NBER WORKING PAPER SERIES

FIXED EXCHANGE RATES AND TRADE

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Working Paper 10696
http://www.nber.org/papers/w10696

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 2004

We thank Eric Edmunds, Jim Feyrer, Andrew Rose, Douglas Staiger, and participants at the Dartmouth Junior Lunch and Dartmouth International Macro Summer Camp for helpful suggestions. All errors are ours. The views expressed herein are those of the author(s) and not necessarily those of the National Bureau of Economic Research.

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JEL No. F3

ABSTRACT

A classic argument for a fixed exchange rate is its promotion of trade. Empirical support for this, however, is mixed. While one branch of research consistently shows a small negative effect of exchange rate volatility on trade, another, more recent, branch presents evidence of a large positive impact of currency unions on trade. This paper helps resolve this disconnect. Our results, which use a new data-based classification of fixed exchange rate regimes, show a large, significant effect of a fixed exchange rate on bilateral trade between a base country and a country that pegs to it. Furthermore, the web of fixed exchange rates created when countries link to a common base also promotes trade, but only when these countries are part of a wider system, as during the Bretton Woods period. These results suggest an economically relevant role for exchange rate regimes in trade determination since a significant amount of world trade is conducted between countries with fixed exchange rates.

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I. Introduction

Until recently, the idea that a fixed exchange rate promotes trade was both well understood and not credible. Exchange rate policy has been influenced by the argument that pegging to, say, the US dollar fosters bilateral trade both with the United States and with all other countries that have a dollar peg. This argument is most compelling for trade with countries whose currencies' values cannot be hedged in forward markets. But, despite the logic of this view, and its use in policy debates, the empirical literature fails to present strong evidence that a reduction in exchange rate volatility is associated with an increase in trade.[1]

Those uncomfortable with this dissonance between received wisdom and statistical results may have taken some comfort by a newer branch of empirical research that uses gravity models to study the determinants of bilateral trade. Some of this research finds a big effect of currency unions on trade flows in the modern era.[2] Other work shows that the pre-World War I gold standard had an important role in promoting trade, and its demise contributed in an important way to the reduction in world trade in the interwar period.[3]

Yet a careful reading of the results from this research employing gravity models is less supportive than one might suspect of the policy argument that a country can promote its trade by establishing a fixed exchange rate.[4] The regressions on the effects of currency unions on trade use a dummy variable representing the presence of a currency union as well as a separate variable representing exchange rate volatility. While the coefficient on the currency union dummy variable is large and highly significant, the coefficient on exchange rate volatility tends to suggest that the effect of limiting exchange rate volatility, through a means other than the establishment of a currency union, is small.[5] Furthermore, results on fixed exchange rates

[1] There is a literature in which exchange rate volatility is used as a regressor in import and export equations and, generally, the coefficients on exchange rate volatility are either insignificant or small enough to suggest that a reduction in exchange rate volatility has a small effect on trade. See, for example, Cushman (1983, 1986, 1988), Gotur (1985), Hooper and Kohlhagen (1978), IMF (1984), Kenen and Rodrik (1986), Klein (1990), and Thursby and Thursby (1987).

[2] See, for example, Rose (2000), Rose and Van Wincoop (2001), Glick and Rose (2002), and Frankel and Rose (2002).

[3] See Estevadeordal et al. (2003) and Lopez-Cordova and Meissner (2004).

[4] Frankel and Wei (1993) used a gravity model that included exchange rate volatility as a regressor, but their results suggest a limited role of exchange rate volatility on trade.

[5] Rose (2000) makes a distinction between the effects on trade of a currency union and of a fixed exchange rate, and distinguishes between these systems, writing "Sharing a common currency is a much more durable and serious commitment than a fixed rate." (pp. 10 – 11) Tenreyro (2003) writes "…the findings from currency unions do not generalize to other regimes with lower variability".

(rather than a currency union) drawn from the gold-standard period may not translate to the modern era because bilateral fixed exchange rates at that time were part of a more pervasive exchange rate system. Thus, these considerations, along with results from the earlier literature cited above, may raise doubts about the trade effects of a fixed exchange rate in the modern era since the empirical results that suggest a large effect of a currency union or the gold standard on trade also suggest a minor effect, at best, of limiting exchange rate volatility *per se*.

But the feasible policy set may not include the choice of a currency union, nor membership in a widespread fixed-exchange rate system, and unilateral dollarization is a drastic step. Rather, the realistic choice facing many policy-makers is whether or not to peg their currency to one of the major industrial countries. The question then arises of the effect of this choice on bilateral trade with the country to which they peg, with other countries that also peg to the same country, and with countries that do not share a common peg.

In this paper we address these questions, using a new dataset from Shambaugh (2004) that classifies *de facto* bilateral exchange rate arrangements in the post-Bretton Woods era. This data set enables us to create a fixed exchange rate series for use in a gravity model that is comparable to the currency union and gold-standard membership series used in research cited above.[6] We find a fixed exchange rate between two countries raises the amount of their bilateral trade, and that this effect is of the same order of magnitude (though smaller) as a currency union or a regional free trade arrangement. These results are especially relevant for policy since they speak to the effects of a policy choice less dramatic than the abandonment of the national currency and more attainable than the institution of a widespread fixed exchange rate system.

II. Methodology

II.1 Estimation technique

The gravity model has been heralded as one of the most successful empirical frameworks in international economics.[7] A series of recent papers has augmented the standard gravity model to investigate the effect of a range of variables on bilateral trade, including

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[6] We also include exchange rate volatility as a regressor to ensure that fixed rates are not simply picking up the effect of reducing overall macroeconomic volatility. As will be shown, our core results are robust to the use of another *de facto* exchange rate classification scheme, the one developed by Reinhart and Rogoff (2004).

[7] Anderson and van Wincoop (2003) begin their article with the statement “The gravity equation is one of the most empirically successful in economics.” (p. 170) Anderson (1979) and Bergstrand (1985) provide early theoretical justifications for the gravity model.

membership in a currency union. We adopt this technique by regressing bilateral trade on a standard set of gravity model variables, as well as dummy variables that indicate whether two countries have a direct or indirect fixed exchange rate, a dummy variable that indicates whether one country has formed a currency union with its trading partner, and a variable representing the volatility of the exchange rate between the trading partners. Each observation in the regressions we run represents, for a particular year, a dyad, that is, a country-pair observation. The specification of the core regressions takes the form

$$(1) \qquad \ln(T_{i,j,t}) = \alpha_1 X_{i,j,t} + \alpha_2 Z_{i,j} + \beta_1 F_{1,i,j,t} + \beta_2 F_{2,i,j,t} + \beta_3 CU_{i,j,t} + \beta_4 v_{i,j,t} + \beta_5 v_{i,j,t}^2 + \varepsilon_{i,j,t}$$

where $\ln(T_{i,j,t})$ is the natural logarithm of trade between countries *i* and *j* in year *t*, $X_{i,j,t}$ represents a set of variables that vary over time, such as the product of the natural logarithm of income of countries *i* and *j* at time *t*, $Z_{i,j}$ represents a set of variables that do not vary over time, such as the natural logarithm of the distance between countries *i* and *j*, $F_{1,i,j,t}$ is a dummy variable equal to 1 if there was a fixed exchange rate (but not a currency union) between the two countries at time *t*, $F_{2,i,j,t}$ is a dummy variable equal to 1 if there was an indirect peg (discussed below), $CU_{i,j,t}$ is a dummy variable equal to 1 if one of the countries had a currency union with the other at time *t*, $v_{i,j,t}$ is a measure of volatility of the exchange rate between countries *i* and *j* at time *t*, and $\varepsilon_{i,j,t}$ is an error term.[8] Other specifications add additional exchange rate regime variables discussed below.

This specification differs from the one used in research that considers the effect of a currency union on bilateral trade only by the inclusion of the terms $\beta_1 F_{1i,j,t}$ and $\beta_2 F_{2i,j,t}$. This, however, marks an important distinction between the manner in which we estimate the effect of

[8] The actual set of variables that constitute $X_{i,j,t}$ used in the regressions in this paper include the product of the natural logarithm of income of countries *i* and *j* in period *t*, the product of the natural logarithm of income per capita of countries *i* and *j* in period *t*, a dummy variable indicating whether the two countries had a free trade agreement at time *t*, and another a dummy variable indicating whether one country was a colony of the other country at time *t*. The variables used in the regressions that do not vary over time, represented by $Z_{i,j}$ in (1), include the natural logarithm of the distance between countries *i* and *j*, the product of the natural logarithm of the land areas of countries *i* and *j*, dummy variables representing whether or not countries *i* and *j* share a common border or share a common language, and other dummy variables indicating whether one country had been a colony of the other, whether either country is landlocked, whether either country is an island, whether both countries had a common colonizer, and whether one of the countries was, at one time, a dependency, territory or colony of the other.

a fixed exchange rate on trade and the manner in which that effect has been estimated both in the context of gravity models as well as in the older literature that estimates import or export equations. In both of those cases, the estimated effect of a fixed exchange rate on trade is calculated by multiplying the estimated coefficients on the exchange rate volatility terms, β_4 and β_5 in specification (1), by a given change in exchange rate volatility and exchange rate volatility squared, respectively. Results obtained in this fashion suggest only a minor effect of a fixed exchange rate on trade.

In contrast, the estimated effect of a currency union on trade from a gravity model, calculated as $\exp(\beta_3)-1$ in a specification like that in (1), is reported as very large (as much as tripling trade, *ceteris paribus*) and highly statistically significant.[9] Quah (2000), in his comment on the original Rose (2000) paper, notes that this implies a large discontinuity in the effects on trade of restricting exchange rate volatility. In this paper, we estimate the effect of a fixed exchange rate on trade as $\exp(\beta_1)-1$, in a manner completely analogous to way that the coefficient on the currency union dummy variable has been interpreted in gravity models that investigate that issue. This method recognizes reducing volatility from, say, 5% to zero may be qualitatively different than a reduction in volatility from 20% to 15%, even when allowing for non-linearities in the relationship between exchange rate volatility and trade. In fact, we find the response of trade to a fixed exchange rate to be much closer to, and in many cases statistically indistinguishable from, its response to a currency union.[10] Fixed rates may have an effect beyond that of volatility for a number of reasons, most notably, the certainty a peg generates. Most fluctuations in volatility are not known to participants ahead of time, so even if a pair of countries has low volatility in a given year, this probably does not increase trade while a fixed rate provides a certainty which may be helpful in forming trading relationships.

One concern with the estimates from an equation like (1) is that, despite the plethora of controls included in the gravity model, there may be omitted variables that affect bilateral trade.

[9] For example, Frankel and Rose (2002) present an estimated coefficient on the currency union dummy variable of 1.38 with an associated standard error of 0.19 (see their Table 1) which implies that membership in a currency union triples bilateral trade, *ceteris paribus*, since $e^{1.38} - 1 = 2.97$.

[10] The partial derivative of trade with respect to either a fixed exchange rate or a currency union could include both the direct effect, $\exp(\beta_1)-1$ or $\exp(\beta_3)-1$, respectively, and the separately estimated effect of a reduction in exchange rate volatility, involving the coefficients β_4 and β_5. In practice, however, the estimated effect of exchange rate volatility on trade is small and we only refer to the estimated direct effects.

Anderson and van Wincoop (2001) show that omitting a variable that reflects each country's (time-invariant) resistance to international trade leads to an inflation of the estimated effect of the reduction of trade due to national borders. A solution to the presence of such "multilateral resistance" is to include country fixed effects (CFE) when estimating the gravity model. As predicted by their theory, the empirical results presented in their paper demonstrate that the estimated effect of a border is significantly reduced when CFE are included. Following this insight, we present CFE estimates in this paper in which we effectively include about 140 dummy variables in the regression, one for each country, and any observation will have each of the two dummy variables representing the countries in its trade dyad equal to 1 while all the other country dummy variables will equal 0.

In the context of the issue we study, however, the CFE estimation approach may fail to provide estimates that enable us to make a policy-relevant argument on the likely bilateral trade consequences of a fixed exchange rate. The problem is that unobserved variables could be correlated with both the error term of a gravity model and the likelihood that two countries have a fixed exchange rate.[11] In this case, the estimated effect of fixed exchange rates on trade will be too large when using CFE estimation. Recognizing this, Rose and Glick (2002) argue for using country-pair fixed effects (CPFE) estimation, rather than OLS or CFE estimation. The CPFE estimates effectively include a dummy variable for each of the roughly 10,000 country pairs in the data set. Thus, any particularly strong bilateral tendency to trade is captured in the fixed effect and statistical identification comes after controlling for the average level of trade for a given pair. This can be seen as a generalization of the Anderson and van Wincoop (2003) approach by assuming bilateral resistance to trade at the country-pair level, rather than the multilateral resistance to trade at the country level. Thus, while presenting CFE estimates, we focus our discussion on the estimates we obtain from gravity models that include CPFE.

A first glance at the tables of results using CPFE estimation may be disconcerting since this method does not offer estimates of the effect of variables that do not vary over the sample period (e.g. distance), and, therefore, the "gravity" (as represented by the distance term) disappears from the gravity model when it is estimated using CPFE estimation. In fact, the

[11] On a related note, Eichengreen and Irwin (1995) show that the estimated effect of trade blocs on trade is overstated when one does not control for the fact that, even before these trade blocs were instituted, there was significantly more trade between countries in a trade bloc in the inter-war period.

impact of distance is still in the regression, but it is captured by the fixed effect.[12] The more significant aspect of this issue for our paper is that any country pair that has a fixed exchange rate for the entire sample period will not yield information in the estimate of the impact of a fixed exchange rate on trade. Rather, CPFE estimates identify the effect of fixed exchange rate on trade only from those country pairs that switch exchange rate status during the sample period. But, as it turns out, most fixed exchange rate regimes do not last for the entire sample, so we lose information from relatively few country pairs when we use CPFE estimation rather than CFE estimation.

Section II.2a: Exchange Rate Regime Classifications

The methodology outlined above differs from previous research studying the effect of fixed exchange rates on trade primarily through the variable used to assess the presence of a fixed exchange rate. As mentioned, our contribution is distinguished by its use of a dummy variable representing the presence of a fixed exchange rate between two countries. In this section we discuss the exchange rate classification scheme used in this paper and present some statistics on the number of fixed exchange rates as well as the characteristics of countries that peg their currencies.[13]

The *de facto* classification scheme described here, and used in our first set of results, is drawn from Shambaugh (2004) and is based on the behavior of countries' official exchange rates. A particular country is judged to have a *direct peg* with a certain base country in a given year if their bilateral exchange rate stays within a +/- 2 percent band.[14] In addition, if a country maintains a perfectly flat peg to the currency of a base country for 11 out of 12 months within a year, but then has a single change in its bilateral exchange rate, this "single change" observation is also coded as a direct peg . The logic in this case is that the currency of the country is pegged for the entire year but, at some point in that year, there is a realignment to a

[12] As Quah (2000) notes, the entire gravity model is in a sense a large nuisance parameter in projects of this kind as we are trying to estimate an effect that is not theoretically embedded in the gravity model, and are simply using the gravity model to generate our controls.

[13] To test the robustness of these results, we also employ the *de facto* exchange rate classification scheme from Reinhart and Rogoff (2004) and the *de jure* regime classification scheme based on information published by the IMF in its *Annual Report on Exchange Arrangements and Exchange Restrictions*. These alternative classification schemes are discussed in more detail below in the section that presents results using them. Shambaugh (2004) provides more extensive commentary on different choices of exchange rate regime classifications.

[14] We have a separate category for currency unions and, therefore, there is no overlap between those dyads that are classified as having a currency union in a particular year and any dyad classified as having a fixed exchange rate in that year.

new peg.[15] Finally, exchange rates that are maintained within a +/- 2 percent band for only one year are not coded as a direct peg since a single year of stable exchange rates may be a random lack of volatility rather than a policy-driven peg. It is reasonable to think that the market responses to these single year pegs are distinct from those to longer-lived pegs.

A crucial aspect of this classification scheme is the identification of a base country. Base countries may include those that have a major currency, such as the United States, France, the United Kingdom, or Germany, as well as those that are important within a given region, such as India or Australia. Base countries can often be determined by reference to the official declarations, or by historical relationships. In addition to the countries already mentioned, Belgium, Spain, Portugal, Italy, New Zealand, South Africa, India, and Malaysia are all bases at some point in time.[16]

Countries engaged in a direct peg with a base will also be involved in a number of *indirect pegs* with other countries. The range of indirect pegs is illustrated in Figure 1. The "family tree" mapped in this figure shows that two countries pegged to the same base will also be pegged to one another in a "sibling" relationship. For example, India and South Africa had this type of indirect peg when both were pegged to the US dollar. Another type of indirect peg is a "grandchild" relationship that exists between a base country, such as the United States, and another country pegged to a country that is itself pegged to the base. Bhutan had this type of exchange rate relationship with the United States during those years that its currency was pegged to the Indian rupee and the rupee was pegged to the dollar. In this case, there is also the indirect "aunt/uncle" relationship between Bhutan and South Africa , and the indirect "cousin" relationship between Bhutan and Lesotho, whose currency was pegged to the South African rand. In our regressions, we include an indirect peg dummy variable that equals 1 for a dyad that has any of the family of indirect pegs described in this paragraph along with a separate dummy variable that represents direct pegs. Currency unions, direct pegs, and indirect pegs are

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[15] See Shambaugh (2004) for more discussion. Changing the definition of bands from +/- 2% to +/- 1% had little effect on the number of observations coded as pegs. "Single change" pegs represent a small fraction of total pegs.

[16] The biggest challenge in choosing a base country comes when considering the Bretton Woods era since most potential base countries were pegged to the US dollar. We rely on the few revaluations and devaluations that occurred during the Bretton Woods period, as well as the small variations in exchange rates during that time, to identify base countries. For example, a country that devalued against the dollar at the same time as the British pound in 1967 is judged as having Britain as its base country. A country would also be judged as having Britain as its base if it maintained a strict peg with the pound sterling while exhibiting some fluctuation with the United States dollar .

all mutually exclusive. Observations can only be coded as one type of exchange rate regime. While currency union observations naturally generate direct pegs or indirect pegs in the coding due to their stable exchange rates, those observations are only considered currency unions, not pegs.

Table 1 presents some statistics on the number of direct pegs, the number of indirect pegs, and the number of currency unions in the data set we use. This data set is based on information on 181 countries over the period 1973 – 1999, yielding 4381 country-year observations (rather than 181 × 27 = 4887 because some countries, like Estonia, did not exist for the entire sample period) As indicated in the second row of Table 1, there are 11,805 separate country pairs (rather than (181 × 180)/2 = 16,290 because of missing observations) and, over the 27 years of the sample, there are 168,868 observations. The third row of Table 1 shows that there are 1562 direct pegs in this sample, and 90 percent of these observations are industrial country / developing country dyads.[17] Given the fact that most countries contemplating pegging are developing countries considering pegging to an industrial base, it is useful that most of the data used to generate our results comes from that type of relationship. We also note that while the overall number of direct pegs may seem small in relation to the total number of observations, the number of direct pegs in a bilateral trade data set will necessarily be a small proportion of the number of overall observations since any country can have a direct peg with only one other country while it can trade with as many as 100 other countries. The relevant statistics regarding the frequency of pegs, therefore, are that roughly half the 4381 country year observations are coded as pegs, even in the post Bretton Woods era, and 135 countries are involved in a peg at some point. The fact that almost 50 percent of the countries peg at any one time helps explain why there are 13,679 indirect peg observations, as indicated in the third panel of Table 1, since any direct peg can create a large number of indirect pegs,

The bottom panel of Table 1 indicates that 2005 observations include a currency union in the post-1972 sample. This number is not directly comparable to the number of observations with either a direct peg or an indirect peg since it includes all intertwining relationships within a multilateral currency union (e.g. among the countries in the CFA), but not dyads in which two

[17] Industrial countries are defined as those countries with an IFS number under 199 with the exception of Turkey. This includes the US, Canada, Japan, Australia, New Zealand, and Western European nations.

countries have both, unilaterally, adopted the currency of a third country (e.g. the dyad of Panama and Liberia would not be coded as a currency union, even when both had a currency union with the United States). As shown in the table, 88 percent of these currency union observations are dyads between two developing countries.

As noted above, CPFE estimation identifies coefficients on direct pegs, indirect pegs, and currency unions from country pairs that switch regimes during the sample period. Of the 144 country pairs that ever have a direct peg from 1973-1999, 118 show a change in regime with 56 of these switching once, 25 switching twice (that is, both on and off a peg), and 37 switching more than twice. Thus, we are not simply identifying off a single break in most cases, but a more rich history of regime transitions. The multiple switches per pair result in a total of 257 switches over the period, comprised of 141 switches off of a peg and 116 switches onto a peg. [18]

Section II.2b: Pegged Country Characteristics

Statistics on the ratio of average trade between dyads with pegs or currency unions to the average trade for all dyads are also presented in Table 1.[19] Trade of direct peg dyads is 1,253 percent of average trade. Thus, while dyads with a fixed exchange rate are a relatively small proportion of all dyads, they comprise a meaningful portion of the volume of world trade. Direct peg dyads account for 11% of average annual world trade in the post-Bretton Woods period, with a range of 7 percent to 19% percent of trade in these years (the maximum value during the Bretton Woods era was 33% of world trade). This reflects the fact that a typical direct trade dyad includes one large, industrial country and that base country is ten times the size of the average country (and six times the size of the average industrial country) in a given year. The non-base country in a direct peg dyad is, on average, about 30 percent the size of the

[18] 2673 country pair have an indirect peg at some time during the sample, and 146 country pairs are engaged in a currency union at some time during the sample. 2357 dyads switch indirect peg status and this relatively high proportion of switches to indirect pegs, as compared to the case with direct pegs, reflects the fact that when a country changes from non-pegged to a peg, it triggers one regime switch for a direct peg, but it often creates many indirect peg switches. 62 country pairs switch currency union status in the post-Bretton Woods era, and all of these switch only once, with 42 of these observations representing the dissolution of a currency union and 20 representing the establishment of a currency union. Because of the intertwining relationships in currency unions, not all of these switches represent independent events, unlike the case with direct pegs. For example, 10 of the creations come from Mali joining the CFA and thus creating a currency union with each existing member.

[19] Results are based on taking the average size of base countries divided by the average size of all countries by year and then averaging those results across years. This procedure gives equal weight to information from all years regardless of the number of pegs in a given year, but it also removes any problems associated with changes in the number of pegs over time as countries have grown richer.

average country, with pegged (non-base) industrial countries about 40 percent the size of all industrial countries and pegged developing countries about half the size of other developing countries

We have already noted the relative preponderance of direct peg observations among dyads that include an industrial country and a developing country and the policy relevance of focusing on the possible trade-creating effects for this subsample of the data. Table 1 indicates that this subsample already represents a significant proportion of world trade. The statistics in the first panel of this table show that trade between industrial and developing countries accounts for 38 percent of overall annual trade in the post-Bretton Wood era.[20] Thus, the policy option we study is one that is frequently used and involves a meaningful portion of world trade.[21]

III. Results:

III.1: Core Results

The statistic cited above, that the average dyad with a fixed exchange rate trades ten times more than the average dyad without a fixed exchange rate, is striking. But this unconditional statistic can only suggest a role for fixed exchange rates in influencing trade. Compelling evidence must control for a range of determinants of bilateral trade. In this section, we use the gravity model to determine the effect of fixed exchange rates on trade, conditional on the role of other factors. As will be shown, results from estimating gravity models imply that fixed exchange rates have a statistically significant and economically important role in influencing trade.

Most of the results presented in this section are based on a sample of annual data from the post Bretton Woods period of 1973 to 1999.[22] We focus on this period because we are

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[20] That percentage is the same if the sample is restricted to be rectangular and is 32% if trade involving "oil exporters" (as defined by the World Bank) is dropped.

[21] These results concerning the amount of trade represented by direct peg dyads contrast with the amount of trade represented by currency union dyads. The majority of currency unions observations consist of dyads with two developing countries. Consequently, the average amount of trade for these dyads is only 35 percent of the average trade for all dyads. Moreover, developing countries in currency unions are typically only 10% the size of a typical developing country in the post Bretton Woods sample.

[22] The exchange rate classification data comes from Shambaugh (2004). His post-Bretton Woods data was extended to the 1960-72 period for this paper. The exchange rate volatility data is the standard deviation of the monthly percentage change in the bilateral exchange rate; this is calculated using IMF exchange rate data (period

interested in relevant policy lessons for the present day, when the decision to peg a currency is, in most cases, a unilateral choice concerning a single bilateral relationship. In contrast, a country that pegged its currency to the dollar during the Bretton Woods era necessarily chose membership in a wide, multilateral system of pegged rates. Such a system neither exists today nor is likely to be instituted in the foreseeable future. However, results presented towards the end of this section draw on the experience of the Bretton Woods era in order to consider the possibility of systemic effects of a fixed exchange rate.

The first set of results is presented in Table 2. The differences in the three sets of estimates presented in this table highlight the sensitivity of results to the inclusion of country-level fixed effects (CFE) and country-pair-level fixed effects (CPFE). As mentioned in Section II, OLS estimation, like that presented in Column 1 of Table 2, may misstate the true effect of fixed exchange rates on trade due to the presence of omitted variables. This omission can be corrected by country-level fixed effects if one assumes multilateral resistance to trade, as is done by Anderson and van Wincoop (2001). In fact, the coefficient on the direct peg variable is about half as big in the country-fixed effects estimate (Column 2) as in the OLS estimate (Column 1). The alternative assumption, of bilateral resistance to trade, demands country-pair fixed effects, rather than country-level fixed effects, as discussed in Section II. This estimate is the one that most thoroughly isolates the fixed-exchange rate effect from other, unobserved, effects that may contribute to trade between two countries and may also be positively correlated with the likelihood of those countries having a fixed exchange rate. Accordingly, the estimate of the coefficient on the direct peg dummy variable in Column 3 is one-third the value of the OLS estimate and two-fifths the value of the CFE estimate, but it is statistically significantly different from zero at better than the 95 percent level of confidence.[23]

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end). We gratefully acknowledge that the trade data, gravity regressors, and currency union dummies from Rose (2004) were made available on Rose's website.

[23] The standard errors reported in the regressions are clustered at the country pair level. This both allows for different variance across the pairs and, more importantly, for an unstructured covariance within the clusters allowing for correlation across time. Bertrand, Duflo, and Mullainathan (2004) suggest clustering as the appropriate way to handle autocorrelation in panel differences-in-differences estimation techniques. They note that clustering in this manner is similar to a Newey-West setup but allows all lags to be potentially important. They also argue that clustering outperforms parametric corrections to the autocorrelation (such as AR(1) models) in simulations. Kezdi (2002) makes a number of similar points in a more general panel fixed effects setup, and again strongly recommends clustering as the appropriate correction. When country-pair fixed effects are not included, it seems quite clear that the level at which one should cluster is the country pair, as the country pair means are still in the error and require correction. On the other hand, once these means have been removed with the dummies, it is less clear whether clustering should be at the country pair level or a more general level. We

The estimates of the effect of a fixed exchange rate on trade that are presented in Table 2 are economically meaningful, as well as statistically significant. The coefficient on the direct peg in Column 1, estimated with OLS, implies an 80% increase in trade for country pairs that have a fixed exchange rate compared to those that do not.[24] This result holds despite the fact that we control for exchange rate volatility in addition to all the standard gravity controls.[25] The CFE estimate (which also includes fixed year effects) of the coefficient is 0.32 (an impact of 38%), and, the CPFE estimate of 0.19 implies a 21% increase in trade. These effects are broadly comparable to (and statistically indistinguishable from) the estimated effects of currency unions when one uses country-pair fixed effects to control for bilateral trade resistance.[26] For example, the CPFE estimates suggest a pair of countries in a currency union trade 38 percent more than an otherwise similar pair; but the confidence intervals for the fixed exchange rate and the currency union coefficients clearly overlap (we can only reject that they are different at the 60 percent level of confidence).[27] The indirect pegs are statistically insignificant in this sample once CFE or CPFE are introduced.

One interpretation of these results is that 11 percent of world trade (the proportion in the sample that includes trade between countries with a direct peg) would be reduced by 20 percent (using the most conservative, but also most convincing, CPFE estimate) if countries were to

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cannot cluster at the country level as two countries appear in each observation. Therefore, we have experimented with clustering on the larger country in the pair (so all US pairs would be in one cluster, etc.) and also separately clustering on the smaller country. The small country clusters produce standard errors quite similar to country pair clusters. Often, though, big country clustering yields smaller standard errors than those reported implying some negative correlation across the individual country pair clusters. In theory, given that this correlation exists, we should cluster at that level in the CPFE regressions, but we take the more conservative approach and report the larger country pair cluster standard errors and simply note where the clustering technique affects the interpretation of the results. We also note that other approaches: uncorrected standard errors, heteroskedasticity consistent standard errors, or Newey West standard errors are always smaller (with the Newey West standard errors approaching those reported as we increase the lags included), and thus our choice has made significant results less likely.

[24] Trade is 1.8 times higher for country pairs with fixed rates (80% larger) because $e^{0.59} = 1.80$.

[25] As would be expected from previous studies, the impact of exchange rate volatility is low over the various specifications in Table 1. Reducing exchange rate volatility from the mean to zero suggests only a -1 to -2% impact on trade. Removing the exchange rate volatility measure slightly increases the coefficients on all exchange rate regime variables. The volatility used is nominal because this is consistent with looking at a fixed nominal exchange rate. We use official rates because, again, this is consistent with the way the exchange rate regime variables are generated.

[26] But, as noted above, the currency union dummy variable is not strictly comparable to the direct peg dummy variable. See Levy-Yeyati (2003) for differences across types of currency unions.

[27] It is important to note the impact of the number of country pairs that switch regimes over a particular time period when using country pair fixed effects. Glick and Rose's (2002) results which first explored the impact of currency unions using country pair fixed effects had a longer time series and show 146 switches. In the post-1972 era, there are only 62 country pairs that have a regime switch for currency unions. Thus, we are leery of viewing our results as retesting the currency union effect, it is included more as a control than a test variable.

abandon pegged exchange rates. This might reduce trade by 2 – 3 percent. But this calculation obviously masks the effects across different countries. In particular, it understates the extent to which trade between industrial and developing countries, which represents approximately 40 percent of world trade, could be affected by a change in the pattern of fixed exchange rates since the bulk of our fixed rate observations occur in industrial / developing country dyads.

We are also interested in whether these results are widely applicable across groups of countries. We address this question in Table 3 which presents CPFE estimates (in columns 1 – 3) and CFE estimates (in Columns 4 – 6) of the effect of fixed exchange rates, and currency unions, on bilateral trade between industrial countries and developing countries, as well as bilateral trade among industrial countries and bilateral trade among developing countries.

The country fixed effects regressions show that the effect of direct pegs seems to be coming from the industrial and developing pairs. Looking at the CPFE regressions (columns 1-3), we see that none of the groups yield a significant coefficient. By splitting the sample, we have reduced the number of pairs that switch regimes in any given sample. Thus, there is very little data to identify industrial-industrial or developing-developing pairs, making effects difficult to estimate.[28] For the industrial-developing sample, we note that any other form of clustering generates a significant result in column 2. The CPFE results indicate that a direct peg raises trade between an industrial country and a developing country by 15 percent, *ceteris paribus*, while the CFE result, which does not control for unobserved pair-specific factors, indicates an increase in trade of 50 percent. These results suggest that the significant effects presented for the full sample in Table 2 reflect the effect of trade between industrial and developing countries. The results in Table 3 are distinguished from those in the preceding table in that an indirect peg has a significant and positive effect on trade between industrial countries, when controlling for country pair fixed effects (Column 1) and between industrial and developing countries, when controlling for country fixed effects (Column 5). Finally, we also note that the significant role that currency unions play in promoting trade that is evident from

[28] As shown in Table 1, there are 102 switches among the industrial – developing dyads, but only 14 among the industrial – industrial dyads and 2 among the developing – developing dyads. The situation with currency unions differs in that there are 52 currency union switches among the dyads including two developing countries, but only 9 among those representing industrial –developing dyads and 1 among the industrial – industrial dyads.

the results in Table 2 seems to arise as a result of bilateral trade among developing countries (Columns 3 and 6).[29]

Section III.2 Potential Diversion and System Effects

It is conceivable that the effect of a fixed exchange rate between two countries on the level of their bilateral trade depends upon the broader environment in which that policy choice is made. In particular, one might suspect that there is a bigger effect of an indirectly fixed bilateral exchange rate on trade, due to its credibility or perceived permanence, when that indirect peg is part of a broader web of fixed exchange rates, such as during the Bretton Woods period or within the European Monetary System of the 1980s and 1990s. This suspicion is fostered by previous work on the Gold Standard that shows how that exchange rate system promoted world trade (Taylor *et al.*, 2003). We investigate the possibility of systemic effects of fixed exchange rates on trade in Table 4 by including, along with country-pair fixed effects and the regressors described above, interaction terms that are the product of a systems dummy variable and the indirect peg dummy variables. The system dummy variable equals 1 for observations in which the two countries are both members of the Bretton Woods system (for the period 1960 to 1970) or, in the post-Bretton Woods era, if both countries in a dyad with a pegged exchange rate are in Western Europe.[30]

Another consideration is that the overall trade-promoting effects of a peg could be mitigated if it simply redirects trade towards the base country and away from other countries. In Table 4 we consider possible trade diversion effects by examining the role of *unlinked pegs*. A dummy variable representing an *unlinked peg* is set to 1 if one, but not both, of the countries in the dyad has a fixed exchange rate with another country, or if both countries have fixed exchange rates but there is no indirect peg between them.[31] There are over 90,000 observations for which this dummy variable is equal to 1, a statistic that illustrates the potential economic relevance of this effect. We also test whether diversion effects are more pronounced when one

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[29] Recently, some studies have taken preliminary looks at the progress of trade under EMU, providing evidence on industrial / industrial trading pairs in currency unions. Micco et al (2003) find an impact of roughly 10%.

[30] We include all Western European post Bretton Woods countries as part of this "system" even though this includes a variety of systems (the Snake, early EMS, late EMS) and includes countries such as Austria which were not formal members at all times, but shadowed these systems.

[31] For example, the pair India / Japan is marked an "unlinked peg" when India pegs to the US and Japan is not pegged. Also, the pair India / France is an unlinked peg when India pegs to the US and France to Germany.

a peg is part of a larger system by including, in the regression, the interaction between the system variable and the unlinked peg variable.[32]

The first column of Table 4 presents a CPFE estimate that is comparable to the one in Column 3 of Table 2, in that it includes the same sample period, but the estimate in Table 4 includes three new regressors; the interaction term between the system dummy variable and the indirect peg dummy variable, an unlinked peg dummy variable, and the interaction of the unlinked peg dummy variable and the system dummy variable. Among the coefficients on these new regressors, only the one on unlinked peg is significant, and it is positive, indicating that countries that have a fixed exchange rate trade more, even with countries to which they are not pegged. Thus, rather than diverting trade away from other trading partners, pegging significantly increases trade with the both the base country by 23 percent (the coefficient on the direct peg dummy variable of 0.205 is significant) and other countries not pegged to the same base by 5 percent.[33] Given the large number of dyads for which unlinked peg equals 1, as compared to the number for which the direct peg dummy variable equals 1, this result on unlinked peg is nearly as economically important to the level of world trade as the larger coefficient on direct peg.[34]

The second column of Table 4 demonstrates the sensitivity of the results presented in Column 2 to an extension of the sample period to include the Bretton Woods era. Comparing the results in Columns 1 and 2 of Table 4 shows that the addition of the observations from the Bretton Woods period has little impact on the coefficient on the direct peg variable.[35] But these additional observations result in a significant and relatively large effect of indirect pegs within a system of fixed exchange rates, with an estimated effect of an increase in trade of 29 percent.

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[32] We do not include an interaction between the direct peg dummy variable and the system dummy variables since we think system effects would be manifested in the effects of indirect pegs and diversion. In fact, the coefficient on the interaction between the direct peg dummy variable and the system dummy variable (in an estimate not reported here) is not significant.
[33] Rose (2000) also explores diversion and also finds that potentially diverted pairs show more trade not less.
[34] The unlinked peg observations represent 28% of world trade, and, therefore, increasing that portion by 5% could increase trade 1-2%. Added to the direct peg impact, the total impact on trade flows is as much as 5%.
[35] A number of caveats about the pegged exchange rate data for this pre-1973 period should be acknowledged. Pegging is pervasive in the Bretton Woods era, with 90% of the observations classified as direct pegs, indirect pegs, or currency unions. This leaves few excluded observations to separately identify the time dummies that are also included and, therefore, the time dummies themselves may proxy for the system effects. We also note that if one does not include controls for the Bretton Woods system effects the time dummies increase in value during the Bretton Woods time period making the direct peg observations of that era appear weaker and lowering the coefficient on direct peg

The positive unlinked peg effect is also significant within a system of fixed exchange rates, with an estimated effect of an increase in trade of 9.6 percent.[36]

We may suspect that there are a number of important differences between the Bretton Woods era and more recent times that result in instability across these periods in the value of coefficients in the gravity model. For example, the changing role of developing countries in the world economy, changes in the relative price of commodities, and a change in policy towards a more outward orientation could all alter the results The CPFE estimates presented in the third column of Table 4 allows us to consider this possibility by presenting results that allow for different effects of GDP and GDP per capita in the Bretton Woods era as compared to the later period.[37] The estimates presented in Column 3 suggest that there is, in fact, a significantly smaller effect on bilateral trade of both of these variables in the earlier period as compared to the later period. But most notably, for the question of interest for us, the inclusion of these additional interactive regressors has a big effect on the estimated values of the coefficients on both the direct peg and the indirect peg. The direct peg coefficient more than doubles, from 0.161 to 0.370, and the estimated increase in bilateral trade due to the presence of a fixed exchange rate is 45 percent. The indirect peg coefficient increases and the estimated effect when the dyad represents two countries within an exchange rate system is 10.5 percent, with the combined coefficient of 0.10 significantly different from zero at better than the 99 percent level of confidence. The CPFE estimates in Column 3 also indicate a positive, insignificant unlinked peg effect when a dyad is not part of a broader exchange rate system and 8.3 percent when it is in a system (the combined effect is significantly different from zero at the 99% confidence level). While the instability of the coefficients across the estimates presented in Columns 2 and 3 may make specific point estimates somewhat suspect, the broader result that fixed exchange rate countries trade more, and indirect pegs matter more in systems than in isolation, is preserved across specifications.

We have noted the prevalence of developing industrial observations in our sample. We cannot consider the effects of a system of fixed exchange rates on industrial – developing trade

[36] The estimates that include the Bretton Woods era data in Columns 2 and 3 include coefficients on the currency union dummy variable that are much larger than the estimate presented in Column 1, and, therefore, are closer to the value reported by Glick and Rose (2002). This difference implies that either the number of switches in the post 1972 sample is insufficient or the country pairs that show the largest change in trade had already dissolved by 1972 and thus do not show up as pairs that dissolve a currency union when the sample is limited.

[37] Most of the other controls are time invariant and thus, we cannot observe their impact, or changes in it, with a CPFE regression. Thus we do not try to estimate the changing role of distance over time.

using the post Bretton Woods sample, though, since there is no broad exchange rate system during that time that includes both industrial and developing countries. Therefore, we present, in columns 4-6, CPFE estimates that allow for possible system effects in industrial – developing trade (as well as in industrial – industrial trade and developing – developing trade) that use data spanning the Bretton Woods and later periods. These regressions are disaggregated versions of the regression presented in Column 2 in Table 4.

The Bretton Woods sample includes many more direct peg switches among industrial – industrial dyads than the post-Bretton Woods era. This may be one reason that the coefficient on the direct peg variable is significant (and equal to 0.10) in Column 4 of Table 4, whereas it was insignificant and equal to 0.036 in the comparable regression in Table 3 (Column 1). The effect of an indirect peg is significant and indicates an increase in trade of 12.7 percent for industrial – industrial dyads when both countries are part of a broader exchange rate system (adding the system and non-system coefficients), but there is not a similar significant effect outside of a system. There is evidence of significantly negative trade diversion in bilateral trade among industrial countries in the longer sample period when the countries are not part of a broader exchange rate system, but this estimate switches to a significant positive effect when the countries are part of a system of fixed exchange rates.

While the longer sample period has a marked effect on the estimated effect of a direct peg on bilateral trade between industrial countries, a comparison of the second column in Table 3 and the fifth column in Table 4 shows less of a distinction between the estimates on bilateral trade between an industrial country and a developing country though the result is now significant regardless of the type of clustering. The longer sample does show, however, a significant effect of an indirect peg on trade for the industrial –developing dyads of 10.5 percent outside of a system and 18.4 percent within a system. In addition, the coefficients on the unlinked peg dummy variables for this set of trading relationships is significant and equal to 0.115 outside of a system (indicating an increase in trade of 12.2 percent) and 0.201 within a system (indicating an increase in trade of 22.3 percent).

The estimated effect of a direct peg on bilateral trade between two developing countries does not change much with different sample periods, as can be seen by comparing the third column in Tables 3 and sixth column in Table 4. As with the estimates from the post-1973 sample presented in Table 3, the estimates using the longer sample that are presented in Table 4 show no significant evidence that either a direct peg or an indirect peg affects bilateral trade among developing countries, even though there are a great many indirect peg observations in this sample period. There is some evidence, however, of trade diversion in the set of dyads involving two developing countries. This negative result on the unlinked peg dummy is small and insignificant outside of a system of fixed exchange rates, but, when one or both countries is part of a system of fixed exchange rates, the effect of diversion is to reduce bilateral trade to 75.8 percent of what it would otherwise be. Since all the system observations come from the Bretton Woods era, this negative diversion result suggests that bilateral trade among developing countries that were not indirectly pegged to each other was quite low during that time.

Overall, then, the results presented in Tables 2 through 4 suggest that direct pegs make a statistically and economically significant impact on trade flows. Rather than divert trade, they seem to create trade and even increase trade amongst other countries (the exception being developing countries during Bretton Woods). In addition, when the fixed exchange rate comes as part of a system, the indirect fixed exchange rates that result seem to increase trade as well. In the post Bretton Woods era, the limited number of direct pegs seem to increase world trade by 2-3% and the positive impact on unlinked peg pairs adds another 1-2%. In the longer sample, the direct peg share of trade is higher (16%) and indirect and unlinked peg observations are both more prevalent and have stronger positive impacts, implying an even bigger impact on trade.

It is notable that these results differ so much from those presented in other research that indirectly addresses the role of fixed exchange rates on trade by considering the estimated effect of exchange rate volatility on trade. In fact, there is one way in which our results are consistent with this literature since we, too, find a quantitatively small (albeit statistically significant) effect of exchange rate volatility on trade. But our results also suggest that the channel through which a fixed exchange rate relationship affects trade goes beyond the diminution of exchange rate volatility, even when controlling for country-pair fixed effects that may be correlated with both the level of trade and the choice of exchange rate regime. The certainty of a fixed rate simply means more than reduced volatility.

IV. Robustness

This section presents results that address the robustness of the estimates presented above. We begin with an investigation of the robustness of our results to the use of alternative exchange rate classification schemes since the identification of a peg is at the center of our empirical analysis. Section IV.2 presents instrumental variables estimates that consider the endogeneity of the exchange rate regime. We then turn to an issue that is important for policy, in Section IV.3, the effect on trade of a transition from a fixed exchange rate to a flexible exchange rate, or from a flexible exchange rate to a fixed exchange rate. This is followed by a consideration of the robustness of our estimates to the use of alternative econometric methodologies in Section IV.4, and Section IV.5 concludes with estimates based on subsamples of the data.

IV.1 Alternate classifications

We argue in section II.2 that using fixed exchange rate dummy variables based on the *de facto* classification of Shambaugh (2004) is a more appropriate way to test the impact of fixed exchange rates on trade than relying on exchange rate volatility measures. There are, however, other available classification schemes, and in this section we consider results obtained when using two of them; the *de facto* classification of Reinhart and Rogoff (2004), and a *de jure* classification based on countries' declared exchange rate status. The estimates obtained from a *de facto* classification different from the one used in Section III enables us to test the sensitivity of our results to the classification scheme. A comparison of results obtained with the Shambaugh (2004) *de facto* classification to those obtained with a *de jure* classification addresses the important question of whether the effects on trade of declaring a fixed exchange rate differ from those of actually maintaining a fixed exchange rate.

The *de facto* classification scheme of Reinhart and Rogoff (2004) is based on the probability that a market-determined exchange rate remains within a band over a five year window.[38] This classification scheme has five categories (fourteen in the detailed taxonomy) which, for comparability to Shambaugh's classification used in Section III, we collapse into two, the pegged category, and a non-pegged category that ranges from crawling pegs to freely

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[38] A central part of the Reinhart and Rogoff (2004) system is their identification of the market-determined exchange rate. They define the market-determined exchange rate as either the official exchange rate, in a unified exchange rate system where no black market premium exists, the parallel rate (if it is determined in a market) in a multiple exchange rate system, or the black-market exchange rate, when it exists. We are grateful to Carmen Reinhart who makes the Reinhart Rogoff classification publicly available her website.

floating countries.[39] The classification is available for 143 countries in our sample for a total of 3341 country / year observations, generating 123393 country pair year observations in our data set in the post Bretton Woods era (158893 total observations in the full post 1959 sample).

The Reinhart-Rogoff classification, based on five year windows, exhibits more stability than the Shambaugh (2004) classification. Combined with the smaller country coverage, in the post-1972 data, this leads to only 76 country pairs coded as switches, while there are 118 switches under the Shambaugh classification.[40] One might expect, therefore, a less significant coefficient on the Reinhart-Rogoff direct peg dummy than on the Shambaugh direct peg dummy since the latter captures the possible effect on trade of year-to-year instability while, in the former, this instability may not alter the pegged status of a country. On the other hand, we might expect a more significant coefficient on the direct peg dummy based on the Reinhart – Rogoff classification if their market-based exchange rates better capture the relevant exchange rate used in international transactions than the official rate used by Shambaugh. Thus, there is not a strong *a priori* expectation on the relative size and significance of coefficients based on these two *de facto* classification schemes.

In addition to these two *de facto* classification schemes, we also use a *de jure* classification based on countries' declared exchange rate status, as reported to the IMF and as published, over time, in its *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER)*. We classify an exchange rate arrangement as pegged if the AREAER lists it as a single currency peg, as having limited flexibility to one currency, or if the country is in a cooperative exchange rate arrangement (like the EMS). We classify all other AREAER categories, including those ranging from basket pegs to freely floating, as non-pegged.[41] We might expect that coefficients on direct peg dummy variables based on these *de jure* codes to be less significant than coefficients on direct peg dummy variables based on a *de facto* classification since the *de jure* classification is misleading at times. For example, Brazil declared a peg in the 1970's but did not maintain it, and South Korea maintained a tight peg for years in the 1980s and 1990s, but its government did not declare it as having a fixed exchange rate at that time. In these cases, the divergence between declared exchange rate status and

[39] Base countries are determined by declared status or by observing exchange rate behavior.
[40] This disparity in the number of switchers suggests that we use some care when comparing results based on regressions that employ country pair fixed effects.
[41] Base countries are determined by country's declarations, with the exception of the EMS for which we code Germany as the base country.

actual exchange rate behavior may weaken the estimated link between identified *de jure* fixed exchange rates and trade.[42]

Table 5 shows the results using alternative classifications. We report CFE estimates in odd-numbered columns, and CPFE estimates in even-numbered columns (all estimates also include year dummy variables). For comparison purposes, this table includes, in Columns 3 and 4, the results using the Shambaugh classification but with the smaller sample that is available when using the Reinhart-Rogoff classification.

The estimates obtained with the Reinhart-Rogoff classification are presented in Columns 1 and 2 of Table 5. A comparison of the results in Columns 1 and 3, and in Columns 2 and 4, shows that the coefficients on the direct peg dummy variables are very similar across the two classification schemes. The smaller data set has led to a slightly increased standard error for the Shambaugh codes, pushing it past standard confidence intervals. Again, we note that this is one place where less conservative standard errors generate a statistically significant result. There is a bit more of a difference in the value of the coefficient on the indirect pegs, but in the case of CFE (Columns 1 and 3), neither coefficient is significant and in the case of the CPFE (Columns 2 and 4), the confidence intervals overlap, even at relatively low levels of significance. Thus, overall the results are robust to using either of these two *de facto* exchange rate classification schemes.[43] Both sets of results support the contention that fixed exchange rates can increase trade, and the quantitative estimate of this effect is in the 15-20% range (based on the CPFE results), or about 30% (using the CFE estimates).[44] Both classification schemes estimate a negative and significant effect on trade of indirect pegs when CPFE are included, but this puzzling result seems to be a consequence of the smaller sample used to generate the results in this table since, in Table 2, the comparable coefficient, while negative, has a t-statistic of less than 1.

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[42] There are 112 switches in the post-1972 period for direct pegs based on this *de jure* classification, a number comparable to that of the number of switches from the Shambaugh (2004) classification used in Section III.

[43] A comparison of the results in Columns 3 and 4 to those in Columns 2 and 3 of Table 2 shows that restricting the sample size, as is necessary when using the Reinhart – Rogoff classification, tends to make the results weaker.

[44] The similarity in results is not simply a consequence of a similarity in the two *de facto* classifications. In fact, the Reinhart-Rogoff and Shambaugh classification schemes have a substantial amount of disagreement. For example, there is disagreement on the status of 19% of the country-year observations in the post-1972 sample. In the subset of the country-pair observations where one or both countries are classified as having a direct peg by either Shambaugh or by Reinhart and Rogoff, there is disagreement on 43% of the observations.

As predicted above, the results obtained using the *de jure* classification, presented in Columns 5 and 6 of Table 5, are much weaker than those that use either of the two *de facto* classifications.[45] The estimated effects of a *de jure* direct peg are both smaller than the respective results for either of the *de facto* pegs, and the coefficients on the *de jure* direct pegs are not significant.[46] This suggests that simply declaring an exchange rate peg will not generate an increased trade flow, rather actually maintaining it is the important thing.[47]

While the results in Table 5 show little difference between estimates based on the two *de facto* classifications, especially as compared to the estimates obtained with the *de jure* classification, there is more divergence between the Reinhart – Rogoff classification and Shambaugh classification estimates when the sample is expanded to include observations from the Bretton Woods era. The reason for this is that there is a greater divergence between these two classification schemes in the Bretton Woods era than in the subsequent period. The Reinhart-Rogoff classification codes fewer fixed exchange rates than Shambaugh in the Bretton Woods era since extensive capital controls at that time caused more instances of a divergence between official rates (used by Shambaugh) and market rates (used by Reinhart and Rogoff) than in the post-1972 period. The two classification schemes also differ more often in the Bretton Woods era because of disagreements on the base country, with Reinhart-Rogoff using the UK as a base for a number of former British colonies that Shambaugh coded as having the US as a base.[48]

Table 6 presents estimates for each of the two *de facto* classification schemes using a sample that includes the Bretton Woods period. As with the estimates presented in Table 4, the specification used in this table allows for system effects on indirect pegs and unlinked pegs. Estimates using the Reinhart-Rogoff classification and including country pair fixed effects are

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[45] For comparison purposes, we limit the *de jure* sample to the same used in columns 1-4. In fact, *de jure* codes are available for most observations used in the full post 1972 sample. There is very little difference between the results shown here and the larger sample results.

[46] It is worth noting that these results are indistinguishable from zero when one does not cluster at all and significant at 10% when big country clusters are used.

[47] These results might be viewed as somewhat surprising given that the Shambaugh *de facto* codes agree with the *de jure* codes 87% of the time, when simply examining the annual series, but this statistic masks the fact that most of the agreements are on nonpegs. There are disagreements on 28% of the observations where either the Shambaugh *de facto* classification or the *de jure* classification reported to the IMF reports a peg.

[48] Shambaugh used information on the behavior of countries in the wake of the 1967 British devaluation to determine whether they were pegged to the US or to the UK. Countries that did not change their dollar exchange rate when the pound devalued were judged to be pegged to the US. It is this set of observations that appears to drive the difference in results between the Shambaugh and Reinhart-Rogoff classifications in the full sample.

presented in Column 1, and those including country fixed effects are presented in Column 2. Comparable estimates based on the Shambaugh classification, and using the same set of country pairs, are presented in Columns 3 and 4.[49] A comparison of the estimates in Columns 1 and 3 shows that the Reinhart – Rogoff classification yields a larger coefficient on the direct peg dummy variable than the one obtained with the Shambaugh classification.[50] This is also true of the estimates that use the country fixed effects, though in this case the difference between the two estimates is smaller. Thus, estimates based on the Reinhart – Rogoff classification support the conclusion that the direct effect of a pegged exchange rate is to increase trade. Likewise, both classification systems lead one to the conclusion that an indirect peg, when it is part of a broader exchange rate system, significantly promotes trade.

IV.2 Instrumental Variables Estimation

The next concern that we address is the possible endogeneity of exchange rate regimes to trade. Of course, the use of country pair fixed effects already controls for the possibility that there are omitted variables that affect both the level of trade between two countries and their choice of their exchange rate regime. But one might argue that there are time-varying effects and, rather than bilateral trade responding to a change in the exchange rate regime, the exchange rate regime responds to an anticipated change in bilateral trade. We address these concerns by undertaking estimation using instrumental variables to explore the extent that these issues may be affecting our results.[51]

Previous research on the effects of currency unions on trade reports results obtained with instrumental variables estimates that are consistent with those obtained using OLS, namely that currency unions increase trade and there is only a weak effect of exchange rate volatility on trade. Rose (2000) uses inflation and monetary quantity variables as instruments and obtains results consistent with those from OLS. Alesina, Barro, and Tenreryo (2002) use, as an instrument, a dummy that indicates whether two countries share a common base country or the probability of that two countries share a common base, and find a strong effect of currency unions on trade. Tenreyro (2003) uses the same triangular approach to generating

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[49] We do not include results using the *de jure* classification since it is not available before 1973 in a consistent fashion.

[50] Even without controlling for system effects, the direct peg is large and significant in the sample that includes Bretton Woods era observations when using the Reinhart-Rogoff codes. Again, the coefficient on direct peg in column 3 is significant at 99% with big country clusters and 95% with no clustering.

[51] Rose (2000) argues that "trade considerations seem irrelevant when a country decides whether to join or leave a common currency area," and as such, IV should not be necessary.

instruments in her work on exchange rate volatility and finds negligent impacts of volatility.[52] Frankel and Wei (1993) and find a negative and significant effect of exchange rate volatility on trade when they instrument for this regressor using the standard deviation of relative money supplies, but the size of this effect is smaller when using IV than when using OLS.[53] Estevadeordal *et al.* (2003) raise the possibility that membership in the gold standard is more likely to be endogenous than the choice of the exchange rate regime in the modern era. They find, however, that the bilateral trade estimates obtained with OLS are robust to estimation in which membership in the gold standard is instrumented by a function that includes both countries' average distance from all the countries on the gold standard at the time.[54]

An appropriate instrument for our study will predict whether a country pegs its currency, but this variable itself will have no direct impact on trade, outside of its indirect effect through the channel of exchange rate regime choice. Our construction of an instrument draws on the insights of Estevadeordal *et al.* (2003) and Tenreyro (2003), and uses information about whether neighboring countries peg and, if so, to whom. We calculate, for a given pair of countries, country i and country j, the percentage of countries in country j's region that are directly pegged with country i. This percentage serves as our instrument.[55] Thus, we assume that sometimes a country will choose to peg to a base to help stabilize its exchange rate with its neighbors who may also have a peg. Such a decision is not related to trade with the base, but through the peg, may affect trade with the base. To employ this strategy, we calculate the percentage of each region pegged to each potential base. Then, for any pair where a potential base is a member, the percentage of the other country's region (excluding it) which is pegged to

[52] Such triangular approaches require eliminating observations with the base country. This would make examining direct pegs impossible. That is not a problem with currency unions because so many currency union observations are the interlocking relationships of countries sharing a currency union with one base (e.g. the bilateral relationships among CFA countries).

[53] Tenreyro (2003) raises the possibility that the relative money supplies will be moved by factors that also affect trade flows.

[54] One could try to look to the determinants of exchange rate regimes literature, but unfortunately, a large number of the variables considered in that literature are already being used as regressors in the gravity model (GDP, per capita GDP), or are trade related (terms of trade, openness), or could be related to trade (capital mobility, political stability), or finally, are more likely outputs of exchange rate regimes rather than exogenous predictors (reserves level, inflation). See Juhn and Mauro (2002) for a recent example in this literature. In addition, Rogoff et al (2003) note that "it is difficult to find empirical regularities between a large set of potential determinants of regime choice – including standard measures of the broader policy context – and countries actual regime choices." (p. 25) This makes it even more difficult to find proper instruments, but also makes one somewhat less worried about reverse causation.

[55] If country j is in fact a potential base and country i is not, then the percentage of country i's region that is pegged to country j is used.

the base is used as the instrument for whether there is a direct peg.[56] A simple regression of direct peg on the instrument yields a positive coefficient and an R^2 of .36. Adding in all the other exogenous regressors increases the R^2 to .38.

The instrumental variable results presented in the three columns of Table 7 should be compared to the respective columns in Table 2. In both tables, the estimates in the first column include time dummy variables, those in the second column include time dummy variables and country fixed effects, and those in the third column include time dummy variables and country-pair fixed effects. A comparison of the results in Tables 2 and 7 shows that the coefficient on direct peg goes up when the IV regression is used.[57] In the third column, when pair fixed effects are used, the standard error rises enough such that the coefficient is no longer statistically different from zero at 95%, but it is significant at 90%. Thus, to the extent that one accepts the exogeneity of the instrument, these IV regressions appear to support the core specifications by showing that eliminating endogeneity does not weaken our results.

IV.3 Entry and exit of pegs

Estimates based on coding a country as a having either a pegged exchange rate or a flexible exchange rate may raise concerns that some important links between the exchange rate regime and trade are not captured. In particular, one concern is that an increased level of bilateral trade may prompt a country to institute a fixed exchange rate with its trading partner. In this case, the estimated link between a fixed exchange rate and bilateral trade reflects the influence of the latter on the former. While we have tried to address these issues with IV estimation, we can also look at the dynamic patterns. Beyond this possibility, we are also interested in knowing whether the effects of a change in exchange rate status on trade are manifest immediately, or only with time.

We explore these issues by including four new dummy variables in the specification, representing the first year of a peg, the last year of a peg, the first year after abandoning a peg,

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[56] If the other countries are pegging and this choice is correlated with other measures designed to increase trade, and these measures are correlated with unobserved measures in the local country, then this percentage is not a good instrument. We do, though, see many instances where a country has switched bases to be more like the other countries in the region (Ireland switching to a German base within the EMS, former British colonies in the Western Hemisphere switching to the US, and former Portuguese colonies switching to a French base to be more like their neighbors.). In addition, a regression that includes the instrument directly in the regression with all the other variables and country pair and year fixed effects, the coefficient on the instrument is not statistically different from zero, see table 7, column 4)

[57] If one instead instruments for currency unions, the coefficient on currency unions go up as well, but the standard error rises to the point that the result is not statistically significant when CPFE are included.

and the last year before adopting a peg. Results are reported in table 8. The hypothesis that a peg is used to lock in a higher level of trade would be consistent with a finding of a positive coefficient on the dummy variable representing the last year before adopting a peg. The hypothesis that trade is significantly different in the immediate wake of adopting or abandoning a peg can be tested by considering the sign and significance of the coefficients on the dummy variables representing the first year of a peg and the first year after a peg is abandoned, respectively. In fact, however, we find that only the dummy for a last year of a peg is statistically significantly different from zero indicating perhaps the impending end of the peg is forseeable. The fact that the other coefficients on these dummy variables are not significant suggests odd dynamics are not generating the results presented above. In particular, trade is not higher right before a peg begins, suggesting the concerns above do not show up in the data.[58] Also, trade in the year immediately after a peg ends is not different from any other year of where there is no peg, suggesting crises or messy exits do not drive our results.[59]

IV.4 Alternate Econometric Techniques

Our central results are robust to varying the econometric methods used to obtain estimated effects of fixed exchange rates on trade. These results are not presented in a table, in order to save space, but can be summarized as follows. First we consider using random effects at the country pair level instead of fixed effects. Including random effects strengthens the direct peg and moves the indirect peg to a negative significant coefficient. However, the Hausman specification test rejects the hypothesis that there is no systematic difference between the random and fixed effects coefficients suggesting that fixed effects are appropriate. Second, results are largely unchanged when using data from every fifth year rather than annual data, an exercise undertaken in an effort to remove some of the serial correlation Third, employing an AR(1) correction still results in large and significant effects of fixed exchange rates on trade, albeit smaller than the simple OLS results reported above.[60] Finally, we include a lagged

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[58] Because the classification only codes full year pegs as a peg, most years coded as the last year before a peg will also incorporate a number of months of the beginning of the peg (assuming not all pegs begin on January 1). Thus, we would expect the coefficient on the last year before a peg to be marginally positive, and despite that, it is still statistically insignificant.

[59] None of the insignificant coefficients become significant under big country clusters or even no clustering.

[60] As noted above, alternate means of handling autocorrelated errors, such as Newey-West standard errors only strengthen the results from those reported. The standard errors when just one lag is included are almost identical to heteroskedasticity robust standard errors and as lags included approach the maximum lags of the sample, the errors approach the reported results using country pair clusters.

dependent variable to control for possible unobservable omitted variables, a strategy that seems to us to be less promising than the use of country pair fixed effects. But, as it turns out, there is a close correspondence to the OLS results presented in Section III and those obtained with a lagged dependent variable. The coefficient on direct peg is .10 and significant at 99% when a lagged dependent variable is included, and the coefficient on the lag is .8. This suggests a long run impact of roughly .5, not far from our original OLS estimates with time controls.

These results suggest that the estimates presented in Section III are not merely a reflection of spurious correlations.

IV.5 Alternate sub-samples

Finally, we look at two other subsets of the data, trade with base countries and non-oil trade. For the former, we may worry that non-pegged trade between, say, Ivory Coast and Thailand is simply not a relevant comparison to the pegged observations because most of our pegs are to large countries. We thus restrict our sample to trade with a country that is a base country (i.e. someone else pegs to this country) somewhere in the sample. This has little effect on the results; the coefficient on direct peg actually goes up slightly. We consider non-oil based trade because oil based trade may be atypical of other trade flows and because many oil exporters are pegged to the dollar and the price of oil is denominated in dollars.[61] Again, we find that eliminating oil exporters does not dramatically change the results. These more limited samples also do not have an impact on the results when we include unlinked pegs or allow indirect pegs that are part of systems to have different effects.

V Conclusion:

Countries peg for many reasons. Often the concern is macroeconomic stability and the provision of a nominal anchor. Still, one of the presumed benefits of a fixed exchange rate is that it should expand trade, at least with the base country. Empirical backing for this presumption, though, has proved elusive. This paper shows that when one focuses on bilateral exchange rate regimes as coded from *de facto* performance, rather than proxying for regimes by using bilateral exchange rate volatility, there are statistically and economically significant impacts on trade from a fixed exchange rate.

We find that with few controls pegging appears to increase trade by as much as 80%. These are clearly over-estimates and when more appropriate controls are included, the results

[61] Oil exporters are defined by the World Bank as countries with more than 50% of their exports in the form of oil.

are 40% with country effects or 20% with country pair fixed effects. These results seem robust to a variety of econometric checks, considerations of start and stop years, and alternate *de facto* classifications. We find that indirect pegs do not appear to have strong impacts on trade unless they come as part of an exchange rate system, in which case they seem to have a positive impact on trade. Finally, we do not see evidence of trade diversion. Instead, pegged countries seem to trade more with all other countries (though the increase is smaller than with the base).

The magnitudes, on the order of 20%, may or may not be sufficient to offset some of the costs of fixing the exchange rate, but they are both statistically and economically relevant. Countries hoping to expand trade may choose the less restrictive and permanent fixed rate as opposed to a currency union. In addition, countries already pegged may have already captured some of the gains of increased trade that appear available from creating a currency union. On the other hand, the difficulty of maintaining a peg in the face of market pressure may lead countries to prefer the permanent link that a currency union can provide. Finally, we note that the rapid expansion of trade in the post-Bretton Woods era is even more surprising than we may have already thought. Not only has trade expanded rapidly, it has done so despite the collapse of an exchange rate system that was fostering it.

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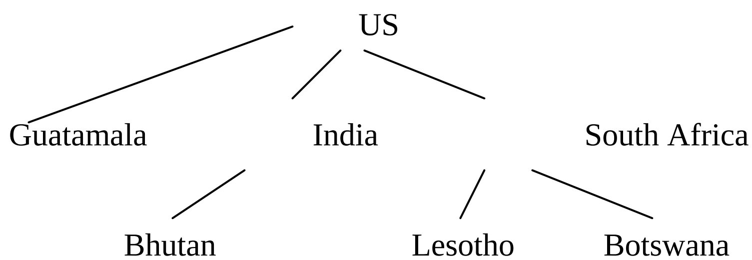
Figure 1.

A Family Tree: Example



Guatamala, India, South Africa are “direct pegs” to the US
Bhutan is a “direct peg” to India, Lesotho and Botswana to South Africa

Guatamala, India, South Africa are “siblings” amongst themselves
Lesotho and Botswana are “siblings”

Bhutan, Lesotho, and Botswana are “grandchildren” of the US

Bhutan is “cousin” with Lesotho and Botswana

Bhutan to Guatamala and South Africa is an “aunt/uncle” relationship

all considered indirect pegs

Table 1. Sample Descriptions

	Total sample	Post 1972	Industrial / Industrial pairs post 1972	Industrial / Developing pairs post 1972	Developing / Developing pairs post 1972
Total					
Observations	213391	168868	6349	68108	94411
# of country pairs	11857	11805	276	3569	7960
% world trade	100%	100%	52%	38%	9%
Direct Pegs					
Observations	2753	1562	130	1407	25
% of world trade	16%	11%	7%	5%	0%
# switchers	162	118	14	102	2
Average trade / average for all dyads	1151%	1253%	715%	573%	6136%
Indirect peg # of obs.	45591	13679	332	1730	11617
Indirect peg # of switches	5896	2357	59	315	1983
System indirect # obs.	29669	329	329	0	0
System indirect # switchers	4953	59	59	0	0
Unlinked peg # of obs.	103845	94614	2075	39819	52720
Unlinked peg # of switches	10183	6164	191	2113	3860
Currency Unions					
Observations	3055	2055	6	193	1806
% of world trade	2%	<0.5%	<0.5%	<0.5%	<0.5%
# switchers	129	62	1	9	52
Average trade / average for all dyads	71%	35%	252%	231%	23%

Note: % of trade results are the average of annual results for the relevant time sample

Table 2. Core Results

	1	2	3
	OLS, time	CFE, time	CPFE, time
direct peg	0.586	0.324	0.194
	0.124**	0.145*	0.089*
indirect peg	-0.351	-0.031	-0.015
	0.050**	0.04	0.028
currency union	1.341	1.231	0.323
	0.158**	0.155**	0.132*
exch rt volatility	-0.262	-0.271	-0.205
	0.046**	0.039**	0.032**
$(\text{exch rt volatility})^2$	0.007	0.007	0.006
	0.001**	0.001**	0.001**
ldist	-1.212	-1.431	
	0.025**	0.026**	
lrgdp	0.968	0.059	0.445
	0.010**	0.066	0.061**
lrgdppc	0.392	0.322	0.007
	0.015**	0.063**	0.058
comlang	0.342	0.302	
	0.046**	0.050**	
border	0.582	0.360	
	0.126**	0.123**	
regional	1.050	0.529	0.265
	0.139**	0.163**	0.072**
landl	-0.25	-0.155	
	0.035**	0.322	
island	0.007	2.168	
	0.040	0.228**	
lareap	-0.106	0.628	
	0.009**	0.045**	
comcol	0.337	0.547	
	0.073**	0.070**	
curcol	0.741	0.104	-0.032
	0.383+	0.480	0.452
comctry	-0.511	0.472	
	0.877	0.558	
colony	1.403	1.398	
	0.120**	0.120**	
Constant	-29.862	-6.797	-11.603
	0.390**	1.344**	2.007**
Observations	168868	168868	168868
R^2	0.64	0.71	0.87
Number of country pairs FE			11805
Impact of reducing volatility from mean to zero	-1.3%	-1.3%	-1.0%

+ significant at 10% * significant at 5%; ** at 1%
standard errors clustered at country pair level

Table 3 Different country types

	1	2	3	4	5	6
	indind	inddev	devdev	indind	inddev	devdev
direct peg	0.036	0.137	-0.260	-0.211	0.403	0.240
	0.055	0.100	0.140+	0.132	0.085**	0.909
indirect peg	0.109	-0.034	0.008	-0.054	0.177	0.081
	0.037**	0.036	0.033	0.063	0.058**	0.046+
currency union	-0.039	0.209	0.302	-0.359	0.590	0.967
	0.043	0.223	0.160+	0.221	0.359	0.177**
exch rt volatility	-3.998	-2.184	-0.158	-8.821	-2.598	-0.192
	1.518**	0.263**	0.032**	2.908**	0.302**	0.037**
(exch rt vol)^2	39.065	3.446	0.004	96.004	4.652	0.005
	22.218+	0.783**	0.001**	37.873*	0.906**	0.001**
ldist	-0.401	0.007	0.519	-1.108	-1.412	-1.621
	0.236+	0.092	0.095**	0.068**	0.053**	0.034**
lrgdp	0.907	0.617	0.050	-0.516	-0.017	0.170
	0.248**	0.090**	0.092	0.251*	0.090	0.103+
lrgdppc	0.280	0.225	-0.019	0.977	0.601	0.369
	0.053**	0.19	0.137	0.260**	0.088**	0.098**
comlang		-0.006		0.237	0.431	0.166
		0.459		0.107*	0.060**	0.068*
border				-0.107	-0.078	0.514
				0.137	0.341	0.128**
regional				0.102	2.63	1.628
				0.075	0.227**	0.189**
landl				4.036	-5.011	-2.489
				0.700**	0.384**	0.366**
island				6.956	-3.821	-2.153
				1.073**	0.319**	0.919*
lareap				1.287	0.272	0.473
				0.214**	0.044**	0.056**
comcol					0.065	0.704
					0.214	0.082**
curcol					0.225	
					0.483	
comctry					0.133	
					1.006	
colony				0.804	1.155	0.091
				0.216**	0.104**	0.161
Constant	18.147	0.167	-16.48	-8.273	12.157	-1.584
	8.089*	3.021	3.084**	2.540**	2.512**	2.426
R^2	0.98	0.91	0.80	0.95	0.83	0.57
Observations	6349	68108	94411	6349	68108	94411
Number of CPFE	276	3569	7960			

+ significant at 10%; * significant at 5%; ** at 1% standard errors clustered at country pair level

Note: indind is industrial only pairs. inddev is industrial / developing pairs. devdev is developing only pairs. Time fixed effects in all regressions. Country pair fixed effects in 1-3. Country effects in 4-6.

Table 4. System Effects

	1	2	3	4	5	6
	post 72	full sample	full sample	ind ind	ind dev	dev dev
direct peg	0.205	0.161	0.370	0.100	0.183	-0.295
	0.089*	0.064*	0.065**	0.050*	0.079*	0.314
indirect peg	0.029	-0.041	0.044	-0.14	0.100	-0.013
	0.033	0.029	0.029	0.125	0.040*	0.039
currency union	0.361	0.758	0.599	0.877	0.681	0.458
	0.134**	0.121**	0.116**	0.297**	0.138**	0.164**
exch rt volatility	-0.200	-0.244	-0.234	-1.918	-2.161	-0.179
	0.032**	0.033**	0.033**	0.768*	0.252**	0.033**
(exch rt volatility)^2	0.005	0.007	0.006	6.920	3.232	0.005
	0.001**	0.001**	0.001**	2.743*	0.827**	0.001**
lrgdp	0.449	0.448	0.632	-0.112	0.645	0.698
	0.061**	0.049**	0.048**	0.227	0.075**	0.081**
lrgdppc	-0.001	0.184	0.006	0.873	0.154	0.027
	0.059	0.048**	0.047	0.213**	0.076*	0.079
regional	0.258	0.459	0.438	0.395	0.462	0.280
	0.073**	0.068**	0.067**	0.059**	0.224*	0.126*
curcol	-0.023	0.208	0.085	0.251	0.231	
	0.452	0.207	0.202	0.236	0.219	
unlinked peg	0.054	0.009	0.056	-0.145	0.115	-0.040
	0.017**	0.017	0.017**	0.039**	0.021**	0.027
system indirect	0.040	0.293	0.056	0.256	0.069	0.005
	0.064	0.041**	0.042	0.135+	0.05	0.133
system unlinked	0.017	0.083	0.024	0.275	0.086	-0.525
	0.020	0.023**	0.023	0.047**	0.025**	0.139**
BW*lrgdp			-0.138			
			0.008**			
BW*lrgdppc			-0.095			
			0.015**			
Constant	-11.683	-14.217	-20.291	3.406	-23.423	-23.907
	2.008**	1.694**	1.664**	8.4	2.566**	2.725**
Indirect + system indirect	.070	.251	.100	.116	.169	-.077
	.056	.035**	.035**	.046*	.039**	.133
unlinked + system unlinked	.071	.092	.080	.129	.201	-.564
	.019	.022**	.022**	.032**	.024**	.140**
Observations	168868	213391	213391	9318	90011	114062
R^2	0.87	0.86	0.86	0.98	0.9	0.78
Number of CPFE	11805	11857	11857	276	3569	8012

Country pair and time fixed effects included in all regressions, therefore cannot include ldist, comlang, border, landl, island, lareap, comcol, comctry or colony as regressors.
* significant at 5%; ** significant at 1%
standard errors clustered at the country pair level

Table 5. Results across different classifications

	1	2	3	4	5	6
code	RR	RR	Shambaugh	Shambaugh	De Jure	De Jure
	CFE, time	CPFE, time	CFE, time	CPFE, time	CFE, time	CPFE, time
direct peg	0.284	0.155	0.262	0.174	0.106	0.069
	0.157+	0.078*	0.161	0.109	0.170	0.120
indirect peg	0.048	-0.121	-0.047	-0.068	-0.080	-0.148
	0.058	0.046**	0.046	0.032*	0.047+	0.035**
currency union	1.371	0.174	1.354	0.195	1.335	0.156
	0.176**	0.171	0.176**	0.167	0.176**	0.169
exch rt volatility	-0.224	-0.188	-0.228	-0.191	-0.228	-0.191
	0.040**	0.034**	0.040**	0.035**	0.040**	0.034**
(exch rt vol)^2	0.006	0.005	0.006	0.005	0.006	0.005
	0.001**	0.001**	0.001**	0.001**	0.001**	0.001**
ldist	-1.292		-1.294		-1.297	
	0.028**		0.028**		0.029**	
lrgdp	0.022	0.346	0.008	0.347	-0.001	0.329
	0.081	0.078**	0.081	0.077**	0.081	0.078**
lrgdppc	0.355	0.103	0.371	0.102	0.380	0.121
	0.076**	0.074	0.076**	0.074	0.076**	0.074
comlang	0.352		0.355		0.357	
	0.057**		0.056**		0.056**	
border	0.555		0.551		0.549	
	0.135**		0.135**		0.135**	
regional	0.137	0.344	0.144	0.333	0.153	0.350
	0.179	0.068**	0.179	0.067**	0.179	0.068**
landl	-3.45		-3.484		0.411	
	0.357**		0.357**		0.393	
island	-1.380		-1.419		1.892	
	0.262**		0.263**		0.251**	
lareap	0.624		0.631		0.637	
	0.054**		0.054**		0.054**	
comcol	0.605		0.605		0.604	
	0.084**		0.084**		0.084**	
curcol	0.093	0.391	0.113	0.411	0.100	0.417
	0.524	0.125**	0.538	0.132**	0.539	0.132**
colony	1.258		1.258		1.282	
	0.125**		0.125**		0.127**	
Constant	0.220	-8.261	0.494	-8.299	-5.947	-7.700
	1.724	2.574**	1.727	2.568**	1.614**	2.583**
Observations	123393	123393	123393	123393	123276	123276
R^2	0.73	0.88	0.73	0.88	0.73	0.88
Number of CPFE		8163		8163		8163

+ significant at 10% * significant at 5%; ** significant at 1%
standard errors clustered at country pair level

Table 6. System effects across classifications (full time sample)

	1	2	3	4
	rr	rr	js	js
	CPFE, time	CFE, time	CPFE, time	CFE, time
direct peg	0.305	0.425	0.114	0.364
	0.068**	0.121**	0.072	0.110**
indirect peg	0.020	0.111	-0.031	-0.069
	0.038	0.048*	0.033	0.042+
currency union	0.740	1.345	0.749	1.321
	0.155**	0.145**	0.155**	0.147**
exch rt volatility	-0.218	-0.263	-0.217	-0.269
	0.035**	0.041**	0.036**	0.042**
(exch rt volatility)^2	0.006	0.007	0.006	0.007
	0.001**	0.001**	0.001**	0.001**
unlinked peg	0.040	-0.047	0.034	-0.052
	0.021+	0.027+	0.020+	0.025*
system indirect	0.218	0.142	0.220	0.203
	0.049**	0.061*	0.045**	0.059**
system unlinked	0.017	0.106	0	0.137
	0.031	0.038**	0.026	0.036**
Constant	-11.31	-8.679	-11.591	-9.036
	1.951**	1.279**	1.953**	1.277**
Indirect + system indirect	.238	.253	.189	.134
	.040**	.046**	.037**	.046**
unlinked + system unlinked	.058	.059	.034	.085
	.027*	.032+	.024	.031**
Observations	158893	158893	158893	158893
R^2	0.86	0.73	0.86	0.73
Number of CPFE	8194		8194	

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

standard errors clustered at country pair level

Standard gravity controls are included as in all other tables. The coefficients are omitted here to save space.

Table 7. IV regressions (instrument is percentage of region pegged to base)

	1 IV with time	2 IV with CFE, time	3 IV with CPFE, time	4 CPFE, time
direct peg	1.436	0.656	0.495	0.179
	0.216**	0.284*	0.288+	0.087*
indirect peg	-0.343	-0.027	-0.015	-0.015
	0.050**	0.040	0.017	0.028
currency union	1.352	1.249	0.334	0.32
	0.157**	0.155**	0.096**	0.132*
exch rt volatility	-0.253	-0.268	-0.204	-0.205
	0.046**	0.039**	0.021**	0.032**
(exch rt volatility)^2	0.007	0.007	0.006	0.006
	0.001**	0.001**	0.001**	0.001**
ldist	-1.211	-1.43		
	0.025**	0.026**		
lrgdp	0.966	0.058	0.444	0.444
	0.011**	0.066	0.029**	0.061**
lrgdppc	0.389	0.322	0.008	0.008
	0.015**	0.063**	0.027	0.058
comlang	0.328	0.299		
	0.046**	0.050**		
border	0.577	0.358		
	0.128**	0.124**		
regional	1.031	0.523	0.265	0.265
	0.141**	0.164**	0.055**	0.071**
landl	-0.251	-2.785		
	0.035**	0.375**		
island	0.006	-1.216		
	0.040	0.226**		
lareap	-0.108	0.630		
	0.009**	0.045**		
comcol	0.340	0.548		
	0.073**	0.070**		
curcol	0.733	0.093	-0.078	-0.037
	0.368*	0.465	0.197	0.452
comctry	-0.446	0.505		
	0.822	0.542		
colony	1.297	1.349		
	0.122**	0.129**		
% region pegged to base				0.156
				0.147
Constant	-29.73	-0.011	-11.538	-11.567
	0.393**	1.433	0.989**	2.008**
Observations	168868	168868	168868	168868
R^2	0.64	0.71	.50	0.87
Number of CPFE			11805	11805

+ significant at 10% * significant at 5%; ** significant at 1%
R^2 in column 3 is the "overall" R^2

Table 8: Controls for Dynamics

	1	2	3	4
direct peg	0.198	0.211	0.203	0.222
	0.094*	0.096*	0.093*	0.097*
indirect peg	-0.015	-0.015	-0.015	-0.015
	0.028	0.028	0.028	0.028
currency union	0.323	0.322	0.324	0.323
	0.132*	0.132*	0.132*	0.132*
exch rt volatility	-0.205	-0.205	-0.205	-0.205
	0.032**	0.032**	0.032**	0.032**
(exch rt volatility)^2	0.006	0.006	0.006	0.006
	0.001**	0.001**	0.001**	0.001**
lrgdp	0.445	0.445	0.445	0.445
	0.061**	0.061**	0.061**	0.061**
lrgdppc	0.007	0.007	0.007	0.007
	0.058	0.058	0.058	0.058
regional	0.265	0.265	0.265	0.264
	0.072**	0.072**	0.072**	0.072**
curcol	-0.032	-0.032	-0.033	-0.035
	0.452	0.452	0.452	0.452
Last year before a peg	0.036			
	0.069			
First year pegging		-0.111		
		0.073		
Last year pegging				-0.138
				0.070*
First year after a peg			0.07	
			0.053	
Constant	-11.603	-11.599	-11.6	-11.599
	2.007**	2.007**	2.007**	2.007**
Observations	168868	168868	168868	168868
R^2	0.87	0.87	0.87	0.87

Country pair and time fixed effects included in all regressions, therefore cannot include ldist, comlang, border, landl, island, lareap, comcol, comctry or colony as regressors.
* significant at 5%; ** significant at 1%
standard errors clustered at the country pair level