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ABSTRACT

The impermanence of fixed exchange rates has become a stylized fact in international finance. The combination of a view that pegs do not really peg with the "fear of floating" view that floats do not really float generates the conclusion that exchange rate regimes are, in practice, unimportant for the behavior of the exchange rate. This is consistent with evidence on the irrelevance of a country's choice of exchange rate regime for general macroeconomic performance. Recently, though, more studies have shown the exchange rate regime does matter in some contexts. In this paper, we attempt to reconcile the perception that fixed exchange rates are only a "mirage" with the recent research showing the effects of fixed exchange rates on trade, monetary autonomy, and growth. First we demonstrate that, while pegs frequently break, many do last and those that break tend to reform, so a fixed exchange rate today is a good predictor that one will exist in the future. Second, we study the exchange rate effect of fixed exchange rates. Fixed exchange rates exhibit greater bilateral exchange rate stability today and in the future. Pegs also display somewhat lower multilateral volatility.

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The choice of an exchange rate regime, and the consequences of this choice, traditionally represents a central topic in international finance. But, recently, research has called into question the relevance of this line of inquiry. This is demonstrated by two of the more evocative titles in international finance articles published in the last decade, “The Mirage of Fixed Exchange Rates” (Obstfeld and Rogoff 1995), and “The Fear of Floating” (Calvo and Reinhart 2002). Obstfeld and Rogoff (1995) suggest that fixed rates are not all that fixed, writing “literally only a handful of countries in the world today have continuously maintained tightly fixed exchange rates against any currency for five years or more.” [p. 87] Calvo and Reinhart (2002) argue that floating rates do not really float, rather governments that claim to allow market forces to determine the value of their currencies actually act to minimize exchange rate fluctuations.

Taken together, these influential articles suggest that the exchange rate regime is, in practice, unimportant and perhaps irrelevant for the actual behavior of the exchange rate. This conclusion is bolstered by empirical research that finds little role for exchange rate regimes in determining major macroeconomic outcomes beyond the real exchange rate (see Mussa (1986), Baxter and Stockman (1989), and Flood and Rose (1995)). Altogether, based on these works, there is a general impression that exchange rate regimes – in spite of all the attention they receive – are in some ways unimportant.

Several strands of more recent research, however, demonstrate a relevant role for the exchange rate regime. Most of these papers, in part motivated by Calvo and Reinhart (2002), used *de facto* classifications to determine pegging status. In the realm of trade, Rose (2000) finds that currency unions stimulate trade, and Klein and Shambaugh (2006) find similar results for fixed exchange rates which, of course, exhibit less permanence than currency unions. In the context of macroeconomic policy, Shambaugh (2004) and Obstfeld, Shambaugh, and Taylor (2005) find that fixed exchange rates significantly limit monetary autonomy. Broda (2004) and Edwards and Levy-Yeyati (2005) find that the exchange rate regime affects the transmission of terms of trade shocks, and Broda (forthcoming) finds the exchange rate regime affects national price levels. Ghosh, Gulde, and Wolf (2002) note effects on inflation. Other recent research finds a role for the exchange rate regime on growth (see Aghion, Bachetta, Ranciere and Rogoff 2006, Levy-Yeyati and Sturzenegger 2003, Husain *et al.* 2005, di Giovanni and

Shambaugh 2006, and Ghosh *et al*. 2002) or growth volatility (Ghosh *et al.* 1997). This new set of evidence on the economic impact of the exchange rate regime calls for a re-examination of the common impression, based on earlier research, that exchange rate regimes are irrelevant.

This paper demonstrates the extent to which exchange rate regimes really do matter for exchange rate outcomes, and thus helps explain the source of effects of recent research demonstrating trade and macroeconomic consequences of exchange rate regimes. It examines the nature of *de facto* exchange rate regimes themselves, studying their duration, dynamics, and the extent they affect the exchange rate. If exchange rates regimes do not last, they should not affect the economy. Even if they last, if they do not have an appreciable impact on the exchange rate (perhaps due to fear of floating behavior) they would still be irrelevant. In essence, we try to provide a new set of stylized facts on exchange rate regimes that helps explain why the new wave of empirical evidence on their effects can occur. We generate a number of results that demonstrate that while not infinitely lived, fixed exchange rates do provide a stability of the exchange rate notably different from floating countries. These results are robust across a variety of exchange rate regime classifications. Differences in results across classifications demonstrate how these classification schemes diverge and the types of questions that each is best suited to address.

We begin, in Section 2, by explaining how we use a modified version of the Shambaugh (2004) classification scheme to obtain *de facto* fixed exchange rate spells and floating (i.e. non-fixed) exchange rate spells for 125 countries over the period 1973 to 2004. In Section 3 we then demonstrate that, while almost half of the fixed exchange rate spells do not last more than two years, the expected duration of a peg increases dramatically if it survives past that age. Consequently, at any one time, the set of countries that are pegged includes a large proportion of those with a peg lasting for a relatively long duration.

We also demonstrate, in Section 3, that the distribution of floating exchange rate spells is similar to the distribution of fixed exchange rate spells, with a large number of short-lived floating exchange rate spells and a smaller number of long-lived floating exchange rate spells. An implication of this is that when an exchange rate switches from a peg to a float, the float itself may be quickly changed back into a peg. This dynamic behavior of exchange rate regimes, when combined with an analysis of the duration of fixed exchange rate spells and floating exchange rate spells, paints a different picture than one would expect from the well-known "mirage" of fixed exchange rates.

In addition, pegs and nonpegs do look quite distinct in terms of exchange rate volatility. This is not to argue that no countries manage their nonpegged exchange rates, or that no countries mis-declare their regimes, but to say that some countries actually do float and their exchange rates are notably more volatile than the pegs.

A consequence of these characteristics concerning the duration and the dynamics of exchange rate regimes is that a country that has a fixed exchange rate today can be expected to exhibit greater exchange rate stability, both today and over the course of time, than a country that currently has a floating exchange rate, notwithstanding the fact that exchange rate pegs break with some frequency and a country that has a fixed exchange rate today may find its currency floating tomorrow. In particular, we show that a country that is pegged today will have lower bilateral exchange rate volatility in the future than a country that is floating. An implication of this result is that firms have a reasonable expectation that a current fixed exchange rate will last. This helps explain why, for example, Klein and Shambaugh (2006) find that fixed exchange rates are associated with greater bilateral trade in a gravity model, even given the fact that there are a large number of short-lived exchange rate spells.

The lower volatility of a bilateral exchange rate extends to multilateral volatility as well (beyond the reduction in multilateral volatility due to a reduction in bilateral volatility with the base country). Pegging the exchange rate tends to prevent extremely high bilateral volatility outcomes which, due to a high correlation in the volatility across all major exchange rates, can lead to high multilateral volatility. However, but for cases of extreme volatility, there is not strong evidence that a bilateral peg reduces multilateral volatility. There are important implications of this distinct effect of pegging on bilateral and multilateral volatility for trade and macroeconomic outcomes since bilateral trade, and macroeconomic stability obtained by an exchange rate anchor, only require bilateral stability while broader results across many sectors, for example economic growth, may be somewhat situation or time dependent.

II. Exchange Rate Spells, Fixed and Floating

A central part of this study, or any other one that focuses on the role of the exchange rate regime, is its definitions of the regimes themselves. It has been well documented that governments' declarations to the International Monetary Fund as to the exchange rate regimes in place are not always accurate (see, for example, Calvo and Reinhart 2002). Therefore, in this paper we rely on *de facto* exchange rate behavior rather than *de jure* declarations of whether a country has a fixed or a flexible exchange rate.

The basis of our coding a country as having a fixed or a floating (i.e. not a fixed) exchange rate is a modification of the classification scheme used by Shambaugh (2004) who, in turn, closely followed the method employed by Obstfeld and Rogoff (1995).[1] In this paper, we considered a country as having a fixed exchange rate in a given calendar year, with its currency pegged to the currency of a base country, if its month-end official bilateral exchange rate stays within a +/- 2 % band both each month and over the course of that year.[2] This requires that a currency is within the same +/- 2% band at the end of each month for the full year, not simply that the change in the exchange rate between January and December is less than 2%. The coding is annual and, therefore, the peg must last for a full calendar year for a country to be classified as pegged for that year. Pegs that last less than a full year are classified as nonpegs.[3] An advantage of such a procedure, as opposed to looking at relative volatility benchmarks is that this definition of a peg (within a 2% band) is clear, invariant over time, and matches the

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[1] Two other prominent studies that developed a classification scheme for exchange rate regimes are Levy-Yeyati and Sturzeneggar (2003) and Reinhart and Rogoff (2004). The classification used by Levy-Yeyati and Sturzenegger (2003) uses information on reserves as well as currency values such that stable rates in the absence of reserve changes might not be called pegs while somewhat volatile exchange rates paired with extensive intervention may be considered as pegged. Reinhart and Rogoff (2004) use parallel market rates and focus on the conditional probability of staying within a range over a five year period, a method that could bias our results to finding long lived pegs. In an appendix we provide detailed analysis of alternate classifications. We compare our classification with these others, as well as the declared status countries report to the IMF, in the body of the text, although the use of the LYS classification for the duration analysis presented below is difficult due to the presence of observations marked "inconclusive" in that coding.

[2] Results are not sensitive to the defined width of the band. Most of the pegged observations stay within an even tighter band, but 2% is consistent with bands used in Bretton Woods, the EMS, and in Obstfeld and Rogoff (1995).

[3] For example, a country with a peg lasting from June 2001 to May 2005 would be classified as floating in 2001 and 2005 and pegged from 2002 – 4. By including in the float sample years of partial pegging, this should bias against finding any difference between pegs and floats. While there may be pegs, or attempted pegs, shorter than one year, our view is that for the time spans less than one year it becomes increasingly likely that the stability one would find in the data is an accident and not a peg – false positives would rise. Also, we posit that market participants will not have detected or believed a peg until it has lasted more than a few months.

historical definitions of pegs such as the gold points in the Gold Standard, the bands in Bretton Woods and the EMS.

The base country is determined through the pegging history of a given country as well as through tests against a variety of countries, the declared intent of the country, and readings of various currency histories. For the purpose of comparative bilateral volatility tests, we need a "base" country for countries when they have a floating exchange rate. In these cases, the base is the country to which the country with the floating exchange rate pegged in the past, or a major industrial country with which it has a prominent economic relationships (for details see Shambaugh 2004). We drop from our sample countries with a population of less than 400,000 in 1999. We also drop observations that represent currency unions (but for the members of the single currency in Europe from 1999 onwards) in order to keep these episodes from biasing the sample towards long-lasting fixed exchange rate pegs.[4] The United States is not included in the data set.

While one might be concerned that a country / year observation is being classified as a peg simply due to a lack of shocks, Calvo and Reinhart show that the probability that the bilateral exchange rate during classic floats like the US dollar / DM rate, the US dollar / yen rate or the US dollar / Australia dollar rate had a monthly change of less than 2.5% was roughly 60-70%. This means that the probability of 12 straight months of changes smaller than 2.5% (in either direction) is between 0 and 1%. In addition, our classification requires the tighter restriction of staying within the same +/- 2% bands over the entire year, not simply having each month be smaller than +/- 2%. Thus, the odds of "accidentally" coding a peg are, in fact, quite low. We see further evidence from the fact that well known floats, such as the three mentioned above, are never coded as pegs in our classification system.[5] Also, the undeclared pegs in our coding, those countries / year observations that we code as *de facto* pegs but are not *de jure*

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[4] Obstfeld and Rogoff (1995) identify 27 small countries with long lasting pegs in their Tables 2 and 3. By dropping countries with small populations, and currency unions, we retain only 8 of these 27; Bahrain, Djibouti, Lesotho, Namibia, Oman, Qatar, Swaziland, and United Arab Emirates. We set the population hurdle at 400,000 in order to retain in our data set the smallest country that Obstfeld and Rogoff keep (Luxembourg) and yet to exclude most of the countries they exclude.

[5] Countries not based on the dollar, such as EMS countries or African countries pegged to the Franc, also show roughly 60% chances of being within 2.5%. Again, this suggest only a 0.2% chance of happening 12 months in a row and an even lower chance of being within the same 2% bands over a year.

pegs, are typically instances generally recognize as pegs, such as East Asian countries in the early 1990's.[6]

In the interest of robustness, we consider reclassifying a set of single year pegs that seem most likely to be unintentional, those that are neither *de jure* pegs nor are coded as pegged by either Reinhart and Rogoff (2004) (RR) or by Levy-Yeyati and Sturzenegger (2003) (LYS). There are 39 country / year observations that fit within this category. Within this set, the exchange rate of 12 single year pegs remained within a +/- 1% band, a situation that is highly unlikely band to have arisen accidentally. Thus, we focus on the 27 "questionable peg" observations that are within 2% bands and are neither declared nor identified as a peg by RR nor by LYS. This set of observations represents 20 countries and 16 different years, and, therefore, is not evidence of a lack of world volatility in a particular year or country. It also includes many country / year observations that are widely considered to be *de facto* pegs, such as Malaysia and Indonesia in 1996, as well as countries whose currency was clearly shadowing that of another country, such as Portugal in 1975 which was linked to the DM unofficially in the Snake. Other countries, such as India, Pakistan, Tunisia, and Jamaica, all of which have two "questionable" single year pegs, have many other unquestionable pegs in the sample, making it unlikely that the "questionable" peg is just an accident of coding. Nevertheless, we repeat our analysis below coding these 27 observations as nonpegs. We find no change in the volatility results and only small differences in the duration and dynamics results.[7]

In this work, we focus on the differences between actually being pegged and not being pegged. We do not attempt to distinguish among a set of intermediate regimes because this would necessarily introduce more errors to a classification scheme since the boundary between

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[6] Shambaugh (2004), by requiring two consecutive years of staying in a band to have an observation qualify as a peg, effectively ruled out any coding of unintentional pegs. We do not follow this procedure since dropping single year pegs would bias our results towards finding longer pegs by eliminating short lived pegs. In addition, Shambaugh (2004) considered one-time discrete devaluations (one month with a change in the exchange rate greater than 2%, but 11 months exactly equal to zero) as pegs, but here we count these as breaks in the peg to avoid a bias towards finding long lasting pegs and to avoid artificially increasing the length of peg spells by, for example, defining a country as pegging even if it devalues every other year but otherwise stays pegged. As discussed in more detail in the appendix, this treatment of devaluations distinguishes the main coding used here from Reinhart and Rogoff, Shambaugh, and *de jure* classifications that allow devaluations, making the main coding quite similar to the way Obstfeld and Rogoff scheme.

[7] We cannot identify countries that attempted to peg in a particular year but failed. These observations would be coded as floats, which is appropriate for our analysis since we are investigating the characteristics of actual pegs, not the implications of unfulfilled desires.

a *de facto* peg and a nonpeg can be fairly clearly draw while the lines separating one intermediate regime from another is much less distinct. For example, some of the most freely floating countries manage their exchange rate to some extent, but it is difficult, in practice, to distinguish these managed floats from target zones with wide and movable bands.

Table 1 presents statistics on the prevalence of fixed and floating exchange rates in our panel data set that covers the period 1973 - 2004. This first two columns show that this data set is drawn from the experience of 125 countries, 21 of which we classify as major industrial countries (those that began the period as members of the OECD).[8] Of the 3,924 country / year observations in this data set, 47.53 percent are pegs.[9] Pegs are more prevalent among developing countries than among industrial countries, with 49.22 percent of the developing country / year observations representing pegs but only 39.34 percent of the industrial country / year observations representing pegs.

Table 1 also presents some basic statistics on fixed exchange rate spells and floating exchange rate spells. A fixed exchange rate spell is a set of consecutive years during which a country continually pegs its currency, and a floating exchange rate spell is a set of consecutive years during which a country continually does not peg its currency. These spells are the basic unit of analysis in this paper. We focus on spells to understand the extent to which a particular peg lasts as opposed to over-arching policy regimes. The minimum spell duration is 1 year, and the maximum spell duration is 32 years, the full length of the sample period. The statistics in Table 1 show that there are 398 peg spells in our panel, with an average of 3.18 peg spells per country, and 395 float spells, with an average of 3.16 float spells per country. The median duration of both peg and float spells is 2 years, and the mean durations are also similar, with the average peg spell lasting for 4.67 years and the average float spell lasting for 5.21 years. There are not dramatic differences in these statistics between the 21 major industrial countries and the 104 other countries included in the sample. The differences between the means and the medians of peg and float spells, and the size of the standard deviations relative to the means for both types of spells, suggest skewness in the distribution. This is demonstrated in the

[8] Iceland is the only OECD member not included in our data set, and is dropped because its population was less than 400,000 in 1999.
[9] There are 3,924 observations, rather than 125 × 32 = 4000, because 76 observations represent (non-Euro) currency unions.

histograms in Figures 1 and 2 that show that both peg and float spells are characterized by a large number of spells with very short duration, and a smaller number of spells with longer duration.[10]

A motivation for using a coding that requires a continuous, unvarying peg as opposed to one that allows discrete devaluations in addition to unbroken pegs is that these two types of experiences are different from the perspective of economic agents. The mean length of both peg spells and float spells would be longer if one counted a peg spell broken by a one-time devaluation to count as a continuous peg (as is done with the Reinhart and Rogoff, Shambaugh, or *de jure* codings) rather than as two separate pegs with an interceding one-year float spell at the time of the devaluation (as is done with our main classification scheme).[11] This is one source of the difference in statistics on peg and float spells between our main classification scheme and that of Shambaugh (2004) or of Reinhart and Rogoff, as shown in the Appendix.[12] Reinhart and Rogoff in particular smooth regimes over time, relying on exchange rate behavior over five year windows; they are focused on identifying exchange rate policy over time, not a specific spell, and they find much longer lived regimes than our spells.[13] Thus, the classifications are not imperfectly measuring the same thing, but are often simply trying to identify different things.

The large number of both peg and float spells that have short duration in our data is also evident from the statistics in Table 2. These statistics show that about 56 percent of the peg spells, and about 65 percent of the float spells, survive for at least two years; of course, this means that 44 percent of the peg spells and 36 percent of the float spells last for only one year. Somewhat less than a third of the peg spells (30.14 percent) and a little more than a third of the float spells (33.97 percent) last for at least 5 years. While the view that pegs frequently break is not uncommon, the result presented here that floats are equally fleeting is more novel. As seen

[10] Klein and Marion (1997) show that exchange rate pegs among Latin American and Caribbean countries are also characterized by a large number of very short pegs and a smaller number of long-lived pegs.
[11] Obstfeld and Rogoff (1996) do not count an episode that includes a one-time devaluation as a continuous peg.
[12] In his study of inflation targeting in which he uses peg duration as an indicator of monetary regimes, Rose (2006) examines the durability of exchange rate regimes and finds pegs are fragile using a set of countries in the 1990s using both Reinhart and Rogoff and Levy-Yeyati and Sturzenegger coding.
[13] See Husain, Mody, and Rogoff (2005) who give details on regime duration (discussed in Appendix) and comment in their footnote 8, "the Natural Classification [RR] attempts to identify longer term regimes rather than short term "spells."

in the 4th column of table 3, a large number of broken pegs have repegged by the third year after breaking the peg (only 48% of floats last 3 years).

The general finding, that over 70% of peg spells do not last over five years, confirms the basic idea of Obstfeld and Rogoff (1995) that a majority of pegs are short-lived. On the other hand, a fair number do last long term, more than the "handful" suggested by Obstfeld and Rogoff, and certainly more than that suggested by the stylized fact that all pegs break. [14] There are two sources of the difference in our results from those of Obstfeld and Rogoff (1995). One is that we include some countries omitted by Obstfeld and Rogoff because of strict population cutoff. The second, more important, reason for the difference concerns the timing of Obstfeld and Rogoff's study. Their paper was, in part, motivated to explain why pegs in the mid-1990s were not lasting, as evidenced by the fact that many countries in the EMS that could have defended their pegs chose not to do so and reflecting the notion that the large and swift-moving capital markets of the day had made pegging more difficult. The 1995 date of their study meant that many longstanding pegs had ended in the previous few years due to the EMS crisis, the Tequila Crisis, and the devaluation of the CFA countries against the franc. Despite the size and speed of capital markets, though, many of these pegs were re-established and new ones lasted as well such that by 2000, there were just as many long-lived pegs as there were in 1990. Figure 3 shows that our coding shows the period from 1994-8 as the low point of long-lived pegs with only an average 17 in those years (out of roughly 125 countries in the sample)[15] vs. a post Bretton Woods average of 32 and 36 by the year 2000.[16] Thus, a focus on

[14] Obstfeld and Rogoff (1995) write "The striking conclusion from Table 2 is that aside from some small tourism economies, oil sheikdoms, and highly dependent principalities, literally only a handful of countries in the world today have maintained tightly fixed exchange rates *against any currency* for five years or more." (p. 87, italics in original).

[15] The panel is roughly balanced with between 122 and 125 countries in the sample. The slight variation comes from the fact that currency unions are eliminated from sample with the exception of spells that began as pegs and converted to currency unions (e.g. some EMU observations)

[16] Pegs lasting at least 5 years in 2000 includes some oil countries and the CFA countries, but also many EU nations as well as Argentina, China, and El Salvador. The full list is: Argentina, Austria, Bahrain, Belgium, Benin, Burkina Faso, Cameroon, Central African Republic, Chad, China, Comoros, Congo (Republic of), Cote D'Ivoire, Denmark, Djibouti, El Salvador, Equatorial Guinea, Gabon, Hong Kong, Jordan, Lebanon, Lesotho, Luxembourg, Mali, Namibia, Nepal, Netherlands, Niger, Oman, Qatar, Saudi Arabia, Senegal, Swaziland, Syria, Togo, UAE.

the entire post–Bretton Woods era, rather than the situation in 1995, and on peg spells, rather than countries, alters the impression one has of the durability of exchange rate pegs.[17]

A more complete characterization of these spells involves an analysis of their survival rates, duration dependence, and factors that affect their duration dependence. We next turn to these issues.

III. Exchange Rate Spells: Survival Rates and Hazard Functions

The statistics presented in Tables 1 and 2 offer a sketch of the unconditional characteristics of spells, such as their mean and median duration. But these might not be the relevant measures for considering, say, how an importer at a particular moment views the likelihood of a fixed exchange rate being maintained between that time, when a contract is signed, and some time in the immediate future when delivery is taken and payment is made. In this section we offer analyses of peg and float spells that more closely reflects how economic agents view the likely permanence of a peg or the continuation of a policy of allowing the exchange rate to float.[18]

The statistics in Table 3 present a first look at the conditional likelihood that a current peg spell or a float spell will be maintained in subsequent years. The first rows of that table show that about 82 percent of the countries in the sample that are pegging their exchange rate in any given year continue to peg the exchange rate in the subsequent year, and about 83 percent of countries that have a floating exchange rate in any given year continue to float in the subsequent year. At a longer horizon, 65.75 percent of countries that peg their exchange rate in any given year peg continuously for three more years, and 55.29 percent peg continuously for

[17] As demonstrated by the figures in the Appendix, other classification schemes also show the early nineties as a low in terms of the number of long pegs and all show today as a post Bretton Woods high. Given that the other classifications allow a discrete devaluation, they do not show a large drop in the number of 5 year pegs after the EMS and CFA crises, but the overall message is the same.

[18] Masson (2001), Masson and Ruge-Murcia (2005) and Eichengreen and Razo-Garcia (2006) are related to this analysis, although these papers focus on whether the international monetary system is moving toward an "empty middle" consisting of mainly currency unions, on the one hand, and free floats, on the other, or, alternatively, whether transitions are slow and countries shift back to the middle, not exclusively away from it. These papers look at switching propensities across hard pegs, intermediate regimes (including pegs) and floats. Their results are related to our observations that neither pegging nor floating is an absorbing state and flipping back and forth is common. The focus in these papers on extreme polar cases, and the inclusion in the broad middle band of what we define as both pegs and nonpegs, however, distinguishes this paper from those works.

five years from the initial given year. The statistics for floating exchange rates are quite similar, with 65.08 percent floating in a given year continuing to do so three years hence, and 54.07% of those continuing to float five years hence. This high persistence of maintaining a state of pegging or floating, especially relative to the fact that nearly half of the peg spells and more than a third of float spells end within their first year, reflects the fact that the statistics in this table are based on annual cross sections, rather than spells, and there is a large weight given to long-lived spells in these annual cross section calculations. Given that analysis of exchange rate regime's effects on growth or other variables involves annual observations, they too will draw a long peg observation more often, which is why these statistics may be more important than the spell based ones.

Based on these statistics, we may think of an importer or an exporter as viewing spells as fairly durable. But the statistics in Table 3 are based on annual data alone, and are only conditioned on whether a country was pegged or had a floating exchange rate in a previous year. Economic agents have more information than this and, in particular, they know how long a peg spell or a float spell has been in effect. Thus, it is useful to consider a spell-based method for addressing the issue of the likelihood that a country has a pegged or floating exchange rate this year, conditional on its currency arrangement in the previous year. One method of doing this involves survival analysis. In Table 4 we present statistics that show the probability of a spell surviving through year t, given that it has survived up until the beginning of that time (that is, the peg was maintained or the float continued through year $t - 1$). Survival probabilities are presented for the full sample, as well as for the subsamples of the 21 industrial countries and the 104 developing countries, for the conditional survival rates in years 2 through 6 (as discussed in Section II, all pegs must survive for one year, by definition, and for purposes of this table, this initial year is called year *1*). The statistics in this table show that 55.9 percent of all peg spells, and 65.8 percent of all float spells, survive to their second year. Of those that survive this long, a larger proportion (70.7 percent of pegs and 75 percent of floats) survives until the third year. The proportion of those peg and float spells that survive into their fourth year, conditional on surviving their third year, again rises. Once a peg has been in existence for three years, there is a very strong chance (greater than 85%) that it will last another year.

One tool used in survival analysis is the hazard function. In this context, a hazard function, $h(t)$, represents the likelihood that a peg that has lasted up until year $t-1$ ends in year t when the currency begins to float or, alternatively, the likelihood that a floating exchange rate that has lasted up until year $t-1$ switches to a peg in year t. A set of spells is said to exhibit positive duration dependence and a decreasing hazard if $h'(t) < 0$, negative duration dependence and an increasing hazard if $h'(t) > 0$, or constant duration dependence and a constant hazard if $h'(t)=0$.[19] Thus, the statistics in Table 4 imply a decreasing hazard, and positive duration dependence, for both peg spells and float spells.

Beyond the duration dependence of spells themselves, we are interested in the question of how quickly a country that goes off of a peg returns to a fixed exchange rate after a period of floating, and the associated question of the effect of time spent on a previous peg on the duration dependence of a float spell. This issue of the dynamic nature of switching from peg spells to float spells, or from float spells to peg spells, can be addressed by estimating the effect on a hazard function of the time spent on the immediately preceding spell. To do this, we estimates a Weibull hazard function that takes the form

$$h(t,\lambda,\mathbf{x},\beta) = \lambda t^{(\lambda-1)} \exp(\mathbf{x}\boldsymbol{\beta})$$

where t is the time in the spell, $\mathbf{x}$ is vector of covariates that shift the hazard function, $\boldsymbol{\beta}$ is a vector of coefficients associated with these covariates, and λ is a parameter in the baseline Weibull hazard function, $\lambda t^{(\lambda-1)}$. A larger value of a particular covariate, x_i, increases the hazard (i.e. it makes it more likely that a spell will end in period t, given its survival to period $t-1$), if its associated coefficient, β_i, is positive, and conversely. The baseline hazard function is decreasing in t (and thus exhibits positive duration dependence) if $\lambda < 1$, while it exhibits negative duration dependence if $\lambda > 1$, and constant duration dependence if $\lambda = 1$.

The central covariate of interest for our analysis is the time spent in the immediately preceding float spell, when estimating a peg spell hazard function, or the time spent in the immediately preceding peg spell, when estimating a float spell hazard function. A positive

[19] For a distribution of stochastic durations, T, the probability distribution of durations is $F(t) = \Pr(T<t)$. A Survivor Function is $S(t) = 1 - F(t) = \Pr(T\geq t)$. S(t) is the likelihood that a spell will last up to period t. The Hazard Function is the probability that spells will be completed (i.e. pegs will end, or floats will end) at duration t, conditional on the fact that they have lasted up until moment t. The hazard function is the derivative of the natural logarithm of the survivor function with respect to t, $h(t) = - d \ln S(t) / dt$. For a good introduction to duration data and hazard functions, see Kiefer (1988).

value of the coefficient associated with the length of the immediately preceding float spell in an estimate of the peg spell hazard function implies that a shorter previous float is associated with a lower subsequent peg spell hazard; that is, peg spells tend to last longer if the immediately preceding float spells are shorter (as we have seen, a high proportion of float spells last for only one year). Also, a positive value of the coefficient associated with the length of the immediately preceding peg spell in an estimate of the float spell hazard function implies that longer peg spells are associated with shorter subsequent float spells.

Table 5 presents the estimates of the coefficients for the covariates of the length of the immediately preceding spell, as well as a dummy variable that equals 1 for spells associated with the 21 industrial countries in the sample, and, for peg spells, another dummy variable that equals 1 if the base country is the United States. This table also presents the estimate of the hazard function parameter λ. The estimated λ is 0.84 and is statistically significantly less than one. This confirms the statistical robustness of the observation that both pegs and floats become more durable over time.[20]

The estimates presented in Table 5 show that the coefficient on the previous float spell is positive and significant for peg spells, and the coefficient on the previous peg spell is positive and significant for float spells. As discussed above, these coefficients imply that, for the estimated peg spell hazard, short float spells are associated with longer subsequent peg spell (since the hazard is lower) and also, from the estimated float spell hazard, that a long peg spell is associated with a shorter subsequent float spell. The results in this table also show that pegs to the United States dollar have a higher hazard rate, *ceteris paribus*, than pegs to other bases.[21]

The results presented in this section suggest a greater durability of exchange rate spells than one might expect from other research and, even when pegs break, they tend to re-form. Next, we will show that this matters because exchange rate behavior under a pegged exchange rate differs dramatically from under a float, and the number of years spent with a peg is a determinant of the volatility of the exchange rate over the sample period.

[20] The estimated λ is less than one and significant even if no covariates are included. For peg spells: 0.798 with a s.e. of 0.032 and for float spells: 0.845 with a s.e. of 0.034.

[21] The United States is the base country for 51percent of the pegs in this sample. The other base countries include France (the base for 27 percent of the pegs), South Africa (6 percent), the United Kingdom (2 percent), Belgium (1.5 percent), India (1 percent), Portugal (less than 1 percent), Malaysia (less than 1 percent), and Australia (less than 1 percent).

IV. The Exchange Rate Consequences of Pegging

Currency pegs, by definition, exhibit more bilateral exchange rate stability than floating exchange rates, but how much more? The "fear of floating" result suggests that this difference is not large. Furthermore, is stability from a bilateral peg with a base country associated with greater multilateral stability with non-base exchange rates? For a peg to matter for some outcomes, such as growth, it seems a difference across the trade weighted exchange rate, not just one bilateral rate, is important. In light of the dynamic behavior of exchange rate spells, whereby pegs break but then re-form, what is the exchange rate volatility in the future for a country pegged today? For forward looking behavior to be affected by the current exchange rate arrangement, pegs must tell us something about the future. Finally, is the volatility of the exchange rate in the wake of the breaking of a peg a function of that peg's duration? In this section we address these questions regarding the exchange rate effects of fixed exchange rates.

The qualitative result that one can associate lower bilateral volatility with *de facto* pegs is not striking, and may even be viewed as tautological, but the interesting question is the quantitative implications of pegging. This line of inquiry is especially relevant given the widely cited 2002 "Fear of Floating" paper by Calvo and Reinhart. Calvo and Reinhart focus on *de jure*, not *de facto*, pegs, and show that many countries that say they float do not really do so. But this paper has had a strong influence and its message has sometimes been extrapolated more broadly to mean that floats do not really float at all. For this reason, in this section we consider the magnitude and the characteristics of the difference in exchange rate volatility between pegs and floats, not simply whether volatility is significantly different across these two categories. We will compare the results across bilateral and multilateral indices as well as focus on the magnitude of differences and what part of the distribution drives results.

IV.1 Nonparametric estimates

As an introduction to this topic, and to provide an initial indication of how a focus on *de jure* pegs understates the extent of the volatility of *de facto* floating exchange rate spells, we note that Calvo and Reinhart (2002) often cite the benchmark of Australia and Japan as examples of idealized floats, arguing that few countries have had as unfettered an exchange rate as these two. In the case of Japan, the considerable movement of the yen over the past three decades, going from 360 yen to the dollar in the early 1970s to a rate as strong as 80 yen to the dollar in the mid-1990s, as well its 16% average range in a given year, might well be taken as *prima facie* evidence of its flexibility, notwithstanding the maintenance and use of foreign exchange reserves by the Bank of Japan. But, strikingly, the average exchange rate volatility during floating exchange rate spells for Australia, Japan, and Germany (another country viewed as a free float against the dollar) are between the 50th and 60th percentiles of volatility for nonpegs in our data set.[22] That is, these countries have fairly typical volatility during their floating spells.

The focus of this section, however, is not the difference between volatility across differently classified float spells but, rather, differences between peg and float spells. We begin this line of inquiry by considering quintile indices for both the annual and spell datasets for both bilateral and multilateral volatility.[23] The volatility measure that we use, EVOL, is the standard in the literature, the standard deviation of the monthly percentage change in the exchange rate (see for example Lane and Devereux (2003) and Rose (2000).). It need not be the case that this measure lines up exactly with our peg coding since the latter is simply based on staying within a tight range. For example, a country with a steady crawling peg may exhibit low volatility while violating our condition for a peg of staying within a 2% band over the course of a year.

The results presented in Table 6 show, however, that the lowest quintile of bilateral volatility among country / year observations consists exclusively of pegs. A small number of the observations in the second quintile represent non-pegs, and most of these are truly crawling pegs where the rate of crawl pushes them out of the annual +/-2% bands, but the percentage change is very similar from month to month.[24] Furthermore, no country / year pegs nor any peg spells exhibit the highest quintile of volatility. Thus, any differences in average volatility between pegs and floats are not simply reflecting a few outliers or some odd distributional

[22] If we drop the first year of floats, this rises to these countries being in the 60-70th percentiles.
[23] The bilateral exchange rate used is line ae from the IFS database, the month end official exchange rate, converted to be the bilateral exchange rate against the relevant base country. The multilateral rate is the trade-weighted multilateral exchange rate index. The data used is the volatility index generated in di Giovanni and Shambaugh (2006) which is based on the IMF WEO database. The data is the same as that from the IFS but it has better country coverage.
[24] Leaving these crawling pegs in with the floats should make it less likely that we see a difference between the pegs and the nonpegs.

properties, rather nearly all country / year float observations, or float spells, have higher volatility than nearly all of the respective peg observations or peg spells.

Trade, foreign investment, and import prices depend on more than one bilateral rate and, therefore, it is relevant to see if bilateral pegs affect multilateral exchange rate volatility. The statistics presented in Table 6 indicate that the consequence of pegging for multilateral volatility is much less stark than its effect on bilateral volatility.[25] Pegs make up sixty percent of the lowest multilateral volatility quintile (using annual observations), with nonpegs having a much higher presence than is the case with bilateral volatility. Correspondingly, pegs show up more in higher multilateral volatility quintiles, making up about one-third of the fourth quintile using either country / year observations or spells. High multilateral volatility outcomes, however, remain the province of floats, with pegs making up only 10% of these observations. Thus, pegging seems associated with somewhat lower multilateral volatility, and this is most pronounced in the fact that pegs are quite unlikely to exhibit the very high volatility outcomes that can sometimes plague floats.[26]

A further understanding of these results comes from a comparison of the bilateral and multilateral volatility that one cannot glean from Table 6. For example, 75% of the highest quintile bilateral volatility country / year observations and 83% of the highest quintile bilateral volatility spells are also in the respective highest annual or spell quintiles for multilateral volatility. It is also true that 75% of the highest quintile multilateral volatility observations appear in the highest bilateral volatility quintile. The converse is not the case, however, since a large number of annual observations or spells coded as floating are in the lower two quintiles of multilateral volatility. Thus, a country that does not have a peg may still find it enjoys low

[25] Some other research on this topic includes Ghosh *et al*. (2002), who find lower trade weighted exchange rate volatility for *de jure* pegs, and Canales-Kriljenko and Habermeier (2004), who provide some evidence that nominal effective exchange rates have higher volatility under *de jure* floats. Dubas, Lee, and Mark (2005) also consider effective exchange rates. Rather than focus on the multilateral impact of a peg, they use multilateral rates to classify observations as pegged or not and study the consequences for growth. There is also an older literature on exchange rate regime's impact on real effective exchange rates, with Mussa (1986) a seminal contribution. For a review of this literature, see Carrera and Vuletin (2002).

[26] Industrial countries rarely hit high levels of multilateral volatility, even when floating, making up only 10% of the overall top quintile and none of the top decile.

multilateral volatility even if its bilateral volatility with a "base" is not as low as the bilateral volatility of countries that do peg; pegging is not required for low multilateral volatility.[27]

IV.2 How much do floats float ?

The discussion above indicates that pegs and floats occupy different parts of the volatility distribution. In this section we turn to the crucial question of the magnitude of the difference in volatility across these codings.[28] We first analyze the differences in exchange rate stability between peg spells and float spells. We regress exchange rate volatility on a peg dummy and other controls, including country fixed effects (CFE) (which precludes the use of most covariates used in other studies e.g. distance, colonial relationship, common language) and time-varying covariates such as inflation and capital controls in some specifications. Country fixed effects address many concerns with endogeneity. If a particular country has no logical base or is generally unstable, it may have high volatility and rarely peg, leading to the impression that floats have high volatility. Likewise, a country which often pegs may maintain the peg because it has naturally low volatility and there is little cost to pegging. In both cases, the country fixed effects will take into account the country's relationship with the base and identification will come from strictly comparing the times it is pegged with the times it is not. The basic specification is

$$EVOL_{it} = a + a_i + bPEG_{it} + u_{it}$$

where the subscript t represents a spell in the spell regressions (Table 7) or time in the panel regressions with country / year observations (Table 8).[29]

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[27] The Appendix shows these results across classifications. The general pattern is similar with differences quite logical given classification differences. For bilateral volatility, there are pegs in the highest volatility quintiles if a coding allows devaluations to still be considered pegged, and the *de jure* classification give weaker results given its tendency to mix up actual pegs and nonpegs.

[28] A significant difference between our work and that which studies bilateral volatility overall is our focus on volatility against the base country. Lane and Devereux (2003) is a leading example of tests of bilateral volatility across many country pairs. In their work, the goal is to explain why countries may try to lower exchange rate volatility, rather than the impact of exchange rate regimes as we study here. Many of their variables (such as distance or debt burden) are time invariant across countries or close to being so. As such, our use of country fixed effects eliminates most comparisons between the works. They find that bilateral external debt is a significant explanatory variable in explaining volatility for developing countries, and that general optimal currency variables (trade, correlation of shocks, country size) are more important for industrial countries.

[29] Standard errors are clustered at the country level. This allows for an unstructured autocovariance matrix that can correct for heteroskedasticity and autocorrelation issues in the data. The dependent variable EVOL is persistent, but nowhere near unit root levels (autocorrelation coefficients range near .3) suggesting this correction is sufficient to handle time series issues relating to the use of panel data. See Bertrand *et al.* (2004) for discussion.

We focus on the difference in conditional means across the two groups, as represented by the coefficient *b*. We pay particular attention to the effect of outliers since the observations are quite skewed because a limited number of spells and annual observations show very high volatility. For this reason, we cannot suggest that a typical country will see a treatment effect based on the size of the coefficient. Also, we cannot claim that a choice to peg is the only policy in place or is even a feasible choice. Clearly some countries may be unable to peg due to policy weakness or chaos and, therefore, in some instances a float may represent a combination of a choice not to peg and an inability to peg.

Table 7 includes regressions in which the unit of observation is the average annual volatility during a peg spell or a float spell. In the full sample, pegs on average show an annual volatility 16 percentage points lower than nonpegs and highly statistically significant. This coefficient, along with the estimated value of *a*, indicates that pegs have an average conditional volatility between 0 and 1% and floats have an average conditional volatility of about 16%, which yields a full sample mean volatility of about 8%.[30] The standard deviation of the full sample is quite large (roughly 70%) largely due to the presence of outliers with very high volatility.

To put the numbers in context, if we assume half the monthly exchange rate changes are at one extreme and half are at the other extreme, the estimated intercept and slope coefficients suggest that monthly changes in the -1% to 1% range for pegged observations and the large range of about -16% to 16% for floating exchange rates. In fact, the ranges consistent with these estimated coefficients could be larger if some monthly changes are not at the extreme values.[31] Two examples are instructive in this regard. The volatility of the exchange rate of Paraguay during its 1984-86 float is quite close to the average volatility for all floats. During this period, Paraguay failed in its efforts to peg and had repeated devaluations. The monthly

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[30] The regression has country fixed effects, but the average country fixed effect is close to zero meaning the sample averages reported at the bottom of the table can be recovered from adding the coefficients despite the presence of country fixed effects. This happens because the technique used ("areg" in stata) will generate a constant which makes the prediction calculated at the means of the independent variables equal to the mean of the dependent variable. The fact that there are an equal number of pegs and floats is what then makes this dummy equal to the population mean.

[31] That is, if one takes the standard deviation of 6 months where the percentage change is 16% and six months where it is -16%, the result is roughly .16. On the other hand, if not all the observations are at the boundaries, the range could be larger. That is, .16 is also the standard deviation if 3 months are 21%, 3 months are -21%, 3 months are 7% and 3 months are -7%. Thus, the volatility measure does not directly translate into range, but gives us a sense for the size of the range.

exchange rate changes ranged from 0% to 72% during this period, with four months during which the change in the exchange rate exceeded 25%. Combined with the many months during which the exchange rate did not change, the average value for EVOL for Paraguay during these two years was 0.16. Chile's 1973-79 float provides another illustration. For example, in 1975, a typical year for Chile during this period, EVOL = 0.11, and the changes in the exchange rate ranged from 0% to 45% with most falling between 7% and 19%.

While the episodes provide us with volatility values near the full sample average, a sample without outliers gives us a better picture of a typical float. In what follows we consider samples that drop the spells with the top 1% values of volatility. As seen in column 2 of Table 7, the mean and standard deviation of this sample drops considerably, even though we have only eliminated 1% of the observations. In this case, the coefficient on PEG is less than half as big as in the full sample regression (though it remains statistically significant) and its (absolute) value of 0.07 is now nearly equal to the standard deviation of the dependent variable. That is, once outliers are removed, pegs have a roughly one standard deviation lower volatility than floats. Also, once outliers are removed, the R^2 jumps up to .31 with only the PEG and CFE in the regression, despite the fact that this specification, using the dummy PEG, does not allow us to distinguish across differences in volatility within the float group. The coefficients in this regression show that pegs have roughly zero volatility and nonpegs nearly 7%, again suggesting at minimum a range of -7% to 7%. Many floats with an annual volatility of 7% show a range in most months of -3% to 5% with one month in the mid 20% range (e.g. Spain 1977, New Zealand 1984, Fiji 1998).

The remaining columns of the bilateral panel of Table 7 show that the estimated quantitative effect presented in Column 2 is robust to a number of changes in the regression specification or sample. The inclusion of country fixed effects makes little difference (Column 3). Dropping the first year of a float spell, so that a potential crisis year is not included in the overall subsequent float spell, has some effect (with the absolute value of the coefficient falling to 0.045), but the difference between pegs and floats is still highly significant (Column 4). Finally, there is only a small difference between the full sample and a sample that includes only post-1979 observations (Column 5).[32] The message from all of these results is that, while there may be fear of floating behavior, there is a clear difference in bilateral exchange rate volatility between peg spells and float spells.[33]

The estimates in the two columns in the multilateral panel of Table 7 allows us to return to the question of whether pegging lowers multilateral volatility, a topic first addressed in Table 6. The results in that table indicated a difference for multilateral volatility across peg and float observations, though the distinction was not as strong as was the case with bilateral volatility. This estimated presented in Column 6 of Table 7 are consistent with this result. The coefficient on the peg dummy variable in the multilateral regression is about one-third the value of the coefficient in the respective bilateral regression, but it remains statistically significant. As with the estimate on the peg dummy in the bilateral volatility (in column 2) the estimated gap between pegs and floats (of about 2%) is roughly 80% of the standard deviation. Compared to the mean, though, the impact on bilateral volatility is much larger, twice the mean for bilateral, one times the mean for multilateral. Moreover, the gap in volatility is simply smaller for the trade weighted volatility. Whereas the gap between pegs and nonpegs is 7% in bilateral rates for floats and zero for pegs, the multilateral volatility gap is only 2% with pegs showing volatility of 1.2% and floats 3.2% (the medians are even closer). The specification in Column 7 includes bilateral volatility with the base to see if the lower multilateral volatility is solely due to this lower bilateral volatility. The significant coefficient on the peg dummy variable suggests that this is not the case. Thus, while pegging can bring some measure of stability to the multilateral exchange rate, the effect is not dramatic.

The estimates in Table 8 are based on regressions in which the unit of observation is a country / year data point rather than a peg spell or a float spell. These data allow us to include year effects (to take into account that some years may have seen broad volatility across the globe) and annual covariates that align directly to our data (as opposed to including averages over the course of long spells). This analysis also allows for estimating whether the first year of a floating spell is marked by an unusually high level of volatility; thus, the estimates on the peg dummy in specifications that include a first-year-of-float dummy are interpreted as the

[32] This column is used as a comparison with results on multilateral data which are only available since 1979.
[33] Results across classifications are shown in the appendix. Of particular interest is the fact that, consistent with Calvo and Reinhart, *de jure* pegs have a statistically insignificant effect on volatility.

effect of a peg as compared to a second or subsequent year of a float. Following the sample selected for most of the estimates in Table 7, all of the estimates in Table 8 are based on samples that drop the 1% most volatile country / year observations. Once again, we include country fixed effects. Combined with year fixed effects, the CFE allow us to isolate the differences in volatility across pegs and nonpegs controlling for differences in country behavior and differences in world volatility from year to year.

The estimates in the first column of Table 8 indicate that annual volatility is 5 percentage points lower for peg country / year observations than for float country / year observations. The estimate in the second column shows that annual volatility for pegs is 4.2 percentage points lower for pegs than for non-first year floats, and volatility is 2.3 percentage points higher during the first year of a float than during subsequent years. The median for bilateral float volatility is close to that of Japan in 1984 (2% volatility) when its monthly percentage changes ranged from -4% to 3% and the yen/dollar rate, beginning the year at ¥235 / dollar, went as low (in the end-of-month data) as ¥220 / dollar and as high as ¥250 / dollar. The mean for non first year float floats was 3.8% which is similar to Germany in 1981 when monthly changes ranged from 8% to -4% and the DM ranged from DM 2.1 / dollar to DM 2.46 / dollar. These were not crisis driven years, but represent the average volatility of floats, considerably different than the pegged countries staying in the 2% bands where behavior is usually close to 1% up or down a month. It is important to note that these "classic" floats, as mentioned above, are near the middle of the distribution. They are not unusual floats in terms of the magnitude of volatility. They are fair descriptions of the experiences of floats. When adding covariates, inflation is positively correlated with volatility as is having capital controls, but in both cases, a peg is substantially more stable than a non-peg with little change to the magnitude of the PEG coefficient.[34]

Results for multilateral volatility using country / year observations are similar to those obtained, in Table 7, using spell data, with a smaller but significant effect of pegging. However, there is no difference between pegs and floats when we include bilateral volatility and control for the first year of floating (Column 7). Column 8 includes trade share with base

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[34] Results hold across industrial countries and non-industrial countries with means and coefficients smaller for industrial countries and first year floats not associated with higher volatility for rich countries

and the interaction with pegging. If multilateral volatility were only lowered through large trade shares with the base country and the subsequent impact on the weighted average, we would expect this term to dominate, yet the peg variable has roughly its typical magnitude when these additional terms are included.[35] From a policy perspective, it does not matter whether pegs have more stable multilateral volatility due to more stable bilateral rates (and a large trade share with the base) or because of high cross-correlation of major exchange rates meaning stabilization against one stabilizes to some extent against many. The important point is the multilateral rate is more stable, just not dramatically so.[36]

IV.3 Persistent Effects of Pegging

As mentioned above, an important question concerning pegging, one that has a bearing on its consequences for forward-looking behavior, is whether a peg today suggests lower volatility in future years. This question addresses issues raised by both the mirage of fixed exchange rates perspective and the fear of floating view; if pegs do not last, or if they are not very different from floats, then we would not expect a current peg to imply lower volatility going forward.

We investigate this question by running regressions that are similar to those in Table 8 but for the inclusion of successive lags of the peg dummy variable, rather than its contemporaneous value. The estimates from this analysis are presented in Figures 4 and 5. The numbers along the horizontal axis in these figures represents the number of years that the peg variable is lagged in a regression of country / year volatility on a peg dummy. Thus, the point associated with the "0" value in each of these figures represents the contemporaneous effect of a peg on bilateral volatility (Figure 4) or multilateral volatility (Figure 5), that is, the coefficient reported in Column 1 or Column 4 of Table 8, respectively. The associated

[35] Again, see Appendix for results across classifications. Including the devaluations in the peg sample now moves a number of the higher volatility instances out of first year floats and into the peg category. This weakens the differences across the regimes, but they are still present. Using the *de jure* coding, there is no statistically significant difference across pegs and nonpegs.

[36] Once again, results hold across industrial countries and non-industrial countries with means and coefficients smaller for industrial countries and again first year floats not associated with higher volatility for rich countries. The means are small enough for rich countries that while statistically significant; it is simply quite rare for rich countries to demonstrate high enough volatility to be problematic. This may help explain why in work such as Aghion *et al*. (2006), countries with highly developed financial systems (rich countries) are less impacted by pegs. Even when not pegging, they simply do not experience too much multilateral volatility (the channel in Aghion *et al*. through which pegging affects growth).

horizontal lines around these points represent a confidence interval equal to two times the standard error.[37] The other points and lines represent point estimates and standard errors for 1, 2, 3, 4 and 5 lags of the peg variable. The regressions are estimated using the lagged peg dummy variable irrespective of the subsequent history of the peg spell. As these figures indicate, 1 and 2 year lags of pegs significantly lower bilateral volatility, while a 1 year lagged peg significantly affects multilateral volatility. Earlier lags than these, however, have no significant effect on volatility. These results are not simply a function of an increased likelihood that a peg breaks over time since, as we have seen, there is a significant probability that a broken peg will re-form.[38] In fact, re-estimating these results without the first year of pegs (which eliminates one-year pegs) substantially increases the persistent effect of a peg on subsequent volatility. These results suggest why, for example, Klein and Shambaugh (2006) find an increase in bilateral trade from pegging even when controlling for contemporaneous volatility since a peg today implies lower exchange rate volatility in the future.[39]

IV.4 Peg Duration as a Determinant of Breakup Volatility

We conclude this section with an investigation of the behavior of the exchange rate in the immediate wake of the end of a peg spell. The estimates in Table 8 show that both bilateral and multilateral exchange rate volatility are significantly higher in the first year of a float spell than at other times during that spell. But, as we will show, extremely high volatility outcomes do not occur more often in the wake of a peg than they do in a year that follows a float. However, among the set of extremely high volatility country / year observations that do occur

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[37] The top 1% outliers are excluded as in column 1 of table 8. We do not include the first year float variable. By controlling for these separately, when we look at lagged pegs, we would eliminate some of the largest volatility outcomes for previous pegs and thus artificially increase the difference between lagged pegs and floats.

[38] We eliminate new pegs from the regression, that is, countries that floated at time zero but begin to peg subsequently. Thus the result is a comparison of pegging at time zero to countries that float throughout. The idea is to show not whether pegs at time zero have lower volatility than floats at time zero – many of the floats will start to peg – but rather to show whether pegs at time zero have lower volatility than floating countries in general over time.

[39] Ghosh *et al*. (2002) also examined volatility over time and also found lower volatility for pegs, but they restricted themselves to regimes that stayed pegged or stayed floating, eliminating the important role of pegs breaking or repegging.

immediately in the wake of a peg, there is a disproportionately high number of observations that arise in the wake of a long peg as opposed to a short peg.[40]

The statistics presented in Table 9 illustrate these points. Panel A of this table divides the 37 top 1% volatility outcomes and the 187 top 5% volatility outcomes according to whether the preceding year was one in which the exchange rate was pegged or whether it floated. There is a near even division between these categories, especially when considering the proportions relative to the prevalence of pegged and floating country / year observations. The 37 top 1% volatility outcomes are divided between 21 that followed a float year (which is 1.1% of the float observations) and 16 that followed a peg (which is 0.9% of the peg observations). Similarly, 118 of the 187 top 5% volatility observations followed a float (representing 5.9% of the float observations) while the remaining 69 followed a peg (4.0% of the peg observations). Thus, an extremely high volatility outcome is not significantly more likely to follow a peg than it is to follow a year in which the exchange rate was not pegged.

The statistics presented in Panel B of Table 9 allows us to consider whether those high volatility outcomes that followed a peg spell came after the first year of that spell, the second through fifth year of that spell, or after later years of that spell, regardless of whether these dates in the peg spell actually represented the terminal year of the peg. If there was no difference across the tenure of the peg spell then one would expect to see entries of 0.9%, 0.9%, and 0.9% in the column for the top 1% volatility observations, and 4.0%, 4.0% and 4.0% in the column for the top 5% volatility observations since these are the respective values of the percentage of observations that follow peg spells. In fact, the numbers in these columns are quite close to this. There is a slightly higher value for the percentage of extremely high (top 1% and top 5%) volatility observations that follow in the wake of a one-year float (1.5% and 4.6%, respectively), but the differences are not especially notable. This is counter to the Friedman (1953) view that smoothly floating exchange rates would generate less volatility than the large devaluations within adjustable peg regimes. Instead, we see high volatility outcomes following a year in which a country is floating as often as when it was pegging.[41]

[40] Asici, Ivanova and Wyplosz (2005), in their study of the consequences of ending a peg, show that the likelihood of a disorderly exit from a peg spell increases as the duration of that spell increases.

[41] Friedman (1953) argued that given underlying instability in an economy, "freezing of exchange rates cures none of the underlying difficulties and only makes adjustment to them more painful," while floating allows "continuous

A striking difference across duration does arise, however, when we condition on the fact that an observation occurs immediately after a peg breaks rather than on just whether the preceding year was one in which the exchange rate was pegged. This is shown in Panel C of Table 9. The statistics in this part of the table show that 8.8% of the years immediately following the breakup of a long (i.e. longer than 5 year) peg are in the set of the top 1% volatility observations, and more than half (54.4%) of these are in the set of the top 5% volatility observations. The comparable numbers for 1 year pegs and for pegs that last between 2 and 5 years are much smaller.

Thus, the message from Table 9 is that high volatility outcomes are no more likely to follow a year in which a currency was pegged than a year in which a currency floats. Also, the number of years that a peg has been ongoing is not especially informative for predicting whether, in the next year, there will be an extremely high volatility outcome. But if we know that a peg ends in after a particular number of years, we can predict that volatility is higher if the peg has lasted longer. The distinction between the second and the third statements reflects the fact that there is a decreasing hazard for pegs, that is, that the longer the peg lasts, the less likely that it will break in a subsequent year; but if it does break, it does so in a more spectacular fashion if it is older than if it is younger.

V. Conclusion

There has been a flurry of new work showing substantial effects of the exchange rate regime on trade and a variety of macroeconomic outcomes. The results of this research seem inconsistent with widespread perception that pegs do not really peg and floats do not really float, that is, that exchange rate regimes do not matter for the exchange rate, let alone other outcomes. This paper provides a new set of empirical regularities regarding the relevance of exchange rate regimes for exchange rate related outcomes which, in an important way, is a prerequisite for understanding how these regimes affect any other outcomes.

We find that, despite the fact that many peg spells break soon after they begin, a fair number of last beyond five years. These longer spells are overrepresented in an annual cross

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sensitivity" to changes in real conditions and hence smoothes adjustment. See also the Appendix which shows our results using the Shambaugh (2004) classification which includes discrete devaluations within peg spells.

section, as compared to short spells. In addition, once a peg lasts longer that a year or two, the probability that it will continue for one more year, conditional on lasting up until that year, begins to rise dramatically. The implication of this is that the length of a particular peg is more important than the less specific knowledge of average peg duration for agents considering actions that are affected by the maintenance of the peg. We also show that float spells have properties similar to those of peg spells, especially with respect to the prevalence of many short duration spells. An implication of this is that many countries re-form pegs quickly after experiencing the end of a peg spell.

We also demonstrate important quantitative differences in exchange rate volatility across exchange rate regimes. These results are obtained even when controlling for country and year fixed effects, and for inflation behavior and capital controls. The difference also persists into the future, and we find that a peg today predicts lower volatility for a number of years out. We also find that bilateral pegging lowers multilateral exchange rate volatility, although this comes from the avoidance of high volatility outcomes rather than through an effect across the wide distribution of pegs and floats. Finally, we show that extremely high volatility outcomes are not more likely to follow a year with a peg than a year with a float, although there are a disproportionate number of high volatility outcomes in the immediate wake of long duration pegs as compared to shorter duration pegs.

There are a number of policy implications one could draw from these results. Pegging does promote greater exchange rate stability, but a newly initiated peg may not last and the first year after a peg has a significantly higher rate of volatility than other years during a float spell. In addition, a peg may not stabilize other bilateral exchange rates unless it prevents high volatility; but other stable economic policies or strong institutional structures are, perhaps, better positioned to do this. But once a peg has lasted for a few years, its likelihood of enduring increases and, even if it breaks, it is likely to re-form quickly.

The results presented in this paper help resolve the puzzle of why recent empirical work has found the exchange rate regime can matter in a variety of contexts when the perception is that fixed exchange rates are a mirage and governments fear floating currencies. These results can also provide some guide for theory that focuses on exchange rate stabilization by highlighting the distinction between the effects of fixed exchange rates for multilateral and bilateral exchange rates. For example, current debate in the New Open Economy Macroeconomics literature revolves around the appropriate exchange rate regime choice, often focusing on the ability of pegs to stabilize prices and consumption across countries. However, in these two country models, multilateral and bilateral volatility are the same. Our results show that the multilateral rate will be stabilized, but cannot be stabilized perfectly. The peg has a weaker effect on the multilateral rate and many pegs still have fairly volatile multilateral rates. Thus, we need to take care when using tractable two-country models to recall when results involving a peg require the peg to stabilize the bilateral rate or the multilateral rate.

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Table 1: Basic Statistics on Peg Spells and Float Spells													
	No. of Annual Obs.	No. of C'ntry	% peg obs.	No. of peg spells	Peg Spell / C. Av'g	Peg Median	Peg Mean	Peg s.d.	No. of float spells	Float Spells / Country Av'g.	Float Median	Float Mean	Float s.d.
Full Sample	3924	125	47.53	398	3.18	2	4.67	6.42	395	3.16	2	5.21	6.69
Industrial Countries	671	21	39.34	56	2.67	2	4.63	6.81	61	2.90	3	6.67	8.88
Developing Countries	3253	104	49.22	342	3.29	2	4.68	6.37	334	3.21	2	4.95	6.18
Sample includes countries for which population > 400,000, USA not in sample, Industrial countries are those with IFS code < 200 but not Turkey nor South Africa, Developing Countries are those with IFS code > 200 and Turkey and South Africa, Currency Unions not included in sample.													

Table 2: Peg Spell and Float Spell Survival Statistics (Unconditional), by Spell						
	Peg Spells			Float Spells		
	All Countries	Industrial	Developing	All Countries	Industrial	Developing
At least 2 years	55.89%	56.36%	55.81%	64.38%	72.88%	62.75%
At least 3 years	40.27%	32.73%	41.61%	48.49%	54.23%	47.39%
At least 4 years	34.52%	32.73%	34.84%	38.36%	42.37%	37.58%
At least 5 years	30.14%	32.73%	29.68%	33.97%	37.29%	33.33%
> 5 years	27.67%	32.73%	26.78%	30.41%	32.20%	30.07%
No. of spells	365	55	310	365	59	306
Sample includes countries for which population > 400,000, USA not in sample, Industrial countries are those with IFS code < 200 but not Turkey nor South Africa, Developing Countries are those with IFS code > 200 and Turkey and South Africa, Currency Unions not included in sample.						

Table 3: Probability of Switching Spell State Next Year, and of Remaining in Same Spell 1, 3, or 5 years in Future, Annual Data							
	All Countries	Industrial	Developing		All Countries	Industrial	Developing
Float(t)|Peg(t-1)	18.43%	17.13%	18.65%	Peg(t)|Float(t-1)	16.76%	13.28%	17.63%
Peg(t)|Peg(t-1)	81.57%	82.87%	81.35%	Float(t)|Float(t-1)	83.24%	86.72%	82.38%
Peg(t)|Peg(t-3)	65.75%	71.11%	64.92%	Float(t)|Float(t-3)	65.08%	70.23%	63.76%
Peg(t)|Peg(t-5)	55.29%	61.69%	54.34%	Float(t)|Float(t-5)	54.07%	60.82%	52.28%
Years in Peg Spell or in Float Spells. Sample includes countries for which population > 400,000, USA not in sample, Industrial countries are those with IFS code < 200 but not Turkey nor South Africa, Developing Countries are those with IFS code > 200 and Turkey and South Africa, Currency Unions not included in sample. Sample up through 2003 for next year conditional probabilities, up through 2001 for 3 years hence conditional probabilities, and 1999 for 5 years hence conditional probabilities. Countries must remain in same state continuously; that is, Peg(t)|Peg(t-3) suggests staying pegged in (t-3), (t-2), t(-1) and (t). Countries that flip in and out of a state are considered to have broken the state.							

Table 4: Conditional Survival Rates by Spell **Probability (in percent) of Surviving to year *t*, given still pegged at year *t-1* (initial year of peg or float is Year 1)**						
	Peg Spells			Float Spells		
	All Countries	Industrial	Developing	All Countries	Industrial	Developing
Year 2	55.90%	56.14%	55.86%	65.81%	73.77%	64.39%
Year 3	70.70%	58.06%	72.83%	75.00%	72.73%	75.48%
Year 4	86.09%	100.00%	84.21%	79.89%	78.13%	80.26%
Year 5	87.69%	100.00%	85.71%	88.97%	88.00%	89.17%
Year 6	91.82%	100.00%	90.22%	89.52%	86.36%	90.20%

Years from Beginning of Peg Spell or Beginning of Float Spell.
Sample includes countries for which population > 400,000, USA not in sample, Industrial countries are those with IFS code < 200 but not Turkey nor South Africa, Developing Countries are those with IFS code > 200 and Turkey and South Africa, Currency Unions not included in sample.

Table 5: Estimates of Weibull Conditional Hazard Functions				
	Peg Spells		Float Spells	
	Coefficient	Standard Error	Coefficient	Standard Error
Previous Spell	0.033**	0.011	0.047**	0.014
Industrial Country	0.256	0.190	0.211	0.175
US Base Dummy	0.650**	0.135		
λ	0.844**	0.034	0.912*	0.041
Number of Spells	397		332	

* significant at 95% level of confidence, ** at the 99% level for null hypothesis of $\beta = 0$ for covariates and null hypothesis of $\lambda = 1$ for baseline hazard function parameter.

Table 6: Volatility Quintiles								
	Bilateral Volatility				Multilateral Volatility			
	Annual		Spell		Annual		Spell	
	Range	%peg	Range	%peg	Range	%peg	Range	%peg
1	.000 – .000	100%	.000 - .001	99%	.000 - .007	61%	.002 - .008	76%
2	.000 - .004	87%	.001 - .007	92%	.007 - .011	59%	.008 - .011	73%
3	.004 - .013	44%	.007 - .015	58%	.011 - .015	53%	.011 - .016	56%
4	.013 - .027	1%	.017 - .031	3%	.015 - .025	34%	.016 - .027	37%
5	.027 – 40.0	0%	.031 - 15.0	0%	.025 – 1.8	11%	.027 - .582	13%

This table shows the % of observations (annual and spell) that are pegged when the data is divided into quintiles by volatility.

Table 7 Exchange Rate Volatility in Spells							
	1	2	3	4	5	6	7
dep variable	bilateral volatility	bilateral volatility	bilateral volatility	bilateral volatility no first year	bilateral volatility post 79	multilateral	multilateral
Sample	full	drop 1%	drop 1%	drop 1%	drop 1%	drop 1%	drop 1%
FE	CFE	CFE	none	CFE	CFE	CFE	CFE
Peg	-0.158	-0.068	-0.065	-0.045	-0.081	-0.022	-0.008
	0.051**	0.008**	0.007**	0.006**	0.010**	0.003**	0.001**
spell_bilateral volatility							0.209
							0.029**
Constant	0.161	0.071	0.069	0.049	0.082	0.033	0.018
	0.026**	0.004**	0.007**	0.004**	0.005**	0.001**	0.002**
Observations	792	785	785	649	616	590	590
R-squared	0.17	0.31	0.14	0.3	0.35	0.45	0.74
Smpl mean	.082	.036	.036	.021	.041	.022	.022
Smpl sd	.689	.086	.086	.052	.097	.026	.026
Smpl med	.010	.010	.010	.008	.010	.013	.013
Peg mean	.004	.004	.004	.004	.004	.012	.012
Peg sd	.004	.004	.004	.004	.004	.009	.009
Peg med	.003	.003	.003	.003	.003	.010	.010
Nonpeg mean	.161	.069	.069	.048	.079	.032	.032
Nonpeg sd	.971	.112	.112	.075	.128	.033	.033
Nonpeg med	.025	.024	.024	.023	.023	.019	.019

Note: standard errors clustered at the country level, CFE means country fixed effects, drop 1% drops the 1% largest volatility observations to reduce the impact of outliers.
* represents statistically significantly different from zero at the 95% confidence level, ** at the 99% level.

Table 8 Exchange Rate Volatility in Annual Panel data

	1	2	3	4	5	6	7	8
Dependent vbl	bilateral	bilateral	bilateral	multilateral	multilateral	multilateral	multilateral	multilateral
Sample	Drop 1%	Drop 1%	Drop 1%	Drop 1%	Drop 1%	Drop 1%	Drop 1%	Drop 1%
FE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE
Peg	-0.049	-0.042	-0.037	-0.016	-0.0140	-0.014	-0.001	-0.017
	0.005**	0.004**	0.003**	0.002**	0.002**	0.002**	0.001	0.003**
1st year float		0.024	0.029		0.009	0.010	-0.002	0.011
		0.006**	0.007**		0.002**	0.003**	0.002	0.003**
inflation			0.007			0.003		
			0.001**			0.000**		
Trade w/ base								-0.007
								0.011
Peg* Trade w/ base								0.009
								0.010
Bilateral volatility							0.361	
							0.021**	
Capital controls			0.011			0.004		
			0.004*			0.002		
Constant	0.035	0.032	0.027	0.025	0.023	0.015	0.012	0.026
	0.002**	0.002**	0.005**	0.002**	0.001**	0.002**	0.001**	0.003**
Observations	3816	3816	3572	3008	3008	2869	3001	2472
R-squared	0.25	0.26	0.34	0.29	0.3	0.34	0.7	0.31
Smpl mean	.023	.023	.024	.021	.021	.021	.020	.021
Smpl sd	.056	.056	.056	.025	.025	.025	.025	.026
Smpl med	.008	.008	.009	.012	.012	.012	.012	.013
Peg mean	.002	.002	.002	.012	.012	.012	.012	.012
Peg sd	.003	.003	.003	.011	.011	.011	.011	.011
Peg med	.000	.000	.000	.010	.010	.010	.010	.010
Nonpeg mean	.042	.042	.043	.027	.027	.027	.027	.028
Nonpeg sd	.072	.072	.072	.030	.030	.030	.030	.031
Nonpeg med	.020	.020	.020	.017	.017	.017	.017	.017
* significant at 5%; ** significant at 1%								

Notes: Standard Errors clustered at the country level. CFE means country fixed effects, YFE means year fixed effects, drop 1% drops the 1% largest volatility observations to reduce the impact of outliers. Trade with base is the percentage of trade with the base country. Col 7 also drops 1% evol outliers (an additional 7 observations)

* represents statistically significantly different from zero at the 95% confidence level, ** at the 99% level.

Table 9: Exchange Rate Regime Status in Year Prior to High Volatility outcomes

	observations	in top 1%	Percent	in top 5%	Percent
PANEL A					
Full sample	3738	37	1.0%	187	5.0%
Nonpeg in previous year	1998	21	1.1%	118	5.9%
Peg	1740	16	0.9%	69	4.0%
PANEL B					
Pegged in previous year with peg representing:					
1st year of pegging	388	6	1.5%	18	4.6%
2-5 years of pegging	575	5	0.9%	20	3.5%
>5 years of pegging	777	5	0.6%	31	4.0%
PANEL C					
Final year of peg	342	16	4.7%	69	20.2%
1 year peg spell	173	6	3.5%	18	10.4%
2-5 year peg spell	112	5	4.5%	20	17.9%
>5 year peg spell	57	5	8.8%	31	54.4%

Note: Column 1 shows the total number of observations following a given exchange rate regime status. Column 2 shows how many of those observations are in the top 1% of the volatility distribution.

Figure 1

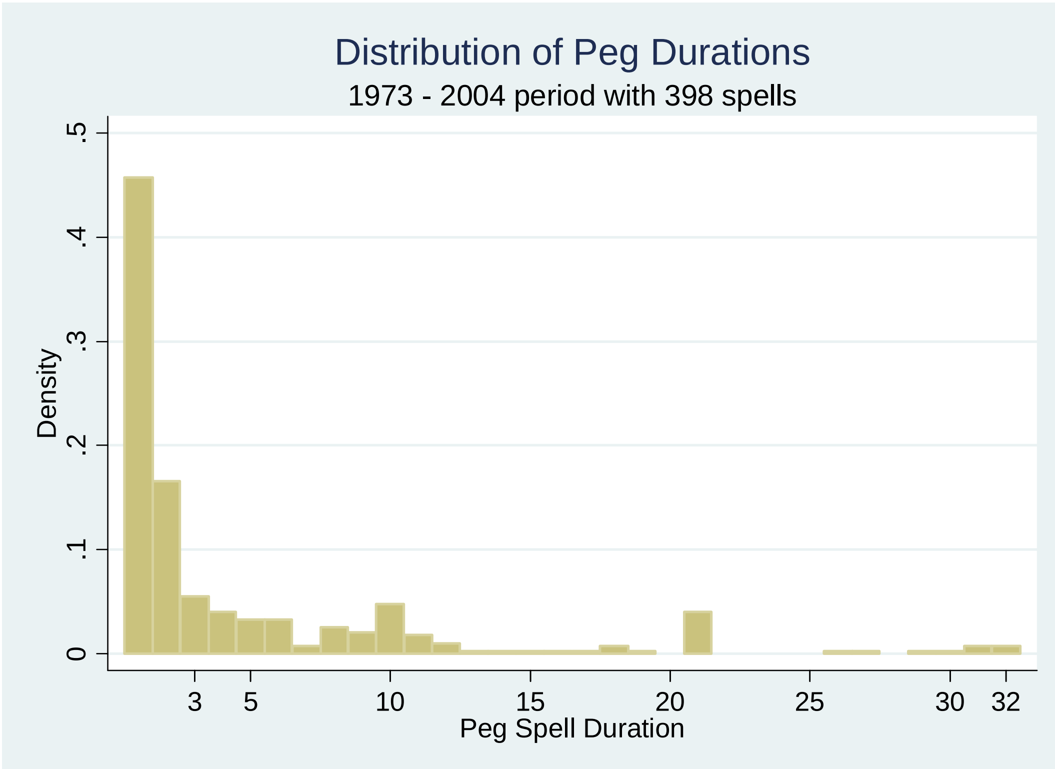


Figure 2

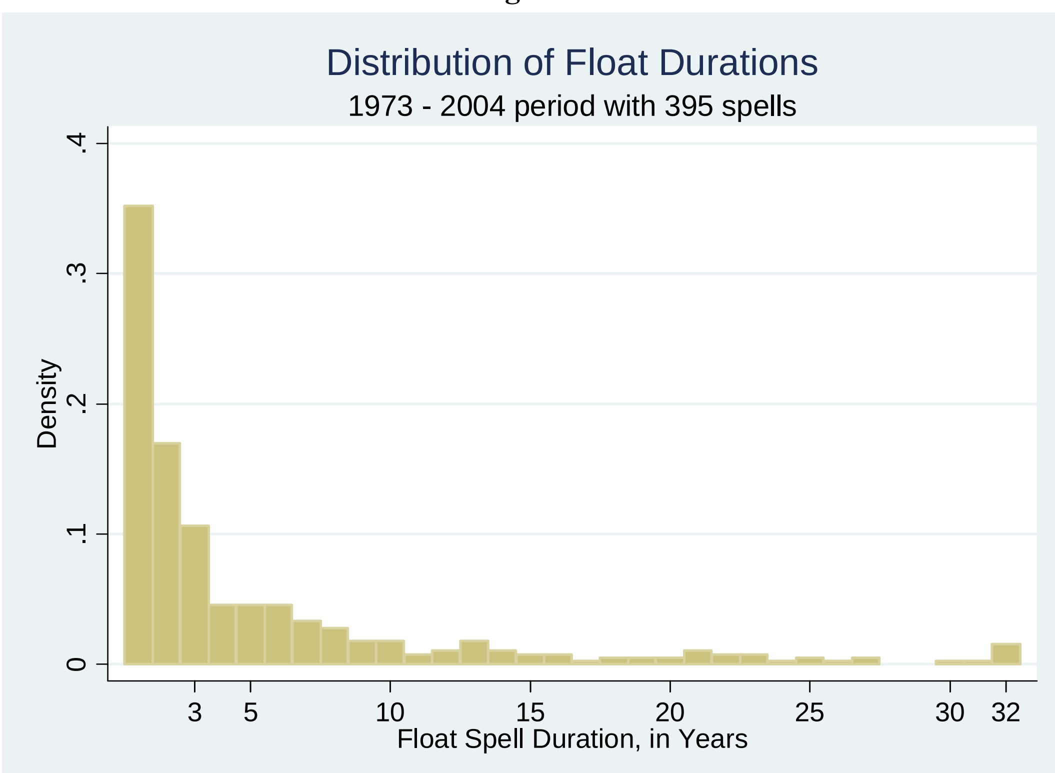


Figure 3 Long-lived pegs

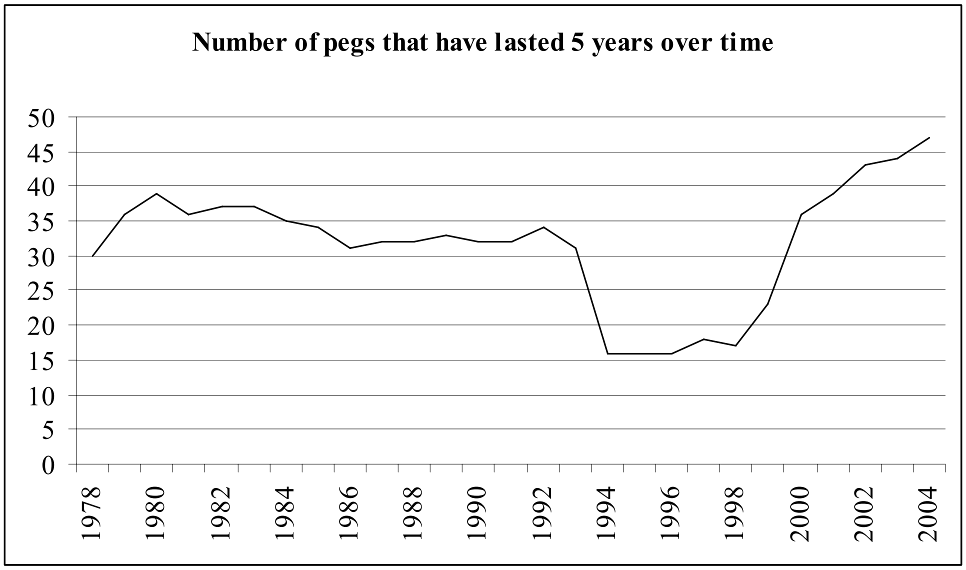
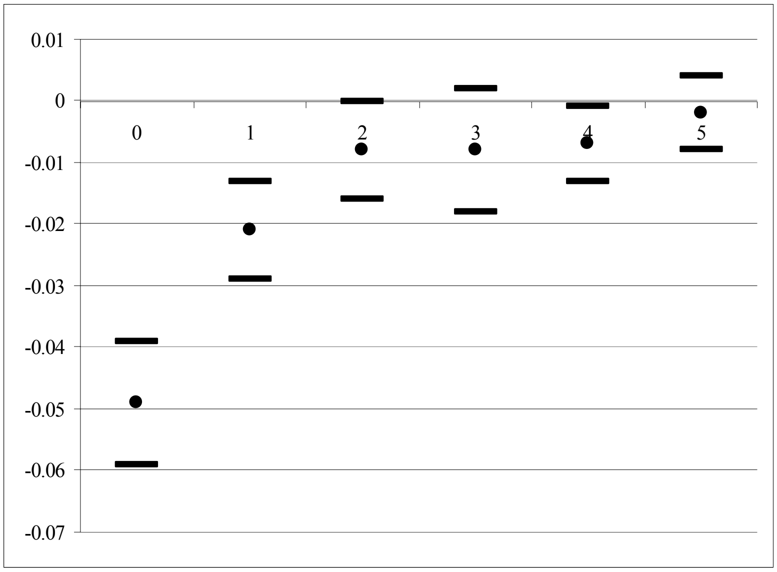


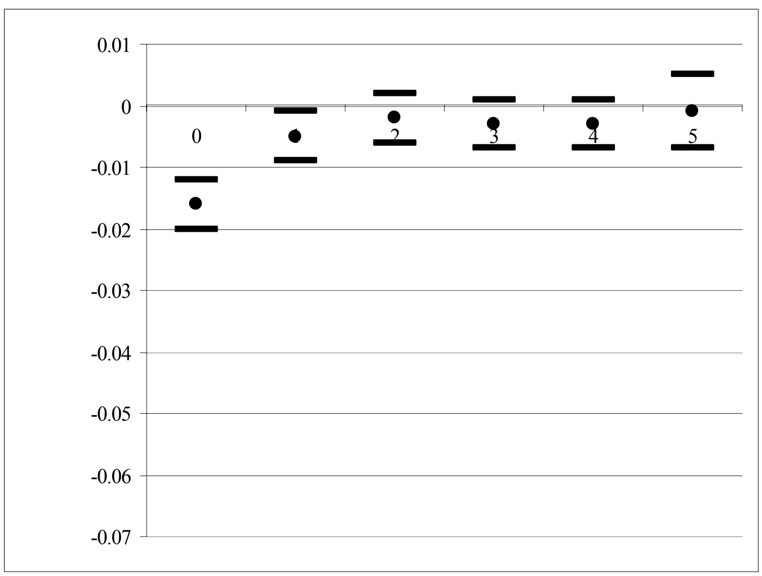
Figure shows the number of countries in a peg that has lasted for more than 5 years at that moment. The panel is roughly balanced with between 122 and 125 countries in the sample. Currency unions are eliminated from sample with the exception of spells that began as pegs and converted to currency unions (some EMU observations).

Figure 4: Bilateral Exchange rate volatility over time



Note: time zero represents the contemporaneous coefficient of exchange rate volatility on pegging. Time 1 represents the coefficient on a lagged peg and so on. Thus the point at "2" represents the difference in volatility for a country that was pegged two years ago (whether it has remained pegged or not). Country and year fixed effects are included. The dark lines represent 2 times standard error bands where standard errors are clustered on country. To insure that the comparison is with nonpegged observations, new pegs that are not repegs are excluded.

Figure 5: Multilateral Exchange rate volatility over time



Note: time zero represents the contemporaneous coefficient of exchange rate volatility on pegging. Time 1 represents the coefficient on a lagged peg and so on. Thus the point at "2" represents the difference in volatility for a country that was pegged two years ago (whether it has remained pegged or not). Country and year fixed effects are included. The dark lines represent 2 times standard error bands where standard errors are clustered on country. To insure that the comparison is with nonpegged observations, new pegs that are not repegs are excluded.

Appendix:
Comparing Classification Schemes

A1. Different Classifications Schemes:

As mentioned in the text, we employ a classification scheme in this paper in which a peg spell is defined as a situation where, over the course of a calendar year, the month-end bilateral exchange rate with the base country stays within a 2% band. This classification scheme, which we call KS in this appendix, is similar in spirit to that used by Obstfeld and Rogoff (1995), although that paper did not provide an extensive classification of all countries as pegged or not pegged. In this appendix we compare this classification scheme to those used by Shambaugh (2004) (hereafter "JS"), Reinhart Rogoff (2004) (hereafter RR), Levy-Yeyati and Sturzenegger (2003) (hereafter LYS) and the declared or *de jure* regimes (hereafter "DJ") (Calvo and Reinhart (2004) focus on *de jure* regimes).

The KS classification scheme is most similar to the JS classification scheme, which was used to test the policy trilemma. The two principal differences between the KS and JS classification schemes are that the latter excludes one year pegs and also the latter allows a peg spell to continue if there is a one-time discrete devaluation during a year. Thus, comparisons between the KS and JS classification schemes show the effect of these two conditions since, but for the treatment of one year pegs and discrete devaluations, they are quite similar.

The RR classification scheme was developed to study the evolution of policy regimes. It focuses on the conditional probability of the exchange rate staying within a given range over a rolling five year window, and it also uses information about parallel (dual market) exchange rates in determining whether a peg continues from one year to the next. This classification scheme allows devaluations to occur within a peg spell so, consequently, it results in fewer peg spells and peg spells of longer duration than the KS classification scheme. (see also Section II and its footnotes for further discussion).[42]

LYS differs from the other classification schemes discussed here in its use of information on reserves. Cluster analysis and information on reserves/M2 volatility, exchange rate volatility, and volatility of the change in the exchange rate is used by Levy-Yeyati and Sturzenegger to sort observations into pegs, intermediate regimes, and floats. One result of this use of cluster analysis is that about half of the countries with an unvarying exchange rate, those with no reserve volatility or without reserve data, are coded as "ad hoc" pegs since the cluster analysis initially places these cases in an "inconclusive" category. Another result of the cluster analysis is that the LYS classification scheme results in far more pegs than other classifications, partly because observations with a fair amount of exchange rate volatility may, nonetheless, be classified as pegs if there is also substantial change in reserves/M2. The LYS coding does not, however, include most years with a discrete devaluation from one fixed rate to another as a peg year because the change in the exchange rate relative to the change in reserves volatility is gauged as being too large to be a peg in those cases. Thus, this classification scheme does not include as pegs many of the highest volatility outcomes that RR and JS code as pegs.

The DJ coding is the most straightforward classification scheme, simply representing the regime declared to the IMF and reported in the IMF's annual yearbook on exchange rate arrangements.

[42] We use the Reinhart Rogoff annual data set from Carmen Reinhart's website extended to 2004 with data from Eichengreen and Razo-Garcia on Barry Eichengreen's website.

A2. Correlations of Pegging and Floating Across Classification Schemes:

Table A1 presents the percentage of observations for which binary versions of each classification scheme agree with one another.[43] The statistics in this table show that the classification schemes are broadly similar, but differ in somewhat systematic ways that generate different results on a number of areas of our analysis. See also Shambaugh (2004) or Frankel (2003) for comparisons of different *de facto* classification schemes.

Table A1: Percentage agreement of various coding methodologies for our sample

	Peg	jspeg	rrpeg	Djpeg
Peg	1			
Jspeg	93%	1		
Rrpeg	80%	82%	1	
Djpeg	81%	86%	81%	1
Lyspeg	81%	80%	73%	74%

Note: This table shows the percentage of observations where different codings yield the same result as one another. "peg" is the classification used in the paper. "jspeg" is the JS coding, "rrpeg" is the RR coding, "djpeg" is the *de jure* coding, and lyspeg is the LYS classification. All codings are collapsed to a binary peg and nonpeg coding.

A3. Spell Lengths Across Classification Schemes:

The spell length and number of spells is the category for which the results differ most across classification schemes. Table A2 presents statistics illustrating this by reproducing Table 1 in the text for the different classification schemes.

Table A2 shows that the RR classification scheme identifies far fewer spells and, accordingly, much longer duration than the others. The RR median peg length is 8 years, and the RR mean peg length is 12 years. Floats are even more durable in the RR classification scheme, with a mean and median of 20 years. This long duration is a consequence of the effort to identify overall policy regimes as opposed to specific peg spells. The RR classification scheme involves a great deal of smoothing due to the use of the conditional probability of staying within a range over a five year period.[44] Contrast this with the statistics presented in Table A2 for the JS classification scheme. The JS classification scheme, like RR, allows devaluations and drops single year pegs but it differs from RR in its focus on annual patterns and in that it does not smooth regime switches. The peg spell median in the JS classification scheme is 5 years, the mean is 9 years, the float spell median is 7 years and the mean is 11 years. A specific example also illustrates the difference between the JS and RR classification

[43] For RR, mgcode = 1 is considered a peg (this includes pre-announced pegs, horizontal bands that are narrower or equal to +/-2%, and *de facto* pegs. For DJ, peg is defined as pegs, limited flexibility, and cooperative agreements (the EMS).

[44] As an example of this, consider the results presented in Husain *et al.* who use the Reinhart Rogoff classification scheme. They report an average peg spell duration of 28 years. There are a number of reasons beyond coding for such a large average. They have a much longer sample and as such, very long regimes will affect the average (medians are not reported). In addition, they include very small countries (eliminated in Obstfeld and Rogoff) which have much longer spells and include some long run currency unions (such as Panama).

schemes: RR codes France as not pegged at all from 1973-86 and pegged throughout thereafter while JS (and KS) identify the short-lived pegs in 1979-80 and 1984-5.

Table A2 Basic Statistics Across Classifications

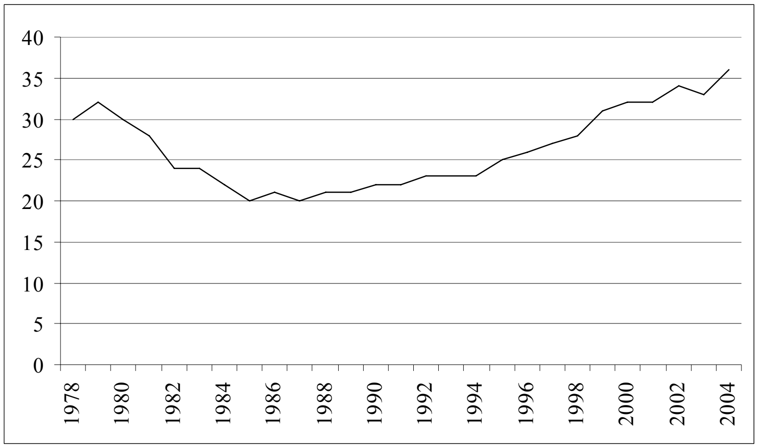
	No. of Annual Obs.	No. of C'ntry	% peg obs.	No. of peg spells	Peg Median	Peg Mean	Peg s.d.	No. of float spells	Float Median	Float Mean	Float s.d.
Full Sample	3202	104	34.01	91	8	11.82	10.9	107	20	20.31	10.05
	3924	*125*	*46.02*	*199*	*5*	*9.16*	*9.75*	*191*	*7*	*11.09*	*10.10*
	3924	**125**	**47.53**	**398**	**2**	**4.67**	**6.42**	**395**	**2**	**5.21**	**6.69**
Industrial Countries	671	21	31.74	16	10.5	13.0	10.0	20	25	24.0	6.44
	671	*21*	*35.62*	*31*	*6*	*7.55*	*8.08*	*36*	*5.5*	*12.0*	*11.79*
	671	**21**	**39.34**	**56**	**2**	**4.63**	**6.81**	**61**	**3**	**6.67**	**8.88**
Developing Countries	2531	83	34.61	75	8	11.57	11.1	87	20	19.46	10.32
	3253	*104*	*48.17*	*168*	*5*	*9.46*	*10.0*	*155*	*8*	*10.88*	*9.70*
	3253	**104**	**49.22**	**342**	**2**	**4.68**	**6.37**	**334**	**2**	**4.95**	**6.18**

Note: figures in bold reproduce statistics from table 1, plain text are for RR coding, and italics are for JS.

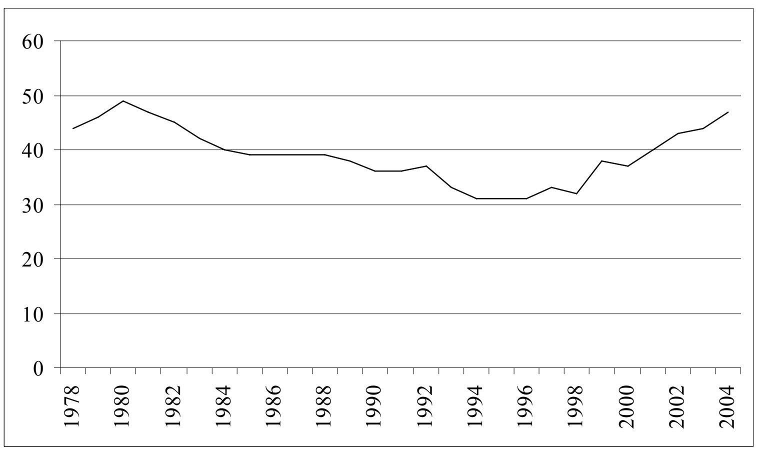
An important point made in the text is that the Obstfeld and Rogoff (1995) finding of relatively few peg spells that lasted for at least five years is partly due to the time their paper was written. We show in Figure 3 of the text that, using the KS classification scheme, the mid-1990s represents a low point of number of spells of long duration. Below, we reproduce this figure using the JS, RR, and DJ classification schemes to show the robustness of this point when using these classifications (see end of section II for discussion).

Long lasting pegs over time: For comparison to classification used in paper, see figure 3.

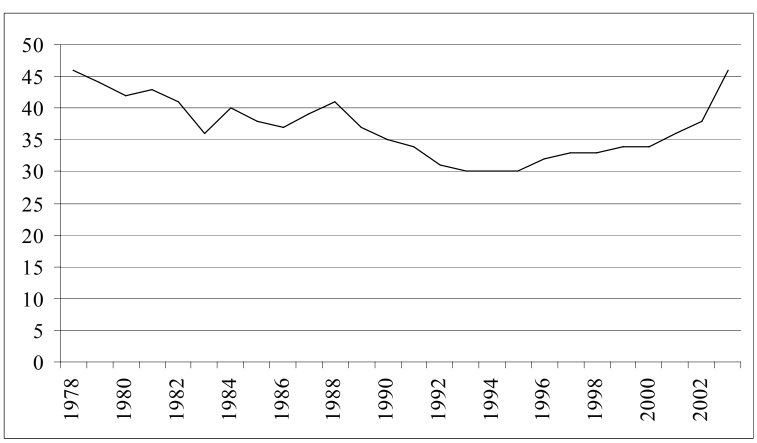
Reinhart Rogoff classification:



Shambaugh 2004 Classification



De Jure Classification



Figures show the number of countries in a peg that has lasted for more than 5 years at that moment. The panel is roughly balanced with between 98 and 104 countries in the Reinhart Rogoff sample and 122 and 125 countries in the other samples. Currency unions are eliminated from sample with the exception of spells that began as pegs and converted to currency unions (some EMU observations).

A4. Exchange Rate Outcomes Across Classifications:

The quintile analysis used to investigate the exchange rate consequences of pegging do not differ as dramatically across classification schemes as does peg duration or peg length, with Table A6 demonstrating the broad similarity of the overall pattern across schemes. A source of the difference between the KS-based results presented in the text and those obtained when the peg dummy is defined using the JS classification scheme is that the latter allows a peg to continue through a one-time devaluation and, consequently, more volatile bilateral and multilateral volatility outcomes occur during peg spells. Likewise, peg spells can last through devaluations in the RR classification scheme and, for this reason, the RR results look similar to the JS results with regards to the percentage of high volatility outcomes that are pegs. Also, the RR classification does not count all stable official rates as pegs (due to the use of secondary market rates), and thus many of the most stable outcomes are nonpegs (29%). A fifth of the DJ pegs are highly volatile since some countries declare pegs that do not hold. There are also instances of low volatility nonpegs as countries that have a *de jure* peg actually exhibit a fear of floating. The LYS classification scheme also has a large number of volatile pegs, even more on a percentage basis the DJ. These high volatility pegs are not discrete devaluations but simply moderate to high volatility outcomes.

Table A6
Percentage pegged by exchange rate volatility quintile

	Peg	**JSpeg**	**RRpeg**	**DJpeg**	**LYSpeg**
	Bilateral				
1	100%	99%	71%	89%	99%
2	87%	83%	58%	66%	93%
3	44%	31%	16%	21%	41%
4	1%	1%	7%	9%	39%
5	0%	11%	11%	20%	21%
Total	47%	45%	33%	41%	58%
	Multilateral				
1	61%	53%	51%	47%	78%
2	59%	54%	45%	46%	65%
3	53%	50%	33%	38%	58%
4	34%	32%	16%	27%	51%
5	11%	18%	12%	22%	29%
Total	44%	41%	31%	36%	56%

Like Table 6, the table shows the percentage of annual observations pegged in each quintile of exchange rate volatility. The top half shows the bilateral volatility quintiles and the bottom half shows multilateral volatility.

The most notable difference on the exchange rate effects of pegging across classification schemes is that with the DJ classification the coefficients on the *de jure* peg variable in exchange rate regressions are never significantly different from zero. This result, and others using the RR, JS and LYS classification schemes are presented in Table A8. This table includes specifications matching those in Columns 2 and 5 of Table 8 in the text to show how the effect of PEG on exchange rate volatility depends upon the classification scheme employed. The results in columns 1, 2, 5 and 6 shows that the JS and RR classification schemes, which allow peg spells to continue through one-time devaluations, result in weaker results for the coefficient on PEG than is the case with the KS classification scheme used in the paper. The results in Columns 3 and 7 show that the misidentification of regimes that occurs with DJ results in insignificant coefficients on PEG. The results in Columns 4 and 8 demonstrate that the coefficient on PEG is weaker when using LYS than what one obtains with the KS results in the text of the paper because LYS includes more volatile observations as pegs. However, the results using LYS are stronger than those with RR or JS because LYS does not classify cases with very large devaluations as continuing pegs.

Table A8. Exchange Rate Volatility in Annual Panel Data across classifications

	1	2	3	4	5	6	7	8
variable	bilateral	bilateral	bilateral	bilateral	multilateral	multilateral	multilateral	multilateral
Sample	drop 1%	drop 1%	drop 1%	drop 1%	drop 1%	drop 1%	drop 1%	drop 1%
coding	JS	RR	DJ	LYS	JS	RR	DJ	LYS
Fixed effects	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE	CFE, YFE
Peg	-0.025	-0.013	-0.001	-.033	-0.006	-0.006	0.004	-0.013
	0.004**	0.004**	0.005	0.004**	0.002**	0.003*	0.003	0.002**
1st year float	0.027	0.017	0.035	0.034	0.011	0.017	0.023	0.015
	0.007**	0.012	0.010**	0.007**	0.004**	0.006**	0.005**	0.003**
Constant	0.020	0.025	0.013	0.031	0.019	0.019	0.017	0.025
	0.003**	0.005**	0.003**	.003*	0.002**	0.002**	0.003**	0.002**
Observations	3816	3101	3704	3088	3008	2478	2901	2560
R-squared	0.18	0.16	0.15	0.31	0.26	0.26	0.26	0.33

Note: this table reproduces columns 2 and 5 from table 8. There are country and year fixed effects included, 1% outliers are dropped, and standard errors are clustered at the country level. The change in observations across columns 1-3 and 4-6 is due to the fact that multilateral volatility is only available from 1979 on. The variation within 1-3 and 4-6 is due to different availability of the classifications.
* represents statistically significantly different from zero at the 95% confidence level, ** at the 99% level.

A5. Summary:

The lack of agreement across *de facto* exchange rate classification schemes may be viewed as an indication of an inability of these schemes to accurately code country behavior.[45] As this discussion shows, however, disagreements often stem from efforts to address different questions and hence not simply a difference in measuring pegs, but a difference in defining them.[46] The Klein-Shambaugh classification of this paper measures direct peg spells to consider the length of peg spells and float spells. Shambaugh (2004) measures annual coding of exchange rate behavior based on well established band criteria as well as allowing discrete devaluations so as to prevent artificially breaking up a consistent regime in an effort to test the monetary policy implications of pegging. Reinhart and Rogoff's classification both smoothes over time to determine regimes as opposed to spells and uses the black market rate – hence merging both exchange rate choices and capital control choices in an effort to consider the implications of policy regime choices broader than that of the choice of peg or float alone. Levy-Yeyati and Sturzenegger use reserves behavior in addition to exchange rate behavior to better identify intermediate from floats, while possibly allowing somewhat volatile but heavily managed exchange rates to be considered pegs. Thus, the classification scheme one may choose depends upon the question posed: those interested in whether a country is pegged and stable in a given year may use the JS classification scheme, those interested in absolute stability of the peg may choose the KS coding used in the paper, those interested in over-arching policy regimes smoothed over time could choose to refer to the RR coding, and those exploring intermediates versus floats or intervention behavior may refer to LYS.

[45] See for example Ghosh et al (2002).

[46] It is worth noting that even different *de jure* codings, all of which rely on the same IMF yearbooks, disagree depending on how researchers aggregate declared regimes. For example, a "cooperative system" which is how the EMS was listed could be considered a peg or intermediate. Likewise managed floats can be called intermediates or floats. Thus, using *de jure* classifications does not change the fact that an author must decide what behavior is considered a peg and what is not.