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A multinomial logit approach to exchange rate policy classification with an application to growth☆

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A B S T R A C T

We model a country's *de jure* exchange rate policy as the choice from a multinomial logit response conditioned on the volatility of its bilateral exchange rate, the volatility of its international reserves, and the volatility of its effective exchange rate. The category with the highest predictive probability implied by the logit regressions serves as our *de facto* exchange rate policy. An empirical investigation into the relationship between the *de facto* classifications and GDP growth finds that growth is higher under stable currency-value policies. For non-industrialized countries, a more nuanced characterization of exchange rate policy finds that those who exhibit 'fear of floating' experience significantly higher growth.

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1. Introduction

Accurate, rigorous, and scientific classifications of exchange rate policy are an important ingredient for assessing the merits between fixed and floating exchange rates. Until relatively recently, empirical research employed the *de jure* classification, which largely reflects the self-reported policy submitted by a country's central bank to the International Monetary Fund. However, many observers

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have noted that the *de facto* currency management for some countries seemed at odds with their *de jure* management.[1] As a result of such discrepancies, the *de jure* classification has been viewed as unsatisfactory for assessing the role of exchange rate stability in economic performance and has motivated researchers to propose *de facto* exchange rate classifications that are based on observed properties of the foreign exchange market data. Influential contributions include the pioneering work of Reinhart and Rogoff (2004) (hereafter RR) and Levy-Yeyati and Sturzenegger (2003) (hereafter LYS). RR argue that a natural classification of exchange rate policies should be based on the behavior of the parallel market exchange rates on the grounds that they better reflect underlying market and monetary conditions than do the country's official exchange rates whereas LYS advocate the use of a k-means cluster algorithm to sort and assign countries to the various exchange rate policies.[2]

In this paper, we propose using a familiar econometric technique to obtain *de facto* classifications of a nation's exchange rate policy. The procedure uses tools that are familiar to economists, produces sensible results that are easily replicated, modified and updated. Specifically, we see three attractive features in the approach. First, classifier judgment is required primarily in selecting the variables to be included in the exchange rate regime classification model. Modifying and updating the classifications is therefore straightforward since one only needs to adjust the variables or update the data employed in estimation of the response problem. Second, the optimization criteria of our approach is familiar as it is based on the likelihood principle and has well-known properties. Difficulties associated with 'inconclusive' regimes often observed in RR and LYS methods are much less problematic. Third, it is feasible with our method to include a potentially large number of policy determinants.[3]

The idea that underlies our methodology goes like this. It must be the case that for many countries, the *de jure* exchange rate policy (regime) reported matches the *de facto* execution of that policy. We assume that these *de jure* policies would seem to be thoughtful assessments of the degree of perceived and economically relevant exchange rate stability experienced by that country. This is our motivation for modeling the *de jure* classifications as the outcome of a multinomial logit response conditioned on measures of the volatility of the country's bilateral exchange rate against an anchor currency, the volatility in the country's international reserves, and the volatility in the country's effective exchange rate. The unsystematic component–the error term in the model–captures unobservable factors that cause some countries to deviate from the announced exchange rate policy. The classification that has the highest predictive probability implied by the model serves as the *de facto* policy. For ease of reference, we refer to them as the LP (logit policy) classifications.

Two explanatory variables that we employ, the volatility of a bilateral nominal exchange rate against an anchor currency and the volatility of international reserves, follow directly from the literature. This paper is the first to also use the volatility of the *effective* exchange rate. We give four reasons

[1] Reference to potential inconsistencies between *de jure* and *de facto* regimes dates back at least to Frankel and Wei (1995). While some *de jure* exchange rate fixers may appear to be *de facto* floaters due to frequent changes in their peg, others that are *de jure* floaters appear to be *de facto* fixers since they maintain very stable exchange rates – a phenomenon that Calvo and Reinhart (2002) refer to as 'fear of floating.'

[2] Assessing the role of a country's exchange rate regime in economic performance is an active area of research. The LYS classifications have been used by Juhn and Mauro (2002), who explore the long-run determinants of exchange rate regimes, Bordo and Flandreau (2001), who examine the link between financial depth and exchange rate regimes, Frankel et al. (2002) who use it to examine the link between regime choice and local interest rate sensitivity, Edwards and Levy-Yeyati (2003) and Broda (2004), who analyze the impact of terms of trade on economic performance under different regimes. Both the LYS and RR regime classifications are used by Alesina and Wagner (2003) to find the politico-economic institutional qualities of countries with different exchange rate regimes. RR is employed by Reinhart et al. (2003), who attempt to correlate the degree of exchange rate flexibility and degree and type of financial dollarization and Rogoff et al. (2004), who explore economic performance under alternative regimes.

[3] Limiting the role of the classifier's judgment can be an advantage over RR's methodology: Because it is heavily dependent on their judgment, future research with their classifications may require RR to provide updates. The econometrics of our approach has some advantages over LYS's cluster analysis. LYS's method attempts to sort countries into exchange rate regimes by minimizing the unweighted average of within group sum of squared deviations from the group mean over each country characteristic yielded 698 inconclusive country-year observations and is feasible only when the set of regime determinants is small. Moreover, the optimality properties of their method are not well understood.

why this strategy would seem to make sense.[4] First, the incorporation of multilateral factors to assess exchange rate policy makes sense when central banks (such as the Bank of Korea) have increasingly diversified their reserve holdings away from US dollar denominated assets.[5] Second, if one restricts the analysis to movements in a single bilateral exchange rate, there are countries (such as the US) where it is not so obvious which exchange rate should be used. LYS based their US *de facto* classification on the dollar-deutschemark (DM) exchange rate and marked the US as a floater. Such a designation might make sense given the infrequency of US interventions in the dollar-deutschemark market, but when one considers that US trade shares with China have exceeded those with Germany since 1995 coupled with the Chinese policy of pegging to the dollar, looking exclusively at the dollar-DM exchange rate appears less defensible.[6] Third, in cases where a country maintains a bilateral peg, unless that country trades exclusively with the anchor currency country (or within a bloc that pegs to the same anchor), the effective exchange rate will exhibit more instability than the bilateral exchange rate. The non-anchor exchange rates may even be economically more important than the anchor rate, especially if countries engage in relatively little trade with the anchor country. Thus movements of the effective exchange rate may have some weight in how one reports the fixity of 'the exchange rate.'[7] Fourth, while one of the central economic implications behind a hard bilateral peg are the constraints it imposes on monetary policy, instability in non-anchor exchange rates could compel the monetary authorities to pursue policies that are ultimately inconsistent with the peg so that the anchored bilateral rate may appear stable at the present time, but this does not necessarily imply that the country is pursuing a fixed exchange rate policy.

Having obtained the LP classifications, we use them to study the impact of exchange rate policies on GDP growth. This is an issue for which economic theory does not have clear-cut predictions. While the trade-offs between fixed and flexible exchange rates have been studied in terms of the exchange rate's effect on stabilization and trade, the effect on growth is imperfectly understood. In the empirical literature, Ghosh et al. (2002) (who use the *de jure* classifications) and RR report that higher growth outcomes are associated with the more stable exchange rate policies whereas LYS finds that higher growth outcomes are associated with greater exchange rate flexibility. In our analysis using the LP policies to measure *de facto* exchange rate policy, we find that higher growth outcomes are associated with more exchange rate stability. We find that industrial country growth is not significantly related to the exchange rate regime so this result is driven mainly by the experience of non-industrialized countries.

We also consider a more nuanced characterization of exchange rate policy by examining whether differences between what a country says (*de jure)* and what it does (*de facto)* matters for growth. Here, we examine growth asymmetries hypothesized by Genberg and Swoboda (2004) between countries that say they fix but float and for countries that say they float but fix. They argue ``breach of commitment'' when a *de jure* fixer that floats *de facto* and that this ``has negative consequences for the economy.'' On the other hand, a *de jure* floater that fixes *de facto* (fear of floating) delivers better than expected exchange rate performance and might is rewarded with superior growth outcomes. Our empirical work provides evidence to support to the Genberg-Swoboda hypothesis. For non-industrialized countries, growth is significantly higher for *de jure* floaters who are LP *de facto* fixers.

The remainder of the paper is organized as follows. Section 2 presents our regime-response model and discusses features of the LP classifications. Section 3 contains our analysis of the relationship between the exchange rate regime and growth and Section 4 concludes. A description of the data and how variables were constructed is contained in the Appendix.

[4] We are not proposing a classification system for effective exchange rates. We are simply allowing for the possibility that *de jure* exchange rate policy is partially explained by the properties of the effective exchange rate. See the Appendix for effective exchange rate construction.

[5] New York Times, Feb 22, 2005.

[6] In 1998, the top 5 trade shares for the U.S. belonged to Canada (0.21), Japan (0.12), Mexico (0.11), China (0.06), and Germany (0.05). In 2002, they were Canada (0.21), Mexico (0.13), Japan (0.10), China (0.09), and Germany (0.05).

[7] In fact, we find that in approximately half of the observations the volatility of the effective exchange rate lies below that of the bilateral exchange rate.

2. Classifying exchange rate policy

Only elementary textbooks characterize exchange rate policy as a simple choice between fixed and flexible rates. In actual practice, the taxonomy of policy can be involved and thorny. Frankel (2003) finds policy distinctions across nine separate categories while RR produce a fine grid of fourteen categories. Our task will be to classify country exchange rate policy according to the six *de jure* categories [Ghosh et al. (2000)] which we arrange in order of increasing stability as shown in the accompanying table.

Category	IMF Description
1	Independently Floating
2	Managed Floating
3	Adjusted According to a Set of Indicators
4	Cooperative Arrangements
5	Limited Flexibility
6	Currency Peg

We present the discrete response model that underlies our method in Section 2.1. Section 2.2 discusses general features of our LP classifications and compares them to IMF, LYS and RR classifications. In Section 2.3 presents a detailed comparison among the alternative classifications for several countries.

2.1. *Modeling* De jure *response probabilities*

The multinomial logit model that we employ has often been employed to analyze revealed preference from survey responses. McFadden (1974) first introduced the multinomial logit model to explain the choice of transportation modes of urban commuters with the random utility model. Schmidt and Strauss (1975) extend McFadden's (1974) analysis by allowing different sets of parameters over different alternatives to analyze occupational choice among multiple alternatives. We adopt the Schmidt and Strauss framework.

The idea underlying this methodology is that an individual's response to a survey question must be the particular alternative that gives them the highest utility. Since the utility associated with an unchosen alternative is not observed, the observed response is used to estimate the parameters of the utility function. In our case, the observed response for a country is its *de jure* exchange rate policy. The monetary authorities of a country seek to achieve certain policy objectives. Instead of maximizing utility, they take actions to minimize some loss function. For example, the country may have an objective to control the exchange rate, to achieve a certain inflation target and to stabilize output. We assume that the authorities choose to report the particular *de jure* regime that best advances its policy objectives even though for some countries this *de jure* choice may differ from its *de facto* policy. While the typical use of the multinomial logit model in applied microeconomic studies is for estimation of model parameters to explain different choice alternatives, our main purpose is to use it to predict the *de facto* exchange rate policy conditional upon effective exchange rate behavior together with conventional characteristics of bilateral exchange rate and reserves.

Estimation is based on an underlying latent variable model of the *de jure* exchange rate policy. Let R^*_{ijt} be the policy objective achieved by exchange rate regime j by country i in year t where

$$R^*_{ijt} = x'_{it}\beta_j + \varepsilon_{ijt}. \tag{1}$$

x_{it} is an observable vector of country characteristics and the error ε_{ijt} has an extreme value distribution. By analogy to the random utility model, country i reports the *de jure* exchange rate policy j, if

$$R^*_{ijt} > R^*_{ikt} \quad for \quad k = 1, \ldots 6, \neq j. \tag{2}$$

Since R^*_{ijt} is unobservable, Eq. (1) cannot be estimated directly. We can estimate the model's parameters using the extreme value distribution assumption for ε_{ijt}. Then the probability p_{ijt} that country i reports itself to pursue policy j in year t is the multinomial logit probability

$$p_{ijt} = \frac{\exp(x'_{it}\beta_j)}{\sum_{K=1}^{6}\exp\left(x'_{it}\beta_k\right)}, \tag{3}$$

where the coefficient vector β_j associated with exchange rate regime j is estimated with a random-effects panel regression.[8] Country i declares *de jure* policy j because it is the choice that best achieves its policy objective but not necessarily because it is the most accurate description of exchange rate behavior.

The regime categories in our multinomial logit specification are unordered. This has an important advantage over an ordered response model in our context because it allows for coefficient heterogeneity across different policies. That is, for country i, we allow the impact of the characteristics on the response probability to differ across categories $j = 1,\ldots 6$ whereas an ordered response model imposes homogeneity restrictions on the coefficients across categories. We adopt the less restrictive approach since our emphasis is on measurement as opposed to inference.

The country characteristics that we include in x_{it} are

(i) the volatility of the effective exchange rate,
(ii) the mean absolute change of the effective exchange rate,
(iii) the volatility of the bilateral exchange rate relative to an anchor country,
(iv) the mean absolute change of the bilateral exchange rate, and
(v) the volatility of the country's international reserves.[9]

As with LYS and RR, we include reserve volatility because it is predicted to be directly related to the 'fixity' in the exchange rate regime. The idea here is that high reserve volatility should be associated with frequent foreign exchange market intervention and active management. We also include measures of the volatility of the country's effective exchange rate which we constructed using trade weights. For many economies, the effective exchange rate may convey relevant information concerning economic performance due to underlying exchange rate exposure that cannot be obtained from a single bilateral exchange rate.[10]

We then use the estimated model to predict the probability $\widehat{p}_{ijt}$ that a country with characteristic vector x_{it} will pursue exchange rate policy j by assigning the country-year observation. We call this predicted exchange rate regime the *de facto* regime. As there are a large number of coefficients to estimate and because the individual coefficient estimates do not have natural interpretations in this context, we do not report them in the text but relegate them to the Appendix. The *de facto* exchange rate policy j for country i at time t is the policy with the highest predictive probability,

$$\widehat{p}_{ijt} > \widehat{p}_{ijt} \quad for \quad k = 1,\ldots 6, \neq j \tag{4}$$

We are also able to construct a continuous index of exchange rate policy using the predicted mean value

$$IDX_{it} = \sum_{k=1}^{6} k\widehat{p}_{ikt}. \tag{5}$$

[8] A normalization with respect to one of the regimes is required for identification. We use regime 5, which is the regime that occurs most frequently, for the normalization.

[9] We use the same anchor countries as LYS to determine which bilateral exchange rate to use. We measure volatility as the annual sample standard deviation of the monthly percentage change in the respective variables. The mean absolute change for year t is similarly computed from the annual average of monthly percentage changes. We note also that interest rate volatility is also an important characteristic to determine exchange rate regimes. However, due to data availability, we lost a significant number of observations in estimation and we dropped the interest rate volatility from the estimation problem.

[10] Due to hyper-inflation countries, there are a non negligible number of outliers that we excluded by restricting the sample to observations for the volatility of the nominal effective exchange rate to those less than 10% per annum. Doing so excluded the upper 4 percentile of observations. Similarly, we include only observations on the volatility of reserves that are less than 50% which excluded the upper 5 percentile of observations.

Table 1
Logit exchange rate policy classifications.

	LP		LP^B		LP^E	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
1	532	16.8	280	6.4	525	16.6
2	116	3.7	0	0	60	1.9
3	34	1.1	0	0	0	0
4	811	25.7	233	5.3	60	1.9
5	1602	50.7	3634	90.0	2445	77.4
6	64	2.0	234	5.3	70	2.2
Nobs	3159		3160		4381	

Notes: LP^B omits effective exchange rate volatility. LP^E omits bilateral exchange rate volatility.

Since the *de facto* policy variable is discrete, this index can serve as a continuous proxy measure of the country's *de facto* exchange rate flexibility. We will use this index variable together with discrete exchange rate policy variable in the growth regressions in Section 3.

2.2. Properties of the LP classifications

Table 1 displays the distribution of the classifications generated by three alternative specifications of the country characteristics. Our preferred classification is listed under the LP heading and is generated using both measures of effective exchange rate dispersion (volatility and mean absolute deviation), the mean absolute change in the bilateral exchange rate and international reserve volatility.[11] Including effective exchange rate volatility measures as a policy determinant is strongly supported by the data as a likelihood ratio test for their exclusion yields a chi-square statistic of 165. With 10 degrees of freedom, these 'zero-restrictions' are rejected at any reasonable level of significance.

It can be seen that most of the country-year observations are categorized as outcomes of relatively stable exchange rate policies falling in categories 4 (cooperative) and 5 (limited flexibility). Only 64 observations are classified as hard fixers. The next largest classification is category 1 (independently floating), which forms 17% of the observations.

What happens when only reserve volatility and bilateral exchange rate volatility are used? The classification distribution obtained by dropping effective exchange rate volatility appears under the column labeled LP^B (B for bilateral). Here, as with the *de jure* classifications, we see a substantial 'hollowing-out' of the intermediate ranges as we obtain no classifications in categories 2 or 3. This hollowing out is somewhat attenuated when the classifications are generated using only reserve and effective exchange rate volatility (labeled LP^E). Here, we obtain nearly the same number of free-floaters, but many more fixers (categories 5 and 6). The point is that using only one measure of exchange rate volatility to the exclusion of the other results in a dearth of middle-range classifications. Because this seems to present a distorted view of exchange rate policy, our preferred classification employs both measures.

Fig. 1 plots the evolution of the LP classifications along with the *de jure,* LYS, and RR classifications.[12] Nearly all countries begin the sample as *de jure* fixers (categories 5 and 6). Then this proportion declines steadily over time. Increasingly, countries report themselves to pursue flexible exchange rate policies (categories 1 and 2).

The evolution of LP pure floaters is similar to that of *de jure* floaters. Very few country-year observations are classified as LP hard fixers. Most observations are placed in categories 1, 4, and 5 with

[11] We originally performed estimation using all five variables but because bilateral exchange rate volatility and mean absolute change measures are highly correlated (0.94) we dropped the volatility measure. Very similar results are obtained by keeping bilateral volatility and dropping the bilateral mean absolute change.

[12] Our LP classifications are not directly comparable to RR nor LYS since they do not provide a 6-way classification. For RR, we reversed and renumbered their 5-way classification broken down as 2) Freely falling, 3) Freely floating, 4) Managed floating, 5) Limited flexibility, 6) Peg. For LYS, we examine their 4-way classification broken down as 2) Flexible, 3) Dirty Float, 4) Crawling Peg, and 5) Fixed. Both RR and LYS have a category for observations that are deemed 'inconclusive,' which we omitted in drawing the figures.

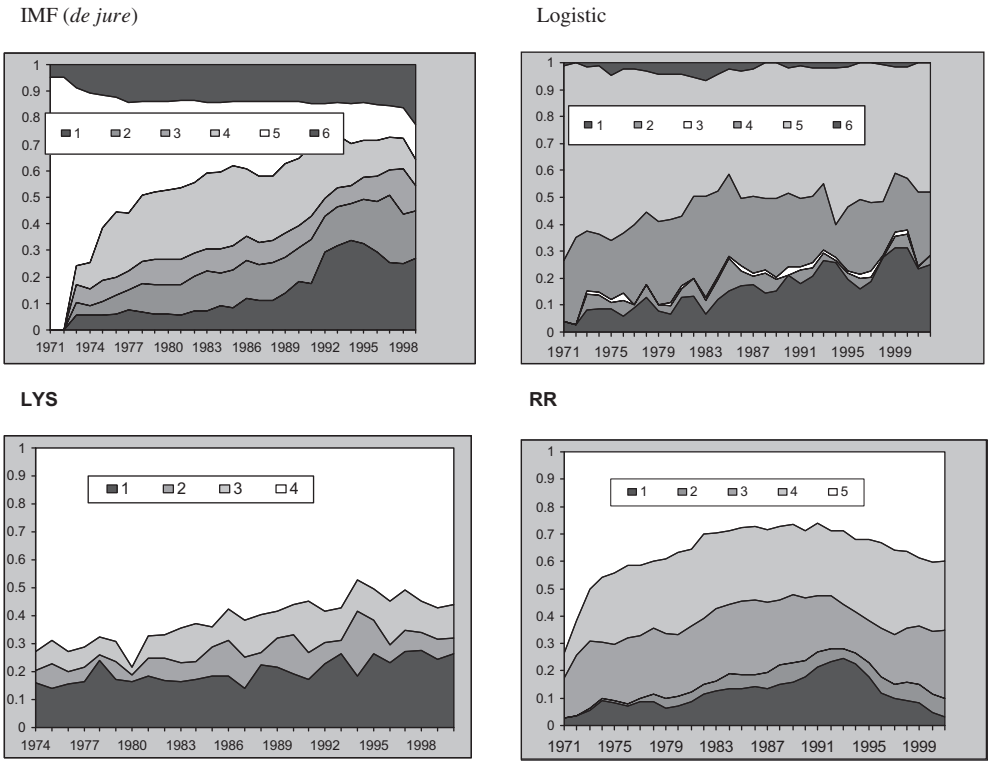

Fig. 1. Evolving distribution of alternative exchange rate policy classifications.

a relatively large proportion of category 5 policies (limited flexibility). There was a tendency to move away from fixing in the 1970s but the proportion of fixers has remained stable in the 1980s and 1990s. Interestingly, in comparing LP categories 5 and 6 to RR's category 5 and comparing LP categories 1 and 2 to RR's categories 1 and 2, it can be seen that the LP classification exhibits a higher correspondence to RR's 'natural classification' than it does either to LYS or the *de jure* classifications. The distribution over time of RR is relatively stable with many more intermediate policies than LP. One possible reason for this stability is that RR employ a 5-year window for computing exchange rate variability whereas LP and LYS employed a one-year window. LYS consistently classifies the majority of observations into the fixed category. More than 70 percent of LYS observations were classified as fixers in 1974 and approximately 55 percent were still fixers in 2000.

Table 2 shows the correlation matrix for the alternative classifications and the country characteristics that we used as determinants in producing the LP classification. Among alternative classifications, LP is most highly correlated with RR (0.53) and are least correlated with IMF *de jure* classifications (0.32). LP and RR (and LYS, barely) are negatively correlated with both measures of exchange rate variability. Only *de jure* is not systematically related to volatility in the effective exchange rate.

LP is the classification that is most highly correlated with reserve volatility (although none are particularly high), which indicates that more stablility in the exchange rate is associated with more reserve activity. [13] RR, on the other hand, is negatively correlated with reserve volatility which runs counter to the idea that reserves are used to stabilize the exchange rate.

[13] Reserves can move around because the authorities are intervening in the foreign exchange market or for nonintervention activities. We are unable to identify the underlying cause of these movements.

Table 2
Correlation matrix.

	LP	IMF	RR	LYS	EV	EMC	RV	BV	BMC
LP	1.000								
IMF	0.315	1.000							
RR	0.527	0.184	1.000						
LYS	0.438	0.401	0.265	1.000					
EV	−0.356	0.008	−0.339	−0.085	1.000				
EMC	−0.447	−0.050	−0.441	−0.080	0.869	1.000			
RV	0.085	0.024	−0.050	0.014	0.056	0.050	1.000		
BV	−0.197	0.031	−0.215	−0.076	0.863	0.714	0.034	1.000	
BMC	−0.314	−0.032	−0.333	−0.118	0.847	0.849	0.039	0.941	1.000

Notes: LP (Logit Policy) is our preferred logit policy classification, EV (BV) is the logit classification using effective (bilateral) exchange rate volatility, EMC (BMC) is the mean absolute change in the effective (bilateral) exchange rate, and RV is international reserve volatility.

Table 3 presents cross tabulations of the alternative classifications. A perfect correspondence between what countries say and what they do would give non-zero values only on the diagonal entries. The *de jure* and *de facto* policies diverge under fear of floating (country says it floats but is a *de facto* fixer) and under failure to fix (country says it fixes but is a *de facto* floater). As can be seen, such divergences are not uncommon.

The table reveals some notable differences between LP and LYS. 63 LYS floaters (category 2) are classified as LP fixers (categories 5 and 6) and 74 LYS fixers were classified as LP floaters (categories 1 and 2). The cross-tabulation with RR is relatively concentrated on and just below the diagonal which reflects the relatively high correlation between the LP and RR.

Table 4 reports the distribution of LP across industrialized and non-industrialized countries. For non-industrialized countries, most country-year observations are assigned to category 5 which reflects substantial exchange rate stability. For industrialized countries, approximately 15 percent of the observations are assigned as 'independently floating' and roughly 80 percent are assigned to relatively stable exchange rate categories 4 and 5.

The table also shows the policy assignments broken down according to whether the country experiences a crisis during the sample year. A crisis is said to occur in year *t* if the country experienced

Table 3
Cross tabulations.

		LP classification						
		1	2	3	4	5	6	Total
de jure	1	168	29	7	116	109	1	430
	2	100	36	10	122	149	6	423
	3	48	15	12	106	134	1	316
	4	47	8	3	277	147	4	486
	5	48	9	0	76	587	22	742
	6	12	5	0	17	231	28	293
	Total	423	102	32	714	1357	62	2690
LYS	2	205	44	21	230	58	5	563
	3	62	10	3	70	53	4	202
	4	76	27	1	56	121	1	282
	5	62	12	1	112	903	49	1139
	Total	405	93	26	468	1135	59	2186
RR	2	140	56	3	26	41	12	278
	3	55	6	10	55	6	0	132
	4	163	28	6	170	182	5	554
	5	74	10	14	338	337	6	779
	6	39	7	1	116	636	37	836
	Total	471	107	34	705	1202	60	2579

Table 4
LP classifications across subgroups.

	1	2	3	4	5	6	Total
Non-industrial (percent)	431	99	18	500	1361	63	2472
	(17)	(4)	(1)	(20)	(55)	(3)	100
Industrial (percent)	101	17	16	311	241	1	687
	(15)	(2)	(2)	(45)	(35)	(0)	100
Non-crisis (percent)	392	60	31	785	1561	52	2881
	(14)	(2)	(1)	(27)	(54)	(2)	100
Crisis (percent)	140	56	3	26	41	12	278
	(50)	(20)	(1)	(9)	(15)	(4)	100

a month-to-month change in its effective exchange rate exceeding 25 percent. Of 5760 country-year observations, there were 434 crisis observations, 424 of which occurred in non-industrialized countries and 10 for industrialized countries. Our methodology does not automatically assign crisis observations to a free float since as can be seen, a relatively large share of crisis country-year observations continue to be grouped in categories 4 and above (28 percent).

2.3. *Comparison of alternative* de facto *classifications for selected countries*

In this section, we present several case studies of the alternative classifications.

Table 5
Alternative classifications for selected emerging market economies.

Year	Argentina				Mexico				Peru				Korea			
	IMF	LYS	RR	LP	IMF	LYS	RR	LP	IMF	LYS	RR	LP	IMF	LYS	RR	LP
1971	5	–	2	1	5	–	6	5	5	–	–	5	5	–	4	1
1972	5	–	2	5	5	–	6	5	5	–	–	5	5	–	4	5
1973	5	–	2	5	5	–	6	5	5	–	–	5	5	–	4	5
1974	5	5	2	5	5	5	6	5	5	5	–	5	5	2	6	5
1975	5	3	2	1	5	5	6	5	5	2	–	5	5	4	6	5
1976	5	3	2	1	2	3	6	4	5	4	2	4	5	5	6	5
1977	5	2	2	1	2	2	6	5	3	4	2	1	5	5	6	5
1978	2	2	2	1	2	–	6	5	3	2	2	1	5	5	6	5
1979	3	2	5	1	2	–	6	5	2	2	2	2	5	5	6	5
1980	3	2	5	4	2	–	6	5	3	2	2	2	2	2	5	2
1981	3	3	2	1	2	4	5	4	3	2	2	2	2	4	5	5
1982	2	3	2	1	2	3	2	1	3	2	2	2	2	4	5	5
1983	2	4	2	2	2	4	2	2	1	4	2	2	2	5	5	4
1984	2	4	2	2	2	2	2	1	3	4	2	1	2	4	5	5
1985	2	3	6	1	2	4	2	1	5	4	2	1	2	3	5	5
1986	3	2	2	1	2	4	2	2	5	5	2	5	2	5	5	5
1987	2	4	2	1	2	4	2	1	5	4	2	1	2	5	5	5
1988	2	4	2	1	2	5	2	4	5	3	2	1	2	3	5	2
1989	2	–	2	1	2	3	5	4	5	3	2	2	2	5	5	5
1990	2	3	2	1	2	3	5	5	1	3	2	1	2	3	5	5
1991	6	3	6	2	2	5	5	5	1	4	2	1	2	5	5	5
1992	6	5	6	5	2	5	6	5	1	4	2	1	2	4	5	5
1993	6	5	6	1	2	5	6	5	1	2	2	1	2	4	5	5
1994	6	5	6	5	1	5	4	1	1	3	5	5	2	5	5	5
1995	6	5	6	5	1	3	2	2	1	2	5	1	2	3	5	4
1996	6	5	6	5	1	3	4	4	1	2	5	4	2	5	5	4
1997	6	5	6	5	1	2	4	1	1	4	5	5	1	4	5	1
1998	6	5	6	5	1	2	4	1	1	2	5	3	1	4	2	1
1999	6	5	6	5	1	2	4	1	1	2	6	4	1	5	3	1
2000	–	5	6	5	–	2	4	1	–	–	6	5	–	5	3	4
2001	–	–	6	5	–	–	4	1	–	–	–	1	–	–	3	4
2002	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	1

2.3.1. Emerging economies of Argentina, Mexico, Peru, and Korea

Table 5 shows the policy classifications for a set of emerging market economies. For Argentina, there is some disagreement across the classifications in the early 70s when LP and RR classifies it as a floater and LYS classifies it as a fixer. Beginning in 1991, Argentina ran a currency board with varying degrees of compliance over the ensuing decade. Over this time period all of the *de facto* classifications catalog Argentina as a fixer. One exception occurs in 1993 when LP-Argentina is a floater but all others say that it is fixed. The reason for this is because Brazil, a large trading partner of Argentina's, headed into a period of hyper-inflation whereupon the Brazilian real depreciated by 2000% against the dollar. The respective logit predictive probabilities for 1993 are $p_1 = 0.39$, $p_2 = 0.23$, $p_3 = 0.04$, $p_4 = 0.00$, $p_5 = 0.20$, $p_6 = 0.14$, which is why our method classifies the country to be in category 1. The factors that lead the RR and LYS to categorize Argentina as a hard peg do have an influence on LP as seen by the relatively large value of p_5. When we generate the classifications without the volatility of the effective exchange rate, Argentina is placed in category 5 in 1993.

LP-Mexico largely agrees with RR-Mexico until the mid 1990s. In the 1970s, LYS systematically classifies the peso to be more flexible than either RR or LP whereas in the 1990s, LYS classifies the peso to be less flexible than either RR or LP. LP places Mexico in the floating category primarily due to the influence of effective exchange rate volatility. LP^B consistently generates a classification of 5 through the 1990s when the effective exchange rate volatility is dropped from the logit regression.

For Peru, LP is largely consistent with RR. For Korea, all three *de facto* classifications are quite similar to each other. Throughout the sample, they consistently classify the won as more stable than its *de jure* floater classification. Korea is an example of a fear of floating country, especially after the Asian crisis.

Table 6
Alternative classifications for selected industrialized countries.

Year	France				Switzerland				Japan				USA			
	IMF	LYS	RR	LP	IMF	LYS	RR	LP	IMF	LYS	RR	LP	IMF	LYS	RR	LP
1971	5	–	6	4	5	–	6	5	5	–	5	5	5	–	6	4
1972	5	–	5	4	5	–	6	4	5	–	6	4	5	–	4	4
1973	1	–	4	4	1	–	4	2	2	–	5	4	1	–	5	4
1974	1	2	4	4	1	2	4	2	2	2	5	1	1	2	5	4
1975	3	3	5	5	1	3	4	5	2	2	5	4	1	2	5	4
1976	1	2	5	4	1	3	4	5	2	2	5	5	1	2	5	4
1977	1	2	5	4	1	3	4	5	2	2	5	1	1	2	5	4
1978	1	2	5	4	1	2	4	1	2	2	3	1	1	2	3	4
1979	3	5	5	5	1	3	4	5	2	2	3	1	1	2	3	4
1980	3	5	5	5	1	3	4	5	2	2	3	1	1	2	3	4
1981	3	3	5	4	1	5	4	1	2	2	3	1	1	2	3	3
1982	3	3	5	4	1	3	5	4	1	2	3	1	1	2	3	1
1983	3	3	5	5	1	2	5	4	1	2	3	1	1	2	3	3
1984	3	5	5	5	1	3	5	4	1	2	3	4	1	2	3	3
1985	3	5	5	5	1	3	5	5	1	2	3	1	1	2	3	4
1986	3	3	5	5	1	3	5	5	1	2	3	1	1	2	3	4
1987	3	3	6	5	1	4	5	5	1	2	3	1	1	2	3	4
1988	3	5	6	5	1	4	5	5	1	2	3	1	1	2	3	4
1989	3	5	6	5	1	3	5	4	1	2	3	1	1	2	3	3
1990	3	5	6	5	1	2	5	4	1	2	3	1	1	2	3	4
1991	3	5	6	5	1	3	5	4	1	2	3	1	1	2	3	4
1992	3	5	6	5	1	3	5	5	1	2	3	1	1	2	3	3
1993	3	5	6	5	1	3	5	1	1	2	3	1	1	2	3	4
1994	3	5	6	5	1	4	5	5	1	2	3	1	1	2	3	4
1995	3	3	6	4	1	3	5	5	1	2	3	1	1	2	3	4
1996	3	4	6	4	1	3	5	1	1	2	3	4	1	2	3	4
1997	3	–	6	5	1	3	5	4	1	2	3	1	1	2	3	3
1998	3	5	6	5	1	3	5	5	1	2	3	1	1	2	3	4
1999	6	5	6	5	1	4	5	1	1	2	3	1	1	2	3	4
2000	–	5	6	5	–	3	5	1	–	2	3	1	–	2	3	4
2001	–	–	6	5	–	–	5	4	–	–	3	1	–	–	3	4
2002	–	–	–	5	–	–	–	4	–	–	–	1	–	–	–	4

All of the *de facto* policies exhibit periods of volatility. The RR-Argentina jumps from 2 to 6 back to 2 between 1984 and 1986. LYS-Peru jumps from 5 to 2 to 4 between 1974 and 1976 while LP-Peru switches from 5 to 1 and back to 5 between 1992 and 1994. While LP tends to exhibit this sort of volatility when the estimated probabilities across classifications are relatively flat, the continuous policy index IDX is markedly less volatile and shows fewer extreme values.

2.3.2. High income and industrialized: US, France, Japan, and Switzerland

The results for these countries are shown in Table 6. LP-US places the dollar in an intermediate regime and classifies it to be more stable than RR or LYS. The LP-France corresponds closely to RR by assessing the franc to be a relatively stable currency whereas LYS often classifies the franc to be relatively flexible. LP-Switzerland corresponds more closely to LYS than it does to RR which is sort of unusual, and all of the *de facto* methods classify this country's exchange rate as more stable than its *de jure* classification. Notice that from 1973 onwards, Switzerland is a fear of floating country. LP-Japan is largely in agreement with RR and its *de jure* classification as a floater whereas LYS-Japan tends to classify policy as being more stable.

De jure hard pegs classified as *de facto* fixes. Table 7 displays the classifications for Panama, Estonia and St. Lucia. These are three countries for which a hard peg classification would seem to be incontrovertible. These are Panama, which has dollarized, Estonia, which has a currency board, and St. Lucia, which has maintained a long-term stable peg. The three *de facto* methods generate similar results.

LP occasionally classifies Panama as a currency peg (category 6 in 1983 and 1984) but generally gives a classification of 5 on account of relatively low reserve volatility (which exceeds the cross-sectional

Table 7
Alternative classifications for selected 'hard pegged' countries.

Year	Panama					Estonia					St. Lucia				
	IMF	LYS	RR	LP	LP^B	IMF	LYS	RR	LP	LP^B	IMF	LYS	RR	LP	LP^B
1971	5	–	6	5	5	–	–	–	–	–	6	–	6	–	–
1972	5	–	6	5	5	–	–	–	–	–	6	–	6	–	–
1973	6	–	6	5	5	–	–	–	–	–	6	–	6	–	–
1974	6	5	6	5	5	–	–	–	–	–	6	5	6	–	–
1975	6	5	6	5	5	–	–	–	–	–	6	5	6	–	–
1976	6	5	6	5	6	–	–	–	–	–	6	5	6	–	–
1977	6	5	6	5	6	–	–	–	–	–	6	5	6	–	–
1978	6	5	6	5	5	–	–	–	–	–	6	5	6	–	–
1979	6	5	6	5	5	–	–	–	–	–	6	5	6	–	5
1980	6	5	6	5	6	–	–	–	–	–	6	5	6	–	5
1981	6	5	6	5	5	–	–	–	–	–	6	5	6	5	5
1982	6	5	6	5	5	–	–	–	–	–	6	5	6	5	5
1983	6	5	6	6	6	–	–	–	–	–	6	5	6	5	5
1984	6	5	6	6	6	–	–	–	–	–	6	5	6	–	5
1985	6	5	6	5	5	–	–	–	–	–	6	5	6	5	5
1986	6	5	6	5	6	–	–	–	–	–	6	5	6	5	5
1987	6	5	6	5	5	–	–	–	–	–	6	5	6	5	5
1988	6	5	6	5	5	–	–	–	–	–	6	5	6	5	5
1989	6	5	6	5	5	–	–	–	–	–	6	5	6	5	5
1990	6	5	6	5	5	–	–	–	–	–	6	5	6	5	5
1991	6	5	6	5	5	–	–	2	–	–	6	5	6	5	5
1992	6	5	6	5	5	6	–	2	–	6	6	5	6	5	5
1993	6	5	6	5	5	6	5	6	–	5	6	5	6	5	5
1994	6	5	6	5	5	6	5	6	–	5	6	5	6	5	5
1995	6	5	6	5	5	6	5	6	5	5	6	5	6	5	5
1996	6	5	6	5	5	6	5	6	5	5	6	5	6	5	5
1997	6	5	6	5	5	6	5	6	5	5	6	5	6	5	5
1998	6	5	6	5	5	6	5	6	5	5	6	5	6	5	5
1999	6	5	6	5	5	6	5	6	4	5	6	5	6	5	5
2000	–	5	6	5	5	–	5	6	4	5	–	5	6	5	5
2001	–	–	6	5	5	–	–	6	4	5	–	–	6	5	5
2002	–	–	–	5	5	–	–	–	–	–	–	–	–	5	5

mean in only 15 of 32 years of the sample) and from movements in the effective exchange rate. A similar story holds for St. Lucia where there is zero bilateral nominal exchange rate volatility but also very low reserve volatility. Estonia is placed in category 4 from 1999 to 2001 on account of effective exchange rate movements. Dropping effective exchange rate volatility results in a LP^B classification of 5.

Euro zone countries from 1999 to 2002 (the end of our sample) also should be *de jure* hard pegs. Here, RR and LYS (when available) classify these observations as hard pegs. LP produces 9 classifications below 5 and none in category 6. LP^B produces 5 classifications below 5 on account of low reserve volatility and none in category 6. The main reason that LP and LP^B classify euro zone countries to be more flexible that RR or LYS is that LP views the Euro to be flexible against the dollar and not that the local currency is fixed to the Euro.

During the operation of the European Monetary System (1978–1997), we have 209 country-year observations. Of these, RR always gives a category equal to or more stabile than the *de jure*. LP gives a category that is equal to or more stable than *de jure* in 202 of 209 observations. LP^B gives a category that is equal to or more stable than *de jure* in 208 of 209 observations.

De jure hard pegs not classified as *de facto* fixers. An examination of *de facto* policies that diverge from *de jure* hard pegs reveals the following. Here, we restrict our observations to the 564 *de jure* hard peg country-year data points (category 6). Of these, LP places 64 observations in category 6. LP^B gives 234 classifications of 6. When accounting for the volatility in the effective exchange rate, the hard peg classification is obtained infrequently. RR classifications are available for 532 cases (out of 564). 24 of these are category 5 or lower. LYS classifications are available for 539 cases. 16 of these are in category 5 or lower. LP classifications are available for 293 cases. 34 of these are in category 5 or lower. These 34 observations are shown in Table 8. In each case, RR agrees with *de jure*. LYS gives a more flexible rating than *de jure* in 6 cases and are also situations where LP^B assigns more flexibility than LP (suggesting that these flexibility LYS ratings are driven by a combination of high bilateral exchange rate volatility and low reserve volatility).

LP^B classifications are available for 507 observations. Only 12 of these are in categories below 5 and these observations are shown in Table 8 below the line. Here, it can be seen that RR is agrees with *de jure* while LYS classifies them to be more flexible than *de jure*. These are country-year observations that are driven by high bilateral exchange rate volatility. Except for one instance, LP classifies the exchange rate policy as more stable than LP^B.

De facto disagreements. Table 9 shows results for countries where some of the largest disagreements occur among the *de facto* classifications.

LP-Australia frequently agrees with *de jure* and these indicate more flexibility than LYS or RR. LYS-Australia doesn't vary at all. RR- and LP-Australia both are correlated with exchange rate volatility but RR does not comove with reserve volatility. For Bolivia, RR, LYS, and LP assign less flexibility to the Boliviano than *de jure*. From 1982 to 1985, LP is the most responsive to the rapid depreciation of the Boliviano. While LP-Bolivia is orthogonal to reserve volatility, RR- and LYS-Bolivia covary with reserve volatility in the wrong direction. LP-Brazil consistently indicates more flexibility than RR or LYS. In the early 1980s the disagreements are generated by volatility in the bilateral exchange rate whereas in the 1990s, differences are generated by volatility in the effective exchange rate. LYS-Brazil is largely unresponsive to the volatility variables whereas RR and LP comove with exchange rate and reserve volatility in similar ways. Interestingly, LYS-Canada largely agrees with the flexible *de jure* assignment whereas LP and RR categorize it as being substantially more fixed than *de jure* (RR-Canada doesn't vary at all). There is not much variability in the bilateral Canadian–US dollar exchange rate. Neither is there much variability in Canada's effective exchange rate because of the large US share in Canadian trade. LP-Chile is freely flexible in most years after 1984, largely on account of effective exchange rate movements. LYS-Chile is similarly relatively flexible. LYS- and RR-Columbia are correlated with reserve volatility with the wrong sign. The three *de facto* methods generally classify Greece to be more fixed than *de jure*, but only LP-Greece is negatively correlated with effective exchange rate volatility. LYS-Thailand agrees closely with intermediate *de jure* classifications while RR and LP assign more fixity. All of the *de facto* classifications for Thailand comove with the volatility measures in similar ways.

When the effective exchange rate has an important effect on the LP classification, it typically creates a rating of more flexibility than the LP^B rating. Although LYS and LP^B use the same determinants, LYS often classifies countries (Chile, Columbia, Australia, Canada) as more flexible than LP^B. Table 10 shows the correlation between the LP determinants and the *de facto* assignments for these countries.

Table 8
De Jure hard pegs not classified as fixers.

Country	Year	IMF	RR	LYS	LP	LP^B
Argentina	1993	6	6	5	1	5
Benin	1999	6	6	5	1	5
Burkina Faso	1976	6	6	5	4	5
Burkina Faso	1977	6	6	5	4	5
Burkina Faso	1999	6	6	5	1	5
Cen.Afr.Rep.	1999	6	6	5	4	5
Cote d'Ivorie	1999	6	6	5	1	5
Estonia	1999	6	6	5	4	5
Germany	1999	6	6	5	4	5
Mali	1974	6	6	5	2	5
Mali	1975	6	6	5	2	5
Mali	1977	6	6	5	4	5
Mali	1978	6	6	5	2	5
Mali	1979	6	6	5	4	5
Mali	1980	6	6	5	4	5
Mali	1982	6	6	5	1	5
Mali	1987	6	6	5	2	5
Mali	1990	6	6	5	4	5
Mali	1996	6	6	5	1	5
Mali	1997	6	6	5	1	5
Mali	1998	6	6	5	1	5
Niger	1976	6	6	5	4	5
Niger	1977	6	6	5	4	5
Niger	1999	6	6	5	1	5
Senegal	1999	6	6	5	1	5
Spain	1999	6	6	5	4	5
Togo	1977	6	6	5	4	5
Togo	1999	6	6	5	1	5
Argentina	1991	6	6	3	2	1
Benin	1994	6	6	3	4	1
Bulgaria	1997	6	6	3	1	1
Burkina Faso	1994	6	6	3	–	1
Cameroon	1994	6	6	3	–	1
Cen.Afr.Rep.	1994	6	6	3	4	1
Chad	1994	6	6	3	–	1
Guinea-Bissau	1996	6	–	2	–	4
Mali	1994	6	6	3	–	1
Niger	1994	6	6	3	–	1
Senegal	1994	6	6	3	4	1
Togo	1994	6	6	3	4	1

3. Links to growth

In this section, we employ LP classifications in a study of the relation between exchange rate policy and GDP growth. Our analysis centers on two questions. In subsection 3.1, we revisit the question of whether fixed or flexible exchange rates (or something in between) is associated with the highest growth rates. In subsection 3.2 we test the Genberg and Swoboda (2004) hypothesis whether differences between what a country says (*de jure*) and what it does (*de facto*) matter for growth. To provide a point of comparison, we also conduct the analysis using the LYS classifications since LP contrasts most sharply with LYS.

3.1. Exchange-rate policy and growth

Although an extensive literature has studied the choice between fixed and flexible exchange rates, economic theory does not have clear-cut predictions about the impact of the exchange rate policy on growth. This is partly because the trade-off between fixed and flexible exchange rates is usually evaluated in terms of the stabilization and trade promoting properties of alternative monetary

Table 9
Classification disagreements.

Year	IMF	LYS	RR	LP	LP^B	IMF	LYS	RR	LP	LP^B	IMF	LYS	RR	LP	LP^B	IMF	LYS	RR	LP	LP^B
	Australia					Bolivia					Brazil					Canada				
1971	5	–	6	5	5	5	–	4	5	5	5	–	4	1	5	5	–	5	5	5
1972	5	–	6	5	5	5	–	4	4	1	5	–	4	4	5	5	–	5	5	5
1973	5	–	6	1	5	5	–	2	5	5	2	–	4	5	5	1	–	5	5	5
1974	4	–	6	1	4	5	5	2	5	5	5	3	4	1	5	1	4	5	4	5
1975	4	–	5	4	5	5	5	4	5	5	5	2	2	1	5	1	4	5	5	5
1976	4	–	5	4	4	5	5	4	5	5	5	2	2	2	5	1	2	5	1	5
1977	4	–	5	4	5	5	5	4	5	5	5	2	2	1	5	1	2	5	4	5
1978	4	–	5	5	5	5	5	4	5	5	2	2	2	1	5	1	2	5	5	5
1979	4	–	5	5	5	5	2	4	4	1	2	4	2	1	1	1	2	5	4	5
1980	4	–	5	4	5	5	5	2	5	5	2	2	2	2	5	1	2	5	4	5
1981	4	–	5	5	5	5	5	2	5	5	2	4	2	2	5	1	4	5	5	5
1982	4	–	5	4	5	5	3	2	1	1	2	4	2	2	5	1	2	5	5	5
1983	4	–	4	4	5	5	3	2	1	1	2	4	2	1	1	1	4	5	5	5
1984	1	2	3	1	4	5	3	2	1	1	2	4	2	2	5	1	2	5	5	5
1985	1	2	3	1	4	5	3	2	2	1	2	5	2	1	5	1	2	5	4	5
1986	1	2	3	1	5	1	4	2	5	5	2	5	2	4	1	1	4	5	5	5
1987	1	2	3	4	5	1	5	4	1	5	2	4	2	1	1	1	2	5	5	5
1988	1	2	3	1	5	1	2	5	5	5	2	4	2	2	4	1	2	5	2	5
1989	1	2	3	4	5	1	3	5	5	5	2	3	2	1	1	1	4	5	5	5
1990	1	2	3	1	5	1	4	5	5	6	1	3	2	1	1	1	2	5	4	5
1991	1	2	3	1	5	2	4	5	5	5	2	4	2	1	1	1	4	5	5	5
1992	1	2	3	1	5	1	5	5	5	5	1	4	2	2	5	1	2	5	4	5
1993	1	2	3	1	5	1	4	5	5	5	1	4	2	2	4	1	2	5	4	5
1994	1	2	3	1	5	1	5	5	5	5	5	3	2	1	1	1	2	5	5	5
1995	1	2	3	1	5	1	4	5	5	5	5	2	5	1	5	1	2	5	4	5
1996	1	2	3	5	5	1	4	5	4	5	5	4	5	4	5	1	2	5	5	5
1997	1	2	3	4	5	2	4	5	5	5	3	4	5	5	5	1	2	5	4	5
1998	1	2	3	1	5	3	4	5	5	5	3	5	5	5	5	1	2	5	4	5
1999	1	2	3	4	5	3	5	5	5	5	1	4	2	2	1	1	2	5	4	5
2000	–	2	3	2	5	–	–	5	5	5	–	5	4	1	5	–	2	5	4	5
2001	–	–	3	1	4	–	–	5	5	5	–	–	4	1	4	–	–	5	1	5
2002	–	–	–	1	5	–	–	–	5	5	–	–	–	1	1	–	–	–	4	5
1971	5	–	2	4	1	–	–	4	5	5	5	–	5	4	5	5	–	6	–	5
1972	5	–	2	4	1	–	–	4	4	5	5	–	5	4	5	5	–	6	–	5
1973	2	–	2	1	1	–	–	4	5	5	2	–	5	1	1	5	–	6	–	5
1974	5	3	2	2	4	–	2	5	1	5	5	2	5	4	5	5	5	6	–	5
1975	5	3	2	2	6	3	4	5	4	5	2	2	5	3	5	5	5	6	–	5
1976	5	4	2	2	5	3	4	5	4	5	2	2	5	4	5	5	5	6	5	5
1977	5	–	2	1	5	3	4	5	5	5	2	2	5	4	5	5	5	6	5	5
1978	2	–	5	2	5	3	4	5	5	5	2	2	5	4	5	4	5	6	5	5
1979	5	2	5	4	5	3	4	5	4	5	2	2	5	4	5	4	5	6	5	5
1980	5	5	6	5	5	3	4	5	4	5	2	2	5	4	5	4	5	6	5	5
1981	5	5	6	5	5	3	4	5	4	5	2	4	4	5	5	4	2	6	5	5
1982	5	4	2	1	1	3	4	5	4	5	2	5	4	4	5	2	5	6	5	5
1983	3	2	4	4	5	3	–	5	4	5	2	2	4	4	1	2	5	6	5	5
1984	3	2	4	1	5	3	2	4	4	5	2	2	4	4	5	4	2	6	5	4
1985	3	2	4	1	1	3	–	4	2	5	2	2	5	1	4	4	2	6	4	5
1986	3	2	4	1	5	3	–	4	2	5	2	3	5	4	5	4	4	6	5	5
1987	3	2	4	4	5	3	–	4	3	5	2	3	5	4	5	4	4	6	5	5
1988	3	2	4	1	5	3	2	4	4	5	2	4	5	5	5	4	4	6	5	5
1989	3	2	4	1	5	3	2	4	4	5	2	3	5	4	5	4	4	6	5	5
1990	3	2	4	1	5	3	2	4	3	5	2	3	6	4	5	4	4	6	5	5
1991	3	4	4	1	5	3	2	4	1	5	2	3	6	5	5	4	4	6	5	5
1992	3	2	4	1	5	3	4	4	4	5	2	3	6	4	5	4	4	6	5	5
1993	3	2	4	1	5	3	4	4	4	5	2	5	6	5	5	4	4	6	5	5
1994	3	2	4	1	5	2	2	4	1	4	2	5	6	5	5	4	4	6	5	5
1995	3	2	4	1	5	2	2	4	1	5	2	3	6	4	5	4	4	6	5	5
1996	3	2	4	4	5	2	2	4	1	5	2	5	6	4	5	4		6	5	5

(*continued on next page*)

Table 9 (*continued*)

Year	IMF	LYS	RR	LP	LP^B	IMF	LYS	RR	LP	LP^B	IMF	LYS	RR	LP	LP^B	IMF	LYS	RR	LP	LP^B
	Australia					Bolivia					Brazil					Canada				
1997	3	2	4	1	5	2	2	4	1	5	2	5	6	5	5	2	4	2	1	1
1998	3	2	4	4	5	3	2	4	1	4	3	5	6	1	5	1	4	4	1	1
1999	1	2	4	1	5	1	2	4	1	4	3	5	6	1	5	1	2	4	4	5
2000	–	2	4	1	4	–	2	4	1	5	–	5	6	1	4	–	2	4	3	5
2001	–	–	4	1	4	–	–	4	4	5	–	–	6	5	5	–	–	4	4	5
2002	–	–	–	1	4	–	–	–	1	4	–	–	–	5	5	–	–	–	–	5

arrangements and the effect of smoothing cyclical fluctuations and trade creation on growth is not fully understood. Frankel (2003) provides a framework for discussing these trade-offs. We briefly review the main points here.

3.1.1. *To fix or to float?*

Frankel gives four reasons to fix. Beginning with the observation that stable exchange rates provide a nominal anchor for monetary policy, a policy of fixing can impose the required discipline on the monetary authorities to keep inflation under control and serves as a commitment device to undo the inflationary bias discussed by Barro and Gordon (1983). Second, by reducing uncertainty, maintaining

Table 10
Correlations for selected countries.

	IMF	LYS	RR	LP	LPN
Australia					
EFFVOL	−0.43	NA	−0.44	−0.54	−0.53
NEXRAVOL	−0.26	NA	−0.31	−0.50	−0.62
RESVOL	0.19	NA	0.10	0.39	0.26
Bolivia					
EFFVOL	0.35	−0.46	−0.50	−0.72	−0.75
NEXRAVOL	0.28	−0.35	−0.41	−0.53	−0.59
RESVOL	−0.10	−0.22	−0.16	0.00	0.02
Brazil					
EFFVOL	−0.22	−0.12	−0.41	−0.42	−0.81
NEXRAVOL	−0.27	0.00	−0.40	−0.35	−0.86
RESVOL	−0.42	0.06	−0.25	−0.17	−0.39
Canada					
EFFVOL	−0.26	−0.56	NA	−0.45	NA
NEXRAVOL	−0.27	−0.64	NA	−0.52	NA
RESVOL	−0.29	−0.01	NA	0.21	NA
Chile					
EFFVOL	0.11	0.01	−0.56	0.03	−0.78
NEXRAVOL	0.10	−0.01	−0.54	0.07	−0.75
RESVOL	0.35	0.17	−0.54	0.03	−0.01
Columbia					
EFFVOL	−0.69	−0.55	−0.36	−0.69	−0.81
NEXRAVOL	−0.76	−0.53	−0.32	−0.75	−0.84
RESVOL	0.18	−0.26	−0.19	0.17	0.24
Greece					
EFFVOL	−0.14	0.32	0.20	−0.34	−0.31
NEXRAVOL	−0.45	0.13	−0.05	−0.07	−0.31
RESVOL	−0.18	0.28	0.37	0.26	0.26
Thailand					
EFFVOL	−0.54	−0.23	−0.59	−0.69	−0.84
NEXRAVOL	−0.60	−0.37	−0.72	−0.87	−0.92
RESVOL	−0.25	−0.14	−0.04	−0.13	−0.27

stability in the currency's value can promote increased international trade and investment. Third, maintaining a fix precludes competitive depreciations which can have a destructive effect on trade. Fourth, the exchange rate will not be driven by speculative bubbles if it is fixed.

On the other hand, Frankel also discusses four reasons why countries may want to promote exchange rate flexibility. First, it allows for an independent monetary policy giving policy makers a tool to offset adverse country shocks. Second, a flexible exchange rate provides an avenue for required relative price adjustments to trade shocks. Third, because a floating rate regime breaks the connection between international reserves and credit creation and allows the central bank to be a lender of last resort and to retain seigniorage revenues. Fourth, the central bank would not be the target of a speculative attack on its currency.

Given the trade-offs involved, it is perhaps not surprising that empirical results are mixed. However, the weight of the evidence points towards an association between high growth and more stable exchange rates. Indirect evidence is provided by Frankel and Romer (2002) who find that an increase in trade has a significant positive effect on per capita income, and Frankel and Rose (2002) who present evidence that trade benefits when exchange rates are stabilized. The estimates from the latter paper imply that membership in a currency union can raise trade with other union members by a factor of 3.[14] In research that directly examines the relation between exchange rate policies and growth, Ghosh et al. (2002) and RR find higher growth is associated with increased exchange rate stability. Ghosh et al. find that the highest growth rates are associated with intermediate policies, followed by fixers then floaters while RR report the growth rank-ordering to be limited flexibility, freely floating, managed float and peg.

LYS, on the other hand, find that the highest growth rates are associated with floaters, followed by fixers then intermediate policies. Their results are driven in largely by the experience of non-industrialized countries–the growth rate of non-industrialized LYS floaters is approximately 1.1 percent higher than LYS intermediate and fixer countries. Also, Edwards (2001), who analyzes a much smaller set of countries, reports complementary fragmentary evidence that 'dollarized' countries have grown more slowly than non-dollarized countries.

3.1.2. A coarse look at the data

We follow the literature by collapsing our six-way LP exchange rate classification into a three categories by combining categories 1–2 (floaters), 3–4 (intermediates), and 5–6 (fixers). Table 11 displays mean GDP growths sorted by exchange rate policy. Note that categorizing by LYS and LP result in very different growth rankings. The relative growth performance for the all-countries sample is evidently is driven by the non-industrialized countries as differences in growth rates by LP classification for industrialized countries are tiny. Mean growth rankings (best to worst) for the all countries and non-industrialized countries sample sorted by LP are fixers, intermediates and floaters. By LYS classifications, growth performance is ranked by floaters, fixers and intermediates.

3.1.3. Growth regressions

We estimate panel data regressions of per capita growth on a standard set of growth determinants and exchange rate policy dummies. The control variables are generally the same variables employed by LYS. Thus, our control variables include

(i) initial year per capita GDP (1971–1974 average),
(ii) initial year population,
(iii) population growth,
(iv) the investment to GDP ratio,
(v) secondary education attainment,
(vi) a political indicator of civil liberties,
(vii) trade openness,
(viii) the change in the terms of trade,

[14] Klein (2002) and Klein and Shambaugh (2004) find the effect on trade creation to be somewhat smaller.

Table 11
Summary statistics for growth rates and exchange rate policy.

Classification	All Countries	Industrialized	Non-industrialize
LP Floaters	2.444	2.718	2.381
LP Intermediates	3.362	2.834	3.710
LP Fixers	3.698	2.622	3.893
LYS Floaters	3.393	2.650	3.748
LYS Intermediates	2.666	1.991	2.796
LYS Fixers	3.315	2.863	3.365

(ix) dummies for transitional economies,
(x) regional dummies for Latin America and Africa, and
(xi) time-specific dummies.

It is well established that investments in physical and human capital, good macroeconomic policies, exposure to trade, and government spending are factors that are conducive to growth.

Table 12 reports random-effects panel growth regressions. The flexible regime (category 1) is taken as the base, so growth effects implied by coefficients on exchange rate regime dummies are relative to the growth rate of floaters. To economize on space, we concentrate on the variables of direct interest and do not report coefficient estimates for the auxiliary controls. In the regressions on the LP classifications, the highest growth rates are associated with *de facto* fixers. In the all countries sample, the coefficient on the fixer dummy is significant and predicts that growth of LP fixers are a bit more than 1% higher than growth of LP floaters. For industrialized countries, the coefficients on the policy dummies are positive (but not significant) and suggest that growth of LP industrial floaters is lower than LP industrial intermediates and fixers. These coefficient estimates are not statistically significant, however. For non-industrialized countries, the estimated coefficient on the fixer dummy is highly significant. If this is a causal relationship, the point estimate implies that switching from a float to a fix would, on average, increase annual per capita growth by 1.4% for non-industrialized countries.

The policy dummy coefficient estimates suggest a monotone relationship between exchange rate stability and growth. When we do so, we obtain positive and significant point estimates in the regressions in the full sample and for the non-industrialized country sample. A unit increase in the stability index (*IDX*, higher means more stability) is associated with nearly a 0.5% increase in per capita growth for non-industrialized countries and is slightly less for all countries.

We are able to qualitatively replicate LYS's results with our data so the contrast between our results and LYS is primarily due to differences between policy classifications.[15] In the all countries and non-industrialized countries samples, regressing the growth rate on LYS classifications suggests that LYS floaters grow significantly faster than intermediates which themselves grow marginally faster than LYS fixers. We note that the LYS classification method assigns a larger proportion of country-year observations in the fixer category than does the LP classification used in this paper.

There is a possibility that the classifications are endogeneous which would lead to biased coefficient estimates. However, a case can be made that the two-step procedure used in this paper, which is similar to two-stage least squares, has mitigated any endogeneity problems since the LP classifications, which are generated from multinomial logit estimates, are orthogonal to endogenous error terms associated with those variables that characterize the macroeconomic policies. We note also that LYS did many robustness checks and concluded in their analysis that the endogeneity of the classifications was not a problem.

[15] We were not successful in obtaining LYS's data set so we constructed our own. In doing so, we constructed variables by conforming as close as possible to descriptions provided by LYS. LYS do not exactly describe their econometric specification so there may be slight differences between our estimation methods.

Table 12
GDP growth and exchange rate regimes.

	LP			LYS		
	All	Indus	Non-Indus	All	Indus	Non-Indus
INT	0.386	0.031	0.438	**−0.617**	−0.307	**−0.911**
	(0.155)	(0.902)	(0.247)	(0.043)	(0.280)	(0.025)
FIX	**1.108**	0.040	**1.385**	−0.011	0.080	−0.282
	(0.000	(0.884)	(0.000)	(0.968)	(0.768)	(0.447)
R^2	0.210	0.398	0.221	0.163	0.378	0.163
Nobs	1703	510	1193	1667	386	1281
IDX	**0.461** (0.000)	0.055 (0.758)	**0.504** (0.000)			
R^2	0.210	0.399	0.219			
Nobs	1703	510	1193			

Notes: Marginal significance levels in parentheses. Bold face indicates significance at the 10 percent level.

3.2. Words, actions, and growth

In this section, we investigate whether the difference between what a country says and what it does matters for growth as hypothesized by Genberg and Swoboda (2004). In this analysis, we assign country-observations into four words and action categories.

Category	*de jure*	*de facto*
A	Float	Float
B	Fix	Fix
C	Float	Fix
D	Fix	Float

Countries in categories A and B do what they say and those in categories C and D do not. Calvo and Reinhart (2002) study countries in category C–countries which they say have a 'fear of floating.' Fear of floating helps to explain the 'hollowing-out of the middle' hypothesis. That is, according to *de jure* classifications, countries are increasingly adopting either the extremes of fixed or floating exchange rates and are abandoning intermediate policies. Calvo and Reinhart examine the behavior of the bilateral exchange rate to an anchor currency, reserves, and interest rates and conclude that *de facto* hollowing-out is much less pronounced.

Genberg and Swoboda (2004) argue that category D countries have breached a commitment to maintaining stable exchange rates and as a result will experience inferior economic outcomes. Fear of floating countries (category C) on the other hand deliver more exchange rate stability than promised and may be expected to be rewarded by superior growth performance.

Table 13
Percentages of country-year observations. *De jure* and *de facto* fixers and floaters tabulation.

Sample	Nobs	A	B	C	D
		de jure Float	*de jure* Fix	*de jure* Float	*de jure* Fix
		de facto Float	*de facto* Fix	*de facto* Fix	*de facto* Float
I. LP *de facto*					
1971–2002	2690	0.16	0.52	0.28	0.05
1971–1980	816	0.07	0.72	0.17	0.05
1981–1990	886	0.15	0.51	0.27	0.07
1991–2002	988	0.23	0.36	0.37	0.04
II. LYS *de facto*					
1971–2002	2889	0.23	0.52	0.19	0.06
1971–1980	730	0.15	0.69	0.08	0.07
1981–1990	1058	0.21	0.55	0.17	0.08
1991–2002	1101	0.29	0.37	0.29	0.05

Table 14
Words, actions and growth.

Words and Action Categories		LP *de facto*			LYS *de facto*		
de jure	*de facto*	All	Indus	Non-Indus	All	Indus	Non-Indus
Fix	Fix	**0.572** (0.055)	−0.013 (0.966)	**0.869** (0.028)	0.114 (0.716)	−0.145 (0.750)	−0.178 (0.659)
Float	Fix	**0.737** (0.010)	−0.103 (0.671)	**1.155** (0.005)	−0.026 (0.930)	0.043 (0.859)	−0.390 (0.364)
Fix	Float	−0.479 (0.323)	0.573 (0.627)	−0.402 (0.492)	−0.442 (0.314)	−0.169 (0.772)	−0.769 (0.162)
R^2		0.207	0.401	0.218	0.161	0.374	0.163
Nobs		1692	510	1182	1657	386	1271
Exclude ASEAN							
Fix	Fix	0.390 (0.207)	−0.013 (0.966)	**0.716** (0.087)	0.017 (0.959)	−0.145 (0.750)	−0.238 (0.575)
Float	Fix	**0.549** (0.063)	−0.103 (0.671)	**0.976** (0.027)	−0.056 (0.857)	0.043 (0.859)	−0.413 (0.374)
Fix	Float	−0.609 (0.215)	0.573 (0.627)	−0.545 (0.365)	−0.544 (0.241)	−0.169 (0.772)	−0.870 (0.142)
R^2		0.198	0.401	0.208	0.154	0.374	0.154
Nobs		1595	510	1085	1570	386	1184

Notes: Marginal significance levels in parentheses. Bold face indicates significance at the 10 percent level.

The evolution of the distribution of observations across categories is shown in Table 13. In panel I, *de facto* policies are given by LP and in panel II they are given by LYS. For both classifications, the proportion of countries that fear floating has increased over time, with the proportion of LP fear of floating being consistently higher than the proportion of LYS fear of floating. While fear of floating has become increasingly prevalent, the proportion of failures to fix is small (category D) and has remained fairly stable. Both LP and LYS show that the proportion of float–float countries has increased over time whereas the proportion of fix–fix countries has declined over time.

Coefficient estimates on the words and actions dummies from growth regressions are reported in Table 14. The base category is A which is consistent with the growth regressions in the previous section so that growth effects are evaluated relative to float–float countries. These regressions also include the full set of growth control variables used in our previous regressions.

Using LP in the all countries sample, we obtain positive and significant coefficients on the fix–fix dummy and a negative but insignificant coefficient on the failure to fix dummy (category D). We find a statistically significant effect on category C (fear of floating) dummy. The non-industrialized country results are qualitatively similar to the all countries sample but the point estimates on the fix–fix and fear of floating categories are even larger. For non-industrialized countries, the growth benefit to fear of floating is 1.16 percent per annum above countries in the float–float category. For industrialized countries, none of the coefficients on the category dummies are significant.

Is it the case that the high growth associated with fear of floating is driven by a handful of south-east Asian countries that have benefitted from strong regional trade integration over the sample period? To address this question, we drop the 10 ASEAN countries.[16] This results in a slight reduction in the magnitude of the estimates. The coefficient on the fix–fix category remains significant at the 10 percent level. The coefficient on fear of floating remains highly significant and suggests a growth advantage near 1 percent per annum over float–float countries.

Thus using LP, we find evidence with non-industrialized countries that supports the Genberg-Swoboda's hypothesis of growth benefits from fear of floating. This result is robust to excluding the ASEAN countries from the sample. Fix–fix non-industrialized countries also experience a growth benefit relative to float–float countries. When *de facto* policies are determined by the LYS methodology however, none of the estimated coefficients on words and action categories are significant.

[16] The ASEAN countries are Brunei Darussalam, Cambodia, Indonesia, Lao Peoples Dem. Rep., Malaysia, Myanmar, Philippines, Singapore, Thailand and VietNam. This useful robustness check was suggested to us by an anonymous referee.

4. Conclusion

This paper has proposed an econometric approach to classifying exchange rate policy. The procedure has three attractive features: First, it is based on tools that are familiar to economists. Second, it can be replicated, modified, and updated in a straightforward manner. Third, it produces sensible results. In producing the classifications, we employed information contained in the country's effective exchange rate. The use of the effective exchange rate in our analysis leads to an improvement in classifying policies and underscores the value in taking a multilateral approach in forming a generalized assessment of national policy towards exchange rate management.

Our investigation of the impact of exchange rate policies and growth found that the highest growth to be associated with *de facto* fixers. This is in line with much of the extant literature and is consistent with research that has found trade benefits from currency blocs. Whether the growth advantages that we find are the result of maintaining a stable currency per se or from selection of countries that are members of trade and currency blocs is unanswered but is a problem for future research.

While the exchange rate regime adopted *de facto* appears to matter for growth, we also find evidence that a more nuanced representation of policy based on the fear of floating concept matters. Point estimates imply a rank-ordering of GDP growth from highest to lowest for categories: i) *de jure* floaters–*de facto* fixers, ii) *de jure* fixers–*de facto* fixers, iii) *de jure* floaters–*de facto* floaters, and iv) *de jure* fixers–*de facto* floaters. Countries may have a good reason to display fear of floating since those that do experience significantly higher per capita growth.

Appendix

The Data

Our primary data source is the International Monetary Fund's *International Financial Statistics* database. Our data set includes 180 countries, each with a unique country code (1–180). Country code 182 represents the world, country code 181 represents residuals, or countries not included in the 180.

Due to hyper-inflations and hyper-depreciations of local currencies for several countries, the real GDP data from source seemed unreliable. (For several countries, per capita real GDP in 1971 US dollars was less than 1 cent per year.) Therefore, we decided to convert real per capita local currency GDP into constant 2000 US dollars, using the bilateral exchange rate to the USD in 2000. Then in the empirical work, we dropped observations for which this real per capita GDP was less than $3 (about 6 percent of the sample). The country-year observations that we excluded are: Congo, Dem. Rep: 1971–1998, Belarus: 1987–2000, Turkmenistan: 1987–2000, Tajikistan: 1985–2000, Ukraine: 1987–2000, Ghana: 1971–2000, Sudan: 1971–2000, Equador: 1971–2000, Guinea-Bissau: 1971–2000, Surinam: 1971–2000, Bulgaria: 1980–2000, Afghanistan: 1971–1982.

Other notes: Fmr. Rep of Vietnam included as Vietnam in sample (cc 176), Fmr. Fed Rep of Germany (West Germany) included as Germany in sample (cc 66), Aruba, Netherlands Antilles defined together as Netherlands Antilles (cc 8) until 1987, separate thereafter, Fmr. Dem Yemen defined as Yemen in sample (cc 177), East and West Pakistan defined as Pakistan in sample (cc 124)

A monthly data set extending from 1960.01 to 2002.12 was used to construct annual volatility measures and other pieces of the annual data set. The monthly data set is comprised of the following.

Net Reserves: (in US$) (IFS line 1L.DZF) When this data was clearly reported on a quarterly basis (i.e., at least 2 consecutive periods), the data was interpolated to get monthly data points. A full list is available upon request. Some data anomalies were discovered in the raw data. Negative reserves were observed for several months for the Central African Republic, Chad, Gabon. Negative reserves in only one month were reported for Congo, Guinea-Bissau, and Ukraine. Except for the Ukraine, these are all Central Franc Zone countries.

WE note that this is not the same definition of reserves as that reported by LYS. We attempted to recreate their reserve data. They describe it as the foreign assets less foreign liabilities and central government deposits (IFS: line 11, line 16c, line 16d). These data contained many anomalies—LYS

reserves are negative for 30 percent of all observations and data are partially or entirely missing for many important countries (Australia, Belgium, Brazil, France, Greece, Japan, New Zealand, Norway, Switzerland, United Kingdom). The reserve measure we utilize has approximately 10,000 more observations than LYS.

Nominal exchange rate: 2 bilateral (US$) measures as in annual data.
Nominal effective exchange rates: Using trade weights from Comtrade data set. Additionally, to give these time series properties, they were smoothed using a 12 month moving average (5 lags, 6 leads, including observation).
CPI: IFS (line 64..ZF) No monthly data available for USSR, Czechoslovakia. Russian monthly CPI data derived from IFS data (CPI change over previous period, line 64XX..ZF), and inserted into database. In Australia, Belize, New Zealand, Papua New Guinea, Vanuatu, the CPI is reported quarterly. These quarterly data were interpolated to obtain monthly measures using Q1 as month 3, Q2 as month 6, Q3as month 9, Q4 as month 12.
Investment derived by using GDP (current Local currency units (LCU)) minus external balance on goods and services minus final consumption expenditure [I = GDP-NX-C] (all from World Development Indicators).
Population, GDP, Exports, Imports, Terms of trade (Exports as a capacity to import), obtained from WDI.
Secondary education: WDI. Data is generally reported every 5 years in the data source which was linearly interpolated to obtain annual observations.
Civil liberties: Following LYS, these data were obtained from Freedom House country rankings.

Properties of effective and bilateral exchange rates

Past research has typically emphasized the properties of the bilateral exchange rate of an anchor currency in connection with policies classification [Calvo and Reinhart (2002), Reinhart and Rogoff et al. (2003), Levy-Yeyati and Sturzenegger (2003), Shambaugh (2004)]. The informal comparison between effective and bilateral nominal exchange rates presented in this section shows that a very different picture about both the level and the volatility of a country's currency value can emerge depending on whether it is viewed through the lens of a bilateral or a multilateral exchange rate. Their properties are sufficiently different for us to conclude that the effective exchange rate contains information beyond that contained in the bilateral exchange rate that is relevant for a country in announcing the *de jure* regime that describes how it manages its currency.

Anchor currencies for bilateral exchange rates are either the US dollar, the British pound, the French franc, or the German mark. For this, we follow the country assignment used in LYS. Because effective exchange rate series do not exist for most non-industrialized countries, these data are constructed by us.[17] We divide our discussion between an examination of the volatility of the alternative exchange rate measures and a comparison of their dynamics.

Volatility

We measure volatility as the annual sample standard deviation of monthly percentage changes in the exchange rate. The effective and bilateral exchange rate will exhibit the same degree of stability only if the country does all of its trade with the country to which it fixes or trades only with countries

[17] We begin with aggregated trade data obtained from the United Nation's Comtrade database. These are imports and exports according to SITC rev.1 commodity classification or SITC rev.2 data when SITC rev.1 was not available for a particular country/year. For each reporting country $i = 1, \ldots, 180$ and year ($t = 1971, \ldots, 2002$), set of weights are formed by taking trade between country i and j as a fraction of country i's total trade for that year. These weights are used to construct the geometric average of respective bilateral nominal exchange rates and normalized such that their value in December 2000 is 100 to form the effective exchange rate. The NEER for country i at month m of year t is constructed as: $\text{NEER}_{im_t} = \prod_{j=1}^{N} (BNE_{ijm_t})^{w_{ijt}}$ where $NEER_{im_t}$ is the nominal effective exchange rate for country i at month m of year t, BNE_{ijm_t} is the nominal bilateral exchange rate between country i and j at month m of year t calculated as the relative rates per U.S. dollar, w_{ijt} is the trade weight between county i and j at year t, and N is total number of countries.

that also fix to the same currency. Such may approximately be the case for the Bahamas, which is a hard fixer to the US dollar and who in 2000 did 86 percent of its trade with the US, but this is an extreme case. Other counties that pegged to the dollar include Panama, who in 2000 conducted 40 percent of its trade with the US, 7 percent with Ecuador, 7 percent with Venezuela and 5 percent with Japan. Further down the line is China, which in 2000 did 19 percent of its trade with Japan, 17 percent with the US, 12 percent with Hong Kong, 8 percent with Korea and 5 percent with Germany. In 2000, the US's major trading partners were Canada (21 percent) and Mexico (13 percent), Japan (11 percent) and China (6 percent). The presumption is that the volatility of the effective exchange rate will exceed that of the bilateral exchange rate for countries that maintain a hard bilateral peg.

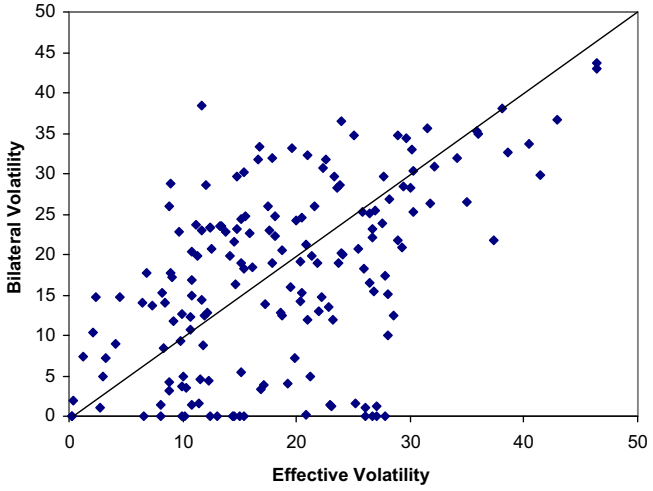

Figure A1. Scatter plot of bilateral exchange rate volatility against effective exchange rate volatility. Fig. A1 presents scatter plots of the volatility of countries' effective and bilateral exchange rates. Hard bilateral fixers should appear below the 45 degree line and roughly half of the countries fit this pattern, as effective exchange rate volatility exceeds bilateral exchange rate volatility in 92 of the 172 countries for which we have data. Of these, 12 are OECD members.

Somewhat surprisingly, about half of the sample lie above the 45 degree line. For these countries, bilateral exchange rate volatility may be relatively unimportant if they do relatively little trade with the anchor country. As the data points appear randomly distributed about the 45 degree line, there seems to be no presumption as to whether effective exchange rate volatility dominates bilateral exchange rate volatility.

Countries whose effective exchange rate volatility exceeded bilateral exchange rate volatility by 50 percent (excluding those who maintained a hard fix throughout the sample) include Angola, Armenia, Austria, Azerbaijan, Bahrain, Belg. Lux, Belize, Cambodia, Chad, Comoros, Congo, Cyprus, Czecho, Estonia, Finland, Georgia, Germany, Guinea Bis, Haiti, Kuwait, Lao, Latvia, Libya, Lithuania, Maldives, Mauritania, Neth.Ant.A, Netherland, Oman, Qatar, Saudi Arab, Singapore, Slovakia, Somalia, Suriname, Switzerland, UAE and USA. Countries whose bilateral exchange rate volatility exceeded effective exchange rate volatility by 50 percent or more include Australia, Bangladesh, Benin, Bolivia, Botswana, Burkina Faso, Cent.Af.Rep.,China, Macao, Cote d'Ivorie, El Salvador, Ethiopia, Gambia, Guatemala, Guinea, Iceland, India, Ireland, Jordan, Kazakhstan, Kiribati, Kyrgyzstan, Lesotho, Mali, Mongolia, Namibia, New Zealand, Niger, Poland, Portugal, Rwanda, SaoTomePri, Senegal, Seychelles, Swaziland, Syria, Tonga, TrinTobago, Tunisia, Uganda and Ukraine.

Dynamics

We compare the dynamic behavior between bilateral and multilateral exchange rate measures by regressing changes in the effective exchange rate on changes in the bilateral exchange rate at various

Table A1
Percent of slope coefficients in regression of effective exchange rate on bilateral exchange rate that indicate divergence

Variable	$\lvert\widehat{\beta}-1\rvert > 0.5$	$\widehat{\beta} < 0$	$\widehat{\beta} > 1$	Nobs
	(percent)	(percent)	(percent)	
1-month change	87.3	13.4	2.5	157
1-year change	65.5	10.5	4.6	152
4-year change	68.1	15.9	8.0	138
Level	46.5	31.4	–	159

horizons as well as in the levels of the observations. The levels observations are standardized so that the slope coefficient gives us an estimate of the correlation. We standardize the levels observations because the effective exchange rate is actually an index and is scaled differently from the bilateral exchange rate.

Table A1 shows the percentage of countries for which slope coefficient estimates indicate dynamic divergence between effective and bilateral exchange rates. The coefficients for most countries exhibit large deviations from unity across the various horizons. At the monthly horizon most of the slope coefficients are positive but very small in magnitude. However, for many countries, the monthly change in the bilateral exchange rate is negatively correlated with the change in the effective exchange rate since negative point estimates are obtained for 21 of 157 available countries (13.4 percent). The discordance between the dynamics of effective and bilateral measures of the exchange rate tends to increase with the time horizon: Slope coefficient estimates are negative for 16 (of 152 available) countries for annual percent changes, 21 (of 138 available) countries at the 4-year horizon, and for 49 (of 157 available) countries when the regressions are performed on exchange rate levels.

Figure A2. Dynamics of effective and bilateral exchange rate for Denmark (in logarithms).

Monthly logarithmic change

Scatter plot of changes

Looking only at the correlation between changes in the effective and bilateral exchange rates will in some cases obscure an underlying divergence in their trends, which is illustrated in the case of Denmark. Fig. A2 shows plots of the monthly percent change, 4-year percent change and the levels of effective and bilateral exchange rates for Denmark. The reciprocal of nominal effective exchange rates are plotted. Therefore, the decrease of NEER represents appreciation of effective rate. Both effective rates and bilateral rate are normalized in the plot. While there has been an effective appreciation of the krone over the sample period and a bilateral depreciation with respect to the deutschemark, first-differences in the two exchange rate measures are positively correlated.[18] The effective and bilateral exchange rates for Canada and many European countries exhibit similar patterns (not shown).

The descriptive statistics that we report combine experiences across policies ranging from hyper-inflation to currency board hard fixes. What these very aggregative summary statistics on volatility suggest, however, is that a very different picture about exchange volatility exposure emerges when viewed through the lens of effective rather than bilateral exchange rates.

Multinomial logit estimation results

Here, we report the multinomial logit estimation results that underlies the 'logit policy' classifications. A normalization with respect to one of the regimes is required for identification. We use regime 5 for this normalization since it is the regime that occurs most frequently.

Table A2
Multinomial logit estimates for logit policy classifications.

	Coef.	s.e.	*t*-ratio		Coef.	s.e.	*t*-ratio
Regime 1				*Regime 2*			
EV1	−0.317	0.108	−2.94	EV1	−0.392	0.110	−3.57
EV2	0.359	0.145	2.48	EV2	0.277	0.149	1.85
BV2	1.700	0.106	16.08	BV2	1.781	0.106	16.82
RV	−0.056	0.009	−6.2	RV	−0.039	0.008	−4.61
Const	−1.292	0.138	−9.34	Const	−1.354	0.139	−9.72
Regime 3				Regime 4			
EV1	−0.546	0.130	−4.19	EV1	0.042	0.135	0.31
EV2	0.003	0.172	0.02	EV2	−1.089	0.212	−5.1
BV2	1.889	0.107	17.61	BV2	1.874	0.105	17.8
RV	−0.067	0.010	−6.42	RV	−0.025	0.007	−3.34
Const	−0.840	0.150	−5.59	Const	−0.420	0.137	−3.06
Regime 6							
EV1	−0.255	0.159	−1.61				
EV2	0.115	0.197	0.58				
BV2	0.0600	0.152	0.4				
RV	0.0212	0.007	3.11				
Const	−1.091	0.159	−6.84				

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[18] Two trend-stationary series $\{x_t\}$ and $\{y_t\}$ can trend in opposite directions and have positively correlated changes if the times when both series increase x_t experiences large changes and y_t experiences small changes and vice-versa when both series decrease. Suppose that $y_t = \alpha(1-\rho) + \rho y_{t-1} + \varepsilon_t, x_t = \beta(1-\gamma) + \gamma x_{t-1} + v_t, (\varepsilon_t, v_t)' \overset{\text{iid}}{\sim} (0, \sum), \sum_{11} = \sum_{22} = 1, \sum_{12} > 0$, $0 < \rho, \gamma < 1$. Let $\alpha < 0$ and $\beta > 0$ so that they trend in opposite directions. Denoting the deviation from the mean with a ' $\sim$ ', it follows that the covariance between changes in x_t and y_t is $E(\Delta\tilde{y}_t \Delta\tilde{x}_t) = (1-\gamma\rho)^{-1}\Sigma_{12}(2-\gamma-\rho) > 0$.

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