DISCUSSION PAPER SERIES

No. 5537

THE INTERACTION BETWEEN CAPITAL CONTROLS AND EXCHANGE RATE REGIMES: EVIDENCE FROM DEVELOPING COUNTRIES

Jürgen von Hagen and Jizhong Zhou

INTERNATIONAL MACROECONOMICS

Centre for Economic Policy Research

www.cepr.org

Available online at: **www.cepr.org/pubs/dps/DP5537.asp**

ISSN 0265-8003

THE INTERACTION BETWEEN CAPITAL CONTROLS AND EXCHANGE RATE REGIMES: EVIDENCE FROM DEVELOPING COUNTRIES

Jürgen von Hagen, ZEI, University of Bonn, Indiana University and CEPR
Jizhong Zhou, Shanghai University of Finance and Economics, ZEI and University of Bonn

Discussion Paper No. 5537
March 2006

Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

CEPR Discussion Paper No. 5537

March 2006

ABSTRACT

The Interaction Between Capital Controls and Exchange Rate Regimes: Evidence from Developing Countries*

The choice of the exchange rate regime and the capital account regime are among the core macro economic policy decisions for developing countries, with important repercussions for a country's macro economic stability, ability to attract foreign capital, and international trade. Existing literature has considered the determinants of these decisions, taking the capital account regime as given when considering the exchange rate regime and vice versa. This paper provides an empirical analysis of the interaction between the two regime choices treating both as simultaneously endogenous. Using a panel data set for developing countries in the 1980s and 1990s, we estimate a simultaneous-equations panel mixed logit model for the joint determination of both choices. We find strong influences from the official, de jure exchange rate regime on capital account policies, but only weak feedback effects. Using de-facto exchange rate regimes, the influences in both directions are similar to each other.

JEL Classification: C33, C35, F20 and F33
Keywords: capital controls, exchange rate regimes, panel mixed logit model and simultaneous equations model

Jürgen von Hagen
Zentrum für Europäische
Walter-Flex- Strasse 3
D-53113 Bonn
GERMANY
Tel: (49 228) 739 199/7
Fax: (49 226) 731 809
Email: vonhagen@uni-bonn.de

Jizhong Zhou
School of Finance
Shanghai University of Finance and Economics
777 Guoding Road
Shanghai 200433
China
Tel: (86 21) 65903886
Email: jzzhou@mail.shufe.edu.cn

*This paper was written when Jizhong Zhou was working as a research fellow at the Center for European Integration Studies (ZEI). The financial support of DFG is greatly acknowledged.

Submitted 02 February 2006

The Interaction between Capital Controls and Exchange Rate Regimes: Evidence from Developing Countries*

Jürgen von Hagen†
ZEI, University of Bonn, Indiana University, and CEPR

Jizhong Zhou‡
Shanghai University of Finance and Economics, ZEI, and University of Bonn

January 26, 2006

Abstract

This paper provides an empirical analysis of the interaction between capital controls and exchange rate policies in developing countries in 1980s and 1990s. We estimate a simultaneous-equations panel mixed logit model for the joint determination of two decisions. We find strong influences from de jure exchange rate regimes on capital account policies but somewhat weaker feedback impacts. With de facto exchange rate regimes the influences in both directions are similar to each other.

Keywords: Capital controls, exchange rate regimes, simultaneous equations model, panel mixed logit model

JEL Codes: F20, F33, C33, C35

1 Introduction

Should developing countries maintain or eliminate capital controls? What are the benefits and risks of capital account liberalization for developing countries? These issues have been debated for long among researchers. One strand of thought believes that, analogous to the case for free trade, free capital movements allow developing countries to participate in intertemporal trade and to benefit from efficient allocation of capital (Fischer, 1998). Since capital controls prevent the most efficient allocation of capital from being achieved, there is a case for eliminating capital controls. Another strand of thought argues that capital controls can be imposed to offset the vicious effects of other distortions, such as information asymmetry on the financial markets and inefficiency in the tax system (Mathieson and Rojas-Suarez, 1993; Razin and Sadka, 1991). Since the theory of the second best implies that removing one distortion may not be welfare enhancing when other distortions are present, capital controls can be viewed as a second best solution to existing distortions.

Recent experiences with currency crises add another dimension to this debate. Since these crises episodes involve combinations of high capital mobility and some type of intermediate exchange rate regimes, i.e., regimes between freely floating and hard pegs, the relation between capital account policies and exchange rate policies becomes an increasingly relevant question. Based on the "impossible

*This paper was written when Jizhong Zhou was working as a research fellow at the Center for European Integration Studies (ZEI). The financial support of DFG is greatly acknowledged.

†ZEI, Walter-Flex-Strasse 3, D-53113 Bonn, Germany. Tel: 0049-228-739199. Fax: 0049-228-731809. Email: vonhagen@uni-bonn.de

‡Corresponding author. School of Finance, Shanghai University of Finance and Economics, 777 Guoding Road, Shanghai 200433, P. R. China. Tel: 0086-21-65903886. Fax: 0086-21-65103925. Email: jzzhou@mail.shufe.edu.cn

trinity" of exchange rate stability, monetary independence, and free capital flows, proponents of the "bi-polar" view of the issue claims that, in the contemporary world of high capital mobility, only hard pegs or freely floating regimes are sustainable. The former buy exchange rate stability at the cost of monetary autonomy, while the latter retain monetary independence at the cost of exchange rate stability. Intermediate exchange rate regimes are doomed to failure, as they are intrinsically vulnerable to speculative attacks.[1] Others believe that, when capital mobility is restricted, intermediate regimes are still viable options for exchange rate policies, especially for many developing countries where capital controls are maintained for good reasons.[2]

Does higher capital mobility resulting from capital account liberalization really lead to the polarization in the choice of exchange rate regimes? Does the sustainability of intermediate exchange arrangements rely on the shelter of capital controls? A general answer to the former question is still lacking. For the latter, however, there is plenty of evidence showing that intermediate exchange rate regimes, such as adjustable pegs, are typically associated with closed capital accounts.[3] While this association is commonly interpreted as supporting the view that choices of exchange rate regimes can influence capital account policies, the possibility of reverse causality, i.e., choices of exchange rate regimes being influenced by capital account policies, is usually not considered. The only exception is von Hagen and Zhou (2005), who study capital account policies and choices of exchange rate regimes in a group of transition economies and explicitly allow for mutual endogeneity of and interaction between capital control decisions and exchange rate regime choices within a simultaneous-equations framework.

The main purpose of this paper is to analyze empirically how decisions on capital controls and choices of exchange rate regimes interact with each other.[4] We follow our earlier approach and use a simultaneous-equations model to capture the interaction, with several extensions. First, instead of using an ordered-choice structure for exchange rate regimes, where a monotonic relation between the flexibility of exchange rate regimes and the intensity of capital controls is imposed, we use a more flexible multinomial-choice structure, which allows different exchange rate regimes to exert different influences on capital account decisions and vice versa. Second, we study the interaction of capital account policies with both de jure and de facto exchange rate policies. Since discrepancies between de jure and de facto exchange rate policies are not uncommon,[5] we suspect that they may also interact with capital account policies in different ways. Third, we allow country-specific heterogeneity to play a role in the determination of both capital account policies and exchange rate policies. Country-specific heterogeneity not only captures the influence of omitted factors influencing the decision process, but also accounts for the time-series correlation in both the decision on capital controls and the choice of exchange rate regimes. Finally, we substantially enlarge the sample to cover as many developing countries and as long time span as data availability permits.

The main findings of this paper confirm our conjecture that capital account policies and exchange rate policies interact with each other. When exchange rate policies are defined on the de-jure basis, the influence of the choice of exchange rate regimes on capital account policies is stronger than the reverse effect. With de-facto exchange rate regimes, in contrast, the effects are similar in both directions. The empirical results also suggest that fixed-rate, intermediate, and flexible regimes may interact with capital account policies in different way, which supports the use of a non-ordered choice structure.

The rest of the paper is organized as follows. Section 2 discusses the measurement of capital account policies, introduces two indices of capital controls, explains the classification of exchange rate regimes, and provides a non-parametric analysis of the interaction between capital controls and exchange rate regimes. Section 3 explains our empirical strategy, including model specification, estimation approach, and variable construction. Section 4 presents and discusses the empirical results. Section 5 concludes.

[1] See, for example, Fischer (2001) for a discussion on the bi-polar view.

[2] See, among others, Williamson (2000).

[3] See for example Alesina et al. (1994), Grilli and Milesi-Ferretti (1995), and Berger et al. (2001).

[4] For the sake of brievity, we will not cover the determination of capital controls and of exchange rate regimes in the main text. See Appendix I for relevant empirical results and a brief discussion.

[5] See Calvo and Reinhart (2002), Ghosh et al. (1997), and Zhou and von Hagen (2004).

2 Capital Controls and Exchange Rate Regimes

2.1 Measuring capital controls

Most empirical studies of capital controls use the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (*AREAER*) as the main source of information. Both simple dummies and sophisticated indicators have been developed to measure capital controls.[6] Up to the 1996 edition (for 1995), the *AREAER* reports the existence or absence of restrictions on payments for capital transactions in each IMF member country. Based on this information, a simple dummy for capital controls can be constructed, which takes a value of one if such restrictions exist, or zero if not. This is the approach commonly adopted in the early empirical literature.[7] Although the dummy is too rough to reflect subtle differences in the intensity of capital controls, it has the advantage of a wide country coverage (available for all IMF members) and a long time span (from 1973 to 1995).

In an attempt to go beyond this binary indicator, Quinn (1997) creates a 0-4 scale (in increments of 0.5) for restrictiveness of capital accounts based on a careful coding of national regulations. While the Quinn index is a refined measurement of capital controls, it covers only 64 industrial and developing countries for the 1954–1994 period. For analyses focusing on a much wider range of developing countries, such as this study, the Quinn index has rather limited scope for application. It is also difficult to extend its country coverage or time span in an objective and straightforward manner.

Starting with the 1997 edition (for 1996), the *AREAER* began to report detailed information on controls for many different types of capital transactions.[8] These various types of capital transactions are grouped into ten or eleven categories, each of them being marked as either subject to or free of controls.[9] This produces a set of dummies of capital controls, based on which more sophisticated measures can be constructed. The pioneers of this approach are Johnston and Tamirisa (1998), who construct an index of capital controls by averaging all possible capital control dummies. Efforts are also made to apply this new reporting procedure backwards to the pre-1996 years. For example, von Hagen and Zhou (2005) search information for 25 transition economies during the 1990s in the earlier editions of *AREAER*, and construct an index of capital controls as the ratio of number of categories of capital transactions subject to controls to the total number of categories. Brune et al. (2001) define their capital account openness index as the sum of nine dummies for 173 countries during 1973–1999.[10] Miniane (2004) defines an index of capital controls as the average of all possible dummies over thirteen categories of capital account transactions for 34 countries during 1983–2000.[11] While these indices can differentiate the intensity of capital controls, only for the post-1996 period can they be constructed without ambigueity. The construction of these indices for earlier periods has to be based on the researcher's personal, and probably subjective, interpretation of earlier editions of the *AREAER*.

We construct two indices of capital controls based on information from the *AREAER*.[12] The first index, labeled RKAP, is the conventional dummy for the existence of capital controls. For the 1974–1995 period, the value of the index is one if restrictions are imposed on payments for capital transactions, and zero if not. For the 1996–2000 period, we summarize the disaggregated information about controls on ten or eleven categories of capital transactions into a single dummy comparable with the old one.

[6] See Miniane (2004) for a recent review of measurement of capital controls. Also see Eichengreen (2001) and Dooley (1996).

[7] See Epstein and Schor (1992), Alesina et al. (1994), Grilli and Milesi-Ferretti (1995).

[8] The new reporting procedure was first applied in a supplement to the usual 1996 edition of *AREAER*. But it covered only 52 countries for 1995. It has been extended to all the IMF member countries since the 1997 edition of *AREAER*.

[9] The 1997 edition of *AREAER* identified ten categories of capital transactions that can be subject to controls: (1) capital market securities, (2) money market instruments, (3) collective investment securities, (4) derivatives and other instruments, (5) commercial credits, (6) financial credits, (7) guarantees, sureties, and financial backup facilities, (8) direct investment, (9) liquidation of direct investment, and (10) real estate transactions. Starting with the 1998 edition, "personal capital movements" is added as the eleventh category.

[10] They identify five types of capital controls, namely controls on (1) invisibles, (2) capital and money market securities, (3) credit operations, and (4) direct investment and real estate transactions, as well as (5) controls specific to commercial banks. The first four types have separate dummies for inflows and outflows of capital.

[11] The thirteen categories include the eleven categories mentioned in footnote 9 plus provisions specific to (1) commercial banks and other credit institutions and (2) institutional investors. Most countries in the sample are industrial countries.

[12] See Appendix II for more details on data sources.

Following a common practice in the literature, we assume that the ten or eleven categories of capital transactions are of equal importance.[13] We count the total number of categories of capital transactions as well as the number of categories subject to controls. Then the RKAP dummy takes a value of one if more than 50% of the categories are subject controls, and zero otherwise.[14] We refer to the RKAP dummy as the narrowly-defined index of capital controls.

The RKAP dummy identifies a large amount of cases of capital controls (see the discussion below), but does not distinguish tight capital controls from loose ones.[15] Because the intensity of capital controls is difficult to measure directly (Eichengreen, 2001), we apply an indirect approach to address the issue. We observe that isolated capital controls can be circumvented through channels not subject to controls.[16] If potential loopholes are closed, the existing capital controls will be more binding. Therefore, we expect that capital control intensity be hightened when supplementary restrictions are put in place, and the more restrictions imposed, the more intensive capital controls will be. This provides a rationale for using the number of restrictions on international transactions as a proxy for the intensity of capital controls.

Inspired by Juhn and Mauro (2002), we consider the following three restrictions on international transactions: (1) dual or multiple exchange rates (DUAL), (2) surrender or repatriation requirement for export proceeds and/or invisible transactions (SURR), and (3) restrictions on payments for current transactions (RCUR).[17] We construct dummy for each restriction, which takes a value of one if it exists, or zero otherwise. Define SUM = DUAL + SURR + RCUR, which is an integer between 0 and 3. We then define an ordered index, labeled CAPC, as follows:

- CAPC = 0 if RKAP = 0 (no capital controls).
- CAPC = 1 if RKAP = 1 and SUM $<$ 2 (weak capital controls).
- CAPC = 2 if RKAP = 1 and SUM = 2 (intermediate capital controls).
- CAPC = 3 if RKAP = 1 and SUM $>$ 2 (strong capital controls).

We refer to the CAPC index as the broadly-defined index of capital controls. It indicates not only the absence (CAPC = 0) or presence (CAPC$>$ 0) of capital controls, but also the intensity of controls if they are imposed. This definition implies that the narrowly-defined index of capital controls, RKAP, plays a primary role in the construction of the CAPC index, while the other three dummies are of secondary and equal importance.[18] As a first pass, if RKAP takes the value of zero, then CAPC takes the value of zero, too, no matter which value SUM takes. Only when capital controls are imposed (RKAP = 1) do we need information on the other three restrictions to have a feeling about the intensity of these

[13]For example, Johnston and Tamirisa (1998), Brune et al. (2001), Miniane (2004), and von Hagen and Zhou (2005) all summarize the dummies for disaggregated capital controls by taking *unweighted* sum or average of these dummies, which requires an implicit assumption that each category of capital transaction is of same importance and each dummy carries the same weight.

[14]When we change the threshold to 40% or 60%, the number of cases with RKAP = 1 increases or decreases only slightly, and the econometric results reported below are generally not affected.

[15]There are some evidences suggesting that the simple RKAP dummy may capture to a certain extent the differences in the intensity of capital controls. For example, Miniane (2004) reports that, for the pre-1996 period, his sophisticated index of capital controls intensity and the simple RKAP dummy share a very similar path of evolution for a sample of 34 industrial and developing countries, and the correlation coefficient between the two indices is 0.95. Although the similarity is less prominent for the sub-sample of 14 developing countries, the correlation coefficient is still as large as 0.48. Brune et al. (2001) also report that the correlation coefficient between their index of capital controls and the *AREAER*-based dummy is 0.78.

[16]For example, if there is no restriction on the payments for current account transactions, then by over- or under-reporting the export proceeds or import expenditures, financial capital can flow freely across the boarder despite of the regulations controling these capital flows.

[17]For the construction of these dummies, all relevant information can be easily found in each edition of the *AREAER* for the 1974–2000 period. See Appendix II for details.

[18]Juhn and Mauro (2002) and von Hagen and Zhou (2004) treat the four dummies as equally important and use their sum as a measure of intensity of external controls. Then a case with RKAP = 0 and SUM = 1 is the same as a case with RKAP = 1 and SUM = 0. Our approach, in contrast, identifies the former as a case with no capital control, and the latter with light capital controls.

Table 1: Two Indices of Capital Controls: RKAP and CAPC

RKAP	CAPC	Observations	Share (in %)
RKAP = 0	CAPC = 0	767	21.3
RKAP = 1	–	2826	78.7
with SUM < 2	CAPC = 1	722	20.1
with SUM = 2	CAPC = 2	1473	41.0
with SUM > 2	CAPC = 3	631	17.6
Total	–	3593	100.0

controls. In reality, cases with RKAP = 0 and SUM > 0 are not very common, justifying the use of RKAP as the first-level criterion in the construction of CAPC.

We collect data for these two indices of capital controls for 160 developing countries over the 1974–2000 period.[19] Due to changes in the IMF membership, we have a total number of 3593 country-year observations. Table 1 shows that, based on the narrowly-defined RKAP index, 767 cases (21.3% of total observations) have no capital controls, while 2826 cases (78.7%) do. Based on the broadly-defined CAPC index, we can break down the group with capital controls into three sub-groups according to the intensity of these controls: 722 cases (20.1% of total observations) have weak controls, 1473 cases (40.1%) have intermediate controls, and 631 cases (17.6%) have strong controls. The RKAP and CAPC indices are highly correlated, with a correlation coefficient at 0.80. A closer look at the relation among four underlying dummies shows that the high correlation between the two indices is mainly caused by high matching rate between RKAP and SURR or RCUR. Here we define the matching rate between two dummies as the percentage share in total observations of those with both dummies taking the same value (0 or 1). This rate is 91.3% between RKAP and SURR, and 76.7% between RKAP and RCUR.[20]

2.2 Classifying exchange rate regimes

Exchange rate regimes can be classified on a de jure or a de facto basis.[21] De jure exchange rate regimes refer to those announced by national authorities and published by the IMF in its *AREAER*. In the 1970s and the early 1980s, the IMF classified each member country's exchange rate regime as either pegged or not pegged to some external reference currency or currency basket. For the most part of the 1980s and up to 1997, the IMF adopted a classification scheme with four regime options: pegged regimes, regimes with limited flexibility, more flexible regimes, and floating regimes. Taking into account the sub-categories under each broad regime, we can identify eight de jure exchange rate regimes, ranging from single currency pegs to independent floating, that have ever been classified by the IMF before 1998. Since 1998 the IMF has applied a new eight-regime classification scheme, with regime options spanning from currency union or dollarization to managed or independently floating, mainly to reflect more accurately the exchange rate policies in the member countries. For both the pre-1998 and the post-1998 period the exchange rate regimes are coded on a 1–8 scale, with larger code numbers assigned to more flexible regimes (see Appendix II for more details). To facilitate the empirical analysis, however, we condense the eight-category classification to one with three broadly defined regimes: fixed-rate, intermediate, and flexible regimes. More specifically, regime categories coded 1, 2, or 3 are classified as fixed-rate regimes, those coded 4, 5, 6, or 7 as intermediate regimes, and those coded 8 as flexible regimes.

Recent studies on exchange rate regimes point out that exchange rate policies in practice do not

[19] Developing countries consist of all the IMF members with a country code larger than 200, plus Malta (country code 181), Turkey (186), and South Africa (199). See any issue of the IMF's *International Financial Statistics* for the list of the member countries and their country codes.

[20] The matching rate between RKAP and DUAL is 39.5%.

[21] See von Hagen and Zhou (forthcoming) for a discussion on the classification of de jure exchange rate regimes. For a discussion on the classification of de facto exchange rate regimes, see Zhou and von Hagen (2004). Reinhart and Rogoff (2004) discuss both de jure and de facto classifications of exchange rate regimes.

necessarily conform officially announced exchange arrangements.[22] De facto exchange rate regimes based on observed behavior of exchange rates can differ from de jure ones, which may lead to different conclusions on the linkage between capital control decisions and exchange rate regime choices. In view of this possibility, we also use de facto exchange rate regimes classified by Levy-Yeyati and Sturzenegger (2002), hereafter LYS, in the empirical analysis.[23] They use a cluster analysis technique to assign de facto exchange rate policies into fixed-rate, intermediate, or floating regimes.[24] In Appendix II we list all sub-categories of the LYS classifications of de facto exchange rate regimes, as well as their positions in the broadly defined trichotomous regime structure.

2.3 Capital controls and exchange rate regimes: a non-parametric analysis

Do capital account policies differ systematically across exchange rate regimes? One way to answer this question is to analyze the cross distribution of the indices of capital controls and the choices of exchange rate regimes. Table 2 reports the conditional distribution of the RKAP dummy across different exchange rate regimes. Based on the IMF classification of de jure exchange rate regimes, 83.5% of cases of fixed-rate regimes (1665 out of 1994) are associated with capital controls (RKAP = 1), while this share is 71.7% (492 out of 686) or 70.7% (400 out of 566) for intermediate or flexible regimes respectively. These results suggest that, while capital controls are common practice for fixed-rate regimes, they are also frequently imposed when intermediate or flexible regimes are announced.[25] There are nevertheless differences in these conditional distributions, and the question is whether these differences are statistically significant. Under the null hypothesis of independent cross distributions, the distributions of RKAP conditioned on the choice of exchange rate regimes should be the same across the three broad exchange rate regimes, implying no interaction between the imposition of capital controls and the choice of exchange rate regimes. We run the χ^2 test and obtain a statistic of 6.46. It is significant at 5% level with two degrees of freedom, leading to the rejection of the independence hypothesis. We conclude that there is strong interaction between the imposition of capital controls and the choice of de jure exchange rate regimes, and fixed-rate regimes are those most frequently associated with capital controls. Note that the direction of influence or causality between two decisions cannot be detected with this simple, non-parametric analysis.[26]

In contrast, the distribution of the narrowly-defined index of capital controls does not seem to be influenced by the choice of de facto exchange rate regimes. As can be seen from Table 2, the shares of cases with RKAP = 1 are fairly similar across three de facto exchange rate regimes based on the LYS classification, all in the range between 75% and 79%. As before, we test whether the conditional distributions of RKAP are the same across the three de facto exchange rate regimes. The χ^2-statistic for the null hypothesis of equal conditional distributions is very small and insignificant with two degrees of freedom. This suggests that, on de facto basis, different exchange rate regimes are similarly accompanied by capital control measures.

Next, we ask whether the intensity of capital controls (the CAPC index) also interacts with the choice of exchange rate regimes. Table 3 reports percentage shares of each value of CAPC as well as

[22] See, among others, Ghosh et al. (1997), Calvo and Reinhart (2000), Zhou and von Hagen (2004).

[23] Reinhart and Rogoff (2004) introduce a "natural classification" of de facto exchange rate regimes based on exchange rates determined on the parallel market. Only in case of unified exchange rates do they use official exchange rates. The results based on the Reinhart-Rogoff classification are in general similar to those based on the LYS data and are not reported for the sake of brevity.

[24] There is a small group labeled "inconclusive" for observations where data conveys too little information to detect the de facto regime. Since this group is also characterized by stable exchange rates, we merge it into fixed regimes to increase degrees of freedom. However, the results have little change if we exclude these "inconclusive" observations from the analysis.

[25] A further investigation into intermediate regimes shows that it is managed floating regimes that are most frequently associated with capital controls (78.6%, or 371 out of 472 cases). Other intermediate regimes (horizontal bands, crawling pegs, or crawling bands, etc) have the lowest share of capital controls, but even within this group, 56.5% of cases (121 out of 214) are still combined with restrictions on capital transactions.

[26] Alternatively, we can analyze the conditional distributions of the choice of exchange rate regimes given the RKAP index. The χ^2 test based on this alternative formulation produces exactly the same result as the previous one. This is consistent with the fact that the analysis of cross distributions identifies association between the two decisions but does not address the issue of causality.

Table 2: Distribution of RKAP Across Exchange Rate Regimes

	IMF			LYS		
Exchange Rate Regimes	RKAP = 0, 1	RKAP = 1	in %	RKAP= 0, 1	RKAP = 1	in %
Fixed-rate regimes	1994	1665	83.5	1790	1359	75.9
Intermediate regimes	686	492	71.7	505	396	78.4
Flexible regimes	566	400	70.7	453	352	77.7
Total	3246	2557	78.8	2748	2107	76.7
χ^2-statistic [p-value] (df)	6.46 [0.04] (2)			0.16 [0.92] (2)		

Note: df stands for degree of freedom.

its mean values for a given exchange rate regime. Let's first look at the IMF classification of de jure exchange rate regimes. When fixed-rate regimes are adopted, 16.5% of observations have open capital accounts, 22.6% have weak capital controls, 44.9% have intermediate controls, and 16.0% have strong controls. When intermediate or flexible regimes are adopted, the share of open capital accounts (CAPC = 0) rises to 28.3% and 29.3% respectively, but shares with other levels of capital controls usually decline. But in general, the distribution of capital controls intensity is not significantly influenced by the choice of exchange rate regimes, since the χ^2-statistic for the hypothesis of same conditional distributions of CAPC is insignificant with six degrees of freedom. If we compare the mean values of CAPC across exchange rate regimes, however, we find significant cross-regime differences. We test the null hypotheses that the mean values of CAPC are the same for any two exchange rate regimes. These hypotheses are all rejected due to highly significant z-statistics. The results suggest that, on average, capital controls associated with fixed-rate regimes are significantly more intensive than those associated with intermediate regimes, which in turn are significantly more intensive than those associated with flexible regimes.

Based on the LYS classification of de facto exchange rate regimes, the χ^2-test for the hypothesis of same conditional distribution of CAPC given the exchange rate regime shows no significant cross-regime differences in the distribution of CAPC. But the z-tests for the hypothesis of equal mean values of CAPC between any two regimes suggest again significant cross-regime differences in average intensity of capital controls. Note that the ranking of regimes is now different: De facto fixed-rate regimes are associated with lightest controls of capital accounts, while intermediate ones have the most stringent capital controls, and the differences between any two regimes are all statistically significant.

In summary, while the choice of de jure exchange rate regimes significantly interacts with the decision as to whether capital controls be imposed nor not (the value of the RKAP dummy), it does not change in any substantial way the distribution of the intensity of capital controls (the distribution of the CAPC index) for some regime choices relative to others. But the average intensity of capital controls associated with fixed-rate regimes is significantly higher than those associated with the other two regime choices. In contrast, the choice of de facto exchange rate regimes seems to be independent of either the decision of imposing capital controls or the distribution of capital controls intensity. Moreover, de facto fixed-rate regimes are now associated with the least intensive capital controls.

3 Empirical Specifications

3.1 The econometric model

3.1.1 The model with the binary RKAP index

We use V_{it} to denote the absence ($V_{it} = 0$) or presence ($V_{it} = 1$) of capital controls in country i ($i = 1, 2, \ldots, N$) in year t ($t = 1, 2, \ldots, T_i$). Exchange rate regimes are denoted by Y_{it}. Both de jure and de facto exchange rate regimes are recoded on a 0, 1, 2 scale, representing fixed-rate, intermediate, and flexible regimes, respectively.

We adopt a simultaneous-equations model to allow direct interaction between decisions on capital

Table 3: Percentage Share and Mean Value of CAPC Across Exchange Rate Regimes

	IMF			LYS		
CAPC	FIX	INTER	FLEX	FIX	INTER	FLEX
CAPC = 0	16.5	28.3	29.3	24.1	21.6	22.3
CAPC = 1	22.6	11.5	19.1	25.0	17.2	17.9
CAPC = 2	44.9	36.3	35.9	39.2	37.4	41.3
CAPC = 3	16.0	23.9	15.7	11.7	23.8	18.5
χ^2-statistic [p-value] (degrees of freedom)	8.15 [0.23] (6)			2.16 [0.90] (6)		
Mean CAPC	1.60	1.56	1.38	1.39	1.63	1.56
INTER-FIX: z-statistic (p-value)	-0.95 (0.03)			4.69 (0.00)		
FLEX-FIX: z-statistic (p-value)	-4.53 (0.00)			3.25 (0.00)		
FLEX-INTER: z-statistic (p-value)	-2.86 (0.00)			-1.07 (0.02)		

Note: FIX, INTER, FLEX stand for fixed-rate, intermediate, flexible regimes, respectively.

controls and choices of exchange rate regimes:

$$V_{it}^* = \gamma_1 U_{it1} + \gamma_2 U_{it2} + \theta X_{it}^V + \alpha_i^V + e_{it}, \tag{1}$$

$$U_{itj} = \lambda_j V_{it}^* + \beta_j X_{it}^Y + \alpha_{ij}^Y + \varepsilon_{itj}, \qquad j = 1, 2. \tag{2}$$

V_{it}^* is a latent index measuring the propensity to impose capital controls. Its relation with the observed V_{it} is that

$$V_{it} = \mathbf{1}\{V_{it}^* > 0\}, \tag{3}$$

where $\mathbf{1}\{\}$ is an indicator function that returns a unity if the statement in brackets is true, and a zero otherwise. Note that we normalize the threshold separating the two choices to zero. U_{itj} is an unobservable measure of the propensity of country i to adopt exchange rate regime j in year t. X_{it}^V is a column vector of determinants of capital controls other than the choice of exchange rate regimes. Note that propensities to adopt different exchange rate regimes may have different impacts on capital account policies. α_i^V is a country-specific random effect involved in the determination of capital controls, assumed to be independently and identically distributed (i.i.d.) normal with zero mean and finite variance $\sigma^2_{\alpha(V)}$. Finally, e_{it} is an i.i.d. logistic error term. We therefore have a binary random effect panel logit model for the determination of capital controls measured by the RKAP index.

We use a non-ordered, multinomial specification to model the determination of the choice of exchange rate regimes. Let U_{itj} denote the (unobservable) propensity to choose exchange rate regime j by country i in year t, then

$$Y_{it} = j \Longleftrightarrow U_{itj} > U_{itk}, \quad j, k = 0, 1, 2, \quad j \neq k. \tag{4}$$

That is, the exchange rate regime with the highest propensity will be adopted. Note that V_{it}^* has regime-specific coefficients in equation (2). Because only the ranking of propensities matters for regime choices, we normalize $U_{it0} \equiv 0$. X_{it}^Y is a column vector of determinants of exchange rate regimes other than capital controls. Let $\alpha_i^Y = (\alpha_{i1}^Y, \alpha_{i2}^Y)'$ denote country-specific random effects influencing the choice of exchange rate regimes. We assume that α_i^Y is i.i.d. normal with zero mean and a variance-covariance matrix $\Sigma_{\alpha(Y)}$. The error term ε_{itj} ($j = 1, 2$) is assumed to be i.i.d. logistic. We therefore have a multinomial random effect panel logit model for the choice of exchange rate regimes.[27]

[27] As an alternative to the multinomial model, we may treat the choices of exchange rate regimes as ordered according to their degrees of flexibility. This effectively imposes a monotonicity restriction, which may result in serious bias in the estimation if there is indeed a non-monotonic relationship between regime flexibility and capital controls decisions. We compare empirical results of such an ordered-choice model with those reported in this paper, and find that the ordered-choice model does not provide additional insights into either the interaction mechanism between exchange rate regime choices and capital controls decisions, or the determination processes of the two issues. In general, it mixes the effects captured by γ_1 and γ_2 in equation (1) and those captured by λ_1 and λ_2 in equation (2). As a result, we prefer to use the multinomial model in this paper.

3.1.2 The model with the ordered CAPC index

The model with the ordered CAPC index is the same as the previous one except for two changes. First, V_{it} can take one of the four integal values between 0 and 3. Second, the realtionship between V_{it} and the unobservable V_{it}^*, equation (3) in the previous model, is now replaced by

$$\left.\begin{array}{lll} V_{it}=0 & \Longleftrightarrow & V_{it}^* \leq 0, \\ V_{it}=1 & \Longleftrightarrow & 0 < V_{it}^* \leq t_1, \\ V_{it}=2 & \Longleftrightarrow & t_1 < V_{it}^* \leq t_2, \\ V_{it}=3 & \Longleftrightarrow & V_{it}^* > t_2. \end{array}\right\} \tag{5}$$

Here we again normalize the threshold separating $V_{it} = 0$ and $V_{it} = 1$ to zero. The remaining two thresholds, t_1 and t_2, are positive parameters that need to be estimated.

3.2 Explanatory variables

Because the main purpose of this paper is to study the interaction between capital account policy and exchange rate policy, the exact roles that other factors play in the determination of capital controls and of exchange rate regimes are of secondary interest. However, these factors must be carefully controlled for, so that we can focus on the interaction between capital controls and exchange rate regimes without being misled by the influence of other factors. In this section we discuss the explanatory variables included in X_{it}^V and X_{it}^Y, which are selected from the related literature. Detailed information on the construction and data sources of these variables can be found in Appendix II.

3.2.1 Determinants of capital controls

A large literature provides the theoretical underpinnings for the imposition or elimination of capital controls.[28] Empirical studies operationalize the theoretical considerations by constructing proxies for the determinants of capital controls. Many empirical papers argue that incidence of capital controls depends on political institutions, including the political orientation of the government or partisan conflicts (Epstein and Schor, 1992; Alesina et al., 1994; Quinn and Inclán, 1997), and political regimes (Quinn, 2000; Brune et al., 2001). Dictated by data availability, we include political regimes (POLITY) as a determinant of capital controls, with higher values assigned to more democratic political regimes. Economic fundamentals are also found to be important determinants of capital account policies. The most important fundamentals include the degree of trade openness (Grilli and Milesi-Ferretti, 1995; Milesi-Ferretti, 1998; Berger et al., 2001) and the level of economic development (Milesi-Ferretti, 1998; Johnston et al., 1999; Brune et al., 2001). In our empirical analysis, we use the ratio of total trade to GDP, labeled OPENNESS, to measure trade openness, and use per capita GDP (PCGDP) as the proxy for the level of economic development.

The decisions on capital controls have also been investigated from a public finance perspective (Aizenman and Guidotti, 1994; Drazen, 1989; Razin and Sadka, 1991). Because tax system efficiency is difficult to gauge, the empirical literature often uses government size (GOVSIZE) and fiscal deficits (FISCAL) to reflect the public finance considerations (Grilli and Milesi-Ferretti, 1995; von Hagen and Zhou, 2005). We follow this convention and include GOVSIZE (the ratio of general government expenditures to GDP) and FISCAL (the central government budget balances as share of GDP) in our estimation. To capture the influence of external payment constraints, current account balances (CURRACCT) is frequently used as a determinant of capital controls (Bai and Wei, 2001; von Hagen and Zhou, 2005). In our analysis, the CURRACCT variable is defined as the ratio of current account balances to GDP.

3.2.2 Determinants of exchange rate regimes

Theoretical investigation on the determination of exchange rate regimes can be traced back to the Optimum Currency Area (OCA) theory. Development in the literature on optimal stabilization and

[28] See Dooley (1996) for an extensive survey of the literature on capital controls.

on currency crises adds new perspectives to the debate. The empirical regime determinants used in this study come from von Hagen and Zhou (forthcoming), who provide a more detailed discussion on the determination of exchange rate regimes in developing countries. Most variables are proxies of the OCA criteria for choices of exchange rate regimes, including trade openness (OPENNESS), geographical concentration of foreign trade (GEOCON, measured by the share of the largest trading partner in total trade), economic size (proxied by GDP), level of economic development (PCGDP), and financial development (FINDEV, proxied by the ratio of broad money to GDP). To take into account the literature on optimal stabilization and on currency crises, we include inflation performance (CPINF, the rate of consumer price inflation) and the sufficiency of international reserves (RESERVE, the ratio of non-gold international reserves to annual import payments) as potential regime determinants.

3.3 Estimation approach

The simultaneous-equations model is estimated in three steps. The first step is to estimate the reduced-form equation for capital control decisions. Using the reduced-form parameters and the observed explanatory variables (X_{it}^V and X_{it}^Y), we compute the fitted values of V_{it}^*. In the second step, we estimate the multinomial logit model for exchange rate regime choices, with V_{it}^* being replaced by its fitted values computed in the previous step. With the estimated structural parameters β_j and λ_j, we compute fitted values of U_{itj} that will be used as instruments when we estimate the structural equation for capital control decision. In the third step we estimate equation (1) to obtain the structural parameters θ and γ_j.

Since we assume that country-specific heterogeneity has a normal distribution, while error terms are all logistically distributed, we have a mixed logit framework for each choice problem. Both for the construction of instruments and for the estimation of structural equations, it is straightforward to express the conditional probability of a country-year observation conditioned on exogenous explanatory variables as well as on country-specific random effects.[29] What we need for maximization, however, are the probabilities only based on observable explanatory variables and not conditioned on unobservable random effects. The link between the conditional and the unconditional probabilities is that the latter is the mathematical expectation of the former when the expectation is formed over the whole domain of the random effect.[30] This mathematical expectation can be approximated by the sample mean based on a set of random draws of the random effect. To illustrate this point, let P_{it} denote the "unconditional" probability of observing the choice made by country i in year t. Let $P_{it}|\alpha_i$ denote the "conditional" probability and $P_{it}|\alpha_i^r$ its value based on a particular realization of the random effect, α_i^r. Let f denote the density of α_i, then we have

$$P_{it} = \int_{\alpha_i} (P_{it}|\alpha_i) f(\alpha_i) d\alpha_i \approx \frac{1}{R} \sum_{r=1}^{R} (P_{it}|\alpha_i^r). \tag{6}$$

Given that the distribution of country-specific random effects (and therefore the density f) is assumed known up to some estimable parameters, we can make random draws (α_i^r) from this distribution, calculate $P_{it}|\alpha_i^r$, and use the simulated mean to approximate P_{it}, which will be plugged into the log-likelihood function for maximization. For the simulated maximum likelyhood estimator to be consistent, asymptotically normal and efficient, the number of random draws, R, needs to rise faster than $\sqrt{N}$ and randome draws must be independent (Train, 2002). In practice we set $R = 20$ because the estimation results generally stabilize at this value.

Several points need to be discussed before we procede. First, both structural equations are estimated with a constant and period dummies. If the full sample period (1981–2000) is used for estimation, then dummies for the period 1986–1990, 1991–1995, and 1996–2000 are included, with 1981–1985 as the

[29] See, for example, von Hagen and Zhou (forthcoming) or Zhou and von Hagen (2004) for a detailed exposition of these conditional probabilities.

[30] The difference between "conditional" and "unconditional" probabilities only concerns the unobservable country-specific random effect. Both probability expressions are conditional on exogenous explanatory variables, of course. But the "unconditional" probabilities are not conditioned on country-specific heterogeneity, while the "conditional" ones do.

reference period. If instead only data from the 1990s are used, then the dummy for 1996–2000 is included, with 1991–1995 being the reference period.[31] Second, except for POLITY, the constant, and the period dummies, all explanatory variables are lagged by one year to attenuate potential endogeneity problems. Third, except for the constant and the period dummies, all explanatory variables (including the fitted values of the endogenous variables) are standardized using the formula $(x - \bar{x})/s_x$, where $\bar{x}$ and s_x denote sample mean and standard deviation of the variable x. This transformation proves useful in scaling the variables and facilitating fast convergence in the maximum likelihood estimation.

4 Results and Discussion

We estimate our model with the IMF classification of de jure exchange rate regimes and the LYS classification of de facto exchange rate regimes. With each regime classification, the model is estimated with four samples. The first sample covers all developing countries for the period 1981–2000.[32] As our empirical results suggest that capital accounts in the 1990s are significantly more open than the 1980s, we are interested in whether the interaction between capital controls and exchange rate regimes also differs across the two decades. We therefore re-estimate the model with the second sample covering all developing countries but only for the 1990s. Besides these time-series differences, cross-sectional variations beyond those captured by country-specific random heterogeneity may also influence the estimation results. The issue of interaction between exchange rate policy and capital account policy should be particularly relevant to emerging market economies, which are more exposed to international capital movements than other developing countries (Fischer, 2001). In order to reflect this consideration, the third sample only uses observations from emerging market economies since 1981, while the forth sample is further restricted to emerging market economies during the 1990s.[33]

Table 4 summarizes our main findings on the interaction between capital controls and exchange rate regimes. Because the values of the coefficients in the discrete choice model do not have directly interpretable economic meanings, while the signs of the coefficients indicate the qualitative influences of the explanatory variables, we only report the signs and significance levels of the coefficients. The influence of intermediate regimes, relative to that of fixed-rate ones, on the decision of capital controls is captured by γ_1, the coefficient for U_{it1} in the determination of V_{it}^*. The larger U_{it1}, the higher the propensity to choose intermediate regimes instead of fixed-rate ones. If γ_1 is positive, the value of V_{it}^* is also higher, so is the likelihood of imposing or intensifying capital controls. In case of negative γ_1, capital controls tend to be fewer or less intensive if intermediate regimes are more likely to be adopted than fixed-rate ones. The reverse influence of capital account policy on the relative chance for intermediate regimes compared with fixed-rate ones is captured by λ_1, the coefficient for V_{it}^* in the determination of U_{it1}. Higher values of V_{it}^* are associated with higher probabilities of imposing or intensifying capital controls. With a positive λ_1, they are also associated with higher values of U_{it1}, raising the chance for intermediate regimes being selected relative to fixed-rate regimes. If λ_1 is negative, higher values of U_{it1} reduces the values of U_{it1}, making intermediate regimes less likely to be selected relative to fixed-rate regimes. Analogously, the influence of flexible regimes on capital account policies is captured by γ_2, while the reverse impact is captured by λ_2.

In order to gain some feelings on the strength of interaction between capital account policies and exchange rate policies, we simulate the probabilities for various capital controls decisions given the choice of exchange rate regimes, as well as the probabilities for the choices of exchange rate regimes given a particular value of the capital control index. To evaluate these probabilities, all the explanatory variables

[31] We use period instead of yearly dummies to increase degrees of freedom of the estimation and to reduce difficulties in achieving convergence in the iteration process.

[32] Due to missing data for some variables in the 1970s and due to one year lag of the explanatory variables, the usable dataset starts with 1981. Data availability also restricts the country coverage substantially. We have complete data for at most 82 developing countries.

[33] Thirty-one emerging market economies are selected based on Fischer (2001) and after taking into account data availability. They include Argentina, Brazil, Bulgaria, Chile, China, Columbia, Czech Republic, Ecuador, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama, Peru, Philippines, Poland, Qatar, Russia, South Africa, Sri Lanka, Thailand, Turkey, and Venezuela.

Table 4: Interaction between Capital Controls and Exchange Rate Regimes

Structural Equation	Variable	Coefficient	IMF RKAP	IMF CAPC	LYS RKAP	LYS CAPC
[A] *All DC, 1981–2000*						
CC determination:	U_{it1}	γ_1	(+)***	(+)**	(−)	(+)
CC determination:	U_{it2}	γ_2	(−)***	(−)	(+)*	(+)
ERR determination:	V_{it}^*	λ_1	(−)	(−)*	(+)	(+)
ERR determination:	V_{it}^*	λ_2	(−)	(−)***	(+)**	(+)***
Number of observations, number of countries			1246, 82		1019, 78	
[B] *All DC, 1991–2000*						
CC determination:	U_{it1}	γ_1	(+)***	(+)***	(+)	(+)
CC determination:	U_{it2}	γ_2	(−)***	(−)***	(+)	(+)
ERR determination:	V_{it}^*	λ_1	(−)	(−)*	(+)	(−)
ERR determination:	V_{it}^*	λ_2	(−)	(−)***	(+)	(−)*
Number of observations, number of countries			657, 82		563, 76	
[C] *EME, 1981–2000*						
CC determination:	U_{it1}	γ_1	(+)	(+)	(+)**	(+)***
CC determination:	U_{it2}	γ_2	(+)	(+)	(+)	(−)
ERR determination:	V_{it}^*	λ_1	(+)	(−)	(+)	(+)**
ERR determination:	V_{it}^*	λ_2	(+)	(−)*	(+)	(+)*
Number of observations, number of countries			473, 28		407, 27	
[D] *EME, 1991–2000*						
CC determination:	U_{it1}	γ_1	(+)**	(+)*	(−)*	(+)
CC determination:	U_{it2}	γ_2	(+)*	(−)	(+)***	(+)**
ERR determination:	V_{it}^*	λ_1	(−)	(+)*	(+)	(+)
ERR determination:	V_{it}^*	λ_2	(+)**	(+)	(+)**	(+)***
Number of observations, number of countries			247, 28		209, 25	

Note: CC: capital controls. ERR: exchange rate regimes. DC: developing countries. EME: emerging market economies. Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively.

are set at their respective sample mean values, and the endogenous variables on the right-hand side of the structural equations are set as follows. For the determination of V_{it}^*, we set $(U_{it1}, U_{it2}) = (-1, -1)$ in case of fixed-rate regimes, $(U_{it1}, U_{it2}) = (1, 0)$ for intermediate regimes, and $(U_{it1}, U_{it2}) = (0, 1)$ for flexible regimes. Because $U_{it0} \equiv 0$ by construction, the above setting can ensure that the propensity associated with the given exchange rate regime is always the highest. For the determination of $U_{itj}, j = 1, 2$, we set $V_{it}^* = -1$ if RKAP $= 0$, or $V_{it}^* = 1$ if RKAP $= 1$. If the ordered CAPC index is used, we set $V_{it}^* = -1, t_1/2, (t_1 + t_2)/2, t_2 + 1$ for CAPC $= 0, 1, 2, 3$, respectively.[34] To save place, Table 5 and Table 6 only report the simulated probabilities based on two samples: the largest sample covering all developing countries and all years, and the smallest sample covering only emerging market economies during the 1990s.

4.1 Interaction with de jure exchange rate regimes

Let us first look at the full-sample results with the IMF de jure exchange rate regimes. With a positive and significant γ_1 in association with both RKAP and CAPC, choosing an intermediate regime instead of a fixed-rate one increases both the probability of imposing capital controls and the intensity of capital controls. The conditional probability of RKAP $= 1$ rises from 71.6% given fixed-rate regimes to

[34] Due to standardization of variables, -1 and $+1$ imply a decrease and an increase, respectively, of the variable in question by one standard deviation. For example, $U_{it1} = -1$ means to set the value of U_{it1} one standard deviation *below* the sample mean (which is zero), and $V_{it}^* = t_2 + 1$ means to set the value of V_{it}^* one standard deviation *above* the threshold t_2.

Table 5: Simulated Probability for CC Decisions Given ERR Choices: in percent

	With IMF Classification						With LYS Classification					
	RKAP		CAPC				RKAP		CAPC			
ERR	(0)	(1)	(0)	(1)	(2)	(3)	(0)	(1)	(0)	(1)	(2)	(3)
	All DC: 1981–2000											
Fixed	28.4	71.6	26.4	26.9	38.0	8.7	33.1	66.9	33.9	25.7	33.5	7.0
Intermediate	1.6	98.4	11.1	17.4	50.0	21.5	21.9	78.1	16.4	19.7	47.6	16.4
Flexible	80.8	19.2	22.6	25.6	41.3	10.5	8.6	91.4	17.1	20.1	47.1	15.7
	EME: 1991–2000											
Fixed	59.2	40.8	41.1	34.8	19.8	4.3	92.0	8.0	49.5	32.1	15.0	3.4
Intermediate	25.5	74.5	13.6	27.8	41.9	16.7	40.5	59.5	22.9	34.5	32.2	10.5
Flexible	24.8	75.2	26.0	35.3	30.5	8.2	0.5	99.5	13.9	28.3	40.1	17.8

Note: CC: capital controls. ERR: exchange rate regimes. DC: developing countries. EME: emerging market economies.

98.4% given intermediate regimes (Table 5). The conditional probabilities for intermediate and strong capital controls (CAPC = 2 and CAPC = 3) are also higher if intermediate regimes are adopted than if fixed-rate regimes are in place. In contrast, with a significant and negative γ_2 in association with RKAP, choosing a flexible regime instead of a fixed-rate one substantially reduces the likelihood of imposing capital controls, with the conditional probability for RKAP = 1 given flexible regimes falling to 19.2%. The intensity of capital controls is also slightly reduced, but the change is not significant, as can be inferred from the negative but insignificant γ_2 in association with CAPC. The simulated probabilities also show no dramatic changes when the conditioning exchange rate regime is switched from fixed-rate to flexible ones. Therefore, after controlling for other factors influencing capital account openness, capital controls are most pervasive and most intensive in countries with intermediate regimes, while flexible regimes are associated with least cases of capital controls and probably least intensive controls. This roughly hump-shaped influence from the flexibility of exchange rate regimes on capital account policies is consistent with the observation that adopting intermediate regimes makes capital controls more likely than other exchange rate regimes (Begg et al., 2003).

While choices of de jure exchange rate regimes significantly influence both the imposition of capital controls and their intensity, the imposition of capital controls does not have substantial impact on the choice of exchange rate regimes, since neither λ_1 nor λ_2 is significant when the RKAP index is used. Both coefficients are negative, suggesting that the conditional probabilities for intermediate and flexible regimes in the presence of capital controls should be lower than in thier absence, which is confirmed by the simulated probabilities listed in Table 6. In view of significant γ_1 and γ_2 in association with RKAP, we find that countries tend to impose or remove capital controls to support their de jure exchange arrangements, which are chosen independent of the imposition of capital controls. This result is generally consistent with the findings of von Hagen and Zhou (2005). However, the intensity of capital controls does influence the choice of exchange rate regimes. The negative and significant λ_1 and λ_2 in association with the CAPC index indicate that intensive capital controls favor fixed-rate regimes over both intermediate and, especially, flexible regimes. Table 6 shows that the simulated probability for fixed-rate regimes rises monotonically from 16.7% conditioned on open capital accounts (CAPC = 0) to 97.3% conditioned on strong capital controls (CAPC = 3), while the conditional probabilities for intermediate and flexible regimes are generally declining when capital controls are intensified.

When the sample period is restricted to the 1990s, the results with the IMF classification do not have any qualitative changes. As far as the imposition of capital controls is concerned, the influence is still one-sided, with exchange rate policies having significant hump-shaped impact on capital account policies but little feedback from the latter on the former. In contrast, there is significant two-way interaction between the choice of exchange rate regimes and the decision on the intensity of capital controls: while intermediate and flexible regimes have strong and opposite influences on the intensity of capital controls, more intensive controls reduce the chances for both regimes relative to fixed-rate ones.

Table 6: Simulated Probability for ERR Choices Given CC Decisions: in percent

	With IMF Classification						With LYS Classification					
	All DC: 1981-2000			*EME: 1991-2000*			*All DC: 1981-2000*			*EME: 1991-2000*		
CC	(0)	(1)	(2)	(0)	(1)	(2)	(0)	(1)	(2)	(0)	(1)	(2)
RKAP												
RKAP = 0	25.8	46.0	28.1	32.1	67.9	0.0	54.5	29.6	15.9	73.6	25.1	1.3
RKAP = 1	49.4	38.4	12.2	0.1	0.0	99.9	39.8	25.9	34.3	9.2	3.7	87.1
CAPC												
CAPC = 0	16.7	30.8	52.4	36.2	37.5	26.4	62.7	26.9	10.4	80.7	14.0	5.3
CAPC = 1	59.7	32.5	7.8	15.2	69.4	15.3	37.1	27.8	35.1	8.6	13.1	78.3
CAPC = 2	87.2	12.4	0.3	4.2	89.9	5.9	11.7	16.0	72.3	0.1	1.0	98.9
CAPC = 3	97.3	2.7	0.0	0.8	97.4	1.7	1.4	4.1	94.6	0.0	0.0	100.0

Note: CC: capital controls. ERR: exchange rate regimes. DC: developing countries. EME: emerging market economies.

Let us now focus on the relation between IMF de jure exchange rate regimes and capital account policies in emerging market economies. In contrast to developing countries as a whole, exchange rate policies and capital account policies in emerging market economies tend to be unrelated with each other over the full sample period of the 1980s and the 1990s. If restricted to the 1990s, however, the interaction between exchange rate regimes and the imposition of capital controls is obvious, with significant and positive γ_2 and λ_2 indicating a reinforcing interaction between the propensity to adopt flexible regimes and the intension to impose capital controls. Table 5 shows that the conditional probability of imposing capital controls RKAP = 1 given flexible regimes is the highest (75.2%), while Table 6 shows that the conditional probability of choosing flexible regimes ERR = 2 given capital controls being imposed is 99.9%. As far as the intensity of capital controls is concerned, it is intermediate regimes, with significant and positive γ_1 and λ_1, that show a reinforcing interaction with the intensity of capital controls during the 1990s. When intermediate regimes replace fixed-rate ones, the conditional probability for open capital accounts (CAPC = 0) drops from 41.1% to 13.6% and that for weak capital controls (CAPC = 1) drops from 34.8% to 27.8%. But the conditional probabilities for stronger capital controls (CAPC = 2, 3) rise sharply (Table 5). On the other hand, given that the intensity of capital controls is rising, only the conditional probability for intermediate regimes is rising steadily, starting from 37.5% given CAPC = 0 to 97.4% given CAPC = 3. The conditional probabilities for both fixed-rate and flexible regimes are all declining (Table 6).

4.2 Interaction with de facto exchange rate regimes

Turning to the full-sample results with the LYS classification, the interaction between de facto exchange rate regimes and capital control decisions is very different from that with de jure regimes. There is no evidence of a hump-shaped influence from regime flexibility on capital account openness. Insignificant γ_1s in association with both RKAP and CAPC indicate that the role that intermediate regimes play in the determination of capital controls and their intensity is not significantly different from that played by fixed-rate regimes. Meanwhile, γ_2 is significant only for the determination of RKAP, indicating that flexible regimes make the imposition of capital controls more likely (with a conditional probability at 91.4%) than fixed-rate regimes do (with a conditional probability at 66.9%). In contrast to the case with de jure exchange rate regimes, the intension to impose or to intensify capital controls makes flexible regimes more likely to be adopted than fixed-rate regimes, as can be inferred from the positive and significant λ_2. Th simulated probabilities in Table 6 confirm this inference. With de jure classifications, the conditional probability for flexible regimes given RKAP = 1 is smaller than that given RKAP = 0 (12.2% versus 28.1%). With de facto classifications, the ranking is reversed (15.9% versus 34.3%).

Based on all developing countries, the interaction between de facto exchange rate policies and capital

account policies is very weak in the 1990s. The choices of de facto exchange rate regimes do not have any significant influence on the imposition or intensification of capital controls. Only the intensity of capital controls tends to have some negative impact on the choice of flexible regimes relative to fixed-rate ones, as can be inferred from the negative and significant λ_2.

Let's now look at the sample with emerging market economies. In general, the interaction between de facto exchange rate policies and the imposition of capital controls (RKAP) can be detected mainly in the 1990s, while the interaction with the intensity of capital controls (CAPC) can be found during the whole sample period. Moreover, while the influence of de facto intermediate regimes on the imposition of capital controls (γ_1 in association with RKAP) has a significant and qualitative change across time periods, de facto flexible regimes always make the imposition of capital controls more likely. Especially, consistent with the positive and significant λ_2 in association with RKAP during the 1990s, the conditional probability of imposing capital controls (RKAP = 1) given flexible regimes is 99.5% (Table 5). The feedback effect from capital account policies on de facto regimes is more unified: with always positive λ_1 and λ_2, the decision to impose capital controls or to intensify controls invariably raises the chance for intermediate, and especially for flexible regimes at the cost of that for fixed-rate regimes. Table 6 shows that, given a switch of the RKAP dummy from 0 to 1 during the 1990s, the simulated conditional probability for fixed-rate regimes declines sharply from 73.6% to 9.2%, while the conditional probability for flexible regimes rises substantially from 1.3% to 87.1%. Similarly, when capital controls become increasingly more intensive, the conditional probability for fixed-rate regimes declines steadily, while that for flexible regimes rises continuously.

5 Conclusions

This paper provides an empirical analysis of capital account policies in developing countries since the end of the Bretton Woods system. We study the decisions on both the imposition of capital controls and the intensity of such controls. We are particularly interested in the role that the choice of exchange rate regimes plays in these decision processes, as well as the feedback effect that capital account policies may impinge on exchange rate policies. We also want to know whether capital account policies interact with de jure exchange rate arrangements in a way different from that with de facto exchange rate policies.

We construct two indices to characterize capital account policies in 160 developing countries over the 1974–2000 period. One is a narrowly defined binary indicator that reflects exclusively the existence or absence of restrictions on payments for capital transactions. Another one is an ordered indicator, based on several dummies for various types of external restrictions, that measures in broader terms the intensity of overall controls on capital transactions and related activities. Compared to some other measures of capital account policies used in the existing literature, these two indices have the advantages of wide country coverage, long time span, easy access to data sources, and unambiguity in the construction.

We first carry out a non-parametric analysis of the interaction between capital account policies and exchange rate policies. We study the cross distributions of our capital control indices over different choices of exchange rate regimes, using both de jure classification produced by the IMF and de facto classification constructed by Levy-Yeyati and Sturzenegger. We find that the decision to impose capital controls as captured by our binary index interacts strongly with the choice of de jure exchange rate regimes, with fixed-rate regimes being most frequently associated with capital controls, but this decision is largely independent of the choice of de facto exchange rate regimes. The average intensity of capital controls, however, exhibits significant cross-regime differences with both de jure and de facto regimes. There are nevertheless differences between de jure and de facto classifications: while de jure fixed-rate regimes are found to be associated with the most intensive capital controls, the intensity of capital controls associated with de facto fixed-rate regimes is much lower than those with de facto intermediate or flexible regimes.

For a formal investigation of the interaction between capital account policies and exchange rate policies, we construct a simultaneous-equations model that is flexible enough to accommodate potential mutual endogeneity of these two decisions. The unobservable propensity to adopt intermediate or

flexible regimes relative to fixed-rate ones enters directly as a determinant of capital account policies, allowing for the possibility that different regime choices have different influences on the imposition and/or the intensity of capital controls. The propensity to impose or to intensify capital controls is included as a determinant of the propensity to adopt intermediate or flexible regimes relative to fixed-rate ones, allowing it to directly affect the probabilities for intermediate and flexible regimes being selected. For both decision problems we use a panel mixed logit specification to model the choice structure, where normally distributed random effects are included to capture country-specific heterogeneity. The estimation is performed using the simulated maximum likelihood approach.

The overall empirical results show that choices of de jure exchange rate regimes have strong influences on capital account policies, while the decisions to impose or to intensify capital controls have somewhat weaker feedback impacts on de jure exchange rate policies. This suggests that, in general, developing countries tend to utilize capital controls to help manage their formal exchange arrangements, but the choices of these formal arrangements are less constrained by their capital account policies. In contrast, choices of de facto exchange rate regimes and decisions on capital controls are influencing each other with similar strength, suggesting that not only capital controls decisions are made conditioned on exchange rate policies, but actual exchange rate policies are also constrained by capital account openness. In other words, the mutual endogeneity of capital controls and exchange rate regimes might be more relevant for de facto than for de jure exchange rate regimes.

This being said, it is worth reminding that the interaction between capital controls and exchange rate regimes can vary with indices of capital controls, the classifications of exchange rate regimes, and time and country coverages. The patterns of interaction found by the full-fledged parametric analysis may also differ from those discovered by non-parametric cross-distribution analysis for several reasons. First, the sample has changed dut to missing data and the one-year lag of the variables.[35] Second, the cross-distribution analysis does not control for the influence of other factors, while the logit estimation is conditioned on the other factors that may affect the interaction between the two decisions. Third, the formal econometric analysis distinguishes between the influence from exchange rate regimes on capital controls and the feedback impact, while the non-parametric analysis does not make this distinction and reports the mixture of these two influences.

Appendix I: Determination of Capital Controls and Exchange Rate Regimes

Determination of capital controls

In Table 7 we report estimation results on the determination of capital controls. For the determination of the binary index RKAP, we report marginal effects of each variable on the probability of imposing capital controls (RKAP = 1). The marginal effect on the probability of RKAP = 0 (not reported) equals the negative of the value listed in Table 7. The marginal effect measures by how much the probability will change if the value of the explanatory variable in question increases by one unit. As we have standardized our data to ease estimation, a one-unit increase in a variable corresponds to a one-standard-deviation increase of that variable. Due to non-linearity of the model, marginal effects vary as the values of explanatory variables change, so we evaluate marginal effects at the sample means of each explanatory variable. For the determination of the ordered index CAPC, three marginal effects need to be calculated separately as CAPC can take four values. We therefore only report the estimates for coefficients and standard errors to save space.

Determination of exchange rate regimes

For the determination of exchange rate regimes, Table 8 reports the signs of the estimated coefficients and their significance levels. With a trichotomous multinomial structure for the choice of exchange rate

[35]The number of observations decreases from 3246 for the cross-distribution analysis to 1246 for the simultaneous-equations estimation when the IMF classification is used, and from 2748 to 1019 with the LYS classification.

Table 7: Determination of Capital Controls

	Binary RKAP		Ordered CAPC			
	IMF	LYS	IMF		LYS	
	ME on $Prob$(RKAP = 1)		Coeff.	S.E.	Coeff.	S.E.
[A] *All Developing Countries, 1981-2000*						
ERR: (U_{it1})	0.523***	-0.027	0.635**	0.322	0.335	0.260
ERR: (U_{it2})	-0.473***	0.143*	-0.214	0.341	0.289	0.344
POLITY	0.042**	0.010	0.158**	0.066	0.117	0.083
OPENNESS	-0.131***	-0.028	-0.663***	0.105	-0.354**	0.177
PCGDP	-0.283***	-0.156***	-0.724***	0.132	-0.679***	0.088
GOVSIZE	0.078***	0.031*	0.381***	0.092	0.161*	0.089
FISCAL	-0.072***	-0.043**	-0.030	0.080	0.017	0.047
CURRACCT	0.009	-0.012	-0.197***	0.075	-0.170**	0.075
Correct Pred. (%)	81.7	78.4	41.8		42.5	
[B] *All Developing Countries, 1991-2000*						
ERR: (U_{it1})	0.770***	0.088	3.341***	1.070	0.357	0.230
ERR: (U_{it2})	-0.704***	0.031	-3.097***	1.035	0.326	0.374
POLITY	0.019	0.007	0.016	0.303	-0.069	0.096
OPENNESS	-0.166***	-0.095*	-0.587***	0.199	-0.426**	0.199
PCGDP	-0.559***	-0.175***	-2.601***	0.820	-0.886***	0.134
GOVSIZE	0.105***	0.043	0.125	0.124	0.402***	0.120
FISCAL	-0.039	-0.038	-0.042	0.103	0.141	0.107
CURRACCT	0.027	-0.013	-0.076	0.112	-0.061	0.107
Correct Pred. (%)	76.4	72.1	42.1		40.1	
[C] *Emerging Market Economies, 1981-2000*						
ERR: (U_{it1})	0.139	0.139**	0.791	0.614	0.677***	0.243
ERR: (U_{it2})	0.052	0.018	0.218	0.415	-0.237	0.384
POLITY	-0.032	-0.022	-0.244**	0.104	-0.121	0.109
OPENNESS	0.004	-0.069**	-0.316**	0.133	-0.631***	0.139
PCGDP	0.013	-0.009	-0.132	0.109	-0.293***	0.103
GOVSIZE	0.067**	0.041	0.681***	0.132	0.281**	0.128
FISCAL	-0.086***	-0.064	-0.050	0.135	-0.109	0.118
CURRACCT	0.015	0.017	0.018	0.234	0.021	0.108
Correct Pred. (%)	76.3	74.0	42.3		40.3	
[D] Emerging Market Economies, 1991-2000						
ERR: (U_{it1})	0.107**	-0.136*	0.765*	0.395	0.194	0.297
ERR: (U_{it2})	0.116*	0.800***	-0.039	0.284	0.807**	0.407
POLITY	0.022	-0.719***	-0.072	0.147	-0.233	0.214
OPENNESS	-0.000	-0.012	-0.098	0.142	-0.342	0.222
PCGDP	-0.070	0.076	-0.409**	0.192	-0.228	0.146
GOVSIZE	0.067	0.021	0.359**	0.174	-0.085	0.175
FISCAL	-0.072*	0.080	-0.136	0.139	0.093	0.167
CURRACCT	-0.001	0.087**	0.138	0.121	0.327*	0.177
Correct Pred. (%)	69.2	76.1	38.8		34.8	

Note: Marginal Effects (ME) are evaluated at sample mean of each variable, including the two estimated latent propensity terms (U_{it1} and U_{it2}) for exchange rate regime (ERR) choices. In-sample predictions are computed as the share of all correct predictions of each value of RKAP or CAPC in total number of observations. *, **, and *** indicate that the (underlying) coefficients are significant at 10%, 5%, and 1%, respectively. Constants and period dummies are not reported.

Table 8: Determination of Exchange Rate Regimes

	With binary RKAP				With ordered CAPC			
	IMF		LYS		IMF		LYS	
	β_1	β_2	β_1	β_2	β_1	β_2	β_1	β_2
[A] *All Developing Countries, 1981-2000*								
V_{it}^* (λ_j)	(−)	(−)	(+)	(+)**	(−)*	(−)***	(+)	(+)***
OPENNESS	(+)**	(+)	(+)	(−)	(+)**	(−)	(+)	(+)
GEOCON	(+)	(+)	(−)	(−)	(+)***	(+)***	(−)*	(−)
GDP	(+)	(+)	(+)***	(+)***	(+)***	(+)***	(+)***	(+)**
PCGDP	(−)	(−)	(+)	(+)*	(−)*	(−)***	(+)	(+)***
FINDEV	(−)*	(−)*	(−)	(−)*	(−)**	(−)**	(−)*	(−)**
CPINF	(+)	(+)	(+)***	(+)***	(+)***	(+)***	(+)***	(+)
RESERVE	(−)	(−)	(−)**	(+)	(−)***	(−)***	(−)*	(−)
Correct Prediction (%)	61.1		54.2		63.0		54.0	
[B] *All Developing Countries, 1991-2000*								
V_{it}^* (λ_j)	(−)	(−)	(+)	(+)	(−)*	(−)***	(−)	(−)*
OPENNESS	(+)**	(+)	(+)	(−)	(+)*	(+)	(−)	(−)***
GEOCON	(+)***	(+)***	(+)	(+)	(+)***	(+)***	(−)	(+)
GDP	(+)***	(+)***	(+)	(+)**	(+)***	(+)***	(+)*	(+)***
PCGDP	(−)	(−)***	(+)	(−)	(−)	(−)***	(−)	(−)*
FINDEV	(−)	(−)*	(−)	(−)	(−)	(−)*	(−)	(−)
CPINF	(+)***	(+)***	(+)***	(+)***	(+)***	(+)***	(+)*	(+)***
RESERVE	(−)	(−)	(−)	(−)	(−)	(−)*	(−)	(−)
Correct Prediction (%)	59.2		49.6		60.3		52.4	
[C] *Emerging Market Economies, 1981-2000*								
V_{it}^* (λ_j)	(+)	(+)	(+)	(+)	(−)	(−)*	(+)**	(+)*
OPENNESS	(+)	(+)	(+)**	(+)	(−)	(+)	(+)***	(+)
GEOCON	(+)	(+)	(+)	(+)	(−)	(−)	(−)	(−)
GDP	(+)**	(+)	(−)	(−)	(+)***	(+)***	(+)	(−)
PCGDP	(−)**	(−)***	(+)	(+)	(−)**	(−)***	(+)	(+)
FINDEV	(−)***	(−)***	(−)***	(−)	(−)***	(−)***	(−)***	(−)***
CPINF	(−)	(+)	(+)	(−)	(+)**	(+)***	(+)*	(+)
RESERVE	(−)	(−)	(−)	(+)	(−)	(−)**	(−)**	(−)
Correct Prediction (%)	63.6		51.4		64.9		51.8	
[D] *Emerging Market Economies, 1991-2000*								
V_{it}^* (λ_j)	(−)	(+)**	(+)	(+)**	(+)*	(+)	(+)	(+)***
OPENNESS	(+)***	(+)***	(+)*	(+)	(+)	(+)	(+)*	(+)
GEOCON	(−)	(+)**	(−)	(+)	(+)	(+)	(−)	(+)**
GDP	(+)***	(−)	(−)	(−)**	(+)*	(+)***	(−)	(−)***
PCGDP	(+)	(−)*	(+)	(+)*	(+)	(−)**	(+)	(+)***
FINDEV	(−)***	(−)***	(−)	(−)*	(−)***	(−)***	(−)*	(−)*
CPINF	(−)***	(−)**	(+)	(−)	(−)	(+)	(+)	(−)**
RESERVE	(+)**	(+)	(−)	(+)	(−)	(−)	(−)	(−)*
Correct Prediction (%)	51.4		56.0		65.6		59.8	

Note: Significance levels at 10%, 5%, and 1% are denoted by *, **, and ***, respectively. In-sample predictions are computed as the share of all correct predictions of each exchange rate regime in total number of observations. Constants and period dummies are not reported.

regimes, β_1 measures the influence of a regime determinant on the propensity to adopt intermediate regimes relative to fixed-rate ones, and β_2 measures the influence on flexible regimes relative to fixed-

rate ones. A positive coefficient means that the chance for the relevant regime will be raised if the variable in question becomes larger in value.

Appendix II: Data Sources

Two indices of capital controls

The data source for RKAP is the IMF's *AREAER*. For the period 1974–1979, it is line 10 in "Analytical Appendix: Principal Features of Member Countries' Restrictive System" at the end of each issue of *AREAER*. For the period 1980–1995, it is line E2 in "Summary Features of Exchange and Trade Systems in Member Countries". For the period 1996–2000, the appendix "Summary Features of Exchange Arrangements and Regulatory Frameworks for Current and Capital Transactions in Member Countries" lists ten or eleven categories of capital transactions that can be subject to controls. For some countries and in some years, information about the existence or absence of controls on some categories of capital transactions are not available, and some categories are indicated as "not regulated". We delete those missing categories, treat "not regulated" categories as free of controls, and then calculate the ratio of the number of categories subject to controls to the total number of categories for each country during 1996–2000. If the ratio is larger than 0.5, the RKAP dummy will be assigned a value of one, and zero otherwise.

The CAPC index is constructed based on RKAP and three other dummies: DUAL, SURR, and RCUR. The data sources for these three dummies are also the appendix table at the end of each issue of *AREAER*. In specific, the data source for the DUAL dummy is line 5 (1974–1979), line B3 (1980–1981), or line B2 (1982–1995). For the period 1996–2000, the dummy DUAL takes a value of one if the exchange rate structure is characterized by either dual exchange rates or multiple exchange rates, and zero otherwise. The data source for the SURR dummy is line 16 (1974–1979) or line G (1980–1994). For 1995, the SURR dummy takes a value of one if either repatriation or surrender requirement exists for export proceeds, and zero otherwise. For the period 1996–2000, the SURR dummy takes a value of one if either repatriation or surrender requirement exists for proceeds from exports and/or invisible transactions, and zero otherwise. The data source for the RCUR dummy is line 9 (1974–1979) or line E1 (1980–1995). For the period 1996–2000, RCUR takes a value of one if there are controls on payments for invisible transactions and current transfers, and zero otherwise.

Exchange rate regimes

Up to 1997, the detailed categorization of de jure exchange rate regimes by the IMF includes the following eight regimes: (1) Single currency peg, (2) SDR peg, (3) Other composite currency peg, (4) Flexibility vis-á-vis a single currency, (5) Flexibility vis-á-vis group of currencies, (6) Exchange rate adjusted according to a set of indicators, (7) Other managed floating, and (8) Independently floating. Since 1998, the new eight-regime categorization is as follows: (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, and (8) Independently floating. In order to construct a trichotomous regime classification, the first three categories are treated as fixed-rate regimes, categories 4, 5, 6, and 7 belong to intermediate regimes, and the last category (8) forms the flexible regime group.

The classification of de facto exchange rate regimes constructed by Levy-Yeyati and Sturzenegger (2002) has four categories: (1) Inconclusive, (2) Fixed, (3) Intermediate, and (4) Floating. The first two categories are combined to form fixed-rate regimes, the third category is treated as intermediate regimes, and the fourth category is treated as flexible regimes.

Explanatory variables

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

CURRACCT: current account balance as share of GDP. Data source is Ghosh et al. (2002).

FINDEV: broad money as share of GDP. Broad money is the sum of "money" and "quasi-money", and data source is the IMF's *International Financial Statistics* (*IFS*) CD-ROM. Data source for GDP is the IMF's *WEO* database.

FISCAL: central government budget balance as share of GDP. Data source: Ghosh et al. (2002).

GDP: log of GDP in billions US Dollars. Data source: the IMF's *WEO* database.

GEOCON: share of the largest trading partner in total trade. Data source: the IMF's *Directions of Trade Statistics* (*DOTS*).

GOVSIZE: general government expenditure as share of GDP. Data source for general government expenditure is the IMF's *IFS* CD-ROM. Data source for GDP is the IMF's *WEO* database.

OPENNESS: total trade (export plus import) as share of GDP. Data source for total trade is the IMF's *IFS* CD-ROM. Data source for GDP is the IMF's *WEO* database.

PCGDP: log of per capita GDP in US Dollars. Data source is the IMF's *WEO* database.

POLITY: combined polity score (score of democracy minus score of autocracy). It takes an integral value between -10 and $+10$, with -10 for strongly autocratic polity and $+10$ for strongly democratic one. Data source is Marshall and Jaggers (2002).

RESERVE: non-gold international reserves as share of annual import expenditures. Data source for non-gold international reserves is the IMF's *WEO* database. Data source for import expenditures is the IMF's *IFS* CD-ROM.

References

[1] Aizenman, Joshua, and Pablo Guidotti, 1994, "Capital Controls, Collection Costs and Domestic Public Debt." *Journal of International Money and Finance*, Vol. 13 (February), 41–54.

[2] Alesina, Alberto, Vittorio Grilli, and Gian Maria Milesi-Ferretti, 1994, "The Political Economy of Capital Controls." In Leonardo Leiderman and Assaf Razin (eds.), *Capital Mobility: The Impact on Consumption, Investment, and Growth*, 289–328. Cambridge: Cambridge University Press.

[3] Bai, Chong-En, and Shang-Jin Wei, 2001, "The Quality of Bureaucracy and Capital Account Policies." The World Bank Working Paper No. 2575.

[4] Begg, David, Barry Eichengreen, Laszlo Halpern, Jürgen von Hagen, and Charles Wyplosz, 2003, "Sustainable Regimes of Capital Movements in Accession Countries." CEPR Policy Paper No. 10.

[5] Berger, Helge, Jan-Egbert Sturm, and Jacob de Haan, 2001, "Capital Controls and Exchange Rate Regimes: An Empirical Investigation." CESifo Working Paper No. 433.

[6] Bernhard, William, and David Leblang, 1999, "Democratic Institutions and Exchange Rate Commitments." *International Organization*, Vol. 53, 71–97.

[7] Brune, Nancy, Geoffrey Garrett, Alexandra Guisinger, and Jason Sorens, 2001, "The Political Economy of Capital Account Liberalization." Mimeo. Yale University.

[8] Calvo, Guillermo, and Carmen Reinhart, 2002, "Fear of Floating." *Quarterly Journal of Economics*, CXVII (2002), 379–408.

[9] Dooley, Micheal, 1996, "A Survey of Literature on Controls over International Capital Transactions." *IMF Staff Papers*, Vol. 43, No. 4, 639–687.

[10] Drazen, Allan, 1989, "Monetary Policy, Capital Controls and Seigniorage in an Open Economy." In Marcello de Cecco and Alberto Giovannini (eds.), *A European Central Bank?* 13–32. Cambridge: Cambridge University Press.

[11] Edwards, Sebastian, 1996, "The Determinants of the Choice between Fixed and Flexible Exchange-Rate Regimes." NBER Working Paper No. 5756.

[12] Eichengreen, Barry, 2001, "Capital Account Liberalization: What Do Cross-Country Studies Tell Us?" *World Bank Economic Review*, Vol. 10 (October), 341–365.

[13] Epstein, Gerald, and Juliet Schor, 1992, "Structural Determinants and Economic Effects of Capital Controls in OECD Countries." In Tariz Banuri and Juliet Schor (eds.), *Financial Openness and National Autonomy: Opportunities and Constraints*, 136–162. Oxford: Clarendon Press.

[14] Fischer, Stanley, 1998, "Capital Account Liberalization and the Role of the IMF." *Essays in International Finance*, No. 207, International Finance Section, Princeton University.

[15] Fischer, Stanley, 2001, "Exchange Rate Regimes: Is the Bipolar View Correct?" *Journal of Economic Perspectives*, Vol. 15, No. 2, 3–24.

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

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

[18] Grilli, Vittorio, and Gian Maria Milesi-Ferretti, 1995, "Economic Effects and Structural Determinants of Capital Controls." *IMF Staff Papers*, Vol. 42, No. 3, 517–551.

[19] Johnston, Barry, with Mark Swinburne, Alexander Kyei, Bernard Laurens, David Mitchem, Inci Ötker, Susana Sosa, and Natalia Tamirisa, 1999, *Exchange Rate Arrangements and Currency Convertibility: Developments and Issues*, World Economic and Financial Survey (September). Washington, D.C.: IMF.

[20] Johnston, Barry, and Natalia Tamirisa, 1998, "Why Do Countries Use Capital Controls?" IMF Working Paper No. 98/181.

[21] Juhn, Grace, and Paolo Mauro, 2002, "Long-Run Determinants of Exchange Rate Regimes: A Simple Sensitivity Analysis." IMF Working Paper No. 02/104.

[22] Levy-Yeyati, Eduardo, and Federico Sturzenegger, 2002, "Classifying Exchange Rate Regimes: Deeds vs. Words." Mimeo. Universidad Torcuato Di Tella. Available from http://www.utdt.edu/ ely/.

[23] Marshall, Monty, and Keith Jaggers, 2002, "Polity IV Project: Political Regime Characteristics and Transitions, 1800–2002." CIDCM, University of Maryland.

[24] Milesi-Ferretti, Gian Maria, 1998, "Why Capital Controls? Theory and Evidence." In Sylvester Eijffinger and Harry Huizinga (eds.), *Positive Political Economy: Theory and Evidence*, Cambridge: Cambridge University Press.

[25] Miniane, Jacques, 2004, "A New Set of Measures on Capital Account Restrictions." *IMF Staff Papers*, Vol. 51, No. 2, 276–308.

[26] Quinn, Dennis, 1997, "The Correlates of Change in International Financial Regulation." *American Political Science Review*, Vol. 91, No. 3, 531–551.

[27] Quinn, Dennis, 2000, "Democracy and International Financial Liberalization." Mimeo. Georgetown University.

[28] Quinn, Dennis, and Carla Inclán, 1997, "The Origins of Financial Openness: A Study of Current and Capital Account Liberalization." *American Journal of Political Science*, Vol. 41, 771–813.

[29] Razin, Assaf, and Efraim Sadka, 1991, "Efficient Investment Incentives in the Presence of Capital Flight." *Journal of International Economics*, Vol. 31 (August), 171–181.

[30] Reinhart, Carmen, and Kenneth Rogoff, 2004, "The Modern History of Exchange Rate Arrangements: A Reinterpretation." *Quarterly Journal of Economics*, Vol. 119 (February), 1–48.

[31] Train, Kenneth, 2002, *Discrete Choice Methods with Simulation*, Cambridge, MA: The MIT Press.

[32] Von Hagen, Jürgen, and Jizhong Zhou, forthcoming, "The Choice of Exchange Rate Regime in Developing Countries: A Multinomial Panel Analysis." *Journal of International Money and Finance.*

[33] Von Hagen, Jürgen, and Jizhong Zhou, 2005, "The Determination of Capital Controls: Which Role Do Exchange Rate Regimes Play?" *Journal of Banking and Finance*, Vol. 29, 227–248.

[34] Williamson, John, 2000, *Exchange Rate Regimes for Emerging Markets: Reviving the Intermediate Option*, Washington D.C.: Institute for International Economics.

[35] Zhou, Jizhong, and Jürgen von Hagen, 2004, "Fear of Floating and Fear of Pegging: An Empirical Analysis of De Facto Exchange Rate Regimes in Developing Countries." ZEI Working Paper B31-2004, University of Bonn.