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ABSTRACT

Fear of Floating and Fear of Pegging: An Empirical Analysis of De Facto Exchange Rate Regimes in Developing Countries*

This paper uses a panel probit model with simultaneous equations to explain the joint determination of de facto and de jure exchange rate regimes in developing countries since 1980. We also derive an ordered-choice panel probit model to explain the causes of discrepancies between the two regime choices. Both models are estimated using simulation-based maximum likelihood methods. The results of the simultaneous equations model suggest that the two regime choices are dependent of each other and exhibit considerable state dependence. The ordered probit model provides evidence that regime discrepancies reflect an error-correction mechanism, and the discrepancies are persistent over time.

JEL Classification: C35, F33 and F41
Keywords: de facto exchange rate regimes, developing countries, simulated maximum likelihood and simultaneous equations model

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1. Introduction

Up until the late 1990s, most studies on the choice of exchange rate regimes have focused on the de jure regimes declared by the governments.[1] De facto exchange rate regimes, which are identified mainly based on the observed behavior of exchange rates, started to attract attentions from researchers after several studies documented the wide difference between the exchange arrangements that countries claim to have and the exchange rate policies that they actually conduct. For example, Ghosh et al. (1997) point out that many countries declare currency pegs as their official exchange rate regimes, but allow frequent and sometimes substantial adjustments of their exchange rates. Their exchange arrangements are therefore observationally equivalent to floating regimes. In contrast, as documented by Calvo and Reinhart (2000), many countries claiming to have floating regimes have so tightly managed their exchange rates that these rates mimic the behavior of a fixed-rate regime. All these studies lead to one and the same conclusion: de facto exchange rate regimes are different from de jure ones, and the discrepancies between the two are not uncommon.

Empirical analysis of de facto exchange rate regimes have been hindered by the lack of convincing data on de facto regimes classified using widely accepted criteria. Even now the debate over the appropriate classification of de facto regimes is still unsolved. At the very least, however, some data series on de facto exchange rate regimes are now available for a wide range of countries over a few decades. The most prominent among them are the classifications made by Levy-Yeyati and Sturzenegger (2000) and by Reinhart and Rogoff (2002). These data can be used to analyze the determination and evolution of de facto exchange rate regimes.

This paper is aimed at providing an empirical analysis of de facto exchange rate regimes in developing countries since the collapse of the Bretton Woods system.[2] We relate the choice of de facto regimes to that of de jure ones, since these two decisions are likely to influence each other. This possibility is captured by a simultaneous equations model, which explicitly allows for the structural interdependence between the two regime choices. We also directly address the issue of regime discrepancies by estimating an ordered probit model, which relates the observed discrepancies between de jure and de facto exchange rate regimes to a set of macroeconomic variables. To reflect the panel nature of the data, we allow random effects as well as lagged endogenous variables to explain state dependence in the regime choices.

The rest of the paper is organized as follows. Section 2 discusses the classification of de facto and de jure exchange rate regimes and provides a comparison between de facto and de jure regimes. Section 3 develops and estimates a simultaneous equations model to explain the joint determination of de facto and de jure regimes. In section 4 we derive and estimate an ordered probit model for the determination of various types of regime discrepancies. Some conclusions are presented in section 5.

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[1] One early exception is Holden et al. (1979), who constructed an empirical index to measure de facto exchange-rate flexibility and regressed it on a set of regime determinants. Later studies involving de facto exchange rate regimes include, among others, Poirson (2001), Hausmann et al. (2000), and von Hagen and Zhou (2002b).

[2] Von Hagen and Zhou (2004) provide an empirical analysis of the determination of de jure exchange rate regimes in developing countries since the late 1970s.

2. Exchange Rate Regimes: Classification and Comparisons

2.1 Classification of Exchange Rate Regimes

The first step for an analysis of exchange rate regime choices is an appropriate classification of these regimes. Because of widely-observed deviations of actual exchange rate policies from official exchange rate arrangements, we need to classify exchange rate regimes from two perspectives: one based on observed behavior of the exchange rate (probably complemented by the movements of other relevant variables such as foreign exchange reserves), which results in a classification of de facto exchange rate regimes, another based on official announcement as to the exchange arrangements in force, which leads to a classification of de jure exchange rate regimes.

2.1.1 De Facto Exchange Rate Regimes

De facto exchange rate regimes are classified based mainly on the movements of exchange rates. Due to differences in the construction and interpretation of data on exchange rate movements, the classification of de facto exchange rate regimes may also be different across various approaches. To check the robustness of our empirical results, we will use two data sets on de facto exchange rate regimes in this paper.

One such classification is made by Levy-Yeyati and Sturzenegger (2000), henceforth "LYS". These authors apply a cluster analysis to a data set with three volatility measures: volatility of the exchange rate, volatility of the change of the exchange rate, and volatility of international reserves. They classify de facto regimes in 172 countries during the period 1974—2000 according to the following principle. Fixed-rate regimes should have low volatility of the exchange rate and of the change of the exchange rate but high volatility of international reserves, as countries use reserve assets to intervene in the foreign exchange market and to stabilize the exchange rate. Floating-rate regimes, in contrast, should be characterized by high volatility in the exchange rate and in its rate of change but low volatility of foreign exchange reserves, since the exchange rate is allowed to fluctuate freely, and interventions, which may cause high volatility in international reserves, should be much less frequent. Lying somewhere between these two corners, intermediate regimes, which cover crawling pegs or bands and tightly managed floating rates ("dirty floats"), should have medium level of volatility of the exchange rate, low volatility of the change of the exchange rate, and medium to high volatility of reserve assets. In the application of the cluster analysis, the authors also identify a small group with low volatility of all the three dimensions. They label it "inconclusive" regimes, as the actual policy intention of the authority is difficult to infer when the foreign exchange market is tranquil. For our analysis, however, we will merge these inconclusive regimes with fixed ones, because they at least share a common feature of stable exchange rates (see Table 1, the upper panel).

[Table 1]

Reinhart and Rogoff (2002) argue that de facto regime classifications based on official exchange rates only, such as the LYS classification, can be misleading when market exchange rates exist on the parallel market. They therefore develop a "natural classification" of de facto regimes based on market-determined parallel exchange rates, and official rates are used only if the exchange rates are unified. We will refer to it as the "RR" classification. The authors examine the chronologies of 153 countries' conduct of exchange rate policies for a period at the longest from 1946 to 2001. By combining official announcements, inflation performances, and volatility of exchange rate movements, they are able to distinguish among 15 de facto exchange rate regimes, ranging from regimes with no separate legal tender (such as full dollarization or currency union) to freely floating or falling rates or hyperfloating regimes. In the upper middle panel of Table 1, we list the RR classification with its 15 regime categories. They are grouped into three broader regimes: the first four categories from "no separate legal tender" to "de facto peg" are reclassified as fixed regimes, the next seven from "pre-announced crawling peg" to "moving band" as intermediate regimes, and the last four from "managed floating" to "hyperfloating" as flexible regimes.

2.1.2 De Jure Exchange Rate Regimes

Official exchange rate regimes refer to those announced by the government and reported to the IMF. The IMF classifies these regimes and publishes the classification results in its publications, especially in *Annual Report on Exchange Arrangements and Exchange Restrictions* (*AREAER*). As summarized by Reinhart and Rogoff (2002), the IMF's classification scheme has evolved from a very rough peg-or-not dichotomy in the 1970s and the early 1980s, to a four-regime classification in the 1980s and most of the 1990s, and finally to an eight-regime scheme since 1998. The most important difference between the pre-1998 and the post-1998 classifications is that the latter, at least claimed by the IMF, pays more attention to de facto exchange rate policies and gives a more accurate classification of actual exchange rate regimes. It can be argued, however, that the new IMF classification system is still one of de jure regimes, since it still relies heavily on official information and looks mainly the behavior of the official exchange rates.[3]

The IMF regime classification is also listed in Table 1. In the lower middle panel, we list the old IMF classification for the period from early 1970s up to 1997. It should be noted that before 1983, the IMF had adopted a virtually dichotomous scheme to classify regimes as either maintaining exchange rates within narrow margins or not maintaining such margins, but sub-categories can be identified within each broad regime. From 1983 onwards, regimes with limited flexibility and more flexible arrangements joined pegged regimes and independently floating to form a four-category classification scheme. Here we list all the eight (sub-)categories ever used by the IMF during this period, and regroup them into three broad regimes: fixed regimes contain single currency pegs or composite currency pegs; intermediate regimes cover those with limited flexibility and those with rule-based exchange-rate adjustments; flexible regimes consist of not rule-based managed floating and independently floating.

The new IMF classification scheme for the post-1998 era is listed in the bottom panel of Table 1. To construct a three-regime classification, the eight regime alternatives are grouped in the following way: the first three, from currency unions to currency boards to conventional fixed pegs, form a broadly-defined "fixed" regime; the middle three—horizontal band, crawling peg, and crawling band—make the intermediate regime; the last two—managed floating and independently floating—form the flexible regime.[4]

[3] See von Hagen and Zhou (2002a, 2002b) and Reinhart and Rogoff (2002).

[4] Ghosh et al (1997) point out that many countries classified by the IMF as maintaining pegged regimes have frequently adjusted their exchange rate parities, while Calvo and Reinhart (2000) argue that many officially declared floating regimes are actually intervening their exchange rates to ensure their strong stability. These evidences suggest that the classification of some regimes is certainly subject to controversy. But this is why a separate de facto classification is necessary and important. Therefore, we

2.2 De facto and De jure Exchange Rate Regimes: A Comparison

In this sub-section, we compare the IMF classification of de jure exchange rate regimes with both the LYS and the RR classification of de facto exchange rate regimes. We restrict our comparison to 112 developing countries during the period 1978—2000, with a total of 1805 country-year data points, where observations on all the three regime classifications are available.

2.2.1 Regime Discrepancies

If we compare the degrees of flexibility of de facto and de jure regimes for a country in a particular year, the result can only be one of the following three alternatives: (1) the de facto regime is less flexible than the de jure one; (2) both regimes are of the same degree of flexibility; or (3) the de facto regime is more flexible than the de jure one. A typical case of the first scenario is a country declaring a floating regime but keeping the exchange rate very stable, a phenomenon what Calvo and Reinhart (2000) dubbed "fear of floating". In our analysis, we will interpret this phrase more loosely to cover all the combinations where de facto regimes appear to be less flexible than the de jure ones, e.g. a combination of a de facto fixed regime with a de jure intermediate one. Conversely, the third scenario is called "fear of pegging" in this paper, since a good example of this scenario is a country declaring a fixed peg, but adjusting the parity so frequently that it is almost impossible to distinguish itself from a truly floating system.[5] Again, the label should be flexibly interpreted to cover all possible regime combinations falling in the third group.

The upper panel of Table 2 presents a cross-classification of exchange rate regimes. It reports the distribution of various de facto regimes given that a certain type of de jure regime is observed. On an aggregate level, the IMF classification suggests that fixed regimes are the predominant one, accounting for 54% of all observations, flexible regimes, with a share of 39.2%, rank the second, and intermediate regimes are the smallest group, having only 6.8% of the total observations. For de facto regimes, however, intermediate regimes have a slightly higher share than flexible ones (21.3% versus 20.1% based on the LYS data, or 31.5% versus 28.5% based on the RR data). The share of fixed regimes in the LYS data (58.6%) is even higher than in the IMF data, but it drops to 40% when the RR classification is used. In both de facto classifications, intermediate regimes gain position at the cost of flexible regimes, suggesting that the fear-of-floating phenomenon is recognized when de facto regimes are classified, but the phenomenon of fear of pegging seems to have been given less attention by the LYS approach than by the RR scheme.

[Table 2]

Based on the more detailed cross-classification of de jure and de facto regimes, we can test whether these two regime classifications are independently distributed of

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stick to the notional classification made by the IMF in order to highlight the discrepancies between de jure and de facto classifications.

[5] Levy-Yeyati and Sturzenegger (2000) use the phrase "fear of pegging" to denote cases where countries are afraid of announcing de jure fixed regimes and prefer to declare more flexible regimes, although they maintain stable exchange rates on a de facto basis. In our terminology, these are the cases of the first scenario, i.e., de facto regimes are less flexible than the official regimes. In this paper, as like in von Hagen and Zhou (2002b), we reserve the term "fear of pegging" for the cases where de facto regimes are more flexible than de jure counterparts.

each other. For both the IMF-LYS and the IMF-RR comparisons, the null hypothesis of independence is rejected due to highly significant chi-squared statistics (122.36 for the former and 107.68 for the latter). Therefore, the distributions of de jure and de facto regimes seem to be correlated with each other, and the choices for one regime can influence that of another and vice versa.

The lower panel of Table 2 reports the numbers and shares of cases of the above-mentioned three scenarios when the flexibility of a de facto regime is compared with that of a de jure one. It is derived from the upper panel of Table 2. Regime combinations on the diagonal have the property that the two regimes have the same degree of flexibility ("regime consistency"), those above the diagonal have a de facto regime more flexible than the de jure one ("fear of pegging"), and those below the diagonal have a de facto regime less flexible than the de jure one ("fear of floating"). Using the LYS data, more than 64% of all cases show regime consistency, 26% of them exhibit fear of floating, and nearly 10% of cases have fear of pegging. Based on the RR data, the prevalence of regime consistency is reduced, with its share now below 56%. The share of fear of floating decreases slightly to 23.7%, but that of fear of pegging increases significantly to 20.4%. This again points to the possibility that the issue of fear of pegging might be less adequately addressed by the LYS approach than by the RR classification.[6]

2.2.2 Regime Persistence and Transition

From a dynamic point of view, current exchange rate regime choices, de jure or de facto, can be dependent on past regime choices. In other words, there can be state dependence in regime choices. If past regime choices have strong positive influence on the possibility for the same regime being chosen in the current period, we should observe strong regime persistence in the data. One way to measure the degree of regime persistence is to calculate the conditional probability for each regime being adopted in the current year given that the same regime has been adopted in the last year.[7] The upper panel of Table 3 presents our estimation for the IMF, LYS, and RR classifications. According to the IMF data, there are 941 observations where a fixed regime is maintained for the second year, accounting for 94% of all the cases where a fixed regime was adopted in the last year. In other words, only 6% of last-year's pegs exit from such pegs in this year. In contrast, the persistence of intermediate regimes is about 82%, with more than 18% of last-year's intermediate regimes switch to other regimes. The persistence of flexible regime is comparable to that of fixed ones, with a conditional probability for continuation at 92.4% and, therefore, an exit rate of 7.6%. On average, de jure regimes have a persistence of roughly 93%.

Persistence of de facto regimes based on the LYS classification is much lower than that of the IMF de jure classification, both on average and for each individual regime. The conditional probability for regime continuation is 85.6% for fixed regimes, 46.9% for intermediate regimes, and 58.0% for flexible regimes. Average

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[6] This can be traced back to the difference in the exchange rate data used for the two classifications. The RR approach uses market exchange rates when available, while the LYS approach uses official exchange rates. If a country declares a fixed regime and maintains a stable official exchange rate, while the market exchange rate fluctuates freely, such a case will be identified as a fixed regime by LYS but a flexible one by RR. This results in a case of regime consistency based on LYS, but a case of fear of pegging based on RR. Not surprisingly, we will have more cases of regime consistency and less cases of fear of pegging with the LYS data than with the RR data.

[7] Masson (2001) assumes that regime transitions follow a first-order Markov process and estimates the transition matrix with three states: fixed, intermediate, and flexible regimes. Our measure of regime persistence corresponds to the diagonal elements of such a transition matrix.

regime persistence is roughly 72% with LYS data. In contrast, the RR data shows that de facto regimes have similar degree of persistence as compared with de jure regimes. Only intermediate regimes exhibit some difference, with the persistence of de facto regimes about 10 percentage points higher than that of de jure ones. On average, however, persistence of de facto regimes based on the RR data is almost the same as that based on the IMF classification.

[Table 3]

A direct result of this difference in regime persistence between the two de facto classifications is that, when combined with de jure regimes, the de-jure-de-facto regime discrepancies may also exhibit different degree of persistence between the two de facto classifications. Here we again use conditional probabilities to measure persistence of regime gaps. Because the RR and the IMF classifications are similarly persistent, any gaps (including no gaps in case of regime consistency) between these two should also be highly persistent. It is shown in the lower panel of Table 3 that the IMF-RR discrepancies has a degree of persistence of 84.0% for fear of pegging, 87.5% for fear of floating, and 91.8% for regime consistency. In other words, more than 80% of regime gaps observed in the last year will continue in this year, while more than 90% of consistent regime combinations will still be maintained in this year. In contrast, due to lower persistence of the LYS de facto regimes, the IMF-LYS discrepancies are less persistent than the IMF-RR discrepancies. The average degree of persistence of the IMF-LYS regime discrepancies is 76.4%, and it is 53.3% for fear of pegging, or 68.7% for fear of floating. It suggests that, because the LYS classification identifies more regime changes than the RR classification does, the discrepancies between the IMF and the LYS classifications are more likely be eliminated than the IMF-RR discrepancies.

[Table 4]

Another comparison between the dynamics of de jure and de facto regimes is to examine the association between changes of the two regimes. For each classification, the degree of flexibility of this year's regime, when compared with that of last year's regime, can be decreased, unchanged, or increased. Table 4 reports the cross-classification of de jure and de facto regime changes. It lists the numbers and shares of various types of de facto regime changes for each type of de jure regime changes. All the three regime classifications show that cases of unchanged regime flexibility are the most dominant type, consistent with high degree of overall regime persistence discussed above. But when regime changes do take place, the association between de jure and de facto regime changes is weak. For example, when de jure regimes become less flexible, only 31.6% of cases are accompanied by reduction of flexibility of de facto regimes based on the LYS classification, and this share is merely 10.5% if the RR data is used. At the other extreme, when flexibility of de jure regimes increases, 43.4% of cases are associated with increase in flexibility of the LYS de facto regimes, and 15.8% based on the RR classification. However, due to higher frequency of regime changes classified by LYS than by RR when de jure regimes are unchanged, the average degree of association of the IMF-LYS regime changes is 71.6%, lower than the IMF-RR association, which is estimated at 87.7%

3. A Simultaneous Equations Model for Joint Regime Determination

We find in the previous section that de facto and de jure regime choices tend to be correlated with each other. It is reasonable to assume that de facto exchange rate policies are constrained by de jure exchange arrangements, while official exchange rate regime choices may formalize the practice in conducting exchange rate policies. A straightforward way of reflecting this assumption is to construct a simultaneous equations model for the joint determination of de facto and de jure regime choices.[8] Because of the panel nature of our data, we include country-specific random effects for both regime choices, and estimated the model with simulation-based maximum likelihood methods.

3.1 The Model

We use q_{it} to denote the de facto exchange rate regime observed in country i in year t. It is a discrete variable that can take one of the three values: 0, 1, or 2. The realization of this random variable depends on whether a latent variable, denoted by q_{it}^*, crosses some threshold. To be specific,

$$\left.\begin{array}{lll} \text{If } q_{it}^* \leq 0, & \text{then } q_{it} = 0 \Leftrightarrow & \text{de facto fixed regime,} \\ \text{If } 0 < q_{it}^* \leq t_q, & \text{then } q_{it} = 1 \Leftrightarrow & \text{de facto intermediate regime,} \\ \text{If } q_{it}^* > t_q, & \text{then } q_{it} = 2 \Leftrightarrow & \text{de facto flexible regime.} \end{array}\right\} \quad (1)$$

We can interpret q_{it}^* as an unobservable measure of the desired degree of regime flexibility, so higher values of this latent variable will typically result in more flexible regimes with higher values for q_{it}. Note that we normalize the lower threshold differentiating fixed and intermediate regimes to zero, while the positive threshold differentiating intermediate and flexible regimes is denoted by t_q. Analogously, de jure exchange rate regime in country i in year t is indicated by y_{it}, and the associated latent variable is denoted by y_{it}^*. The mapping from y_{it}^* to y_{it} is similar to the mapping for de facto regimes, that is,

$$\left.\begin{array}{lll} \text{If } y_{it}^* \leq 0, & \text{then } y_{it} = 0 \Leftrightarrow & \text{de jure fixed regime,} \\ \text{If } 0 < y_{it}^* \leq t_y, & \text{then } y_{it} = 1 \Leftrightarrow & \text{de jure intermediate regime,} \\ \text{If } y_{it}^* > t_y, & \text{then } y_{it} = 2 \Leftrightarrow & \text{de jure flexible regime.} \end{array}\right\} \quad (2)$$

We again normalize the lower threshold to zero, and denote the upper threshold by t_y.

We use a simultaneous equations model to describe the joint determination of the choices of de facto and de jure exchange rate regimes. The structural form of the model is as follows:

$$q_{it}^* = \mathbf{x}_{it}^q \beta_q + y_{it}^* \alpha_q + e_i^q + u_{it}^q, \quad (3a)$$

$$y_{it}^* = \mathbf{x}_{it}^y \beta_y + q_{it}^* \alpha_y + e_i^y + u_{it}^y, \quad (3b)$$

[8] Von Hagen and Zhou (2002b) use a bivariate probit model to analyze the joint determination of de facto and de jure exchange rate regime choices in transition economies. It can be shown that such a bivariate model can be derived as the reduced form of a simultaneous equations model allowing structural interactions between the two regime decisions. See Appendix I for details.

where $\mathbf{x}_{it}^q$ ($\mathbf{x}_{it}^y$) is a row vector of determinants for the choice of de facto (de jure) exchange rate regime. The country-specific and time-invariant random effects in the regime selection process are captured by $e_i = (e_i^q, e_i^y)'$, which are assumed to be independently and identically distributed (i.i.d.) bivariate normal with zero mean and a variance-covariance matrix denoted by Σ_e:

$$e_i = \begin{pmatrix} e_i^q \\ e_i^y \end{pmatrix} \sim \text{i.i.d. N}(\mathbf{0}, \Sigma_e), \forall i, \quad \Sigma_e = \begin{pmatrix} \sigma_{qq} & \sigma_{qy} \\ \sigma_{yq} & \sigma_{yy} \end{pmatrix}. \tag{4a}$$

The two error terms, u_{it}^q and u_{it}^y, are assumed to be i.i.d. standard normal and are independent of each other, that is,

$$u_{it} = \begin{pmatrix} u_{it}^q \\ u_{it}^y \end{pmatrix} \sim \text{i.i.d. N}(\mathbf{0}, \Sigma_u), \forall i, \forall t, \quad \Sigma_u = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}. \tag{4b}$$

This structural model has several features. Firstly, it explicitly models the endogeneity of de facto regime choices to those of de jure ones and vice versa. It is motivated by the conjecture that announced exchange arrangements may restrain the actual conduct of exchange rate policies, which in turn may affect the choice of such formal regime. Secondly, besides the linkage due to the above-mentioned simultaneity, the two decision problems can also be linked due to correlation between the two random-effect terms. These terms are included to control for all the omitted factors which might be important for the decision on regime choices. If these terms are correlated, then there is a possibility that both regime choices are driven by a third common factor. Embedding a variance-covariance structure such as equation (4) into the model may help us deal with this possibility. Thirdly, the existence of time-invariant random effects may also contribute to the empirical persistence of both de facto and de jure regimes. Although for simplicity we assume that neither u_{it}^q nor u_{it}^y is serially correlated, the composite error terms augmented by the random-effect terms will still be serially correlated. Such correlation may explain the state dependence in regime choices, a notion that current regime decision depend on past choices. As pointed out by Heckman (1981), however, this refers to the so-called "spurious" state dependence; the "true" state dependence should be directly caused by past regime choices, which can be incorporated into this model by including dummies for past regime choices in the explanatory variables.

The model can be estimated using a two-stage approach (Heckman, 1978; Maddala, 1983). Here we only sketch the estimation procedures, with all the details collected in Appendix I. In the first stage, we estimate the reduced-form equations for q_{it}^* and y_{it}^* and compute their fitted values as instruments. Note that both error terms of the reduced-form equations are composites of the structural disturbances u_{it}^q and u_{it}^y and are therefore correlated with each other. A bivariate probit model exploits this correlation and generally leads to more efficient estimation of the reduced-form model. In the second stage, we replace the endogenous variables appearing on the right-hand side of the structural equations by their respective instruments, and the structural parameters can be identified accordingly. In both stages we need to first formulate the conditional probabilities conditioned on, besides the explanatory variables $\mathbf{x}_{it}^q$ and $\mathbf{x}_{it}^y$, the random-effect terms, and then approximate the unconditioned probabilities (that is, conditioned only on the explanatory variables) by their simulated means. These simulated probabilities will be plugged into the likelihood function for maximization.

3.2 Explanatory Variables

3.2.1 Determinants of De facto Exchange Rate Regimes

What are the empirical determinants of the choice of a de facto exchange rate regime? In an empirical analysis of the causes of fear of floating, Hausmann et al. (2000) relate this phenomenon to different levels of exchange–rate pass-through and differences in countries' ability to avoid currency mismatches in their international liability. If the pass-through from exchange rate adjustments to domestic prices is perfect, then the adjustment of the nominal exchange rate cannot produce the desired adjustment of the real exchange rate, which is necessary for exchange rate movements to have any real effects on aggregate demand. In this case, exchange rate movements, and de facto flexible exchange rate regimes that actually facilitate such adjustments, are of little use, so the exchange rates may well be stable in reality, resulting in de facto fixed regimes being observed. On the contrary, if a country is able to borrow in its own currency in the international financial market, currency mismatch of its international liability is largely eliminated. Then devaluations of the home currency, when necessary, will not have severe negative balance-sheet effects on the domestic economy. As a result, the country is more likely to allow its exchange rate to float freely, and fear of floating becomes less relevant.

In a study of de facto exchange rate regimes in transition economies, von Hagen and Zhou (2002b) argue that determinants of de jure exchange rate regime choices can also be determinants of de facto regime choices. However, some macroeconomic developments may create policy dilemmas and cause discrepancies between de jure and de facto exchange rate regimes. For example, high inflation may call for exchange rate adjustments and, therefore, de facto flexibility of the exchange rate regime, before an unsustainable peg collapses in a crisis, although a case for de jure fixed regime as nominal anchor can be made. In a similar vein, a formal exchange rate peg may be used to strengthen fiscal discipline, but large budget deficits are typically associated with actual exchange rate flexibility, as currency pegs are increasingly vulnerable to attacks when the fiscal policy is viewed as irresponsible. Moreover, large current account deficits may require currency devaluations to help restore external competitiveness of domestic exports, but such devaluations may fuel into domestic inflation and may worsen the problems caused by currency mismatches.

In the empirical analysis presented below, we use the following variables as proxies for the potential regime determinants mentioned above. Details on the definition and construction of each variable as well as data sources are collected in Appendix II. The pass-through effect of exchange rate adjustment on domestic price stability is measured by the correlation coefficient between monthly consumer price inflation rates and monthly rate of depreciation of the nominal effective exchange rate lagged by one month (PASSTHRU), so a positive value indicates that exchange rate depreciation leads to a higher inflation rate one month later. We calculate this variable for each country in each year. The problem of currency mismatch is captured by gross capital flows (the sum of inflows and outflows) normalized by GDP (KFLOW). The idea is that the larger is the gross capital flows, the larger is the share of foreign-currency denominated capital transactions, and therefore the severer is the currency mismatch problem. Inflation is measured by annual consumer price inflation rates (CPINF), but transformed using the formula $\pi/(1+\pi)$.[9] Fiscal deficits are measured

[9] We follow Ghosh et al. (1997) to apply this transformation to avoid the bias caused by some cases of very high inflation without deleing them from the sample.

by central government budget balances normalized by GDP (FISCAL), with deficits (surpluses) denoted by negative (positive) values. Current account balances (CA) are also normalized by GDP, and with negative (positive) values denoting deficits (surpluses), too.

3.2.2 Determinants of De jure Exchange Rate Regimes

Determinants of de jure exchange rate regimes can be divided into three main groups.[10] The first group contains those criteria suggested by the Optimum Currency Area (OCA) theory, including trade openness (OPENNESS, defined as the ratio of total trade to GDP), geographical concentration of foreign trade (GEOCON, measured by the share of trade with the largest trading partner in total trade), economic size (SIZE, measured by GDP), level of economic development (LEVEL, measured by per capita GDP), and financial sector development (FINDEV, proxied by the ratio of broad money—M2—to GDP). We expect that higher degree of trade openness and more geographically concentrated trade structure will make fixed regimes more preferable than flexible regimes, while larger economic size, higher level of economic development, and more advanced financial industry will make flexible regimes more likely to be adopted.

The second group contains proxies for various types of shocks stressed by the optimal stabilization literature. This strand of literature emphasizes that fixed regimes should be preferable if nominal shocks are the predominant type of shocks impinge on the economy, while flexible regimes will be a better choice if real shocks are more influential. Nominal shocks are proxied by the average absolute deviation of the annual growth rate of broad money from its four-year backward moving average (NSHK). Real shocks are measured by the three-year centered standard deviation of the terms-of-trade growth rate (RSHK).

The third group contains two variables measuring the risk of currency crises. The variable RESERVE is the ratio of non-gold international reserves to broad money, which is designed to reflect the sufficiency of international reserves when it is necessary to use reserves to stabilize the exchange rate. We expect that higher reserve stocks will improve the sustainability of fixed regimes and make them more feasible. The variable KCONTR is a measure of the intensity of capital controls, with higher values denoting more intensive capital controls. It is believed that maintaining capital controls can help protect fixed exchange rate regimes, while liberalization of capital account makes flexible regime more likely to be chosen if countries want to retain monetary autonomy to some extent.

3.3 Empirical Results

We estimate our model with all the above-mentioned variables lagged by one year to attenuate possible endogeneity problem. We also include period dummies for every five-year periods starting in 1986, with the pre-1986 period as the benchmark. Both static and dynamic versions of the simultaneous equations model are estimated, each with both LYS and RR classifications of de facto exchange rate regimes. The results are presented in Table 5.

3.3.1 The Static Model

[10] See von Hagen and Zhou (2004) for a review of empirical studies on the choice of (de jure) exchange rate regimes. The paper also briefly discusses the theoretical literature on the topic, which provides justifications for the various variables used in empirical studies as regime determinants.

The first two columns show the results of the static version of the simultaneous equations model, that is, without past regime choices included as determinants of the current regime choices. The first thing to note is that there is indeed simultaneity in the determination of de facto and de jure regime choices. The coefficients for the two endogenous variables, y_{it}^* and q_{it}^*, are all significant and positive. Therefore, on the one hand, the intention to adopt a flexible de jure regime (i.e., y_{it}^* is high) will raise the desirability of a flexible de facto regime, and on the other hand, the decision to adopt a de facto fixed regime (i.e., q_{it}^* is low) will also reduce the attractiveness of flexible regimes as de jure exchange arrangements. This suggests that countries have actually a strong tendency to conduct their exchange rate policies in a way consistent with their declared official framework, and are willing to formally adopt regimes that best match their exchange rate policies. This is consistent with the fact that, despite of frequently observed regime discrepancies, consistent regime combinations are still far more common.

[Table 5]

The empirical relevance of the potential determinants for de facto regime choices discussed above appears to be rather weak if the LYS classification is used, but relatively strong if the RR classification is used. In both cases, however, all the variables bear expected signs, except for the CA variable. High inflation (CPINF) indeed leads to more flexible de facto regimes, as can be inferred from the positive coefficient. But if the pass-through effect from exchange rate fluctuations to domestic price instability is strong (high PASSTHRU), de facto regimes with higher degree of fixity are more likely to be adopted. Moreover, if a country is active in international capital transactions, especially if a country has large foreign-currency denominated liabilities (high KFLOW), de facto exchange rate stability is also more desirable. In contrast, large fiscal deficits (negative FISCAL) make a flexible de facto regime more likely to be adopted. All these are consistent with our expectations. But the CA variable has a positive coefficient, suggesting that, in case of large current account deficits (negative CA), de facto regimes tend to be less flexible. This probably reflects the reverse causality, i.e., rigid de facto exchange rate policies prevent current account deficits being eliminated by exchange rate adjustments.

For the determination of de jure regime choices, high degree of trade openness and of geographical concentration seem to make flexible exchange rate regimes more likely, which is against our expectations. One explanation is that countries may be concerned with their external competitiveness in the leading export market, and the more concerned, the more they trade with that partner. Therefore, flexible de jure regimes, which facilitate exchange rate adjustment in case of need, are more preferable than rigid fixed regimes. Economic size works in the expected direction. Larger economies are more likely to adopt flexible regimes than smaller ones, reflecting the reluctance of larger economies to give up their monetary autonomy required by the implementation of a fixed exchange rate regime. The level of development, both for the overall economy (LEVEL) and for the financial sector (FINDEV), bear negative and significant coefficients, so more advanced economies tend to have less flexible regimes. This is likely due to the fact that richer countries or those with more advanced financial industry are more able to sustain the monetary pressures when monetary policies are devoted to the stability of the exchange rate. The results with two shock variables (RSHK and NSHK) are not very impressive, probably because they are poor proxies for the underlying shocks. Reserve sufficiency, although insignificant, has the expected negative sign, indicating that availability of international reserves makes fixed regimes more feasible. The intensity of capital controls (KCONTR) is negatively associated with the degree of fixity of the exchange rate regimes, confirming the view that countries impose capital controls to help maintain fixed exchange rate regimes.

There are several interesting results that can be inferred from the estimated variance-covariance matrix of the country-specific random effects. Firstly, both σ_{qq} and σ_{yy} are highly significant with the LYS classification, and almost so with the RR data.[11] Because the random effects are expected to capture the impacts of all the omitted factors that might influence regime choices, there seems to be significant variance in these factors. Secondly, both regime choices tend to be serially auto-correlated due to the presence of these time-invariant country-specific random effects, resulting in some degree of state dependence in the regime choices. Thirdly, the random effects included in the two regime decision processes are significantly and positively correlated with each other, as can be seen from the positive and significant covariance term σ_{qy}. This reinforces our earlier finding that, in the absence of other disturbances, the two regime choices tend to be consistent with each other.

3.3.2 The Dynamic Model

In the third and fourth column of Table 5, we report empirical results for the dynamic version of the simultaneous equations model. The dynamic model is derived by augmenting the static one with dummies for regime choices in the previous year. LDFINTER is a dummy variable, taking a value of 1 if the de facto regime in the previous year is an intermediate one and 0 otherwise. LDFFLEX is similarly defined for past flexible regime choices. LDJINTER and LDJFLEX are the correspondent dummies for past de jure regime choices. Dummies for fixed regimes are excluded to avoid perfect multicollinearity.

As can be seen from Table 5, all the dummies for past regime choices enter with significant coefficients, showing that “true” state dependence plays important role in the determination of both de facto and de jure exchange rate regime choices. And since these coefficients are all positive, it suggests that flexible regimes will be more likely to be adopted in this year if flexible regimes have been adopted in the last year, and the same is true for intermediate and fixed regimes, too. This is consistent with the strong regime persistence discussed in the previous section.

When past regime choices are added to the model, however, some of the other variables lose significance and in some cases even the signs are reversed. This suggests that these variables might have captured to some extent in the static model the influence of past regime choices on the current decisions. Among the variables still with significant coefficients in the dynamic framework, fiscal deficits point to the direction of more flexible de facto regimes, while large exposures to foreign capital favor fixed de facto regimes. For the choice of de jure regimes, open economies still tend to choose more flexible ones, but small economies as well as those with advanced financial sectors prefer fixed regimes.

The variance and covariance terms are again significant for both de facto regime classifications. Therefore, in addition to and despite of “true” state dependence captured by the significant roles of lagged regime dummies, there is also “spurious”

[11] The p-value for σ_{qq} with the RR data is 0.14.

state dependence captured by the random-effect terms. Because of the addition of lagged regime dummies, however, some part of the variance of the omitted factors is now explained by these dummies, so the remaining unexplained variance becomes smaller. The variance and covariance terms are generally smaller under the dynamic specification than under the static one, which is consistent with this interpretation.

Because of strong regime persistence on both de facto and de jure dimensions, and because of the direct inclusion of lagged regime dummies in regression, it is no surprise that the dynamic model performs better than the static one in terms of in-sample predictions. Based on the LYS classification, the rate of correct predictions for de facto regime choices rises from 56% for the static model to 68% for the dynamic one, and the rate for de jure regimes rises from 63% to 91%. The rate of correct predictions on both regimes improves from 41% to 63%. An even more dramatic improvement in the ratio of correct predictions is achieved if the RR classification is used. In general, the static model performs better with the LYS data than with the RR data, but the ranking is reversed for the dynamic model.

4. An Ordered Probit Model for Regime Discrepancies

The simultaneous equations model describes the joint determination of de facto and de jure exchange rate regimes and, therefore, the discrepancies between the two. An alternative approach is to relate the observed regime gaps directly to various factors that might be important causes of regime discrepancies. It is especially interesting to know, given the choice of a formal exchange rate regime, how these factors may lead to a deviation of actual exchange rate policies from the announced framework.[12] In this section we use an ordered probit model to explain the gaps between de jure and de facto exchange rate regimes.

4.1 The Model

The model is closely related to the simultaneous equations model of the previous section. Let g_{it} be the indicator of regime gaps observed in country i in year t. It takes a value of –1 if the de jure regime is less flexible than the de facto one (that is, a case of "fear of pegging" in a broader sense). In other words, $g_{it} = -1$ if $y_{it} < q_{it}$. If de jure regimes are more flexible than de facto ones (a case of loosely interpreted "fear of floating"), $y_{it} > q_{it}$, and $g_{it} = +1$. The remaining possibility is that de jure and de facto regimes are of the same degree of flexibility, i.e. $y_{it} = q_{it}$. In this case we have $g_{it} = 0$.

Because the value of g_{it} depends on the relative flexibility of the de facto regime as compared to that of de jure one, it is straightforward to relate g_{it} to the difference in the desired degree of flexibility of the two regimes, namely, $y^*_{it} - q^*_{it}$. Define a latent variable $g^*_{it} \equiv y^*_{it} - q^*_{it}$. Then the relation between g^*_{it} and g_{it} is as follows:

[12] Due to the symmetry of the simultaneous equation model, it might be argued that regime gaps can also be examined with de facto policies as given conditions. However, we believe that this scenario is less likely the case in reality, since de facto policies can only be identified with time lags and probably based on sophisticated analysis of exchange rate movements, while information on de jure regimes is publicly announced and is easier and earlier to get.

$$\left.\begin{array}{llll} \text{If } g_{it}^* \leq 0, & \text{then } g_{it} = -1 & \Leftrightarrow & \text{fear of pegging,} \\ \text{If } 0 < g_{it}^* \leq t_g, & \text{then } g_{it} = 0 & \Leftrightarrow & \text{consistent regimes,} \\ \text{If } g_{it}^* > t_g, & \text{then } g_{it} = +1 & \Leftrightarrow & \text{fear of floating.} \end{array}\right\} \quad (5)$$

It can be shown that g_{it}^* is determined in the following way (for details see Appendix I):

$$g_{it}^* = \mathbf{x}_{it}\Pi + \bar{e}_i + \bar{u}_{it}, \quad (6)$$

where $\mathbf{x}_{it}$ contains all distinct variables from $\mathbf{x}_{it}^q$ and $\mathbf{x}_{it}^y$, Π is the coefficients vector, $\bar{e}_i$ is the country-specific random effect, which is distributed i.i.d. N($0, \sigma_e^2$), and the error term $\bar{u}_{it} = \tilde{u}_{it}^y - \tilde{u}_{it}^q$, with $\tilde{u}_{it}^y$ and $\tilde{u}_{it}^q$ being the error terms of the reduced-form equation for de jure and de facto regime choices.

Although an ordered probit model based on (6) can be estimated, it is shown in Appendix I that a more efficient way is to use instead

$$g_{it}^* = \mathbf{x}_{it}\Pi + \bar{e}_i + (1-\rho)\mathrm{E}(\tilde{u}_{it}^y \mid y_{it}) + (\bar{u}_{it} - (1-\rho)\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})). \quad (7)$$

We adopt this modification to reflect the fact that information on de jure regime choices becomes available earlier than that on de facto regimes, so the realization of regime gaps can be conditioned on the given choices of de jure arrangements. Moreover, Appendix I shows that $\mathrm{E}(\bar{u}_{it} \mid y_{it})$ depends on $\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})$, and that the latter is typically non-zero. Therefore, given de jure regimes, the error term in (6) generally does not have a zero mean, and a direct estimation of (6) becomes less efficient. This problem is solved in (7) by subtracting from $\bar{u}_{it}$ its conditional mean $(1-\rho)\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})$. This conditional mean also has an economic interpretation: it is a measure of the "error" made in the choice of de jure regimes. For example, if it is positive and large, the adopted de jure regime tends to be overly flexible relative to its desired degree of flexibility captured by y_{it}^*. This inappropriateness in the de jure regime choice is corrected to some extent when the de facto regime is less flexible, that is, when g_{it}^* is increasing in $\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})$, which is the case as long as $\rho < 1$. Therefore, our model based on (7) has the potential to capture the error-correction mechanism in the deviation of de facto exchange rate policies from de jure exchange arrangements.

4.2 Empirical Results

As with the simultaneous equations model, we estimate the ordered probit model with all the explanatory variables mentioned in section 3.2 lagged by one year. Constant terms and period dummies are also included. Given our model specification, a positive (negative) coefficient means that higher values of the variable in question makes de jure regimes more (less) flexible relative to de facto ones, so the probability of having fear of floating (fear of pegging) is increased.

The first two columns of Table 6 report estimation results of the static model. The first thing to note is that our measure of the inappropriateness of the de jure regime choices, $\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})$, has indeed positive and significant coefficients, confirming our conjecture that regime gaps can be created in response to the errors in the choices of the official exchange rate regimes. In case of an overly flexible de jure regime, $\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})$ must be positive and large. Given its positive coefficient, it raises the value of g_{it}^*, making fear of floating more likely, that is, the de facto regime tends to be less flexible than the de jure one. If an intermediate regime is desirable but the country chooses instead a fixed one as its formal exchange arrangement, $E(\tilde{u}_{it}^y \mid y_{it})$ must be negative. This reduces the value of the latent variable associated with regime gaps, so fear of pegging can be expected, with de facto regimes more flexible than de jure one. All these suggest that, given de jure regime choices and given possible errors in these choices, de facto regimes are so selected that such errors can be corrected to some extent.

[Table 6]

For many explanatory variables, their qualitative influences on regime gaps are the same no matter whether regime gaps are defined using the LYS or the RR classification. The significance levels of these variables are usually also the same across two de facto regime classifications. For example, countries more open to foreign trade, more heavily concentrated with one major trading partner, or with larger economic size, are more likely to exhibit fear of floating, as the coefficients for OPENNESS, GEOCON, and SIZE are positive and usually significant. While these variables tend to make de jure flexible regimes more likely, de facto regimes are not being pushed to the more flexible end, therefore resulting in positive regime gaps g_{it}. On the contrary, countries with higher per capita GDP, with more developed financial industry, with larger international reserves, or with more intensive capital controls tend to have fear of pegging, i.e., the regime gaps g_{it} tend to be negative, since the coefficients for LEVEL, FINDEV, RESERVE, and KCONTR are negative and—except for RESERVE—highly significant. These variables tend to be associated with more rigid de jure regimes, but the actual exchange rate policies are often more flexible than the formal frameworks. Strong pass-through of exchange-rate adjustment onto price movement makes fear of floating slightly more likely, as the choice of de facto regimes are likely to be fixed ones, but this effect is insignificant. The other variables have different signs across two de facto regime classifications, and while all the variables tend to create fear of floating based on the LYS data (all the coefficients are positive), they lead to fear of pegging when the RR classification is used (with negative coefficients).

The remaining two columns of Table 6 report estimation results of the dynamic model, where dummies for lagged regime gaps are included in the regression. Here LAGFP is a dummy that takes a value of 1 if fear of pegging is observed in the previous year and zero otherwise, and LAGFF is similarly defined for the case of fear of floating.[13] These two dummies have significant impacts on the current scenario of regime gaps, with fear of pegging (or fear of floating) more likely in this year if such a phenomenon was already there in the last year than otherwise. This is consistent with our previous finding that regime gaps tend to be persistent, even after controlling for the possibility that observed gap persistence might be caused by the presence of time-invariant country-specific random effects, which tend to make the error terms of

[13] If we had derived the dynamic model for regime gaps strictly from the dynamic version of the simultaneous equations model, we would have four dummies for lagged de jure and de facto regime choices included in the model. In actual estimations we modify the model slightly to replace the four regime dummies with two gap dummies, so that we can more directly address the issue of gap persistence.

the regression serially correlated. This conclusion holds irrespective of the de facto classification used.

The qualitative impacts of the other explanatory variables on regime gaps are generally the same as in the static model, although the level of significance has dropped for many variables. This is again due to the fact that, in the static model, these variables have captured the impacts of past regime gaps, which are now reflected by the relevant dummies. Not surprisingly, the estimated standard deviation of the random effects (σ_e) is now smaller in the dynamic model than in the static one, and for the RR classification, it is even statistically not different from zero. As the dynamic model can explain more than 92% of the IMF-RR regime gaps, but only 77% of the IMF-LYS regime gaps, it is understandable to see that σ_e is larger with the LYS data than with the RR data.

5. Conclusions

This paper provides an empirical analysis of the determination of de facto exchange rate regimes as well as their discrepancies with de jure exchange rate regimes in developing countries during the last two decades of the twentieth century. We use two different classifications of de facto exchange rate regimes: the Levy-Yeyati-Sturzenegger classification based on a cluster analysis, and the Reinhart-Rogoff classification based mainly on parallel market exchange rates. The de jure classification is made by the IMF based on official announcements.

Comparing de facto with de jure exchange rate regimes, we find that, while consistent regime combinations have the largest share (more than half but less than two-thirds), regime discrepancies in the form of fear of floating and fear of pegging are not uncommon. Both the regime itself, be it a de facto or a de jure regime, and the regime discrepancy tend to be persistent over time, although there is difference across regime classifications. When regimes do change, however, the concordance between de facto regime changes and de jure regime changes are weak.

Because the distributions of de facto and de jure exchange rate regimes are not independent with each other, we use a simultaneous equations model to explain the joint determination of the two regime choices, which allows explicitly for mutual dependence of the two. Since both regime choices are trichotomous ordered discrete variables, the simultaneity is assumed as concerning the respective latent variables, which measure the desired degree of flexibility of de facto and de jure regimes given macroeconomic situations. Due to the panel nature of our data, we include country-specific, time-invariant random effects in the model, which can account for the correlation of regime choices. However, such correlation can also be caused by the direct influence of past regime choice on the current ones, so we also include dummies for past regime choices to account for state dependence in regime choices. The model is estimated using simulation-based maximum likelihood approach.

The results of the simultaneous equations model confirm our conjecture that the two regime choices are closely related and interdependent with each other. In general, de facto and de jure regimes tend to be consistent with each other. We detect both spurious state dependence, which is caused by unobservable country-specific random effects, and true state dependence, which is caused by the direct influence of past regime choices, in the determination of both de facto and de jure exchange rate regimes.

We also derive and estimate a random-effect panel ordered probit model to explain the causes of discrepancies between de facto and de jure regime choices. The results suggest that the error-correction mechanism is an important cause of regime gaps, since de facto regimes tend to deviate from de jure ones if the latter are viewed as overly flexible or rigid. Moreover, there are evidences showing that regime gaps tend to be persistent over time. Among those potential causes of regime discrepancies, larger economic size or higher inflation rates tend to make countries to exhibit fear of floating, as their de jure regimes are usually flexible ones, but their de facto regimes are often less flexible and their exchange rates tend to be quite stable. In contrast, countries with more advanced financial sector or maintaining intensive capital controls tend to show fear of pegging, i.e., their de facto regimes are more flexible than the de jure ones. The importance of other variables tends to be less robust to model specification and to the change in regime classification.

References

Calvo, Guillermo, and Carmen Reinhart, 2000, "Fear of Floating" NBER Working Paper No. 7993.

Ghosh, Atish, Anne-Marie Gulde, and Holger Wolf, 2002, *Exchange Rate Regimes* (Cambridge, MA, and London: The MIT Press).

Ghosh, Atish, Anne-Marie Gulde, Jonathan Ostry, and Holger Wolf, 1997, "Does the Nominal Exchange Rate Regime Matter?" NBER Working Paper No. 5874.

Hausmann, Ricardo, Ugo Panizza, and Ernesto Stein, 2000, "Why Do Countries Float the Way They Float?" Inter-American Development Bank Working Paper No. 418.

Heckman, James, 1978, "Dummy Endogenous Variables in a Simultaneous Equation System" *Econometrica*, Vol. 46, No. 6 (July), pp. 931-959.

Heckman, James, 1981, "Statistical Models for Discrete Panel Data" in Charles F. Manski and Daniel McFadden eds., *Structural Analysis of Discrete Data with Econometric Applications* (Cambridge, MA, and London: The MIT Press).

Holden, Paul, Merle Holden, and Esther Suss, 1979, "The Determinants of Exchange Rate Flexibility: An Empirical Investigation" *Review of Economics and Statistics*, Vol. LXI, No. 3 (August), pp. 327-333.

Levy-Yeyati, Eduardo, and Federico Sturzenegger, 2000, "Classifying Exchange Rate Regimes: Deeds vs. Words" mimeo, Universidad Torcuato Di Tella, Buenos Aires.

Maddala, G. S., 1983, *Limited-Dependent and Qualitative Variables in Econometrics* (New York: Cambridge University Press).

Masson, Paul, 2001, "Exchange Rate Regime Transitions" *Journal of Development Economics* 6: 571-586.

Poirson, Helene, 2001, "How Do Countries Choose Their Exchange Rate Regime?" IMF Working Paper 01/46.

Reinhart, Carmen, and Kenneth Rogoff, 2002, "The Modern History of Exchange Rate Arrangements: A Reinterpretation" NBER Working Paper No. 8963.

Train, Kenneth, 2002, *Discrete Choice Methods with Simulation* (Cambridge, MA: The MIT Press).

Von Hagen, Jürgen, and Jizhong Zhou, 2002a, "The Choice of Exchange Rate Regimes: An Empirical Analysis for Transition Economies" ZEI Working Paper B02-03, University of Bonn.

Von Hagen, Jürgen, and Jizhong Zhou, 2002b, "De Facto and Official Exchange Rate Regimes in Transition Economies" ZEI Working Paper B02-13, University of Bonn.

Von Hagen, Jürgen, and Jizhong Zhou, 2004, "The Choice of Exchange Rate Regimes in Developing Countries: A Multinational Panel Analysis" CEPR Discussion Paper No. 4227.

Appendix I. Estimation Procedures

A.I.1 Two-Stage Estimation of the Simultaneous Equations Model

In the first stage we estimate the reduced-form model. The reduced form of the structural model, (3a) and (3b), is as follows:

$$q_{it}^* = \mathbf{x}_{it}^q \Pi_{11} + \mathbf{x}_{it}^y \Pi_{12} + \tilde{e}_i^q + \tilde{u}_{it}^q, \qquad \text{(A-1a)}$$

$$y_{it}^* = \mathbf{x}_{it}^q \Pi_{21} + \mathbf{x}_{it}^y \Pi_{22} + \tilde{e}_i^y + \tilde{u}_{it}^y, \qquad \text{(A-1b)}$$

where

$$\Pi_{11} = \frac{\beta_q}{1-\alpha_y\alpha_q}, \quad \Pi_{12} = \frac{\beta_y\alpha_q}{1-\alpha_y\alpha_q}, \quad \tilde{e}_i^q = \frac{e_i^q + e_i^y\alpha_q}{1-\alpha_y\alpha_q}, \quad \tilde{u}_{it}^q = \frac{u_{it}^q + u_{it}^y\alpha_q}{1-\alpha_y\alpha_q},$$

$$\Pi_{21} = \frac{\beta_q\alpha_y}{1-\alpha_y\alpha_q}, \quad \Pi_{22} = \frac{\beta_y}{1-\alpha_y\alpha_q}, \quad \tilde{e}_i^y = \frac{e_i^y + e_i^q\alpha_y}{1-\alpha_y\alpha_q}, \quad \tilde{u}_{it}^y = \frac{u_{it}^y + u_{it}^q\alpha_y}{1-\alpha_y\alpha_q}.$$

Let $\tilde{e}_i = (\tilde{e}_i^q, \tilde{e}_i^y)'$. The distribution of $\tilde{e}_i$ is i.i.d. $\mathrm{N}(\mathbf{0}, \tilde{\Sigma}_e)$, where the elements of $\tilde{\Sigma}_e$ can be expressed as functions of the elements of Σ_e as well as structural parameters α_q and α_y. Similarly, let $\tilde{u}_{it} = (\tilde{u}_{it}^q, \tilde{u}_{it}^y)'$. Its distribution is normalized to be bivariate normal with unit variance on both dimensions and covariance parameter ρ.

The reduced-form equations can be estimated using a bivariate ordered probit model. Let the joint probability of choosing de facto regime j and de jure regime k by country i in year t be denoted by P_{it}^{jk}, and its conditional counterpart conditioned on random effects de noted by $P_{it}^{jk}|\,\tilde{e}_i$. That is,[14]

$$P_{it}^{jk} = \Pr(q_{it} = j \text{ and } y_{it} = k), \text{ and } P_{it}^{jk}|\,\tilde{e}_i = \Pr(q_{it} = j \text{ and } y_{it} = k \,|\, \tilde{e}_i).$$

Define $Q_{it} = \mathbf{x}_{it}^q \Pi_{11} + \mathbf{x}_{it}^y \Pi_{12} + \tilde{e}_i^q$ and $Y_{it} = \mathbf{x}_{it}^q \Pi_{21} + \mathbf{x}_{it}^y \Pi_{22} + \tilde{e}_i^y$. We use Φ_2 to denote the joint distribution function for standard bivariate normal variables, and use Φ to denote its marginal distribution, then the conditional probabilities for various regime combinations are as follows:

$$P_{it}^{00}|\,\tilde{e}_i = \Phi_2(-Q_{it}, -Y_{it}; \rho),$$

$$P_{it}^{01}|\,\tilde{e}_i = \Phi_2(-Q_{it}, t_y - Y_{it}; \rho) - (P_{it}^{00}|\,\tilde{e}_i),$$

$$P_{it}^{02}|\,\tilde{e}_i = \Phi(-Q_{it}) - (P_{it}^{00}|\,\tilde{e}_i) - (P_{it}^{01}|\,\tilde{e}_i),$$

$$P_{it}^{10}|\,\tilde{e}_i = \Phi_2(t_q - Q_{it}, -Y_{it}; \rho) - (P_{it}^{00}|\,\tilde{e}_i),$$

$$P_{it}^{11}|\,\tilde{e}_i = \Phi_2(t_q - Q_{it}, t_y - Y_{it}; \rho) - (P_{it}^{00}|\,\tilde{e}_i) - (P_{it}^{01}|\,\tilde{e}_i) - (P_{it}^{10}|\,\tilde{e}_i),$$

$$P_{it}^{12}|\,\tilde{e}_i = \Phi(t_q - Q_{it}) - \Phi(-Q_{it}) - (P_{it}^{10}|\,\tilde{e}_i) - (P_{it}^{11}|\,\tilde{e}_i),$$

[14] Because the probabilities used in the paper always refer to those conditioned on explanatory variables, they are dropped out from the expressions for simplicity.

$$P_{it}^{20}|\,\tilde{e}_i = \Phi(-Y_{it}) - (P_{it}^{00}|\,\tilde{e}_i) - (P_{it}^{10}|\,\tilde{e}_i)\,,$$
$$P_{it}^{21}|\,\tilde{e}_i = \Phi(t_y - Y_{it}) - \Phi(-Y_{it}) - (P_{it}^{01}|\,\tilde{e}_i) - (P_{it}^{11}|\,\tilde{e}_i)\,,$$
$$P_{it}^{22}|\,\tilde{e}_i = 1 - \Phi(t_y - Y_{it}) - (P_{it}^{02}|\,\tilde{e}_i) - (P_{it}^{12}|\,\tilde{e}_i)\,.$$

The joint probability P_{it}^{jk} not conditioned on $\tilde{e}_i$ can be viewed as an expectation of $P_{it}^{jk}|\,\tilde{e}_i$ over all possible realizations of $\tilde{e}_i$, which can then be approximated by the sample mean of $P_{it}^{jk}|\,\tilde{e}_i^r$, with $\tilde{e}_i^r$ being a random draw from the distribution given by i.i.d. $\mathrm{N}(\mathbf{0}, \tilde{\Sigma}_e)$, that is,

$$P_{it}^{jk} = \int (P_{it}^{jk} \mid \tilde{e}_i) f(\tilde{e}_i) d\tilde{e}_i \approx \frac{1}{R}\sum_{r=1}^{R} (P_{it}^{jk} \mid \tilde{e}_i^r), \quad j,k = 0, 1, 2\,. \qquad \text{(A-2)}$$

This is actually an application of the GHK simulator to panel probit model (for details see Train (2003)). With P_{it}^{jk} being defined in such a way, we can formulate the likelihood function easily and estimate the reduced-form model using maximum likelihood estimation methods.

In the second stage, we estimate the structural model given by (3a) and (3b), but with the endogenous variables appearing on the right-hand side replaced with their instruments. We follow the approach adopted by Heckman (1978) to use fitted values of the endogenous variables, $\hat{q}_{it}^*$ and $\hat{y}_{it}^*$, as instruments. Let $\hat{\Pi}_{mn}$, $m,n = 1, 2$, be the estimates for Π_{mn}, $m,n = 1,2$, then $\hat{q}_{it}^* = \mathbf{x}_{it}^q \hat{\Pi}_{11} + \mathbf{x}_{it}^y \hat{\Pi}_{12}$ and $\hat{y}_{it}^* = \mathbf{x}_{it}^q \hat{\Pi}_{21} + \mathbf{x}_{it}^y \hat{\Pi}_{22}$. Note that we drop the random-effect terms to ensure that the instruments are not correlated with the random-effect terms included in the structural model. Now rewrite the structural model as follows:

$$q_{it}^* = \bar{q}_{it} + u_{it}^q\,, \qquad \text{(A-3a)}$$
$$y_{it}^* = \bar{y}_{it} + u_{it}^y\,, \qquad \text{(A-3b)}$$

where $\bar{q}_{it} = \mathbf{x}_{it}^q \beta_q + \hat{y}_{it}^* \alpha_q + e_i^q$ and $\bar{y}_{it} = \mathbf{x}_{it}^y \beta_y + \hat{q}_{it}^* \alpha_y + e_i^y$. Because u_{it}^q and u_{it}^y are independent of each other (see (4b)), we have

$$P_{it}^{jk}|\,e_i = (P_{it}^{j\bullet}|\,e_i) \times (P_{it}^{\bullet k}|\,e_i)\,,$$

where

$$P_{it}^{j\bullet}|\,e_i = \Pr(q_{it} = j \mid e_i) \text{ and } P_{it}^{\bullet k}|\,e_i = \Pr(y_{it} = k \mid e_i)\,.$$

To be more specific,

$$P_{it}^{0\bullet}|\,e_i = \Phi(-\bar{q}_{it}),\; P_{it}^{1\bullet}|\,e_i = \Phi(t_q - \bar{q}_{it}) - (P_{it}^{0\bullet}|\,e_i),\; P_{it}^{2\bullet}|\,e_i = 1 - \Phi(t_q - \bar{q}_{it})\,,$$
$$P_{it}^{\bullet 0}|\,e_i = \Phi(-\bar{y}_{it}),\; P_{it}^{\bullet 1}|\,e_i = \Phi(t_y - \bar{y}_{it}) - (P_{it}^{\bullet 0}|\,e_i),\; P_{it}^{\bullet 2}|\,e_i = 1 - \Phi(t_y - \bar{y}_{it})\,.$$

Finally, we apply the GHK simulator to approximate P_{it}^{jk} using a formula similar to (A-2), with e_i replacing $\tilde{e}_i$ and e_i^r being drawn from the distribution characterized by (4a). The full-sample log-likelihood function to be maximized is

$$\log L = \sum_i \sum_t \sum_{j=0}^{2} \sum_{k=0}^{2} \mathbf{1}\{q_{it} = j \text{ and } y_{it} = k\} \log P_{it}^{jk}\,,$$

where $\mathbf{1}\{\}$ is an indicator function which takes a value of 1 if the statement in brackets is true and 0 otherwise. The estimable structural parameters include β_q, α_q, t_q, β_y, α_y, t_y, σ_{qq}, σ_{qy}, and σ_{yy}.

A.I.2 Estimation Procedures for the Ordered Probit Model

The expression for g_{it}^*, equation (6), can be derived by subtracting (A-1a) from (A-1b) and by using the definition of g_{it}^*:

$$g_{it}^* \equiv y_{it}^* - q_{it}^* = \mathbf{x}_{it}^q(\Pi_{21} - \Pi_{11}) + \mathbf{x}_{it}^y(\Pi_{22} - \Pi_{12}) + (\tilde{e}_i^y - \tilde{e}_i^q) + (\tilde{u}_{it}^y - \tilde{u}_{it}^q)$$

$$= \mathbf{x}_{it}\Pi + \bar{e}_i + \bar{u}_{it}, \qquad \text{(A-4)}$$

where $\mathbf{x}_{it}$ contains all distinct variables from $\mathbf{x}_{it}^q$ and $\mathbf{x}_{it}^y$, Π is the coefficients vector, $\bar{e}_i = \tilde{e}_i^y - \tilde{e}_i^q$ is the composite country-specific random effect, which is i.i.d. N($0, \sigma_e^2$), and the composite error term $\bar{u}_{it} = \tilde{u}_{it}^y - \tilde{u}_{it}^q$ is i.i.d. N($0, 2(1-\rho)$). Note that $\mathrm{E}(\bar{u}_{it} \mid \mathbf{x}_{it}, \bar{e}_i) = 0$ by construction, and $\mathrm{E}(\bar{u}_{it} | \mathbf{x}_{it}, \bar{e}_i, y_{it}) = \mathrm{E}(\bar{u}_{it} | y_{it})$, which is typically not equal to zero. To see this point, note that

$$\mathrm{E}(\bar{u}_{it} | y_{it}) = \mathrm{E}(\tilde{u}_{it}^y | y_{it}) - \mathrm{E}(\tilde{u}_{it}^q | y_{it}) = (1-\rho)\mathrm{E}(\tilde{u}_{it}^y | y_{it}). \qquad \text{(A-5)}$$

Using results from Maddala (1983, pp.365-366), it can be shown that

$$\mathrm{E}(\tilde{u}_{it}^y | y_{it} = 0, \tilde{e}_i^y) = \mathrm{E}(\tilde{u}_{it}^y | \tilde{u}_{it}^y \le -Y_{it}, \tilde{e}_i^y) = \frac{-\phi(-Y_{it})}{\Phi(-Y_{it})},$$

$$\mathrm{E}(\tilde{u}_{it}^y | y_{it} = 1, \tilde{e}_i^y) = \mathrm{E}(\tilde{u}_{it}^y | -Y_{it} < \tilde{u}_{it}^y \le t_y - Y_{it}, \tilde{e}_i^y) = \frac{\phi(-Y_{it}) - \phi(t_y - Y_{it})}{\Phi(t_y - Y_{it}) - \Phi(-Y_{it})},$$

$$\mathrm{E}(\tilde{u}_{it}^y | y_{it} = 2, \tilde{e}_i^y) = \mathrm{E}(\tilde{u}_{it}^y | \tilde{u}_{it}^y > t_y - Y_{it}, \tilde{e}_i^y) = \frac{\phi(t_y - Y_{it})}{1 - \Phi(t_y - Y_{it})},$$

where $Y_{it} = \mathbf{x}_{it}^q\Pi_{21} + \mathbf{x}_{it}^y\Pi_{22} + \tilde{e}_i^y$ as before, and Φ (ϕ) denotes the distribution (density) function of standard normal variables. Obviously, these conditional means are unlikely to be zero. To obtain $\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})$, we apply the simulation technique, i.e.,

$$\mathrm{E}(\tilde{u}_{it}^y \mid y_{it} = j) = \int \mathrm{E}(\tilde{u}_{it}^y \mid y_{it} = j, \tilde{e}_i^y) f(\tilde{e}_i^y) d\tilde{e}_i^y$$

$$\approx \frac{1}{R}\sum_{r=1}^{R} \mathrm{E}(\tilde{u}_{it}^y \mid y_{it} = j, (\tilde{e}_i^y)^r), \quad j = 0, 1, 2,$$

where $(\tilde{e}_i^y)^r$ is a random draw based on the distribution i.i.d. $\mathrm{N}(\mathbf{0}, \tilde{\Sigma}_e)$. These are again non-zero in usual cases. Utilizing this result, we modify (A-4) in the following way:

$$g_{it}^* = \mathbf{x}_{it}\Pi + \bar{e}_i + (1-\rho)\mathrm{E}(\tilde{u}_{it}^y \mid y_{it}) + \bar{\bar{u}}_{it}, \qquad \text{(A-6)}$$

where $\bar{\bar{u}}_{it} = \bar{u}_{it} - (1-\rho)\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})$ with $\mathrm{E}(\bar{\bar{u}}_{it} | y_{it}) = 0$. By taking out of $\bar{u}_{it}$ its non-zero mean, the efficiency of the estimation can be improved.

If we define $G_{it} = \mathbf{x}_{it}\Pi + (1-\rho)\mathrm{E}(\tilde{u}_{it}^y \mid y_{it})$ and normalize the variance of $\bar{\bar{u}}_{it}$ to be one, then we can use equation (5) to obtain

$$P_{it}^{-1} \mid \bar{e}_i = \Pr(g_{it} = -1 \mid \bar{e}_i) = \Pr(g_{it}^* \le 0 \mid \bar{e}_i) = \Phi(-G_{it} - \bar{e}_i),$$

$$P_{it}^{0} \mid \bar{e}_i = \Pr(g_{it} = 0 \mid \bar{e}_i) = \Pr(0 < g_{it}^* \le t_g \mid \bar{e}_i) = \Phi(t_g - G_{it} - \bar{e}_i) - \Phi(-G_{it} - \bar{e}_i),$$

$$P_{it}^{+1} \mid \bar{e}_i = \Pr(g_{it} = +1 \mid \bar{e}_i) = \Pr(g_{it}^* > t_g \mid \bar{e}_i) = 1 - \Phi(t_g - G_{it} - \bar{e}_i),$$

and the probabilities not conditioned on $\bar{e}_i$ are simulated using

$$P_{it}^g = \int (P_{it}^g \mid \tilde{e}_i) f(\bar{e}_i) d\bar{e}_i \approx \frac{1}{R}\sum_{r=1}^{R} (P_{it}^g \mid \bar{e}_i^r), \quad g = -1, 0, +1,$$

with $\bar{e}_i^r$ drawn from the distribution i.i.d. N($0, \sigma_e^2$). Then we can formulate the likelihood function and use maximization procedures to estimate the model.

Appendix II. Definitions of Variables and Data Sources

CA: current account balances, normalized by GDP. Data source for current account balances and for GDP is the IMF, *International Financial Statistics* (*IFS*).

CPINF: transformed annual consumer price inflation rate (π^*) using the formula $\pi^* = \pi/(1+\pi)$. Data source is the IMF, *World Economic Outlook* (*WEO*) database.

FINDEV: broad money (M2), normalized by GDP. Broad money is the sum of "money" and "quasi-money" taken from the IMF, *IFS*.

FISCAL: the ration of central government budget balances to GDP. Data source is the IMF, *WEO* database.

GEOCON: share of trade (exports plus imports) with the largest trading partner in total trade with the ten largest trading partners. Data source is the IMF, *Direction of Trade Statistics* (*DOTS*).

KCONTR: intensity of capital controls, defines as the sum of the dummies for (1) the existence of multiple or dual exchange rates, (2) the existence of restrictions on payments of current transactions, (3) the existence of restrictions on payments of capital transactions, and (4) the existence of surrender requirements for export proceeds. Data source is the IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions*.

KFLOW: gross capital flows, normalized by GDP. Gross capital flows are the sum of inflows and outflows of direct investment, portfolio investment, and other investment. Data source for capital flows and for GDP is the IMF, *IFS*.

LAGFF: dummy variable, taking a value of one if fear of floating (i.e., the de jure regime being more flexible than the de facto regime) is observed in the last year, and zero otherwise.

LAGFP: dummy variable, taking a value of one if fear of pegging (i.e., the de jure regime being less flexible than the de facto regime) is observed in the last year, and zero otherwise.

LDFFLEX: dummy variable, taking a value of one if de facto exchange rate regime adopted in the last year is a flexible regime, and zero otherwise.

LDFINTER: dummy variable, taking a value of one if de facto exchange rate regime adopted in the last year is an intermediate regime, and zero otherwise.

LDJFLEX: dummy variable, taking a value of one if de jure exchange rate regime adopted in the last year is a flexible regime, and zero otherwise.

LDJINTER: dummy variable, taking a value of one if de jure exchange rate regime adopted in the last year is an intermediate regime, and zero otherwise.

LEVEL: per capita GDP in US dollars and then in logarithms. Data source is the IMF, *WEO* database.

NSHK: average absolute deviation of the annual growth rate of broad money around the four-year backward moving average. Data source for broad money growth rates is Ghosh et al. (2002).

OPENNESS: the ratio of the sum of exports and imports of goods and services to GDP. Data source is the IMF, *WEO* database.

PASSTHRU: correlation coefficient between monthly consumer price inflation rates and monthly rates of depreciation of the nominal effective exchange rate (NEER) lagged by one month. The NEER is calculated vis-à-vis ten largest trading partners. Data source for inflation is the IMF, *WEO* database, for nominal exchange rate is the IMF, *International Financial Statistics* (*IFS)*, for trade data is the IMF, *DOTS*.

RESERVE: non-gold international reserves, normalized by broad money. Data source for reserves and for broad money is the IMF, *IFS*.

RSHK: three-year centered standard deviation of the growth rate of terms of trade. Data source is Ghosh et al. (2002).

SIZE: gross domestic products in current prices, expressed in billions of US dollars and then in logarithms. Data source is the IMF, *IFS*.

Table 1
Classification of Exchange Rate Regimes

Fixed	**Intermediate**	**Flexible**
De facto classification by Levy-Yeyati and Sturzenegger		
(0) inconclusive (1) fixed	(2) intermediate	(3) float
De facto classification by Reinhart and Rogoff		
(1) no separate legal tender (2) pre-announced peg or currency board arrangement (3) pre-announced horizontal band, bandwidth not exceeding ±2% (4) de facto peg	(5) pre-announced crawling peg (6) pre-announced crawling band, bandwidth not exceeding ±2% (7) de facto crawling peg (8) de facto crawling band, bandwidth not exceeding ±2% (9) pre-announced crawling band, bandwidth exceeding ±2% (10) de facto crawling band, bandwidth not exceeding ±5% (11) moving band, bandwidth not exceeding ±2%	(12) managed floating (13) freely floating (14) freely falling (15) hyperfloating
De jure classification by the IMF (up to 1997)		
(1) single currency peg (2) SDR peg (3) other composite currency peg	(4) flexibility vis-a-vis a single currency (5) flexibility vis-a-vis group of currencies (6) exchange rate adjusted according to indicators	(7) other managed floating (8) independently floating
De jure classification by the IMF (since 1998)		
(1) no separate legal tender (2) currency board arrangement (3) other conventional fixed peg	(4) horizontal band (5) crawling peg (6) crawling band	(7) managed floating without pre-announced path for exchange rates (8) independently floating

Sources: Levy-Yeyati and Sturzenegger (2000); Reinhart and Rogoff (2002); IMF, *AREAER* (various issues).

Table 2
Cross-Classification of De Facto and De Jure Exchange Rate Regimes

Regimes	IMF	LYS 0	LYS 1	LYS 2	RR 0	RR 1	RR 2
0: Fixed	975 [54.0]	843 (86.5)	87 (8.9)	45 (4.6)	641 (65.7)	155 (15.9)	179 (18.4)
1: Intermediate	123 [6.8]	37 (30.1)	43 (35.0)	43 (35.0)	20 (16.3)	68 (55.3)	35 (28.5)
2: Flexible	707 [39.2]	178 (25.2)	255 (36.1)	274 (38.8)	61 (8.6)	346 (48.9)	300 (42.4)
Total	1805 [100.0]	1058 [58.6]	385 [21.3]	362 [20.1]	722 [40.0]	569 [31.5]	514 [28.5]
Independence of Regime Distributions							
Chi-squared		122.36***			107.68***		
Regime Discrepancies							
Fear of Pegging		175 [9.7]			369 [20.4]		
Consistent		1160 [64.3]			1009 [55.9]		
Fear of Floating		470 [26.0]			427 [23.7]		

Note: Numbers in parentheses are percentage shares of row sums reported under the column head "IMF". Numbers in brackets are percentage shares of total number of observations (1805). Significance at 1% level is indicated by ***.

Table 3
Regime Persistence and Persistence of Regime Gaps

	IMF Obs.	IMF Share (%)	LYS Obs.	LYS Share (%)	RR Obs.	RR Share (%)
Regime Persistence						
Fixed	941	94.0	920	85.8	695	95.7
Intermediate	95	81.9	183	46.9	513	91.4
Flexible	636	92.4	199	58.0	465	89.8
Average	-	92.6	-	72.1	-	92.7
Persistence of Regime Gaps between IMF and LYS or RR Classifications						
Fear of Pegging			97	53.3	331	84.0
Consistent			964	83.1	912	91.8
Fear of Floating			318	68.7	365	87.5
Average			-	76.4	-	89.1

Note: Regime persistence is measured by the conditional probability of adopting an exchange rate regime in the current year given that the same regime was adopted in the last year. Gap persistence is defined analogously. Average persistence is the weighted average of the persistence of three regimes.

Table 4
Regime Flexibility in This Year Compared with Last Year

Regime Flexibility	**IMF**	**LYS**			**RR**		
		(-)	**(0)**	**(+)**	**(-)**	**(0)**	**(+)**
(-) Decreased	57 [3.2]	18 (31.6)	29 (50.9)	10 (17.5)	6 (10.5)	49 (86.0)	2 (3.5)
(0) Unchanged	1672 [92.6]	206 (12.3)	1241 (74.2)	225 (13.5)	56 (3.3)	1565 (93.6)	51 (3.1)
(+) Increased	76 [4.2]	11 (14.5)	32 (42.1)	33 (43.4)	5 (6.6)	59 (77.6)	12 (15.8)
Total	1805 [100.0]	235 [13.0]	1302 [72.1]	268 [14.8]	67 [3.7]	1673 [92.7]	65 [3.6]
Average	-	(71.6)			(87.7)		

Note: Numbers in parentheses are percentage shares of row sums reported under the column head "IMF". Numbers in brackets are percentage shares of total number of observations (1805). Average association is the weighted average of the three diagonal elements.

Table 5
Simultaneous Equations Model for the Joint Determination of De facto and De jure Exchange Rate Regimes

	LYS		RR		LYS		RR	
Variables	**Coeff.**	**S. E.**	**Coeff.**	**S. E.**	**Coeff.**	**S. E.**	**Coeff.**	**S. E.**
De facto Exchange Rate Regime								
y^*_{it}	0.72**	0.07	0.27**	0.09	0.36**	0.06	0.02	0.04
CPINF	0.47	0.30	6.68**	1.74	0.55	0.43	-0.14	0.42
PASSTHRU	-0.26	0.16	-0.68*	0.41	-0.24	0.25	-0.09	0.17
CA	0.46	0.79	4.57**	2.07	0.73	0.73	-0.28	0.49
FISCAL	-1.16	0.97	-3.87	2.49	-2.37*	1.30	0.01	0.03
KFLOW	-1.17**	0.41	-0.50	0.43	-1.35**	0.57	-0.18	0.21
LDFINTER					1.14**	0.20	3.04**	0.19
LDFFLEX					2.04**	0.27	5.50**	0.29
t_q	1.01**	0.06	3.41**	0.98	1.45**	0.18	2.83**	0.14
De jure Exchange Rate Regime								
q^*_{it}	0.61**	0.17	0.42**	0.10	0.20**	0.08	0.18**	0.04
OPENNESS	0.45**	0.12	0.24	0.21	0.24*	0.14	0.12	0.16
GEOCON	0.74	0.60	1.03**	0.46	0.04	0.51	0.13	0.25
SIZE	0.48**	0.10	0.33**	0.06	0.11**	0.04	0.08**	0.04
LEVEL	-0.34**	0.10	-0.29**	0.10	-0.08	0.13	-0.02	0.05
FINDEV	-1.09**	0.41	-1.46**	0.40	-0.19	0.27	-0.38*	0.22
RSHK	0.97	0.67	-0.52	0.60	1.07	0.80	0.51	0.50
NSHK	0.58	1.66	-3.46**	1.22	-0.36	5.77	-1.46	0.94
RESERVE	-0.05	0.37	-0.28	0.54	-0.21	0.39	-0.16	0.27
KCONTR	-0.25**	0.09	-0.31**	0.10	-0.03	0.04	-0.02	0.04
LDJINTER					1.55**	0.22	1.56**	0.18
LDJFLEX					3.28**	0.23	3.35**	0.20
t_y	0.50**	0.10	0.37**	0.05	0.71**	0.07	0.64**	0.07
Variance-Covariance Matrix of Country-Specific Random Effects								
σ_{qq}	0.68**	0.20	7.00	4.72	1.04**	0.50	0.30**	0.10
σ_{qy}	1.35**	0.27	1.81**	0.72	0.47**	0.14	0.24**	0.08
σ_{yy}	2.70**	1.37	1.29**	0.46	0.21**	0.09	0.20*	0.10
Memorandum Items								
Observations	1315		1336		1280		1335	
Countries	97		88		97		88	
Log-likelihood	-2063.3		-2161.4		-1388.6		-1084.7	
Correct (%)								
De facto	56.1		51.9		67.7		91.5	
De jure	63.3		66.0		90.5		91.8	
Joint	41.1		33.6		62.8		84.6	

Note: All specifications are estimated with a constant and period dummies included in both regime equations. Significance at 10% and 5% level is indicated by * and ** respectively.

Table 6
Ordered Probit Model for Regime Discrepancies

	LYS		RR		LYS		RR	
Variables	**Coeff.**	**S. E.**	**Coeff.**	**S. E.**	**Coeff.**	**S. E.**	**Coeff.**	**S. E.**
$E(\tilde{u}_{it}^{y} \mid y_{it})$	1.94**	0.21	3.39**	0.86	1.49**	0.17	1.88**	0.14
OPENNESS	0.38**	0.10	0.77**	0.30	0.22**	0.09	0.22	0.19
GEOCON	0.83**	0.36	0.52	0.57	0.39	0.32	0.03	0.16
SIZE	0.18**	0.04	0.36**	0.09	0.10**	0.03	0.00	0.04
LEVEL	-0.25**	0.06	-0.15	0.10	-0.10*	0.05	-0.08	0.07
FINDEV	-0.21**	0.06	-3.74**	1.00	-0.12**	0.05	-0.51*	0.29
RSHK	0.29	0.29	-1.15**	0.47	0.16	0.38	-0.12	0.40
NSHK	0.61	0.83	-5.69**	1.91	0.00	0.07	-2.19**	1.00
RESERVE	-0.36	0.24	-0.70	0.43	-0.09	0.20	0.08	0.31
KCONTR	-0.27**	0.05	-0.55**	0.16	-0.11**	0.04	-0.05	0.05
CPINF	1.19**	0.35	-1.65**	0.56	0.69**	0.29	1.08**	0.33
PASSTHRU	0.23	0.18	0.07	0.18	0.10	0.19	-0.13	0.19
CA	0.61	0.67	-0.99	0.99	-0.44	0.62	0.85	0.75
FISCAL	1.88*	1.09	-1.71	1.42	1.46	1.07	-0.52	1.14
KFLOW	0.15	0.11	-0.47	0.32	0.05	0.12	-0.02	0.18
LAGFP					-1.71**	0.22	-3.31**	0.23
LAGFF					1.55**	0.18	2.99**	0.22
t_g	3.89**	0.42	5.55**	1.41	3.26**	0.34	3.96**	0.26
Variance of Country-Specific Random Effects								
σ_e	0.90**	0.22	1.80**	0.62	0.52**	0.24	0.26	0.24
Memorandum Items								
Observations	1315		1336		1280		1335	
Countries	97		88		97		88	
Log-likelihood	-797.7		-808.7		-719.9		-346.8	
Correct (%)	68.8		67.7		77.2		92.4	

Note: All specifications are estimated with a constant and period dummies. Significance at 10% and 5% level is indicated by * and ** respectively.