evidence that the regime matters for external adjustment.

For each of these natural experiments, we estimate (2) where the exchange rate regime variable captures the different (bilateral) regimes in place at different points in time, while

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[24] Frankel (2008) applies a similar methodology and uses CFA franc zone's regime change with Eurozone countries in 1999 to isolate the effect of CUs on bilateral trade.

[25] To the extent that Lithuania's float against the US since 2002 constitutes an "impure float," as discussed above, the decline in persistence in its trade balance against the US would (in part) depend on the matching of Lithuania-US trade balance sign with that of Eurozone-US trade balance sign. Except for the year 2007 (when Lithuania had a deficit against the US, while Eurozone had a collective surplus), both Lithuania and the Eurozone have maintained a surplus against the US. (Likewise, the lower persistence in Lithuania-Eurozone trade balance before 2002 would partly depend on the matching of the signs of trade balance between Lithuania-Eurozone, and US-Eurozone, which were indeed both negative (i.e., deficits) over 1994-2002.)

[26] When analyzing the effect of fixed exchange rate regimes on bilateral trade, there is a legitimate concern that strong intra-regional trade may have encouraged the move toward EMU formation. But it is unlikely that pre-1999 trade *balances* among the Eurozone countries influenced the decision to form a CU.

the estimated coefficient on the interaction term captures the impact of these regimes on the persistence of the bilateral trade balance. The results, reported in Table 9, largely confirm the findings from the panel estimations. The pooled OLS estimates for the CFA franc zone experiment imply a statistically significant increase in the half-life of CFA countries' bilateral trade balance with Eurozone countries (excluding France) of about 1.3 years under the fixed exchange rate system relative to the previous floating regime (col. [1]). The difference in half-lives drops to about 0.1 years when CPFE and year effects are taken into account, but remains statistically significant at the 10 percent level (col. [2]).

These estimates, however, may represent a lower bound of the persistence parameter for the CFA countries against their Eurozone trading partners because, even before adopting the euro, the French franc closely tracked other major regional currencies in the ERM (which constituted the ECU). This stability of the French franc against ERM members in the pre-1999 period implies an indirect peg—rather than a float—between the CFA countries and the Eurozone countries that were formerly part of the ECU. To test this, we exclude from the sample (in addition to France) Eurozone countries that had the largest weight in the ECU (Germany, Netherlands and Belgium), and re-estimate the benchmark specification. Doing so, the estimated coefficient for the interaction term increases in magnitude, and becomes statistically significant at the 5 percent level with CPFE (col. [3]).

Lithuania's trade balance dynamics against the US before and after the switch from the US dollar as the anchor currency are presented in Table 9, col. [4]. The sample begins in 1994 (the year Lithuania adopted a currency board arrangement), and the bilateral exchange rate regime variable takes the value of 0 up to 2002, and 1 thereafter. The estimate yields an AR coefficient of 0.85—implying a half-life of about 4 years when the anchor for the currency board was the US dollar—and a large and statistically significant negative interaction coefficient, implying virtually instantaneous adjustment of the trade balance, after the anchor switch (and effective float against the dollar).[27] The flip side of this natural experiment—the impact of the anchor switch on the dynamics of Lithuania's trade balance against the Eurozone trading partners—is presented in col. [5]. The sample size for this part of the experiment is significantly larger (about 150 observations) as the bilateral trade balance against all Eurozone trading partners is taken into account, but gives a similar result: Lithuania's external adjustment against Eurozone countries has slowed significantly (and the half-life of the trade balance has almost doubled) after adopting the euro as the anchor.

The results of our third experiment—the move to completely rigid bilateral exchange rates among Eurozone countries with euro adoption—are presented in Table 9, cols. [6]-[7]. We restrict the sample to non-crisis years during 1980–2011 so as to exclude the years of the ERM crisis (1990–93) as well as the recent Eurozone debt crisis (2010–11) where some

[27] The reported estimations control for the impact of the global financial crisis (GFC) by including a dummy variable (equal to one for the years 2007-09, and zero otherwise). Restricting the sample up to 2006 (and excluding the GFC years when Lithuania faced a sudden and sharp current account reversal—which may bias the results in favor of finding lower persistence under a float with the US—produces almost identical results.

members of the Eurozone experienced sharp current account reversals. Including these observations would likely lower the magnitude of the estimated AR coefficient under the common currency, but that misses the crux of Friedman's argument that, by delaying adjustment and allowing imbalances to fester, fixed exchange rates can lead to large, abrupt, and disruptive forced adjustment when the deficit can no longer be financed. The pooled OLS results suggest that euro adoption has indeed significantly slowed down external adjustment among the Eurozone countries—increasing the half-life of bilateral trade balance adjustment by about 1 year (col. [6]). Including the CPFE and year effects does not change the estimated coefficient of the AR and interaction terms, but the statistical significance of the latter disappears (presumably because of limited time variation in bilateral regimes; col. [7]). Nevertheless, taking into account the fact that exchange rates between the Eurozone countries have historically been fairly stable, even the (statistically) weak impact of euro adoption is striking, and in support of Friedman's hypothesis.[28]

V. Extensions

While our estimation strategy above follows existing literature and considers a simple AR specification to assess the association between trade balance and exchange rate regimes, in what follows we consider some extensions and alternate formulations of (2).

A. Threshold Effects

Implicit in Friedman's argument that flexible exchange rates encourage "corrective movements before tensions can accumulate and a crisis develop" is that floating rates may be especially important for correcting *large* imbalances, while pegs allow them to fester—until the loss of financing forces abrupt adjustment of deficits (whereas surpluses can persist indefinitely). To allow for possible threshold effects in the association between regimes and external adjustment (as in Ghosh et al., 2010), we include in (2) interaction terms between lagged trade balance and binary variables indicating if the trade balance is in a large deficit (bottom quartile of the bilateral trade balance distribution) or a large surplus (top quartile of the distribution), and estimate the equation separately for direct and indirect pegs, and floats.

In the OLS specification, we find some evidence that large deficits adjust more abruptly under direct pegs—presumably reflecting the sudden loss of financing—though the effect becomes statistically insignificant in the CPFE specifications (Table 10; cols. [1]-[3]). Threshold effects are, however, important under floats, where the persistence of large surpluses/deficits is significantly lower than the persistence of relatively smaller imbalances. This implies that the faster mean reversion of imbalances under floats does not just represent

[28] These results are similar to Berger and Nitsch (2014) who find robust evidence, using data over a longer time span of 1948-2008, that trade imbalances among Eurozone countries have become larger and more persistent since euro adoption.

"noise" of small, short-term movements, but rather the correction of large bilateral imbalances.[29]

B. Corrective Movements in Exchange Rate

Exchange rate flexibility will only promote external adjustment if the exchange rate moves in the correct direction—depreciating when the country has a deficit, and appreciating when it has a surplus. To check whether this holds in the data, we construct a measure of bilateral real exchange rate movement, which captures changes in the bilateral real exchange rate between all trading partners in our sample, and regress it on lagged trade balance (as well as on several control variables, CPFE and time effects) under different regimes.[30] The results, reported in Table 11, indicate that real exchange rate movement under floats is in the "correct" direction: countries with trade surpluses against partners experience statistically significant exchange rate appreciations under floats. By contrast, under (direct and indirect) pegged regimes, the response of the real exchange rate to the trade balance is statistically insignificant (cols. [1]-[6]).[31]

C. Financial Openness and External Dynamics

The transition probabilities reported in Table 5 suggest that the differential in speed of adjustment under different regimes may have changed over time. This may be because as countries have become more financially integrated, their balance of payments have become increasingly dominated by capital flows. Such flows can frustrate corrective movements of the currency, thereby weakening the relationship between exchange rate flexibility and rapid external adjustment. Capital inflows can thus lead to a currency appreciation despite a trade deficit, while outflows can lead to depreciation despite a surplus. In the face of such perverse movements of the currency, exchange rate flexibility may do little to correct imbalances.

To test this conjecture, we divide our sample by decade, and re-estimate (2) for three subsamples (1980–89, 1990–99, and 2000–11).[32] The results show that while the estimated AR coefficient has stayed fairly constant over the years, the estimated coefficient of the interaction term has fallen from the 1980s to 2000s (cols. [1]-[6]; Table 12). Thus, in the CPFE estimation, the differential between the speed of adjustment under fixed regimes and

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[29] Floats here include both impure and pure floats; estimating the equation separately for them shows that threshold effects are statistically significant and quantitatively similar for both. By contrast, threshold effects are insignificant when fixed and intermediate regimes (under direct pegs) are estimated separately.

[30] Bilateral real exchange rates are computed using nominal exchange rates (against the US dollar) and relative price indices (computed from the consumer price index) such that positive changes (increase in value) reflect real exchange rate depreciation, while negative changes indicate real appreciation of the currency.

[31] Estimating the response of pure and impure floats separately, we find that real exchange rates move in the correct direction under both.

[32] Improved bilateral trade data availability over the years implies that relative to the 1980s, the sample size more than doubles in the last decade. Nevertheless, retaining the sample to only those trading pairs for which data is consistently available over the whole period produces similar results.

floats is about 0.2 years for the 1980s, but drops to 0.1 years in the 1990s and 2000s as financial globalization gained momentum. A similar result is obtained if we split the sample according to the de jure financial openness (using the Chinn-Ito index) of the trading partners. Thus, based on the OLS estimates, the half-life differential between fixed and floating regimes is about 0.9 years greater in relatively closed trading partners (i.e., where both partners are in the bottom quartile of the financial openness measure distribution) than more open pairs (i.e., when both partners are in higher quartiles; cols. [7]-[8]), and about 0.1 years greater based on the CPFE estimates (cols. [9]-[10]).

D. Sensitivity Analysis

While the estimates of (2) reported in Table 7 are robust to the de jure classification, different combinations of CFE, CPFE and time effects, and to specific natural experiments, here we conduct some further sensitivity checks. The results presented in Table 13 pertain to alternate dependent variables, model specifications, samples, and bilateral exchange rate regime variables constructed using other aggregate regime classifications.

Cols. [1]-[3] of Table 13 present the results with the bilateral trade balance variable defined in different ways. Regardless of the specific measure used—i.e., bilateral trade balance defined as an absolute value, as exports to imports ratio, or scaled by individual country's GDP—the results do not change materially. The estimated AR coefficient—when CPFE and time effects are included—is about 0.5-0.6, while the half-life of bilateral trade balance under direct fixed exchange rates is about 0.7 years longer than under flexible rates when trade balance is scaled by GDP, and about 0.3 years longer with the other measures.[33] If we use trade balance defined over goods and services, the sample size drops considerably because of limited data availability, but we still obtain the result that floats adjust significantly faster than fixed regimes, with the difference in half-lives a little over 0.1 years (col. [4]).[34]

Col. [5] presents the results with the augmented baseline specification, with several additional control variables that may have an effect on bilateral trade balances such as the economic size of the trading partners, their demographics (proxied by the age dependency ratio), and their fiscal balances (in percent of GDP). While the sample size in this specification drops because data on some of these controls are not available for all countries, the results remain qualitatively similar—trade balances are significantly more persistent under direct fixed exchange rate regimes than under floats, with a difference in half-life of about 0.2 years. Similar results are also obtained when we control for all possible time-

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[33] The sample size drops slightly when the ratio of exports to imports is used as all observations with positive exports but zero imports remain unspecified. The sample size (almost) doubles when bilateral trade balance to GDP is used since every country's trade balance with its trading partners is scaled with its own GDP, thereby implying that $TB_{ij} \neq TB_{ji}$. (The sample size does not exactly double because of missing GDP data for some countries in the early part of the sample.) Since scaling bilateral trade balance by GDP could lead to some large outliers, we exclude observations in the top and bottom 0.5^{th} percentile of the distribution in the estimation.

[34] In addition, if we consider the volatility in trade balance as our dependent variable, then consistent with the results of the benchmark specification, we find that it is lower under fixed regimes than under floats.

varying factors particular to the individual trading partners through the inclusion of country-year fixed effects in col. [6].[35]

While the natural experiments conducted above help to address potential simultaneity concerns, in cols. [7]-[8], we further attempt to address these concerns by using lagged exchange rate regime in (2) instead of contemporaneous values, and by employing the system Generalized Method of Moments estimator, which also takes into account the dynamic nature of (2). Moreover, in col. [9], we do not assume a monotonic relationship between regimes and external balance, but include separate variables for direct fixed and intermediate regimes, and their interaction terms with the lagged trade balance. The results remain reassuringly robust to the use of these alternate specifications, and in each case we find significantly higher persistence under pegs than under floating regimes.[36]

A possible concern about our sample maybe that it includes countries with particular characteristics such as small states and oil exporters that are likely to have persistent trade balances and may also be more prone to adopt fixed exchange rate regimes because of their economic structure. Although above we take into account the time-variant and invariant features of individual trading partners by including CFE/CPFE and country-year effects, we exclude small states (countries with population less than 2 million) and oil exporters (oil exports constituting at least 50 percent of total exports) from the sample to ensure that our results are not driven by a small group of countries (cols. [10]-[11]).[37] In cols. [12] and [13], we exclude extreme trade balance observations (i.e., those in the top and bottom percentile of the bilateral TB distribution) but include exchange rate regime switch years, respectively. Moreover, to address the concern of zero trade balance observations in our sample (which could be a result of no or very little trade between two countries, rather than perfectly balanced trade), and that persistence in balances between major trading partners is more of an issue than that with smaller trading partners, we estimate (2) restricting the sample to only the top 30 trading partners in col. [14]. In each case, the results remain quantitatively similar to above: for CPFE estimates, the difference in half-life under fixed regimes and floats amounts to 0.3-0.5 years.

Finally, to ensure that our results are not driven by the specific aggregate regime classification used, we also construct the bilateral exchange rate regime variable with the R&R and LY&S (aggregate) de facto classifications (available up to 2010 and 2004, respectively). However, because the anchor currency information for these classifications is not publicly available, we use such information (where available) from the IMF's

[35] Moreover, results remain very similar to Table 7 if we include additional lags of the TB in the specification.

[36] While persistence appears to be slightly higher under (direct) intermediate regimes than under fixed regimes in col. [9], restricting the sample to the top (15 or 20) trading partners, we find that fixed regimes have higher persistence than intermediate regimes.

[37] We also restrict the sample to large countries only—defined as those with real GDP in the top quartile of the annual income distribution—and find that the results get even stronger with the difference in half-lives between fixed and floating regimes estimated to be slightly over 1 year.

AREAER.[38] The results obtained from these alternate classifications are reassuringly similar to those reported above—bilateral direct pegged regimes are prone to significantly slower external adjustment dynamics than floats.

VI. Conclusion

This paper revisits Friedman's hypothesis that flexible exchange rates facilitate external adjustment. It argues that the reason existing studies do not find an empirically robust association between exchange rate flexibility and the speed at which imbalances get corrected is because they use aggregate regime classifications that do not differentiate between very heterogeneous bilateral exchange rate relationships, and as such do not adequately capture exchange rate flexibility that is relevant to external adjustment.

To test our hypothesis, we complement existing aggregate regime classifications with detailed information on currency anchors, and construct a comprehensive dataset of bilateral exchange rate regime relationships for a sample of 181 countries over 1980–2011. Combining this information with bilateral trade data, we establish that floats are indeed associated with economically and statistically significantly faster external adjustment than pegs—the half-life of the bilateral trade balance is almost twice as long under a direct peg than under a float (5 years versus 2.5 years) when both cross-sectional and time variation in bilateral exchange rate regimes is allowed (either with or without country fixed effects), and about 0.3 years higher when only the time variation is considered (i.e., when country-pair fixed effects are included in the regression). This pattern generally holds across subsamples comprising different country compositions, as well as when indirect peg relationships are taken into account, and through a range of robustness tests.

Our results are supported by several "natural experiments"—cases of purely exogenous changes in the exchange rate regime between countries, and subsequent changes in the dynamics of their bilateral trade balance. When France adopted the euro, CFA members automatically became pegged to all Eurozone countries and the bilateral imbalances between CFA and Eurozone members became correspondingly more persistent. Likewise, when Lithuania switched anchor currency from the US dollar to the euro, its trade balance with the US became less persistent, while its balances with Eurozone countries became significantly more persistent. Finally, even though the progression from EMS/ERM to euro adoption did not represent a substantial decrease in the volatility of these countries' bilateral exchange rates, there is some evidence of an increase in persistence of their trade imbalances.

These findings highlight the richness and complexity of exchange rate relationships across countries, and underscore the importance of taking this into account while examining the relationship between exchange rate flexibility and the speed of external adjustment. So, for instance, even though the US and New Zealand dollar are typically classified as floating

[38] In cases where no anchor information is available (because these regimes are classified as a float in the IMF's classification), we exercise judgment based on historical information.

currencies, our analysis suggests that external adjustment should be faster for New Zealand (to which no major trading partner pegs its currency) than for the United States (to which several partners directly or indirectly peg). This implication resonates with the documented stylized facts where the autoregressive coefficient on the aggregate external balance of New Zealand and the US is 0.4 and 0.8, respectively. Likewise, the degree to which a fixed exchange rate impedes external adjustment depends on the trade share of the partner(s) to which the country pegs: thus the autoregressive coefficient on the aggregate balance of Greece (about 50 percent of whose trade is with the Eurozone) is 0.9, whereas the corresponding coefficient, say, for Ecuador (which has dollarized since 2000, but its trade with the US constitutes some 35 percent of its total trade) is 0.5.

Our analysis has important policy implications. To the extent that global imbalances are often attributed to the implicit or explicit fixed exchange rates of certain surplus countries, our results show that there is merit to that argument, and greater exchange rate flexibility could help to achieve a reduction in global imbalances. Our findings also have obvious implications for countries trying to adjust under fixed exchange rate regimes, for example, the Eurozone countries, and point to the formidable challenges facing them as they seek to regain competitiveness and restore external balance.

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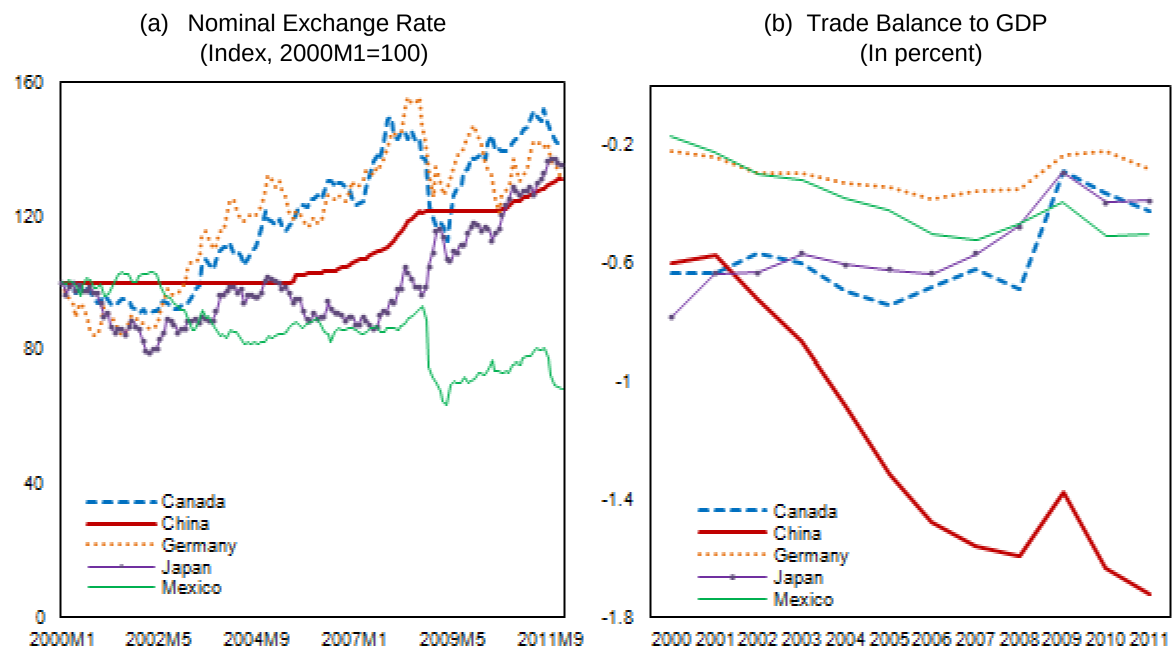
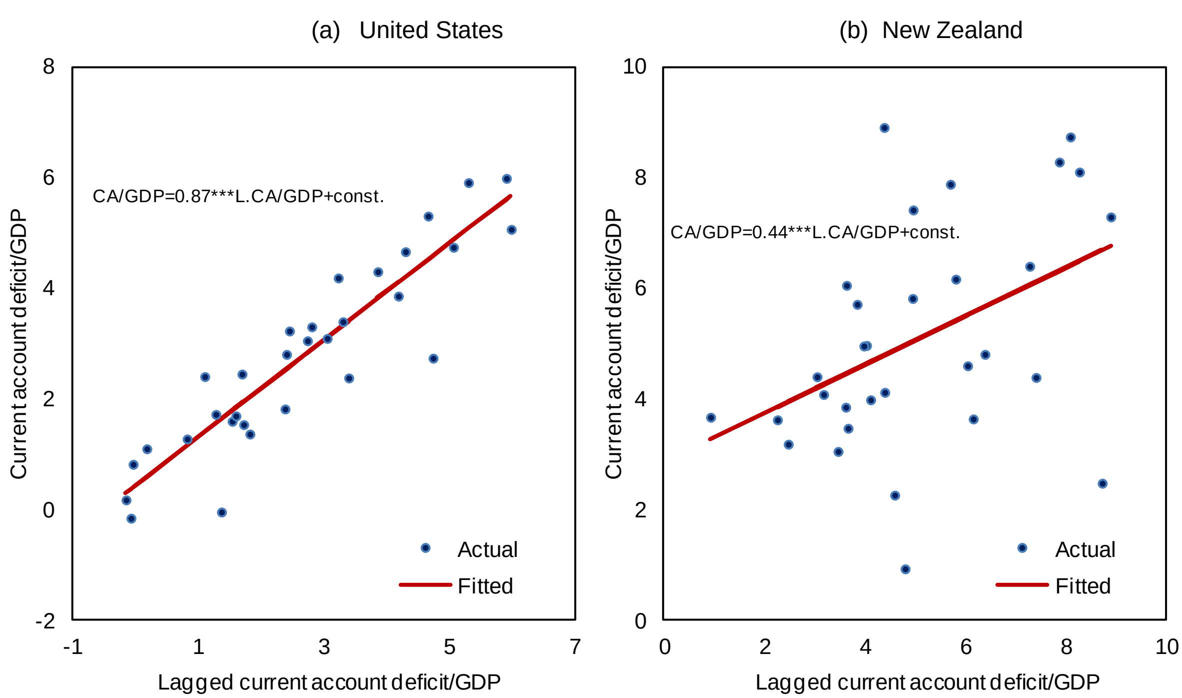
Figure 1. US Trade Balance and Nominal Exchange Rate with Key Trading Partners, 1980–2011



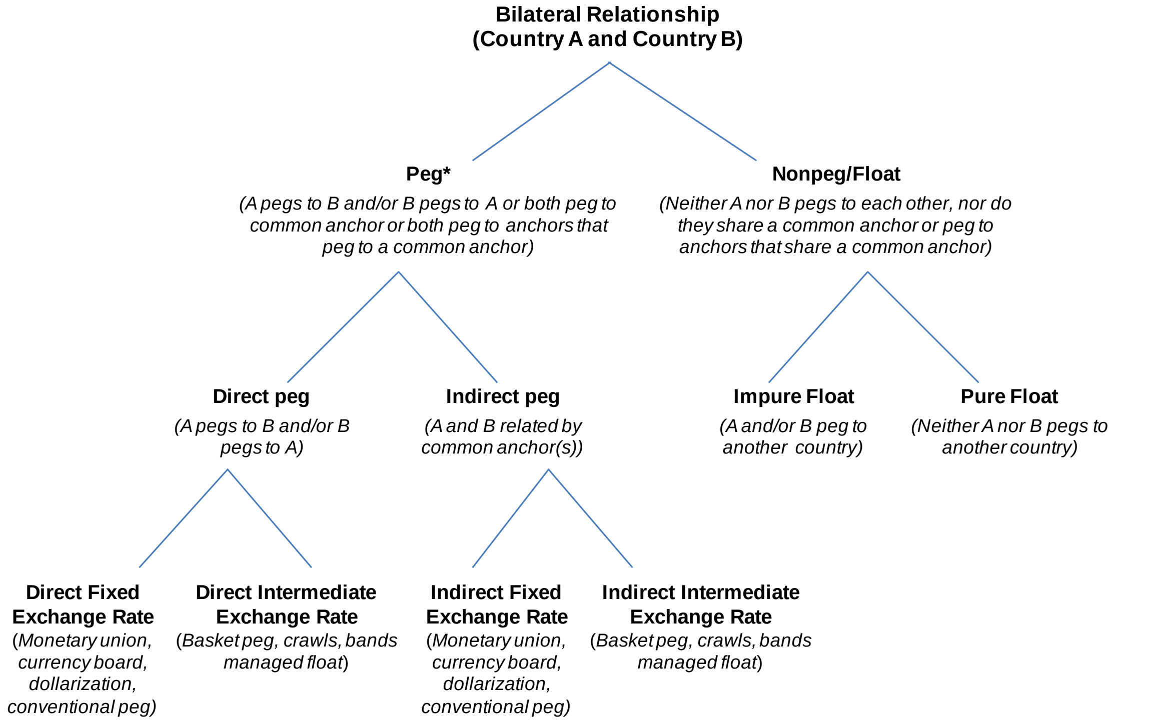
Source: Authors' estimates based on IMF's WEO and INS databases.

Figure 2. External Balance: US and New Zealand, 1980–2011
(In percent)



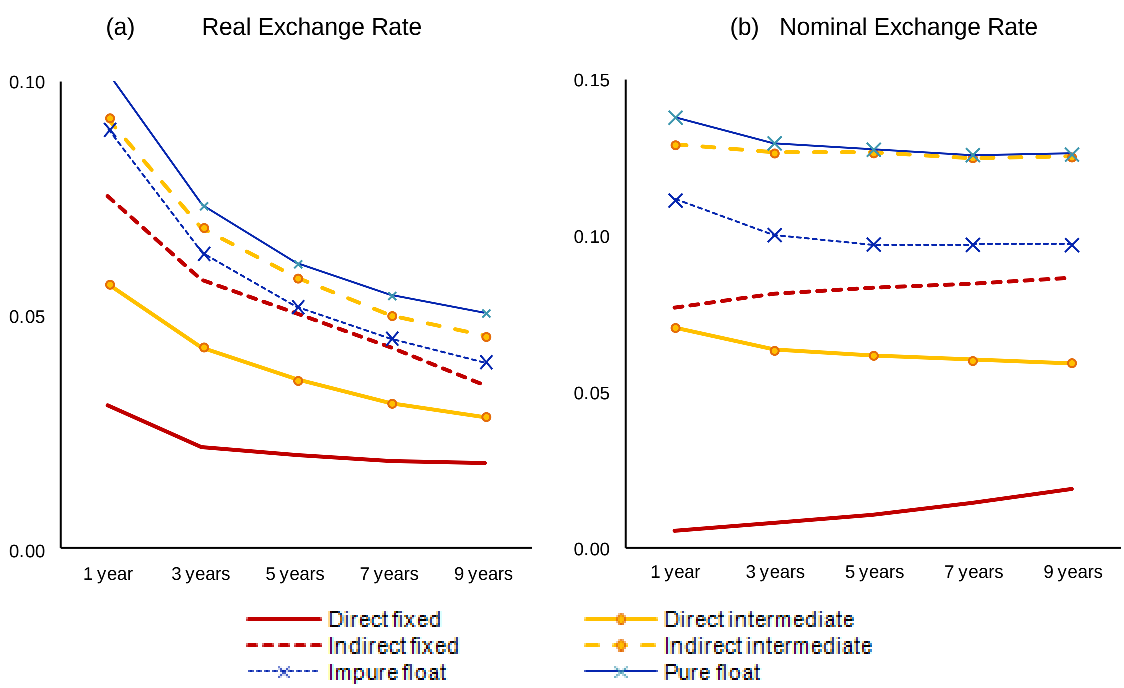
Source: Authors' estimates based on IMF's WEO database.

Figure 3. Classifying Bilateral Exchange Rate Relations



* Peg refers to fixed (currency union, currency board, dollarization, conventional peg), and intermediate (basket peg, crawls, bands, managed floats) regimes.

Figure 4. Bilateral Exchange Rate Volatility and Exchange Rate Regimes, 1980-2011



Source: Authors' estimates based on INS database.
Note: Exchange rate (*V*) volatility between countries *i* and *j* at horizon *n* is defined as $|[E_{ijt}/E_{ijt-n}]^{1/n}-1|$; where *E* is the bilateral exchange rate.

Table 1. Bilateral Real Exchange Rate Volatility and Exchange Rate Regimes, 1980-2011

	Direct pegs		Indirect pegs		Floats	
	Fixed	Intermediate	Fixed	Intermediate	Pure	Impure
All	0.031	0.057	0.075	0.092	0.102	0.090
Advanced	0.010	0.038	0.010	0.051	0.065	0.058
Advanced-EMDC	0.032	0.066	0.065	0.082	0.098	0.082
EMDC	0.036	0.075	0.076	0.099	0.106	0.095

Note: Exchange rate volatility (V) between countries i and j computed at 12 months horizon, where V=$|[E_{ijt}/E_{ijt-n}]^{1/n}-1|$; E is the bilateral real exchange rate and n is the horizon. All=full sample; Advanced-EMDC=trading pairs where one country is advanced and the other is emerging market or developing; Advanced=trading pairs where both countries are advanced; EMDC=trading pairs where both countries are either emerging markets or developing.

Table 2. Distribution of Bilateral Exchange Rate Regimes with IMF Classification, 1980–2011

	De jure				De facto			
	1980-2011	1980-89	1990-99	2000-11	1980-2011	1980-89	1990-99	2000-11
All countries								
Direct fixed	2.3	1.3	1.3	3.6	2.5	1.5	1.4	3.9
Direct intermediate	2.2	3.0	2.1	1.8	1.9	2.7	1.8	1.4
Indirect fixed	2.4	4.2	1.6	2.1	5.7	8.2	3.8	5.7
Indirect intermediate	20.3	40.4	21.7	7.9	23.5	49.3	22.9	9.3
Float	72.8	51.1	73.3	84.6	66.5	38.3	70.1	79.7
Advanced-EMDC								
Direct fixed	3.9	1.5	1.5	7.1	4.4	1.9	1.8	7.9
Direct intermediate	4.6	6.0	3.9	4.2	3.7	5.2	3.2	3.3
Indirect fixed	0.6	0.6	0.5	0.6	1.0	0.8	0.9	1.1
Indirect intermediate	19.7	39.0	22.7	5.7	21.0	46.6	21.6	4.9
Float	71.3	52.8	71.4	82.4	69.9	45.4	72.5	82.8
Advanced								
Direct fixed	8.7	0.2	1.6	20.5	9.4	1.0	2.3	21.2
Direct intermediate	19.4	24.0	26.2	10.5	18.4	23.1	24.5	10.1
Indirect fixed	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.0
Indirect intermediate	15.8	29.3	19.0	3.5	18.7	40.8	19.8	1.8
Float	56.1	46.4	53.1	65.5	53.4	34.8	53.2	66.9
EMDC								
Direct fixed	1.2	1.3	1.2	1.2	1.2	1.4	1.2	1.2
Direct intermediate	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Indirect fixed	3.4	6.3	2.1	2.9	8.2	12.5	5.4	8.0
Indirect intermediate	20.8	41.7	21.3	9.1	24.9	51.2	23.6	11.7
Float	74.3	50.4	75.2	86.5	65.5	34.7	69.7	78.9
All countries (top trading partners)								
Direct fixed	5.9	3.6	3.6	9.2	6.6	4.4	4.0	10.1
Direct intermediate	8.6	12.6	9.3	5.6	7.6	11.6	8.1	4.8
Indirect fixed	1.7	2.9	1.0	1.4	4.3	5.8	3.3	4.2
Indirect intermediate	15.2	28.1	17.0	5.7	18.8	38.4	18.9	6.4
Float	68.5	52.8	69.1	78.0	62.6	39.9	65.6	74.6

Source: Authors' calculations based on IMF's AREAER.

Notes: All countries comprises all trading partners; Advanced-EMDC comprises trading pairs where one country is an advanced economy and the other is an emerging market or developing economy; Advanced comprises trading pairs where both countries are advanced economies; EMDC comprises trading pairs where both countries are either emerging markets or developing; Top trading partners considers only the top 20 trading partners of all countries.

Table 3. Transition Probabilities: Composite Regime Classification, 1980–2011

	TB ≤ -0.5	-0.5 > TB < 0	0 ≥ TB < 0.5	TB ≥ 0.5
		Fixed		
TB ≤ -0.5	75.5*	24.5	0.0	0.0
-0.5 > TB < 0	1.7	91.7	6.6	0.0
0 ≥ TB < 0.5	0.0	13.8	86.2	0.0
TB ≥ 0.5	0.0	0.0	100.0	0.0
		Intermediate		
TB ≤ -0.5	81.6**	18.4	0.0	0.0
-0.5 > TB < 0	1.3	89.2	9.5	0.0
0 ≥ TB < 0.5	0.2	19.1	80.6***	0.2
TB ≥ 0.5	0.0	0.0	100.0	0.0
		Float		
TB ≤ -0.5	50.0	50.0	0.0	0.0
-0.5 > TB < 0	0.8	90.7	8.5	0.0
0 ≥ TB < 0.5	0.0	10.1	89.9	0.0
TB ≥ 0.5	0.0	0.0	0.0	0.0

Note: TB is defined as trade balance to total trade. Years in which the exchange rate regime switched are excluded from the computations. Exchange rate regime is defined using the IMF's de facto aggregate classification.*,**, *** indicate statistically significant differences between transition probabilities of fixed/intermediate regimes and floats across the diagonal at the 10, 5 and 1percent levels, respectively. (For off-diagonal probabilities, results are not reported.)

Table 4. Transition Probabilities: Bilateral Regime Classification, 1980–2011

	TB ≤ -0.5	-0.5 < TB < 0	0 ≥ TB < 0.5	TB ≥ 0.5
		Fixed		
TB ≤ -0.5	81.0***	10.6	3.5	5.0
-0.5 < TB < 0	11.9	69.5***	14.7	4.0
0 ≥ TB < 0.5	2.5	11.8	70.2***	15.4
TB ≥ 0.5	2.2	1.5	8.6	87.7***
		Intermediate		
TB ≤ -0.5	80.9***	15.2	2.4	1.5
-0.5 < TB < 0	6.4	77.4***	15.1	1.1
0 ≥ TB < 0.5	0.6	12.0	80.3***	7.1
TB ≥ 0.5	0.5	1.4	10.5	87.6***
		Float		
TB ≤ -0.5	77.2	10.2	3.9	8.7
-0.5 < TB < 0	18.8	53.9	18.1	9.1
0 ≥ TB < 0.5	7.1	16.7	53.2	23.0
TB ≥ 0.5	6.1	3.3	9.0	81.5

Note: TB is defined as bilateral trade balance to total bilateral trade. Years in which the exchange rate regime switched are excluded from the computations. Bilateral exchange rate regime is computed using the IMF's de facto aggregate classification.*** indicates statistically significant difference between transition probabilities of fixed/intermediate regimes and floats across the diagonal at the 1percent level. (For off-diagonal probabilities, results are not reported.)

Table 5. Transition Probabilities by Decade: Bilateral Regime Classification, 1980–2011

	TB ≤ -0.5	-0.5 < TB < 0	0 ≥ TB < 0.5	TB ≥ 0.5	TB ≤ -0.5	-0.5 < TB < 0	0 ≥ TB < 0.5	TB ≥ 0.5
	Fixed (1980-89)				**Fixed (2000-11)**			
TB ≤ -0.5	80.0	11.4	4.1	4.5	81.8	10.0	3.3	4.9
-0.5 < TB < 0	9.3	65.9	20.5	4.4	10.5	71.6	14.0	3.8
0 ≥ TB < 0.5	3.0	15.7	63.9	17.4	1.9	10.7	72.5	14.9
TB ≥ 0.5	3.7	2.4	11.8	82.1	1.8	1.2	8.2	88.8
LR test of structural stability betw een 1980-89 and 2000-11 (p-value)=0.00								
	Intermediate (1980-89)				**Intermediate (2000-11)**			
TB ≤ -0.5	72.8	24.3	2.0	1.0	85.5	10.5	2.9	1.1
-0.5 < TB < 0	7.1	78.6	13.5	0.8	7.6	72.1	18.4	1.8
0 ≥ TB < 0.5	0.4	14.2	77.1	8.3	1.1	11.9	79.8	7.2
TB ≥ 0.5	0.2	1.0	12.5	86.3	0.7	1.9	9.7	87.7
LR test of structural stability betw een 1980-89 and 2000-11 (p-value)=0.00								
	Float (1980-89)				**Float (2000-11)**			
TB ≤ -0.5	76.4	10.9	4.0	8.7	79.6	9.2	3.3	7.9
-0.5 < TB < 0	18.9	53.4	18.9	8.9	18.5	55.7	16.9	8.9
0 ≥ TB < 0.5	7.1	18.4	52.2	22.4	6.8	15.9	54.1	23.3
TB ≥ 0.5	6.0	3.1	9.0	82.0	5.7	3.1	8.4	82.9
LR test of structural stability betw een 1980-89 and 2000-11 (p-value)=0.00								

Note: LR-test statistic has a chi-squared distribution and is given as follows (where P_{ij} and P^0_{ij} are the transition probability matrices obtained for 1980-89 and 2000-11 subsamples, respectively), with $m(m$-1) degrees of freedom:

$$\sum_{i=1}^{m}\sum_{j=1}^{m}\frac{n_i(P_{ij}-P_{ij}^0)^2}{P_{ij}^0}.$$

Table 6. External Dynamics: Composite Exchange Rate Regime Classifications, 1980–2011

	IMF DJ classification 1/			IMF DF classification 2/			RR classification 3/			LYS classification 4/		
	OLS	FE	FE/TE	OLS	FE	FE/TE	OLS	FE	FE/TE	OLS	FE	FE/TE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
All countries												
TB_{t-1}	0.932***	0.744***	0.737***	0.934***	0.748***	0.743***	0.947***	0.762***	0.757***	0.924***	0.651***	0.647***
	(0.011)	(0.025)	(0.025)	(0.010)	(0.023)	(0.022)	(0.009)	(0.023)	(0.022)	(0.015)	(0.033)	(0.033)
$Regime_t$	0.001	0.007	0.006	0.002	0.004	0.003	-0.002	-0.011	-0.006	0.005	0.014*	0.011
	(0.003)	(0.007)	(0.007)	(0.003)	(0.008)	(0.008)	(0.004)	(0.010)	(0.010)	(0.003)	(0.007)	(0.007)
TB_{t-1} * $Regime_t$	-0.002	-0.017	-0.007	-0.011	-0.037	-0.033	-0.045	-0.073	-0.070	-0.004	0.070	0.073
	(0.022)	(0.038)	(0.037)	(0.023)	(0.045)	(0.043)	(0.030)	(0.057)	(0.057)	(0.032)	(0.045)	(0.045)
Observations	4,460	4,460	4,460	4,460	4,460	4,460	3,885	3,885	3,885	2,419	2,419	2,419
R-squared	0.872	0.557	0.571	0.872	0.557	0.571	0.884	0.568	0.582	0.863	0.476	0.498
No. of countries	180	180	180	180	180	180	180	180	180	174	174	174
Advanced countries												
TB_{t-1}	0.933***	0.755***	0.761***	0.925***	0.725***	0.726***	0.948***	0.782***	0.789***	0.948***	0.733***	0.723***
	(0.023)	(0.044)	(0.045)	(0.025)	(0.048)	(0.050)	(0.018)	(0.029)	(0.031)	(0.019)	(0.050)	(0.055)
$Regime_t$	-0.001	0.005	0.008	-0.001	0.005	0.006	0.001	-0.000	0.003	-0.001	0.011	0.014*
	(0.003)	(0.005)	(0.005)	(0.003)	(0.006)	(0.006)	(0.003)	(0.004)	(0.006)	(0.003)	(0.007)	(0.007)
TB_{t-1} * $Regime_t$	0.019	0.042	0.018	0.033	0.086	0.073	-0.022	-0.017	-0.036	-0.006	0.010	0.021
	(0.037)	(0.052)	(0.050)	(0.042)	(0.056)	(0.055)	(0.046)	(0.048)	(0.048)	(0.058)	(0.059)	(0.061)
Observations	798	798	798	798	798	798	805	805	805	480	480	480
R-squared	0.886	0.629	0.653	0.886	0.631	0.654	0.885	0.633	0.655	0.892	0.602	0.629
No. of countries	29	29	29	29	29	29	29	29	29	28	28	28
Emerging markets												
TB_{t-1}	0.873***	0.697***	0.700***	0.868***	0.693***	0.695***	0.877***	0.679***	0.673***	0.851***	0.517***	0.519***
	(0.027)	(0.054)	(0.057)	(0.023)	(0.062)	(0.065)	(0.024)	(0.030)	(0.030)	(0.062)	(0.129)	(0.129)
$Regime_t$	0.007	0.026*	0.027*	0.016**	0.018	0.018	0.009	0.008	0.005	0.013	0.033**	0.032**
	(0.008)	(0.014)	(0.014)	(0.006)	(0.013)	(0.014)	(0.007)	(0.014)	(0.012)	(0.008)	(0.013)	(0.013)
TB_{t-1} * $Regime_t$	0.015	-0.027	-0.046	0.026	-0.014	-0.039	0.006	0.040	0.018	0.032	0.134	0.114
	(0.036)	(0.071)	(0.070)	(0.030)	(0.088)	(0.095)	(0.039)	(0.064)	(0.058)	(0.076)	(0.121)	(0.125)
Observations	1,192	1,192	1,192	1,192	1,192	1,192	1,092	1,092	1,092	574	574	574
R-squared	0.809	0.503	0.533	0.810	0.500	0.530	0.845	0.532	0.576	0.763	0.365	0.406
No. of countries	53	53	53	53	53	53	53	53	53	51	51	51
Developing countries												
TB_{t-1}	0.933***	0.754***	0.746***	0.939***	0.761***	0.754***	0.950***	0.778***	0.777***	0.924***	0.668***	0.663***
	(0.012)	(0.028)	(0.027)	(0.010)	(0.025)	(0.023)	(0.010)	(0.026)	(0.025)	(0.015)	(0.033)	(0.033)
$Regime_t$	-0.004	-0.003	-0.011	-0.012*	-0.009	-0.013	-0.016*	-0.034	-0.036	-0.007	0.005	-0.002
	(0.004)	(0.012)	(0.013)	(0.006)	(0.017)	(0.017)	(0.009)	(0.028)	(0.028)	(0.015)	(0.015)	(0.014)
TB_{t-1} * $Regime_t$	-0.000	-0.016	0.000	-0.030	-0.057	-0.036	-0.067	-0.120	-0.124	-0.010	0.075	0.092
	(0.026)	(0.045)	(0.042)	(0.033)	(0.066)	(0.060)	(0.044)	(0.089)	(0.087)	(0.069)	(0.068)	(0.064)
Observations	2,470	2,470	2,470	2,470	2,470	2,470	1,988	1,988	1,988	1,365	1,365	1,365
R-squared	0.870	0.569	0.589	0.870	0.569	0.589	0.877	0.573	0.593	0.864	0.499	0.533
No. of countries	98	98	98	98	98	98	98	98	98	95	95	95
Country-fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year effects	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Dependent variable is trade balance scaled by total trade (TB_t). TB_{t-1} is lagged TB. Years in which the exchange rate regime switches are excluded from the sample. Constant included in all specifications. Standard errors, reported in parentheses, are clustered at the country level in all specifications. ***,**,* indicate significance at the 1, 5, and 10 percent levels, respectively.

1/ Regime is IMF's de jure classification regime (0=fixed; 0.5=intermediate; 1=float).

2/ Regime is IMF's de facto classification regime (0=fixed; 0.5=intermediate; 1=float).

3/ Regime is Reinhart and Rogoff's (2004) de facto classification regime (0=fixed; 0.5=intermediate; 1=float).

4/ Regime is Levy-Yeyati and Sturzenegger's (2003) de facto classification regime (0=fixed; 0.5=intermediate; 1=float).

Table 7. External Dynamics: Bilateral Exchange Rate Regime Classification, 1980–2011

	De Jure Classification				De Facto Classification			
	OLS	**CFE**	**CPFE**	**CPFE/TE**	**OLS**	**CFE**	**CPFE**	**CPFE/TE**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All countries								
TB_{t-1}	0.886***	0.866***	0.553***	0.552***	0.879***	0.858***	0.543***	0.542***
	(0.010)	(0.011)	(0.018)	(0.018)	(0.010)	(0.011)	(0.018)	(0.018)
$Regime_t$	0.001	0.025***	-0.029***	-0.027***	0.002	0.026***	-0.030***	-0.028***
	(0.004)	(0.006)	(0.010)	(0.010)	(0.004)	(0.006)	(0.010)	(0.010)
$TB_{t-1} \times Regime_t$	-0.128***	-0.138***	-0.109***	-0.108***	-0.121***	-0.130***	-0.098***	-0.097***
	(0.010)	(0.011)	(0.018)	(0.018)	(0.010)	(0.011)	(0.018)	(0.018)
Observations	258,075	258,075	258,075	258,075	258,075	258,075	258,075	258,075
R-squared	0.585	0.592	0.206	0.207	0.585	0.592	0.206	0.207
No. of trading pairs	12,660	12,660	12,660	12,660	12,660	12,660	12,660	12,660
Advanced and EMDCs a/								
TB_{t-1}	0.878***	0.797***	0.575***	0.573***	0.870***	0.784***	0.562***	0.560***
	(0.013)	(0.015)	(0.019)	(0.019)	(0.013)	(0.015)	(0.019)	(0.019)
$Regime_t$	0.001	0.008	-0.036***	-0.032***	0.002	0.004	-0.040***	-0.037***
	(0.007)	(0.009)	(0.012)	(0.012)	(0.007)	(0.008)	(0.012)	(0.012)
$TB_{t-1} \times Regime_t$	-0.091***	-0.075***	-0.071***	-0.069***	-0.082***	-0.062***	-0.057***	-0.056***
	(0.014)	(0.015)	(0.019)	(0.019)	(0.014)	(0.015)	(0.019)	(0.019)
Observations	106,463	106,463	106,463	106,463	106,463	106,463	106,463	106,463
R-squared	0.630	0.645	0.265	0.266	0.630	0.645	0.264	0.266
No. of trading pairs	4,310	4,310	4,310	4,310	4,310	4,310	4,310	4,310
Advanced countries b/								
TB_{t-1}	0.965***	0.947***	0.696***	0.692***	0.964***	0.946***	0.692***	0.688***
	(0.011)	(0.012)	(0.027)	(0.028)	(0.011)	(0.012)	(0.027)	(0.028)
$Regime_t$	0.007*	0.004	-0.020**	-0.016	0.006*	0.003	-0.019**	-0.016
	(0.004)	(0.005)	(0.010)	(0.010)	(0.004)	(0.005)	(0.009)	(0.010)
$TB_{t-1} \times Regime_t$	-0.046***	-0.038**	0.001	0.003	-0.045***	-0.037**	0.005	0.007
	(0.016)	(0.017)	(0.027)	(0.027)	(0.016)	(0.017)	(0.027)	(0.027)
Observations	10,897	10,897	10,897	10,897	10,897	10,897	10,897	10,897
R-squared	0.861	0.862	0.486	0.490	0.861	0.862	0.486	0.489
No. of trading pairs	406	406	406	406	406	406	406	406
EMDCs c/								
TB_{t-1}	0.844***	0.835***	0.534***	0.535***	0.840***	0.829***	0.524***	0.525***
	(0.021)	(0.021)	(0.039)	(0.039)	(0.021)	(0.021)	(0.039)	(0.039)
$Regime_t$	0.024**	0.038**	-0.011	-0.020	0.023**	0.041***	0.036	0.027
	(0.012)	(0.015)	(0.036)	(0.036)	(0.012)	(0.015)	(0.035)	(0.035)
$TB_{t-1} \times Regime_t$	-0.107***	-0.128***	-0.119***	-0.121***	-0.102***	-0.122***	-0.109***	-0.110***
	(0.021)	(0.021)	(0.040)	(0.040)	(0.021)	(0.021)	(0.040)	(0.040)
Observations	140,715	140,715	140,715	140,715	140,715	140,715	140,715	140,715
R-squared	0.550	0.559	0.179	0.180	0.550	0.559	0.179	0.180
No. of trading pairs	7,944	7,944	7,944	7,944	7,944	7,944	7,944	7,944
Country-fixed effects	No	Yes	No	No	No	Yes	No	No
Country-pair effects	No	No	Yes	Yes	No	No	Yes	Yes
Year effects	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Dependent variable is bilateral trade balance to the sum of bilateral exports and imports (TB). TB_{t-1} is one period lagged TB. Regime is bilateral exchange rate regime constructed using IMF's de jure and de facto aggregate classification (coded as fixed=0, intermediate=0.5, and float=1). Constant included in all specifications. Standard errors are clustered at country-pair level in all specifications. ***,**,* indicate significance at the 1, 5, and 10 percent levels, respectively.

a/ At least one country in the trading pair is an advanced economy.

b/ Both countries in the trading pair are advanced economies.

c/ Both countries in the trading pair are either emerging markets or developing economies.

Table 8. Bilateral Direct and Indirect Pegs, 1980–2011

	OLS	CPFE	CPFE/TE	OLS	CPFE	CPFE/TE
	(1)	(2)	(3)	(4)	(5)	(6)
TB_{t-1}	0.888***	0.576***	0.575***	0.908***	0.561***	0.561***
	(0.027)	(0.043)	(0.043)	(0.016)	(0.022)	(0.022)
Direct $regime_t$	0.009**	-0.029***	-0.030***	0.005	-0.033***	-0.034***
	(0.004)	(0.010)	(0.010)	(0.005)	(0.010)	(0.011)
TB_{t-1} × Direct $regime_t$	-0.123***	-0.105***	-0.104***	-0.130***	-0.101***	-0.100***
	(0.010)	(0.018)	(0.018)	(0.011)	(0.018)	(0.018)
Indirect $regime_t$	0.039***	0.005	-0.004	0.033***	-0.001	-0.009
	(0.004)	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)
TB_{t-1} × Indirect $regime_t$	-0.009	-0.031***	-0.031***	-0.018**	-0.024***	-0.025***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Impure $float_t$				-0.007**	-0.008**	-0.006*
				(0.003)	(0.004)	(0.004)
TB_{t-1} × Impure $float_t$				-0.010*	0.008	0.008
				(0.005)	(0.006)	(0.006)
Obs.	258,075	258,075	258,075	258,075	258,075	258,075
R-squared	0.585	0.206	0.207	0.585	0.207	0.207
No. of trading pairs	12,660	12,660	12,660	12,660	12,660	12,660
Country-pair effects	No	Yes	Yes	No	Yes	Yes
Year effects	No	No	Yes	No	No	Yes

Notes: Dependent variable is bilateral trade balance to the sum of bilateral exports and imports (TB). TB_{t-1} is one period lagged TB. Direct (indirect) regime is defined as 0, 0.5, and 1if there is a bilateral fixed, intermediate or floating direct (indirect) regime between the trading pair. Impure float is a binary variable equal to 0 if there is an impure float relationship between the trading pair, and 1 otherwise. Constant is included in all specifications. Clustered standard errors at country-pair level reported in parentheses. ***,**,* indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 9. External Dynamics: Natural Experiments

	CFA franc zone a/			Lithuania b/		Euro zone c/	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TB_{t-1}	0.823***	0.487***	0.487***	0.850***	0.576***	1.002***	0.799***
	(0.021)	(0.031)	(0.035)	(0.234)	(0.081)	(0.006)	(0.034)
$Regime_t$	-0.063***	-0.042	-0.050	-0.235	0.087**	-0.004	-0.037*
	(0.015)	(0.039)	(0.042)	(0.133)	(0.036)	(0.005)	(0.019)
TB_{t-1} × $Regime_t$	-0.084***	-0.042*	-0.055**	-1.164**	-0.219*	-0.074**	-0.072
	(0.025)	(0.024)	(0.028)	(0.447)	(0.114)	(0.036)	(0.045)
Observations	5,266	5,266	4,174	18	208	1,422	1,422
R2	0.611	0.259	0.249	0.790	0.298	0.948	0.689
No. of trading pairs	223	223	181	1	12	66	66
Country-pair effects	No	Yes	Yes	No	Yes	No	Yes
Year effects	No	Yes	Yes	No	Yes	No	Yes

Notes: Dependent variable is bilateral trade balance to the sum of bilateral exports and imports (TB). TBt-1is one period lagged TB. Regime is bilateral exchange rate regime constructed using IMF's de facto aggregate classification (coded as fixed=0, intermediate=0.5, and float=1). Constant included in all specifications. Standard errors are clustered at country-pair level in all specifications (robust standard errors are reported in col. 4). ***,**,* indicate significance at the 1, 5, and 10 percent levels, respectively.

a/ Cols. (1)-(2) include CFA franc zone's trade balance with Eurozone countries (excl. France); col. (3) includes CFA franc zone's trade balance with Eurozone countries (excl. Belgium, France, Germany and Netherlands).

b/ Cols. (4) and (5) includes Lithuania's trade balance with the US and Eurozone controlling for global financial crisis (GFC) years (2007-09), respectively.

c/ Cols. (6)-(7) include Eurozone countries' trade balance with each other excluding the ERM crisis (1990-93) and the Eurozone crisis (2010-11) observations, and controlling for the GFC years.

Table 10. External Dynamics: Threshold Effects, 1980–2011

	Direct peg			Indirect peg			Float		
	OLS	**CPFE**	**CPFE/TE**	**OLS**	**CPFE**	**CPFE/TE**	**OLS**	**CPFE**	**CPFE/TE**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TB_{t-1}	0.905***	0.514***	0.513***	0.748***	0.378***	0.378***	0.779***	0.442***	0.442***
	(0.009)	(0.025)	(0.025)	(0.008)	(0.011)	(0.011)	(0.004)	(0.006)	(0.006)
$TB_{t-1} \times 1(TB_{t-1} \leq q.25)$	-0.054***	-0.012	-0.013	0.038***	0.002	0.002	-0.012*	-0.046***	-0.047***
	(0.018)	(0.032)	(0.032)	(0.010)	(0.014)	(0.014)	(0.006)	(0.009)	(0.009)
$TB_{t-1} \times 1(TB_{t-1} \geq q.75)$	-0.007	-0.027	-0.026	0.028***	-0.019*	-0.018	0.001	-0.028***	-0.027***
	(0.011)	(0.020)	(0.020)	(0.009)	(0.011)	(0.011)	(0.004)	(0.006)	(0.006)
Observations	12,585	12,585	12,585	58,322	58,322	58,322	166,488	166,488	166,488
R2	0.782	0.262	0.265	0.607	0.142	0.142	0.602	0.177	0.177
No. of trading pairs	1,112	1,112	1,112	7,013	7,013	7,013	11,207	11,207	11,207
Country-pair effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year effects	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Dependent variable is bilateral trade balance to the sum of bilateral exports and imports (TB). 1(.) is an indicator function equal to 1 if the argument of the function is true and 0 otherwise; q.x referes to quartile x based on the estimated sample for benchmark specification (i.e., dropping regime switch years). Direct and indirect pegs include both fixed and intermediate regimes. Constant included in all specifications. Standard errors are clustered at country-pair level in all specifications. ***,**,* indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 11. Real Exchange Rate Corrective Movement, 1980–2011

	Direct peg			Indirect peg			Float		
	OLS	**CPFE**	**CPFE/TE**	**OLS**	**CPFE**	**CPFE/TE**	**OLS**	**CPFE**	**CPFE/TE**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TB_{t-1}	0.001	0.000	-0.001	0.001	-0.001	-0.002	-0.000	-0.005***	-0.004***
	(0.001)	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Obs.	6,892	6,892	6,892	49,064	49,064	49,064	148,014	148,014	148,014
R2	0.011	0.020	0.077	0.011	0.008	0.030	0.006	0.009	0.036
No. of trading pairs	633	633	633	6,068	6,068	6,068	10,160	10,160	10,160
Country-pair effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year effects	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Dependent variable is percentage change in bilateral real exchange rate (larger values indicating a currency depreciation). Direct and indirect pegs include fixed and intermediate regimes. Control variables (log of real GDP and real GDP per capita, and age dependency ratio for both trading partners), and constant included in all specifications. Outliers in the real exchange rate series (top and bottom one percentile of the distribution) are excluded. Standard errors are clustered at country-pair level in all specifications. ***,**,* indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

Table 12. External Dynamics and Financial Openness, 1980–2011

	By decade						By openness			
	OLS			CPFE/TE			OLS		CPFE/TE	
	1980-89	1990-99	2000-11	1980-89	1990-99	2000-11	Less open	More open	Less open	More open
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TB_{t-1}	0.875***	0.871***	0.881***	0.350***	0.258***	0.355***	0.897***	0.890***	0.451***	0.493***
	(0.022)	(0.023)	(0.011)	(0.048)	(0.047)	(0.028)	(0.033)	(0.014)	(0.068)	(0.033)
$Regime_t$	0.011	0.022***	-0.009*	-0.001	-0.087***	0.034*	-0.009	0.006	0.052	0.012
	(0.007)	(0.008)	(0.005)	(0.032)	(0.028)	(0.018)	(0.013)	(0.006)	(0.041)	(0.015)
$TB_{t-1} \times Regime_t$	-0.112***	-0.155***	-0.099***	-0.114**	-0.080*	-0.059**	-0.152***	-0.110***	-0.140**	-0.086***
	(0.022)	(0.023)	(0.011)	(0.049)	(0.048)	(0.028)	(0.034)	(0.015)	(0.068)	(0.033)
Observations	50,943	78,312	128,820	50,943	78,312	128,820	36,285	78,934	36,285	78,934
R-squared	0.593	0.523	0.619	0.059	0.034	0.092	0.559	0.617	0.101	0.177
No. of trading pairs	6,607	11,151	12,287	6,607	11,151	12,287	5,414	11,719	5,414	11,719
Country-pair effects	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes
Year effects	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes

Notes: Dependent variable is bilateral trade balance to the sum of bilateral exports and imports (TB). Regime is direct bilateral de facto exchange rate regime (fixed=0, intermediate=0.5, and float=1). Openness based on the Chinn-Ito openness index, with each country coded as 0, 1 or 2 if it is in the bottom, middle or top quartiles of the index distribution, respectively. Openness of the pair defined as the sum of the scores of the trading partners (with sums of 0 and 1 considered as less open, and 3, and 4 as more open). Constant is included in all specifications. Standard errors are clustered at country-pair level. ***,**,* indicate significance at the 1, 5, and 10 percent levels, respectively.

Table 13. External Dynamics: Sensitivity Analysis

	Dependent variables a/				Specifications b/					Sample composition c/					Classification d/	
	Absolute TB	Exports/ Imports	TB/ GDP	Goods & Serv.	Addl. controls	CYFE	Lagged regime	System-GMM	Non-monot.	Excl. small states	Excl. oil exp.	Excl. ext. TB	Incl. regime switches	Top partners	R&R	LY&S
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
TB_{t-1}	0.507***	0.573***	0.507***	0.238***	0.413***	0.517***	0.535***	0.734***	0.446***	0.563***	0.529***	0.549***	0.537***	0.666***	0.526***	0.484***
	(0.013)	(0.015)	(0.057)	(0.049)	(0.026)	(0.017)	(0.018)	(0.035)	(0.004)	(0.021)	(0.018)	(0.016)	(0.017)	(0.013)	(0.019)	(0.021)
$Regime_t$	0.063***	0.031***	-0.046*	-0.037*	-0.029**	-0.025**	-0.026**	0.009		-0.045***	-0.023**	-0.026**	-0.029***	-0.003	-0.030***	-0.006
	(0.009)	(0.010)	(0.026)	(0.022)	(0.015)	(0.012)	(0.010)	(0.013)		(0.012)	(0.010)	(0.010)	(0.009)	(0.007)	(0.011)	(0.011)
$TB_{t-1} \times Regime_t$	-0.136***	-0.086***	-0.368***	-0.104*	-0.059**	-0.085***	-0.096***	-0.255***		-0.101***	-0.097***	-0.102***	-0.091***	-0.093***	-0.120***	-0.125***
	(0.013)	(0.015)	(0.075)	(0.054)	(0.026)	(0.017)	(0.018)	(0.035)		(0.021)	(0.018)	(0.016)	(0.017)	(0.013)	(0.019)	(0.021)
Fixed									0.035***							
									(0.010)							
$TB_{t-1} \times Fixed_t$									0.073***							
									(0.018)							
Intermediate									0.001							
									(0.007)							
$TB_{t-1} \times Intermediate_t$									0.114***							
									(0.013)							
Observations	258,075	217,769	547,033	18,921	143,833	258,075	252,631	258,075	260,774	176,940	208,937	208,053	260,774	147,376	188,324	133,181
R-squared	0.149	0.253	0.139	0.021	0.134	12,660	0.202		0.208	0.223	0.196	0.226	0.208	0.352	0.175	0.137
No. of trading pairs	12,660	11,859	26,053	2,324	11,321	0.236	12,655	12,660	12,661	8,454	10,896	11,477	12,661	9,748	12,125	11,216
Country-pair effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable (TB) is bilateral trade balance to the sum of bilateral exports and imports in cols. (5)-(16). Regime is direct bilateral exchange rate regime constructed using IMF's de facto regime classification (fixed=0, intermediate=0.5, and float=1) unless otherwise specified. Constant is included in all specifications. Standard errors are clustered at country-pair level. ***,**,* indicate significance at the 1, 5, and 10 percent levels, respectively.

a/ In (1)-(3), the dependent variable is the ratio of absolute trade balance between the trading partner to the sum of total exports and imports between them, the ratio of exports to imports (transformed as x/(1+x) to take into account outliers), and the ratio of the bilateral trade balance to GDP of country i, respectively. In col. [4], the trade balance pertains to goods and services for a limited sample.

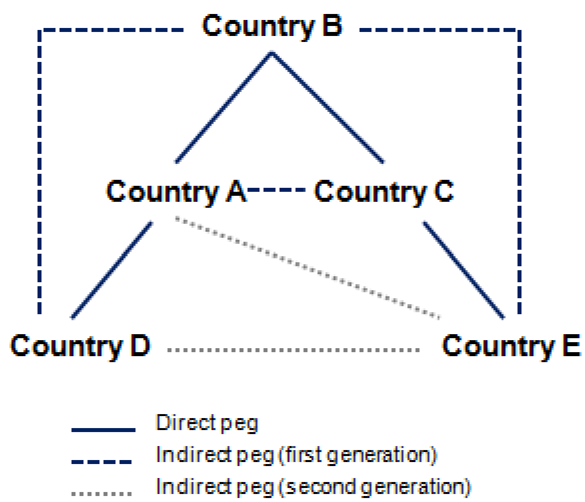
b/ In (5) and (6), additional control variables (log of real GDP, age dependency ratio, and fiscal balance to GDP) of both trading partners, and country-year fixed effects (to capture all country-specific time-varying elements) are included, respectively. In (7), lagged exchange rate regime is used instead of the current regime, while (8) estimates the benchmark specification using the system-GMM estimation method. Col. (9) includes separate binary variables (equal to 1 for fixed and intermediate regimes, and zero otherwise) to capture non-monotonic effects of the regimes.

c/ In (10)-(13), the benchmark specification is estimated excluding small states (with population less than 2 million), oil exporting countries, and extreme trade balance observations (in the top and bottom percentile of the TB distribution) from the sample, and including regime switch years, respectively. In (14), the sample is restricted to include top 30 trading partners only.

d/ In (15) and (16), the bilateral exchange rate regime variable is constructed using Reinhart and Rogoff's (2004) and Levy-Yeyati and Sturzenegger's (2003) de facto exchange rate regime classifications.

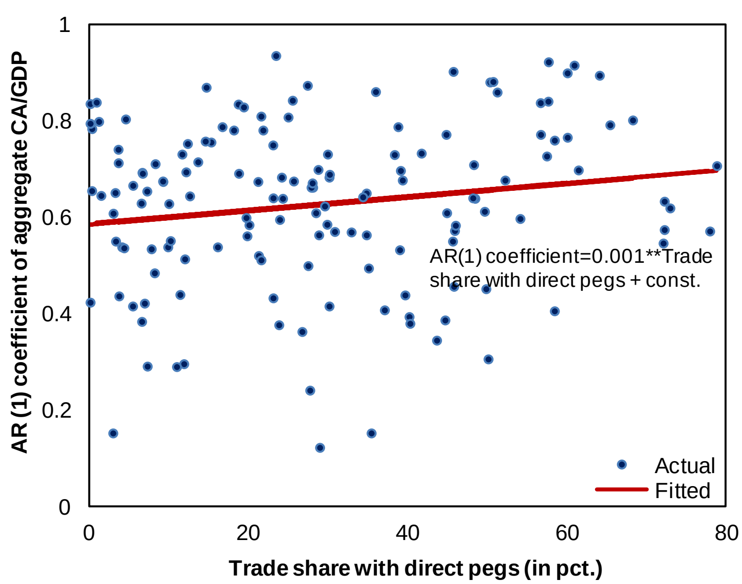
APPENDIX A: DATA AND SUMMARY STATISTICS

Figure A1. Bilateral Direct and Indirect Pegs*



* Among indirect pegs, we consider several types of relationships based on the number of links involved. Thus, countries *A* and *C* peg to anchor country *B*, and are considered to have a "first generation" indirect peg. Country *D* pegs to *A*, which in turn pegs to *B*, thus *D* and *B* are also considered to have a "first generation" indirect peg. Country *D* pegs to *A* and *E* pegs to *C*, then *D*'s relationship with *C* and *E* (and *E*'s relationship with *A* and *D*) is considered as a "second generation" indirect peg. While one could go beyond second generation indirect pegs (e.g., if countries *D* and/or *E* are also anchor currencies), but in our dataset such cases are very few (only 4 country-pairs in the estimated sample).

Figure A2. External Balance Persistence and Trade Share with Direct Pegs, 1980-2011



Note: AR(1) coefficient computed for individual countries by estimating OLS regressions of current account balance to GDP on lagged current account balance to GDP over the sample period. Trade share is the average trade share (over the sample period) with countries against which the country has a direct fixed or intermediate regime. (Countries with fewer than 20 observations to compute the AR(1) coefficient have been dropped from the estimation.) ** indicates statistical significance of the estimated coefficient of trade share with direct pegs at the 5 percent level (based on robust standard errors).

Table A1. List of Countries in the Sample

Advanced	Emerging markets		Developing			
Australia	Albania	Lebanon	Afghanistan	Ethiopia	Myanmar	Trinidad and Tobago
Austria	Algeria	Lithuania	Angola	Fiji	Namibia	Turkmenistan
Belgium	Argentina	Macedonia	Antigua and Barbuda	Gabon	Nepal	Uganda
Canada	Armenia	Malaysia	Azerbaijan	Gambia	Nicaragua	United Arab Emirates
Hong Kong	Belarus	Mexico	Bahamas	Ghana	Niger	Uzbekistan
Cyprus	Bosnia & Herzegovina	Morocco	Bahrain	Grenada	Nigeria	Vanuatu
Denmark	Brazil	Pakistan	Bangladesh	Guinea	Oman	Yemen, Rep. of
Finland	Bulgaria	Panama	Barbados	Guinea-Bissau	Papua New Guinea	Zambia
France	Chile	Peru	Belize	Guyana	Paraguay	Zimbabwe
Germany	China	Philippines	Benin	Haiti	Qatar	
Greece	Colombia	Poland	Bhutan	Honduras	Rwanda	
Iceland	Costa Rica	Romania	Bolivia	Iran	São Tomé & Príncipe	
Ireland	Croatia	Russia	Botswana	Kenya	Samoa	
Israel	Czech Rep.	Serbia, Rep.	Brunei Darussalam	Kiribati	Saudi Arabia	
Italy	Dominican Rep.	Slovak Rep.	Burkina Faso	Kuwait	Senegal	
Japan	Ecuador	South Africa	Burundi	Kyrgyz Rep.	Seychelles	
Luxembourg	Egypt	Sri Lanka	Cambodia	Laos	Sierra Leone	
Malta	El Salvador	Thailand	Cameroon	Lesotho	Solomon Islands	
Netherlands	Estonia	Tunisia	Cape Verde	Liberia	St. Kitts and Nevis	
New Zealand	Georgia	Turkey	Central African Rep.	Libya	St. Lucia	
Norway	Guatemala	Ukraine	Chad	Madagascar	St. Vincent & Grens.	
Portugal	Hungary	Uruguay	Comoros	Malawi	Sudan	
Singapore	India	Venezuela	Congo, Dem. Rep. of	Maldives	Suriname	
Slovenia	Indonesia	Vietnam	Congo, Rep. of	Mali	Swaziland	
Spain	Jamaica		Cote d'Ivoire	Mauritania	Syrian Arab Rep.	
Sweden	Jordan		Djibouti	Mauritius	Tajikistan	
Switzerland	Kazakhstan		Dominica	Moldova	Tanzania	
United Kingdon	Korea		Equatorial Guinea	Mongolia	Togo	
United States	Latvia		Eritrea	Mozambique	Tonga	

Table A2. Variables and Data Sources

Variable	Description	Source
Age dependency ratio	In percent of working age population	World Bank's WDI
Bilateral trade balance	Difference between exports of country i to country j and imports of country i from j (In billions of USD). Bilateral exports and imports are computed as the average of i's exports to j, and j's imports from i, and the average of i's imports from j, and j's exports to i, respectively	IMF's Direction of Trade Statistics
Capital account openness	Index	Chinn-Ito (2006)[1]
Current account	In billions of USD	IMF's WEO database
Exchange rate regime classifications		
IMF's de jure and de facto	Fixed (no separate legal tender/currency board; peg to single currency); Intermediate (basket currency peg; horizontal band; crawling peg/band; managed float); Float (independent float)	Based on Anderson (2008)[2]; IMF's AREAER (various issues)
Levy-Yeyati and Sturzenegger	Fixed; Intermediate (dirty peg/crawl; dirty float); Float	Levy-Yeyati and Sturzenegger (2003)[3]
Reinhart and Rogoff	Fixed (no separate legal tender; pre-announced peg/currency board); Intermediate (pre-announced band ≤ +/-2%; de facto peg; pre-announced crawling peg; pre-announced crawling band ≤ +/-2%; de facto crawling peg; de facto crawling band ≤ +/-2%; pre-announced crawling band ≥ +/-2%; de facto crawling band ≤ +/-5%; moving band ≤ +/-2%; managed float); Float (freely floating)	Ilzetzki at al. (2010).[4] Available online at http://personal.lse.ac.uk/ilzetzki/data.htm
Fiscal balance	In billions of local currency (LC)	IMF's WEO database
Gross domestic product (GDP)	In billions of USD (or LC)	IMF's WEO database
Real GDP	In constant 2000 USD	World Bank's WDI
Real GDP per capita	In constant 2000 USD	World Bank's WDI

1/ Chinn, M., and H. Ito, 2006, "What Matters for Financial Development? Capital Controls, Institutions, and Interactions," *Journal of Development Economics*, 81(1), pp. 163-192.
2/ Anderson, H., 2008, "Exchange Policies before Widespread Floating (1945–89)," mimeo, International Monetary
3/ Levy-Yeyati, E., and F. Sturzenegger, 2003, "To Float or to Fix: Evidence on the Impact of Exchange Rate Regimes on Growth," *American Economic Review*, 93(4), pp. 1173-1193.
4/ Izetzki, E., C. Reinhart and K. Rogoff, 2010, "Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?" mimeo, UMD.

Table A3. List of Anchor Currencies

Country	Currency
Australia	Australian Dollar
Belgium	Belgian Franc
Eurozone countries	Euro
France	French Franc
Germany	Deutsche Mark
India	Indian Rupee
Japan	Japanese Yen
New Zealand	New Zealand Dollar
Portugal	Portuguese escudo
Russia	Russian Ruble
Singapore	Singapore Dollar
Spain	Spanish Peseta
South Africa	South African Rand

Table A4. Transition Probabilities of Current Account Balance: Composite Regime Classification (In percent)

	CA ≤ -15	-15 > CA ≤ -5	-5 > CA < 0	0 ≥ CA < 5	5 ≥ CA < 15	CA ≥ 15
			Fixed			
CA ≤ -15	63.3*	29.2	4.2	1.7	1.3	0.4
-15 > CA ≤ -5	11.7	64.0*	19.0	3.6	1.5	0.2
-5 > CA < 0	1.4	22.6	59.6***	12.8	3.5	0.2
0 ≥ CA < 5	2.4	6.5	23.9	49.8***	16.7	0.7
5 ≥ CA < 15	1.0	2.0	7.9	23.8	54.5***	10.9
CA ≥ 15	1.2	3.7	0.0	6.1	28.0	61.0
			Intermediate			
CA ≤ -15	58.1	36.8	3.7	0.7	0.7	0.0
-15 > CA ≤ -5	6.9	64.6**	25.0	3.1	0.3	0.0
-5 > CA < 0	0.1	18.6	65.9*	13.5	1.8	0.0
0 ≥ CA < 5	1.2	5.0	28.8	50.7***	12.8	1.5
5 ≥ CA < 15	1.5	2.2	9.6	25.9	50.4***	10.4
CA ≥ 15	1.7	0.0	0.0	8.6	20.7	69.0*
			Float			
CA ≤ -15	33.3	44.4	11.1	0.0	11.1	0.0
-15 > CA ≤ -5	5.5	53.8	38.5	2.2	0.0	0.0
-5 > CA < 0	1.5	15.1	72.7	10.2	0.5	0.0
0 ≥ CA < 5	0.0	1.8	18.9	76.6	2.7	0.0
5 ≥ CA < 15	0.0	2.7	0.0	10.8	78.4	8.1
CA ≥ 15	0.0	0.0	0.0	25.0	50.0	25.0

Note: CA is current account balance to GDP (in percent). Extreme values (top and bottom 0.5th percentile of the CA distribution) and exchange rate regime switch years are excluded from the sample. Threshold of -15 percent of GDP corresponds to the bottom 10th percentile of the CA distribution for the full sample. Exchange rate regime is the IMF's de facto aggregate classification.***,** and * indicate statistically significant difference between probabilities of floats and fixed/intermediate regime across the diagonal at the 1, 5 and 10 percent levels, respectively. (Results not reported for off-diagonal probabilities.)

Table A5. Current Account Balance and Composite Exchange Rate Regime Classifications

	IMF DJ classification a/			IMF DF classification b/			RR classification c/			LYS classification d/		
	OLS	**FE**	**FE/TE**	**OLS**	**FE**	**FE/TE**	**OLS**	**FE**	**FE/TE**	**OLS**	**FE**	**FE/TE**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
All countries												
CA_{t-1}	0.649***	0.475***	0.471***	0.674***	0.506***	0.504***	0.681***	0.527***	0.524***	0.527***	0.351***	0.348***
	(0.093)	(0.092)	(0.092)	(0.080)	(0.081)	(0.080)	(0.084)	(0.087)	(0.085)	(0.104)	(0.097)	(0.098)
$Regime_t$	0.241	0.564	0.287	0.200	0.407	0.078	0.308	-0.795	-0.392	0.694	0.998	0.824
	(0.805)	(0.871)	(0.861)	(0.746)	(0.903)	(0.880)	(0.954)	(0.812)	(0.796)	(0.704)	(0.792)	(0.767)
CA_{t-1} * $Regime_t$	-0.023	-0.090	-0.088	-0.146	-0.254	-0.261	-0.215	-0.412*	-0.432*	0.101	-0.022	-0.040
	(0.181)	(0.186)	(0.183)	(0.255)	(0.242)	(0.238)	(0.279)	(0.227)	(0.220)	(0.243)	(0.245)	(0.242)
Observations	4,436	4,436	4,436	4,436	4,436	4,436	3,833	3,833	3,833	2,408	2,408	2,408
R-squared	0.547	0.323	0.336	0.550	0.330	0.344	0.539	0.320	0.339	0.460	0.250	0.267
No. of countries	181	181	181	181	181	181	178	178	178	172	172	172
Advanced countries												
CA_{t-1}	0.925***	0.806***	0.806***	0.892***	0.736***	0.742***	0.935***	0.831***	0.843***	0.900***	0.737***	0.732***
	(0.030)	(0.041)	(0.042)	(0.033)	(0.058)	(0.055)	(0.021)	(0.036)	(0.036)	(0.037)	(0.037)	(0.037)
$Regime_t$	-0.062	0.538	0.874	-0.070	0.876*	1.044*	0.075	0.067	0.553	0.040	1.051	1.307
	(0.249)	(0.411)	(0.583)	(0.252)	(0.454)	(0.512)	(0.249)	(0.465)	(0.671)	(0.241)	(0.753)	(0.796)
CA_{t-1} * $Regime_t$	-0.033	-0.086	-0.102*	0.035	0.048	0.020	-0.020	-0.118	-0.161*	0.088	0.072	0.068
	(0.059)	(0.061)	(0.052)	(0.033)	(0.066)	(0.066)	(0.057)	(0.082)	(0.082)	(0.114)	(0.130)	(0.137)
Observations	795	795	795	795	795	795	802	802	802	474	474	474
R-squared	0.834	0.645	0.665	0.834	0.645	0.664	0.834	0.650	0.674	0.836	0.638	0.656
No. of countries	29	29	29	29	29	29	29	29	29	28	28	28
Emerging markets												
CA_{t-1}	0.841***	0.762***	0.736***	0.734***	0.542***	0.534***	0.807***	0.660***	0.650***	0.695***	0.389***	0.393***
	(0.060)	(0.080)	(0.068)	(0.036)	(0.096)	(0.086)	(0.042)	(0.062)	(0.051)	(0.045)	(0.092)	(0.071)
$Regime_t$	-0.786	0.148	-0.477	0.305	-0.058	-0.806	-0.267	-0.454	-0.545	-0.504	0.187	-0.348
	(1.205)	(0.699)	(0.786)	(0.592)	(0.911)	(1.004)	(0.737)	(1.195)	(1.100)	(0.761)	(0.943)	(0.857)
CA_{t-1} * $Regime_t$	-0.273*	-0.501**	-0.483**	-0.124	-0.139	-0.178	-0.321	-0.436	-0.463	-0.503	-0.403	-0.438*
	(0.144)	(0.209)	(0.197)	(0.144)	(0.094)	(0.113)	(0.256)	(0.273)	(0.290)	(0.310)	(0.244)	(0.239)
Observations	1,188	1,188	1,188	1,188	1,188	1,188	1,090	1,090	1,090	573	573	573
R-squared	0.526	0.329	0.383	0.517	0.285	0.348	0.516	0.284	0.347	0.319	0.093	0.150
No. of countries	53	53	53	53	53	53	53	53	53	51	51	51
Developing countries												
CA_{t-1}	0.627***	0.449***	0.448***	0.669***	0.508***	0.506***	0.648***	0.508***	0.510***	0.500***	0.342***	0.343***
	(0.102)	(0.095)	(0.094)	(0.090)	(0.089)	(0.088)	(0.092)	(0.093)	(0.092)	(0.106)	(0.100)	(0.101)
$Regime_t$	-0.207	0.239	-0.250	-1.381	-0.105	-0.426	-0.111	-1.462	-1.766	0.863	1.789*	1.409
	(1.301)	(1.691)	(1.753)	(1.261)	(1.588)	(1.562)	(1.704)	(1.454)	(1.421)	(0.988)	(0.949)	(1.012)
CA_{t-1} * $Regime_t$	-0.062	-0.072	-0.071	-0.309	-0.370	-0.367	-0.265	-0.471**	-0.491**	0.307*	0.261*	0.252*
	(0.236)	(0.233)	(0.231)	(0.299)	(0.273)	(0.270)	(0.318)	(0.232)	(0.225)	(0.176)	(0.141)	(0.139)
Observations	2,453	2,453	2,453	2,453	2,453	2,453	1,941	1,941	1,941	1,361	1,361	1,361
R-squared	0.521	0.314	0.331	0.529	0.331	0.348	0.508	0.318	0.341	0.454	0.272	0.297
No. of countries		99	99	99	99	99	96	96	96	93	93	93
Country effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year effects	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes

Notes: Dependent variable is current account to GDP (CA_t). CA_{t-1} is lagged current account to GDP. Extreme observations of CA_t (values in the top and bottom 0.5th percentile of the distribution) are excluded from the estimated sample. Years in which the exchange rate regime switches are also excluded from the sample. Constant included in all specifications. Standard errors, reported in parentheses, are clustered at the country level in all specifications. ***,**,* indicate significance at the 1, 5, and 10 percent levels, respectively.

a/ Regime is IMF's de jure classification regime (0=fixed; 0.5=intermediate; 1=float).

b/ Regime is IMF's de facto classification regime (0=fixed; 0.5=intermediate; 1=float).

c/ Regime is Reinhart and Rogoff's (2004) de facto classification regime (0=fixed; 0.5=intermediate; 1=float).

d/ Regime is Levy-Yeyati and Sturzenegger's (2003) de facto classification regime (0=fixed; 0.5=intermediate; 1=float).