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# CAPITAL CONTROLS, CAPITAL FLOW CONTRACTIONS, AND MACROECONOMIC VULNERABILITY*

**By**

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***ABSTRACT***

In this paper I analyze whether restrictions to capital mobility reduce vulnerability to external shocks. More specifically, I ask if countries that restrict the free flow of international capital have a lower probability of experiencing a large contraction in net capital flows. I use three new indexes on the degree of international financial integration and a large multi-country data set for 1970-2004 to estimate a series of random-effect *probit* equations. I find that the marginal effect of higher capital mobility on the probability of a capital flow contraction is positive and statistically significant, but very small. Having a flexible exchange rate greatly reduces the probability of experiencing a capital flow contraction. The benefits of flexible rates increase as the degree of capital mobility increases. A higher current account deficit increases the probability of a capital flow contraction, while a higher ratio of FDI to GDP reduces that probability.

***JEL Classification No*:** F30, F32

***Keywords***: Capital controls, capital mobility, contagion, external imbalances, current account deficits, sudden stops, capital flow contractions.

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## 1. **Introduction**

The East Asian currency crises of 1997-1998 were extremely traumatic. Countries that for years had been praised as examples of how to conduct economic policy were subject to abrupt stops of capital inflows and had to devalue their currencies. As the crisis deepened, contagion spread to other emerging nations, affecting countries as far as Latin America. In many ways, the East Asian crises marked the end of an era; in the years that followed, macroeconomic policies in most emerging countries went through profound changes. Perhaps the most important of these changes is that most countries gave up pegged exchange rate regimes and adopted some form of flexible exchange rates. Indeed, very few countries have rigid exchange rates; at the time of this writing China continues to be the most important cases of exchange rate inflexibility.

It is not an exaggeration to say that the East Asian and subsequent crises -- Brazil, Turkey, Argentina, Uruguay, the Dominican Republic – resulted in the emergence of a new (and more prudent) approach towards macroeconomic policy in emerging and transition nations. The overall objective of this new approach is to reduce vulnerability to external shocks and to lower the likelihood of external crises, including sudden stops and major devaluations. This new view on macro policy has also recognized the need of maintaining the public and external debts at prudent levels. In addition, the accumulation of international reserves has been used as a self insurance mechanism, and current account deficits have generally been kept in check.[1]

[1] The evolution of this new approach to macro policy in emerging nations may be traced through the writings of a number of authors. See, for example, Summers (2000), Fischer (2003), Dornbusch (2002), Aizenman and Lee (2005), and Rogoff, Reinhart and Savastanno (2003). See also Rogoff (2006).

In spite of the emergence of a new view on macroeconomic policy, there are still some areas of disagreement. The most important one refers to the appropriate degree of capital mobility in emerging and transition countries. Some authors argue that limiting the extent of international financial integration reduces speculation and helps countries withstand external shocks without suffering massive crises. According to this view, countries that control and limit capital mobility are less likely to suffer contagion from abroad. In his criticism of the International Monetary Fund (IMF), Stiglitz (2002) argues that the fundamental reason why India and China were spared from substantial currency crises -- and were not subject to contagion from the East Asian or other crises of the 1990s and early 2000s -- is that they did not allow free capital mobility. Stiglitz goes as far as arguing that the easing of controls on capital mobility was at the center of most modern currency crises in the emerging markets -- Mexico 1994, East Asia 1997, Russia 1998, Brazil 1999, Turkey 2001, and Argentina 2002. According to other authors, however, restrictions to capital mobility are ineffective -- the private sector always finds way of circumventing them --, introduce costly microeconomic distortions and encourage corruption.[2] What makes the debate on capital controls particularly interesting is that some of the critics of free capital mobility in the emerging countries are authors that have been staunch supporters of free trade in goods: according to them there are fundamental differences between markets for goods and markets for securities (Bhagwati, 1998, 1999).

The purpose of this paper is to analyze whether restrictions on capital mobility reduce a country's vulnerability to major external shocks. More specifically, I ask if countries that restrict the free flow of international capital are less likely to experiencing

[2] Forbes (2006 a,b).

an abrupt reduction in net capital inflows. I use three new indexes on the degree of international financial integration and a large multi-country data set for 1970-2004 to estimate a series of random-effect *probit* equations. I use these estimates to compute marginal effects of different indicators on the likelihood of a country facing a severe contraction in net capital flows. I also analyze the role played by other variables in determining the probability of experiencing a capital inflow contraction. In particular, I focus on: (a) large current account deficits; (b) the exchange rate regime – fixed or flexible; (c) holdings of international reserves; (d) fiscal imbalances; (e) world interest rates; and (f) the composition of capital inflows, among others. Throughout the analysis I focus on nonlinearities, and on the interaction between the degree of financial integration and other determinants of macroeconomic vulnerability.

The analysis concentrates on what I have called "capital flow contractions" (CFC) episodes. A CFC is defined as an abrupt decline -- at least 3% of GDP – in net capital inflows during a one year period. CFCs differ from the more traditional concept of "sudden stop" (SS) in an important respect. Sudden stops are large contractions in flows to countries that, until that moment, were receiving large positive (net) flows; CFCs, in contrast, are defined for all countries, independently of whether they initially had positive or negative net flows. That is, it is possible for a CFC to take place in a country that was originally experiencing net capital outflows. In that regard, then, CFCs also capture surges in what is sometimes referred to as "capital flight." The reason for concentrating on CFCs is that any abrupt contraction of the capital account – independently of whether the country is initially subject to net inflows or outflows – will require a major current

account adjustment and, thus, is likely to be costly.[3] It follows from the definition of CFC and SS that the incidence of the former will be larger than that of the latter.

Before proceeding, it is important to emphasize that the analysis presented in this paper only deals with one aspect of the effects of capital controls: their impact on the probability of experiencing a large decline in net capital inflows. A complete policy evaluation of the effects of capital controls would also analyze their *costs* in the form of distortions, misallocated investment and others. However, dealing with the (potential) costs of capital account restrictions, is beyond the scope of this paper.[4] ï

The rest of the paper is organized as follows: In section 2 I describe the three indexes on capital account restrictions used in this paper, and I compare them to alternative measures used in the literature. In Section 3 I define capital flow contractions (CFCs) and I briefly discuss their incidence across different regions during the 1970-2004 period. I also provide a brief comparison of CFCs with the more traditional measure of sudden stops. In Section 4 I report results on the determinants of the probability of experiencing a CFC. The analysis concentrates on nonlinearities, and investigates the way in which capital mobility affects the role of other determinants of CFCs. In Section 5 I investigate the relationship between capital mobility, contagion, large current account imbalances and exchange rate regimes. In this Section I also deal with extensions and robustness, and I discuss in greater detail interactive effects between capital mobility and other determinants of the probability of CFCs. In Section 6 I deal with the potential endogeneity of the capital mobility indexes, and I present results obtained when an

[3] On sudden stops, see Calvo(2003), Calvo et al (2004), Caballero And Krishnamurthy (2002, 2003), Frankel and Cavallo (2004), Edwards (2004a,b), Hutchinson and Noy (2005). See also the discussion in Rothenberg and Warnock (2006).

[4] See the papers by Forbes mentioned above. See also Desai et al (2004).

instrumental variables version of probit regressions is used. Finally, in Section 7 I provide some concluding remarks. The paper also has a data appendix.

## 2. Measuring Capital Mobility

### *2.1. Literature Review*

Most early attempts to measure the extent of international financial integration used information provided by the International Monetary Fund. The standard approach has been to use line E.2 of the annual summary published in the *Annual Report on Exchange Arrangements and Exchange Restrictions*. Alesina, Grilli and Milesi-Ferreti (1994) and Rodrik (1998) constructed a dummy variable index of capital controls, which took a value of one when capital controls were in place and zero otherwise. Klein and Olivei (1999) used the IMF's data to construct an index as the number of years in the period 1986 and 1995 during which each country had an open capital account.[5] Leblang (1997), Razin and Rose (1994), Chinn and Ito (2002), Glick and Hutchinson (2005), and Glick, Guo and Hutchinson (2005) also used indicators based on the IMF to construct *zero-one* classifications of openness.

A limitation of these IMF-based binary indexes is that they do not distinguish between de jure and de facto controls, and do not differentiate according to different intensities of capital restrictions, or type of flow being restricted. Montiel and Reinhart (1999) and Chinn and Ito (2002) addressed this issue by combining IMF and country-specific information to construct indexes on the intensity of capital controls in a number of countries.

In an effort to deal with some of these measurement problems, Quinn (1997)

[5] A limitation with this indicator is that it does not say if the index's number (i.e. the percentage of years with restrictions) refers to most recent or most distant years in the time window being considered.

constructed a comprehensive set of cross country indicators on the degree of capital mobility that ranged from 0 through 4. These indexes covered several years, allowing researchers to investigate how changes in capital controls affected key macroeconomic variables. Edwards (1999, 2002) used Quinn's index to analyze whether restricted capital controls affected growth. He found that there was a threshold effect: higher capital mobility benefit countries only after they have reached a certain level of economic development. Edison et al (2004) compared Quinn's (1997) index with an index based on the number of years that, according to the *Exchange Arrangements and Exchange Restrictions*, a country has had a closed capital account, and found out that for most (but not all) countries and periods there was a correspondence between the two indicators. More recently Quinn et al (2003) and Quinn (2003) developed a new index that provides greater detail on the intensity of controls. Mody and Murshid (2002) also used IMF data as the bases for an index of financial integration that covers 150 countries for 1966-2000, and is tabulated from a value of zero to four.

A number of authors have used stock market data to construct indexes on international financial integration. Early attempts were made by Bekaert (1995), Bekaert and Harvey (1995, 2000), and Bekaert et al (2005). According to these authors it is important to distinguish between "official" or "legislative" dates of stock market liberalization. Edison and Warnock (2003) used data on stock markets compiled by the *International Finance Corporation* to construct a new index of restrictions on ownership of stock by foreigners. This index – which is available for 29 countries – has a high degree of correlation with the index by Bekaert et al (2005).[6] Shatz (2000) built an index

[6] See Edison et. al (2004) for a survey of studies on the effect of capital account restrictions on stock markets.

on capital account restrictions based on restrictions on foreign direct investment in 57 countries. Desai et al (2004) used this index in a study on the way in which multinational firms deal with capital controls.

These difficulties in measuring capital mobility and financial integration accurately have resulted in empirical results that have often been tentative, and not very robust. It is not an exaggeration to say that for some time now macroeconomists have tried to obtain better and more detailed indexes of capital account restrictions and financial integration.

*2.2. Three New Indexes*:

In this paper I use three new indexes on the degree of international financial integration.

(i) I constructed the first index – which I call *Capital Mobility* or *CM* -- by combining information from Quinn (2003) and Mody and Murshid (2002), with information from country-specific sources. In creating this new index I followed a three steps procedure: First, the scales of the Quinn and Mody and Murshid indexes were made compatible. The new index has a scale from 0 to 100, *where higher numbers denote a higher degree of capital mobility*; a score of 100 denotes absolutely free capital mobility. Second, I use *Stata's* "*impute*" procedure to deal with missing observations in the new index. In order to impute *preliminary* values to the missing observations I use data on the two original indexes (Quinn and Mody and Murshid), their lagged values, openness as measured by import tariffs collections over imports, the extent of trade openness measured as imports plus exports over GDP, a measure of openness

obtained from the fitted values of a gravity model of trade and GDP per capita.[7] In the third step, I use country-specific data to revise and refine the preliminary data created using the "*impute*" procedure discussed above. The new index covers the period 1970-2004, and has data for 163 countries (although not every country has data for every year).[8]

(ii) The second index is constructed from data on international assets positions compiled by Lane and Milesi Ferreti (2006) for 147 countries for 1970 to 2004. This index is computed as the sum of total external assets *plus* total external liabilities as a proportion of GDP. A higher value of this index – which I call *LMF* – denotes that the country is more integrated to world financial markets. In some ways this index is a financial or capital markets counterpart of the traditional index on trade openness calculated as the ratio of imports plus exports to GDP.

(iii) The third index was constructed by Miniane (2004) for 34 countries. It is based on detailed country-specific data compiled by the IMF since 1996, and considers 13 types of capital controls and restrictions, including restrictions on that affect inflows and outflows of stocks, money market instruments, mutual funds, derivatives, commercial credits, warrants, letters of credit, direct investment, profit repatriation, and real estate transactions. Miniane (2004) used country-specific primary data to recalculate this index all the way back to 1983. This index – which I call *Miniane* or simply *MI* – ranges from zero to 100, and is calculated at the three-decimal level.[9] A

[7] See Aizenman and Noy (2004) on the relationship between trade account openness and capital account openness.

[8] It is important to note that although this new index represents an improvement over alternative indexes, it still has some shortcomings, including the fact that it does not distinguish very sharply between restrictions on capital inflows and restrictions on capital outflows. See the discussion in the preceding section for an analysis of the shortcomings of different indexes. See also Eichengreen (2001) and Edwards (1999).

[9] The original index went from zero to one; I rescaled it.

higher value of this index denotes a higher level of capital account restrictions.

There are some important differences across these indexes. First, while the *Capital Mobility* and *Miniane* indexes are based on an analysis of de jure restrictions, the *LMF* index relies on de facto market integration. A second difference refers to coverage. The *Capital Mobility* and *LMF* indexes cover a longer period of time and larger number of countries than the *Miniane* index; in that regard, the *CM* and *LMF* indexes are preferred to the *MI* index. A third difference is that while in the *Capital Controls* and *LMF* indexes a higher value denotes a higher degree of capital mobility, in *Miniane* a higher value of the index refers to stricter capital controls. An important question is whether, in overall terms, these three indexes tell a similar story. I address this issue by computing Spearman rank coefficients of correlation. The null hypotheses that the indexes are independent were rejected at conventional levels. The Spearman coefficient between *Capital Mobility* and *Miniane* it is -0.880 ; between *LMF* and *MI* it is -0.660; and between the *CM* and *LMF* indexes is 0.430. Given their more general coverage, in the rest of this paper I concentrate on the CM and LF indexes.

## 3. Capital Flow Contractions: Definition and Incidence

In this paper I have defined a "*capital flow contraction*" (CFC) episode as an abrupt contraction in a country's capital account in a given year. More specifically, in order for an episode to classify as a CFC, net capital flows have to decline in a year by at least 3% of GDP. A country could face a CFC independently of whether it was initially a net importer or a net exporter of capital. The more traditional concept of sudden stop, on the other hand, is restricted to abrupt declines in capital inflows to countries that were previously receiving large inflows of capital. As pointed out above, the reason for

concentrating on CFCs is that any abrupt contraction of the capital account – independently of whether the country is initially subject to net inflows or outflows – will require a major current account adjustment and, thus, is likely to be costly. In Section 5 of this paper I show that the main results are similar if the more traditional definition of sudden stops is used in the analysis.

The first two columns of Table 1 provide summary data on the incidence of CFCs for six groups of countries. As may be seen, the overall incidence of CFCs is 0.18; the Middle East and Eastern Europe have the highest incidence, while the advanced nations have the lowest incidence. The $\chi^2$ test is for the null hypothesis that the distribution of "CFCs" and "no CFCs" is independent across group of countries; this null hypothesis is rejected at conventional levels. In the last two columns of Table 1, and for comparison purposes, I present data on the incidence of sudden stops for the same six groups of countries. I have defined a "*sudden stop*" episode as an abrupt and major reduction in capital inflows to a country that, up to that time, had been receiving large volumes of foreign capital. More specifically, I imposed the following requirements for an episode to qualify as a "sudden stop": (1) the country must have received an inflow of capital (relative to GDP) larger than its region's third quartile during the two years prior to the "sudden stop." And (2), net capital inflows must have declined by at least 3% of GDP in one year. As may be seen, the overall incidence is 0.087, less than half of that of CFCs. The Middle East and Latin America have the highest occurrences of SS, while the advanced nations have the lowest.

**[Insert Table 1 about here]**

In the extensions reported in Section 4 I discuss alternative definitions of capital flows disruptions, including definitions that consider more severe reductions in flows, definitions that spread the decline in capital flows over two years, as well as a definition that focuses on sudden stops proper.

## 4. An Empirical Analysis of Capital Controls and Capital Flow Contractions

In this Section I investigate whether the degree of international financial integration affects the probability of a capital flow contraction (CFC). I am particularly interested in analyzing the way in which capital mobility affects the role played by other variables – including contagion, the degree of flexibility of the nominal exchange rate, and external imbalances – in determining the probability of a CFC.

### *4.1.The Empirical Model*

The point of departure of the analysis is a variance component probit model given by equations (1) and (2):

$$y_{tj} = \begin{cases} 1, & \text{if } y^*_{tj} > 0 \\ 0, & \text{otherwise,} \end{cases} \quad (1)$$

$$y^*_{tj} = \alpha\omega_{tj} + \varepsilon_{tj}. \quad (2)$$

Variable $y_{tj}$ is a dummy variable that takes a value of one if country j in period t experienced a CFC (as defined above), and zero if the country in question did not experience a CFC. [10] According to equation (1), whether the country experiences a capital flow contraction is assumed to be the result of an unobserved latent variable $y^*_{tj}$.

[10] Glick and Hutchinson (2005) investigated whether capital controls isolated countries from currency crises. There measure of controls is a zero-one indicator, however.

$y_{tj}^{*}$, in turn, is assumed to depend linearly on vector $\omega_{tj}$. The error term $\varepsilon_{tj}$ is given by a variance component model: $\varepsilon_{tj} = \nu_j + \mu_{tj}$. $\nu_j$ is iid with zero mean and variance $\sigma_\nu^2$; $\mu_{tj}$ is normally distributed with zero mean and variance $\sigma_\mu^2 = 1$. In addition to the random effects model, I also estimated fixed effects and basic probit versions of the probit model in equations (1) and (2).[11]

One of the advantages of probit models is that they are highly non-linear; the marginal effect of any independent variable on the probability is conditional on the values of *all* covariates. This means that if the value of one of the independent variables changes, the marginal effect of all of them will also change. Denoting the (normal) cumulative probability distribution by $\Phi$, then the probit model is defined by:

$$\Pr(y_{jt} \neq 0 \mid \omega_{jt}) = \Phi(\alpha\omega_{jt}). \tag{3}$$

The marginal effect of a particular variable $z_1$ on the probability may be calculated as the slope of the probability function, evaluated at a specific set of values of the covariates $\omega_{jt}s$. Assume that the estimated probit coefficient of $z_1$ is $\alpha_1$, and that we want to evaluate the marginal effect of $z_1$ at a point where covariates have values captured by vector $\tilde{\omega}$. In this case, the marginal effect of $z_1$ (evaluated at $\tilde{\omega}$) is given by:

$$\frac{\partial\Phi}{\partial z_1} = \Phi'(\alpha\tilde{\omega})\alpha_1. \tag{4}$$

Equation (4) may be used to evaluate how a change in particular variable – a "large" current account deficit, say – affects the probability of a CFC, under alternative degrees of capital mobility (captured by different values of $\tilde{\omega}$). In this paper I calculate

[11] In the "basic probit" estimation, the error term is assumed to have the standard characteristics.

the marginal effects of the different covariates for alternative degrees of capital mobility--*high*, *intermediate* and *low* – and different levels of current account imbalances.

*4.2.**Specification***

In determining the specification of this probit model I followed the literature on external crises, devaluations, sudden stops, and current account reversals.[12] In the base-case specification I included the following covariates, all of which are available for a large number of countries and years:[13]

(i) The capital mobility index(es) described above, lagged one period. As pointed out, the sign (and magnitude) of this coefficient is at the center of current policy debates on the effects of capital mobility. If, as some authors such as Stiglitz (2002) have argued, restricting capital mobility reduces the likelihood of a crisis, the sign of the capital mobility index would be positive for the *CM* and *LMF* indexes; for the *MI* index the coefficient should be negative.

(ii) The ratio of the current account deficit to GDP, lagged one period.

(iii) The lagged ratio of the country's fiscal deficit relative to GDP.

(iv) The lagged value of an index that measures the (potential) effect of "contagion." This contagion index is defined as the relative occurrence of CFCs in each country's "reference group." The reference group, in turn, is defined for most countries as their region. There are five geographical regions: Latin America, Asia, North Africa and the Middle East, Africa and Eastern and Central Europe. The advanced countries belong to a group of their own. The contagion variable is calculated, for each year, as the percentage of countries, in the relevant group, that experienced a CFC. In this

[12] See, for example, Calvo et al (2004), Glick and Hutchison (2005), Edwards (2004a, 2004b), and Frankel and Cavallo (2004). See also Eichengreen et al (2006).

calculation data for the country in question are excluded. The coefficient of this "contagion" variable in the probit equation is expected to be positive, reflecting the fact that when a similar country experiences a capital flow contraction, capital flows to the country in question will tend to decline, increasing the likelihood of a CFC.[14] A particularly interesting question – and one that I address in some detail in this paper – is how different degrees of capital mobility affect a country's vulnerability to contagion.

(v) Percentage change in the terms of trade (defined as the ratio of export prices to import prices), with a one year lag. Improved terms of trade are expected to lower the probability of a crisis; its coefficient should be negative.

(vi) Lagged international real interest rates, proxied by real U.S. 10 year Treasuries. As Eichengreen (2001) has argued, a decline in world liquidity – captured by higher international real interest rates – will tend to increase the probability of an external crisis. If this is indeed the case, the coefficient of this variable will be positive.

(vii) A dummy variable that takes the value of one if the country is an "advanced country," and zero otherwise. In some of the regressions I included dummy variables for each region.

(viii) A dummy variable that takes the value of one if that particular country has a flexible exchange rate regime, and zero otherwise. The classification of exchange rate regimes is based on de facto information, as compiled by Levy-Yeyati and Sturzenegger (2003).

[13] See, for example, Frankel and Rose (1996), Milesi-Ferreti and Razin (2000) and Edwards (2002).
[14] There are six groups. Five of them are strictly regional – Latin America, Asia, Middle East and North Africa, Eastern and Central Europe, and Africa --, while the sixth refers to "advanced" nations and, thus, covers more than a region.

(ix) Foreign direct investment (FDI) relative to GDP. This variable measures the composition of capital inflows. To the extent that FDI represents a longer term commitment than portfolio capital flows, it is expected that its coefficient will be negative.

(x) International reserves as a proportion of the country's total external liabilities. This indicator was constructed from data provided by Lane and Milesi-Ferreti (2006). To the extent that a high level of international reserves is seen as an insurance policy, the coefficient of this variable is expected to be negative in the estimation of the probit equations.

In addition to the base estimates with the covariates discussed above, I also estimated a number of regressions that include an index that measures the extent to which the country is dollarized. If countries subject to "original sin" – that is, countries that are unable to borrow in their own currency are more prone to experience an abrupt decline in capital inflows, its coefficient should be positive. The data for this index were taken from Reinhart, Rogoff and Savastano (2003).

Previous work that has analyzed the effects of financial openness on sudden stops has found inconclusive results. Edwards (2004, 2005), for instance, found an insignificant coefficient in the estimation of the probit component of treatment regressions. However, his measures of capital flows declines were different from those used in this paper; also, he used a smaller sample, and a different index of capital mobility from the ones used in this paper. Frankel and Cavallo (2004) found a negative relationship between openness and the probability of a sudden stop. Calvo et al (2004), on the other hand, report a positive effect.

### *4.3.**Basic Results***

The basic results are in Tables 2-4; each table contains the estimates for a different index of capital mobility. As may be seen, most estimated coefficients are significant at conventional levels. The capital mobility indexes are statistically significant in all the equations, and their signs indicate that, with other things given, an increase in the degree of international financial integration increases the probability of a CFC. The fact that these results hold for three very different indexes of capital mobility indicate an important degree of robustness. However, as is discussed in great detail in Sub-Section 4.4, the quantitative impact of changes in capital mobility on the estimated probabilities of a CFC is very small small, almost negligible. An important question is whether different degrees of capital mobility affect the way in which other covariates, such as contagion, the exchange rate regime and external imbalances, affect the probability of a CFC.

**[Insert Table 2, 3 and 4 about here]**

The results in Tables 2-4 indicate that a higher current account deficit increases the probability of a CFC. The results confirm the presence of a "contagion" effect, and indicate that an improvement in the terms of trade reduces the probability of a CFC.[15] As is discussed below, the actual magnitude of the contagion effect changes with the degree of capital mobility. The results in Tables 2-4 also show that countries with a flexible exchange rate regime have a lower probability of experiencing a CFC, as do advanced nations. More stringent global liquidity – captured by higher international real interest rates – increases the probability of a CFC. The results in Tables 2-4 also indicate that the

composition of capital flows matter: higher FDI (as a proportion of GDP) reduces the probability of a CFC. Interestingly, a higher stock of international reserves does not reduce the likelihood of experiencing a large contraction in net capital inflows.

In equations (2.6), (3.6), (4.6) the coefficient of the fiscal deficit is significantly positive, indicating that a higher fiscal imbalance increases the likelihood of a capital flow contraction. However, when the fiscal variable is introduced jointly with the current account deficit – equation (2.3), (3.3) and (4.3) --, its coefficient is not significant. As may be seen, in this case the coefficient of the current account deficit continues to be positive and significant. This result is rather intuitive: higher fiscal imbalances that are *not* associated with a deterioration of the external accounts, do not affect in a significant way the probability of an abrupt contraction in net capital inflows.

Finally, when other covariates, such as the degree of dollarization were introduced in the probit regression, their coefficients were not significant.[16] Since the coverage of the *Miniane* index is narrower – both in terms of countries and time period – than the two other measures of mobility, in the rest of the paper I will concentrate on the *CM* and *LMF* indexes.

### *4.4.Evaluating the Marginal Effect of Capital Mobility on the Probability of CFC*

In order to gain further insights into the way in which the different covariates affect the probability of a CFC, in this Section I report *marginal effects* computed using



[15] The contagion results contrasts with the findings from Glick and Hutchinson (2005) for currency crises. Notice, however, that their measure of contagion differs from the one used in this paper. In their case the contagion indicator is binary.

[16] Detailed results are not reported here due to space considerations. However, they are available on request.

the procedure sketched in equations (3) and (4). I discuss the marginal effects for only one of the equations reported above -- equation 2.2.[17]

As a point of departure for the analysis I evaluated the marginal effects for three different degrees of capital mobility: *low*, *intermediate*, and *high*. The marginal effects for "low capital mobility" were evaluated at a value of the *Capital Mobility* index corresponding to 12.5; all other independent variables were taken at their mean values. The results for "intermediate capital mobility" were calculated when all covariates, including the *CM* index, were at their mean values; and the marginal effects for "high capital mobility" were calculated at a value of the *CM* index of 100, which corresponds to the 95$^{th}$ percentile of its distribution; as before, all other independent variables were maintained at their mean values.

These three sets of marginal effects are reported in Table 5; the bottom row includes the estimated probability of experiencing a CFC. Several results stand out from this Table.

**[Insert Table 5 about here]**

According to the probit estimate, a "typical" country – that is a country with covariate values equal to the sample mean – has an estimated probability of experiencing a CFC of 16.5% (the actual historical incidence of CFC episodes is 18.8%). This estimated probability increases to 21.6% in a country with a "high" degree of capital mobility, and declines to 12.3% for a country with a "low" degree of capital mobility.

[17] When alternative equations were used, the results on the marginal effects were similar. This equation was chosen for calculating the marginal effects because it has the preferred specification and covers a large number of countries. When the probit regressions with the *LMF* index were used to evaluate the marginal effects, the results were also similar. The marginal effects obtained from the probits with the *MI* index were somewhat different. This is not surprising, as the *MI* index is available for a shorter period and a limited sample of countries.

(i) The point estimates of the marginal effects for the *Capital Mobility* indexes are very low: according to Column (5.1), when the initial condition is a low degree of financial integration, a marginal increase in the *CM* index raises the probability of a CFC by a mere 0.1%. The marginal effect of the *CM* index barely changes when it is evaluated at higher levels of capital mobility. This means that, although capital mobility has a statistically significant effect on the probability of a CFC, the magnitude of this effect is so small, that it is almost of no practical or policy consequence. A potentially more interesting question, and one that I discuss below, is whether the marginal effects of other covariates changes for different values of the *CM* index.

(ii) The effect of moving from a pegged to a flexible exchange rate regime is negative, large, and statistically significant. Countries that adopt a flexible exchange rate regime reduce the probability of experiencing a CFC between 5.7% and 8.4%. What is particularly interesting is that this marginal effect becomes more negative with higher degrees of capital mobility. That is, the advantage of having a flexible exchange rate increases significantly in countries with a higher degree of capital mobility.

(iii) "Contagion" has a significantly positive marginal effect on the probability of a CFC. Point estimates, however, are very small. For a typical country, a one percentage point increase in the contagion index, results in an increase in the probability of a CFC of only 0.28%. Notice, however, that in spite of its low point estimate, the marginal effect of "contagion" increases as the degree of financial integration goes up: it is 0.23% for low capital mobility, and 0.33% for high mobility. Figure 1

presents the point estimates, as well as one standard deviation bands, for the "contagion" marginal effect coefficient corresponding to different values of the *Capital Mobility* index.

(iv) The marginal effects of current account deficits are significantly positive, but small. Moreover, and in contrast with the cases of exchange rate regime and contagion, the marginal effect of current account deficits don't experience a significant change when the degree of capital mobility increases.

(v) Improvements in the terms of trade reduce the probability of a CFC. At the margin, however, the effects are not very large; the marginal effects are very similar across different degrees of capital mobility. The p-values are slightly higher than the conventional 0.10 level.

(vi) A marginal decline in world liquidity – captured by an increase in real world interest rates – has a small positive effect on the probability of a CFC. The marginal effect is never higher than 1%.

(vii) Being an advanced nation reduces the probability of a CFC between 2.5% and 3.5%.

To summarize, the results in Table 5 indicate that, although statistically significant, the direct marginal effect of capital mobility on the probability of a CFC is very small – almost negligible. This is true for every level of capital mobility. However, the degree of capital mobility has an important indirect effect on the probability of a CFC, since it affects the importance of other determinants of this probability. In particular, the advantage of a flexible exchange rate is higher in countries with a high degree of capital mobility than in countries with low mobility. The marginal effect of contagion increases as the degree of capital mobility goes up.

## 5. Capital Controls and Macroeconomic Vulnerability

The results discussed in the previous Section were obtained by evaluating the marginal effects at the mean values of all covariates, except the *Capital Mobility* index. In that regard, these results refer to a "typical country" with different degrees of financial integration. From a policy perspective, however, a more relevant question is whether controls on capital mobility reduce the probability of a CFC in *vulnerable* countries. In this Section I expand the analysis in order to address this issue. In Sub-Section 5.1 I analyze the relationship between the degree of capital mobility and CFC in countries with large current account deficits and fixed exchange rates. In 5.2 I analyze in greater detail the role of contagion, and I ask whether the relevant concept of contagion is "regional" or "global." In Section 5.3 I discuss some extensions, I consider alternative definitions of capital account disturbances, and I deal with robustness. Finally, in Sub-Section 5.4 I deal with issues related to the specification of the probit equation, and I discuss the possible role of terms that interact two covariates. Issues related to the possible endogeneity of the capital mobility indexes are taken up in Section 6.

### *5.1.* ***Large Current Account Deficits, Capital Mobility, CFCs, Exchange Rate Regimes and Contagion***

Most emerging countries that suffered major crises during the 1990s and 2000s had run large current account imbalances. Consider the following cases: In Mexico, the current account deficit averaged 7% of GDP during 1992-1994; deficits averaged 8.5% in Thailand during 1995-1996; and in Malaysia they averaged 7% in 1995-1996. The recent surge in current account deficits in some advanced countries, such as the U.S. and New Zealand, has generated an interest in analyzing the role of large external imbalances in

episodes of abrupt contractions in capital flows. In order to address this issue I follow a two-part strategy: First, I evaluate the estimated probability functions reported in Tables 2-4 under two cases of current account imbalances: "*Moderate Deficits"* (2.0% of GDP) and "*Large Deficits*" (9.0% of GDP). This allows me to investigate the way – and channels – through which large deficits affect the probability of a CFC. In the second stage I analyze whether these estimates for "*Moderate*" and "*Large*" current account deficits change for two alternative degrees of capital mobility: *Low*, and *High*.[18]

Table 6 presents the marginal effects and estimated probabilities of a CFC for countries with *Moderate* and *Large* current account deficits.[19] As may be seen, the estimated probability of a CFC increases from 14.3% in the *Moderate Deficit* case to 21.9% under *Large Deficits*. Notice that the benefits of a flexible exchange rate regime – captured by a negative marginal effect – are higher in countries with large current account deficits. The marginal contribution of the current account deficit itself continues to be rather small, and it barely increases when moving from the *Moderate* to the *Large* deficits cases (it goes from 1.0% to 1.2%). Contagion continues to play a significantly positive effect. Moreover, its marginal effect increases from 0.25% in the moderate deficits case, to 0.33% in the large deficits case.

**[Insert Table 6 about here]**

The results reported in Table 6 are for a "typical" country with an average degree of capital mobility – the *CM* index is 56.7. From the perspective of this paper, a particularly important question is whether the effects of large current account deficits are

[18] I define *Low* and *High* mobility as above. I don't report the results for intermediate mobility in order not to clutter the analysis with an excessive number of combinations of deficits and capital mobility. On the effects of large deficits see, for example, Freund and Warnock (2005).

different under different degrees of capital mobility. I address this issue by evaluating the probability function for four cases that combine the level of the current account deficit (*Moderate* and *Large*) with the degree of capital mobility (*Low* and *High*).[20] The results obtained are reported in Table 7. As before, the largest marginal effects correspond to the exchange rate regime variable. Its point estimate reaches the highest absolute value (9.7%) for the combination "*large deficit-high capital mobility*." Its lowest absolute value (5.4%) is for "*moderate deficit-low capital mobility*." Interestingly, the marginal effects of the capital mobility index don't change under the different scenarios; they are 0.1% under all four estimates. On the other hand, the marginal effects for both contagion and current account imbalances are highest under the "*large deficit-high capital mobility*" estimate.

**[Insert Table 7 about here]**

### *5.2.**Contagion: Regional or Global?***

In the results discussed above, "contagion" has a significantly positive effect on the probability of a CFC. The contagion indicator used in these regressions was constructed as the proportion of countries in that specific region that had suffered a CFC; in that regard this is a measure of "regional contagion." An important question, however, is whether crises stemming from more distant regions also affect the probability of a CFC. In order to address this issue I included in the regressions a second contagion variable as the incidence in CFCs (in that particular year) in other regions; I call this variable "*Contagion Other*." If contagion from distant places is an important determinant

[19] As before these marginal effects were computed using the estimated coefficients from equation (2.2) in Table 2. "Typical" in this context means that these marginal effects and estimated probabilities have been evaluated at the mean values of all other covariates.

of the probability of a CFC, its estimated coefficient would be significantly positive. The results obtained when this variable is added to the analysis are reported in Table 8, and indicate that once the incidence of "regional contagion" is taken into account, other crises – or non-regional contagion -- play no role in determining the probability of CFC. This suggests that contagion is a regional phenomenon.

**[Insert Table 8 about here]**

*5.3.**Robustness and Extensions***

I performed standard robustness tests. These included estimating the equations for alternative time periods, and alternative data sets. I also considered alternative specifications, and included additional variables that (potentially) capture the extent of external imbalances. Instrumental variables estimates are discussed in Section 6. In the rest of this Sub-Section I discuss in detail some of the robustness tests performed.

(i) *Alternative Samples:* As an illustration of the degree of robustness of these results, in Table 9 I report variance component probit estimates for two sub-samples: emerging countries and "large" countries.[21] As may be seen, the results support the main conclusions that emerge from the analysis presented above.

**[Insert Table 9 about here]**

(ii) *Net International Investment Position:* The results discussed above were obtained with a specification that considers the current account deficit as the fundamental measure of external imbalances; these results don't control for the country's initial net international investment position (NIIP). When the value of the initial NIIP to GDP

[20] As before low capital mobility is defined as a value of the *CM* index of 12.5; High capital mobility corresponds to a value of the *CM* index at the 95th percentile (100).

[21] Large countries are defined as those countries that in 1995 had a GDP in the top 25 percent of the global GDP distribution.

ratio was included as an additional regressor its coefficient was negative, as expected, indicating that a more positive NIIP would tend to reduce the probability of a CFC. However, the coefficient for this variable was statistically insignificant; see column 1 in Table 10. Moreover, its inclusion did not affect in any way the analysis on marginal effects on probabilities.

**[Insert Table 10 about here]**

(iii) *CFCs with Windows:* In this paper a capital flow contraction episode takes place if net capital flows decline by more than 3% of GD in a particular year. In constructing the CFC variable I did not use "windows" with no observations around each CFC; if capital flows declined by more than 3% of GDP for two years in a row, two successive CFCs were recorded. As a way of further testing the robustness of the results, I re-estimated the variance component probit model using a CFC index constructed with a one year window. The results obtained are reports in column 2 of Table 10. As may be seen, the results support the main conclusions of the previous analysis.

(iv) *CFCs with Alternative Thresholds:* As an additional robustness test I also considered alternative definitions of CFC. In particular, I re-estimated the probits when a CFC was defined as being a 4% or 5% reduction in capital inflows in one year. The results obtained – available on request – are similar to those reported here.

(v) *Sudden Stops as the Dependent Variable*: Throughout this paper the variable of interest has been capital flow contractions (CFCs), a very broad measure of capital changes in the capital account. An interesting question is how the results look like when the more traditional concept of "sudden stops" is used as the dependent

variable. The results obtained when the definition of sudden stops given in Section 2 of this paper was used, are reported in the third column of Table 10.[22] As may be seen, the most important findings from the previous analysis still hold: the coefficients of the vast majority of covariates – including the capital mobility index, the current account deficit, contagion, the exchange rate regime and the foreign direct investment ratio – have the expected sign and are statistically significant.

*5.4.**Alternative Specification of the Probit Equation: Multiplicative Covariates***

In the probit specification used in the preceding Sections all covariates entered on their own. Alternatively, some of the covariates could enter interactively. This specification would provide information on the *cross effect* of one of the covariates on the probability of a CFC. Consider the following simple case where $y$ is a dummy variable and the $x_i$ are covariates:

$$y = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_1 x_2 + \varepsilon_{ij} . \quad (5)$$

The *cross effect*, which measures how a small change in $x_2$ affects the marginal effect of $x_1$ on the probability of $y$, is given by:

$$\frac{\partial^2 \Phi(\cdot)}{\partial x_1 x_2} = \beta_3 \Phi'(\cdot) + (\beta_1 + \beta_3 x_2)(\beta_2 + \beta_3 x_1)\Phi''(\cdot) . \quad (6)$$

Where, as in equation (3), $\Phi$ is the normal cumulative distribution; $\Phi'$ and $\Phi''$ are the first and second derivatives of $\Phi$, evaluated at given values of the covariates. Several interesting results emerge from this expression. First, the cross marginal effect is *not* the same as the marginal effect of the interactive term. Indeed, the marginal effect of

[22] Sudden Stops are defined as an abrupt reduction of capital inflows in a country previously receiving massive amount of capital. In this paper the capital inflows reduction has to exceed 3% of GDP to classify

$(x_1 x_2)$ is given by $\beta_3 \Phi'(\cdot)$, which is only the first term in (6).[23] Second, even if the coefficient of the interactive variable $\beta_3$ is equal to zero, the cross effect in equation (4) will be different from zero. Third, the actual magnitude of the cross effect will depend on the values of the $x_1$ and $x_2$ covariates. Fourth, the sign of the cross effect $\frac{\partial^2 \Phi(\cdot)}{\partial x_1 x_2}$ may be different from the sign of the regression coefficient for the interactive term $(x_1 x_2)$.

From the inspection of equation (5) it is easy to see that, in the presence of an interactive term, the marginal effect of $x_1$ will be different than in the more standard case when there are no interactive terms (This, of course, is also the case for the marginal effect of $x_2$). When there is an interactive effect, we have:

$$\frac{\partial \Phi}{\partial x_1} = \Phi'(\cdot)(\beta_1 + \beta_3 x_2). \tag{7}$$

I estimated a number of fixed effects probit equations that included terms that interacted capital mobility and other covariates. The results obtained confirmed those reported above: the marginal effects of all the covariates have the expected signs and the vast majority are statistically significant. As an illustration, in Table 11 I present the marginal and cross effects from equations where I interacted the *CM* capital mobility index and the contagion variable. In addition to *CM* and contagion I included the following covariates: current account deficit, exchange rate regime, changes in the terms of trade, world real interest rates, the FDI to GDP ratio, and regional dummies (the results presented in Table 11, however, are restricted to the variables of interest). The marginal and cross effects were evaluated for three sets of values for the capital mobility index:

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as a SS. Other papers, such as Edwards (2005), define SS as a reduction in capital flows in excess of 5% of GDP.

Low mobility (*CM*=12.5), Intermediate mobility (*CM*=56), High mobility (*CM*=100). All other covariates were set at their median values. As may be seen, the results confirm that the direct marginal effects of capital mobility and contagion are positive, statistically significant and small. In addition, the direct effect of contagion increases as the capital account becomes more open. These results also show that the cross effect $\frac{\partial^2 \Phi(\cdot)}{\partial x_1 x_2}$ is positive and very small, suggesting that a marginal increase in capital mobility increases the marginal effect of contagion by a very small amount. Although z-statistics are greater than one, their p-values are higher than the customary .90 threshold.

**[Insert Table 11 about here]**

## 6. Instrumental Variable Estimates

As a number of authors have documented, international financial integration has increased significantly during the last decade and a half. However, these changes in the extent of capital mobility have not been linear. Indeed, there is evidence that, beyond the general trend towards liberalization, countries tend to alter the severity of capital controls for a number of political and economic reasons.[24] More specifically, countries that face external payments difficulties have tended to introduce restrictions on capital mobility. This means that it is possible that the capital mobility indexes used in this paper are endogenous, and jointly determined with (future) capital flow contractions.[25] In order to

[23] See Ali and Norton (2003) for a discussion on the role of interactive terms in probit analyses.
[24] See, for example, the discussion in Alessina and Milesi-Ferreti (1994) for an early discussion on this subject.
[25] Although lagged capital mobility is a pre-determined variable, it may still be jointly determined with sudden stops if the error term $\varepsilon$ in equation (2) is autoregressive.

address this potential endogeneity issue I estimated the probit equation using maximum likelihood instrumental variables procedure suggested by Amemiya (1978).[26]

In determining the instruments I relied on several findings from the empirical literature on capital controls: (1) Capital mobility and trade openness are highly correlated. This suggests that an exogenous measure of trade openness is a good instrument for capital mobility.[27] (2) Political considerations also play an important role in determining the extent of capital restrictions. (3) More advanced countries tend to rely less on capital controls. (4) Some countries respond to exogenous external shocks – such as changes in the terms of trade or in world (real) interest rates – by adjusting the degree of capital mobility. Based on these considerations, in the instrumental variables estimation the following instruments were used: a measure of trade openness, obtained as the fitted value from a gravity model of bilateral trade; the lagged contagion indicator in other regions; a measure of civil liberties, as a proxy for political instability; lagged change in the terms of trade; twice lagged current account balance; lagged (real) world interest rates; the log of GDP per capita in 1970; and regional dummies. The results obtained from the instrumental variables probit estimates are reported in Table 12. The estimations reported are both for the complete sample as well as for an emerging countries only sample (where the z-tests were computed with robust standard errors).

**[Insert Table 12 about here]**

As may be seen from Table 12, the results obtained are similar to those reported in Tables 2 and 3. Coefficients continue to have the same signs and are most are

[26] The identifying restrictions is that the number of instruments excluded from the main equation is equal or greater than the number of endogenous variables.

statistically significant. Moreover, the estimated marginal effects support the conclusions reached above: increased capital results in a very small and significant increase in the probability of a CFC. Countries that adopt a flexible exchange rate see a significant reduction in their probability of experiencing a CFC. Contagion has a positive and significant effect on the probability of CFC.

## 7. Concluding Remarks

Previous works on restrictions on capital mobility and sudden declines in capital flows have been inconclusive: while some studies have found that higher mobility increases the probability of an abrupt decline in capital flows, others have failed to detect a significant connection between these two variables. In contrast, the results presented in this paper indicate that higher capital mobility has a positive, statistically significant and small direct effect on the probability of a country experiencing an abrupt contraction of net capital inflows. Two factors explain these differences in results: first, in this paper I have focused on rather broad definitions of capital account contractions, while previous papers have tended to focus on more stringent (and thus less frequent) situations of sudden stops. Second, in this paper I use more general and complete indexes of capital mobility. In principle these indexes capture better the granularity and texture of capital account restrictions across countries.

It is important, however, not to exaggerate the implications of the findings reported in this paper. Indeed, although the direct effects of capital mobility on the probability of capital account contractions are significantly positive, they are quantitatively very small. The point estimate of the marginal effects of capital mobility

[27] As Aizenman and Noy (2004) have shown, there is a strong empirical connection between trade openness and the degree of capital mobility. The use of gravity trade equations to generate instruments in

on the probability of a CFC is approximately 0.1%, and very stable for different values of the vector of covariates.

Although the direct effect of capital mobility on the probability of CFCs is small, there is a fairly important indirect effect. This is particularly the case for the exchange rate regime. The marginal effect a adopting a flexible rate regime on the probability of a CFC is more negative – and always significant -- for higher degrees of capital mobility. The marginal effect of contagion is significantly negative, and increases with the degree of capital mobility. The point estimates are rather small, however.

The results reported in this paper also indicate that a higher current account deficit results in a higher probability of a capital flow contraction, while a higher ratio of FDI to GDP reduces that probability. Lower worldwide liquidity increases the probability, and being an advanced country reduces that probability.

Finally, it is important to reiterate that the results reported here only cover one aspect of the debate on capital mobility and financial integration – whether controls affect the probability of facing a CFC, and the channels through which these effects take place. A complete analysis of the welfare implications of restricting capital mobility would also focus on other consequences and costs of these policies, including its effect on investment, productivity growth, governance, transparency and microeconomic distortions. Such a study is beyond the scope of this paper.



panel estimation has been pioneered by Jeff Frankel. See, for example, Frankel and Cavallo (2004).

# Appendix

## Description of the Data

| Variable | Definition | Source |
|---|---|---|
| Indexes of capital mobility | Indexes | Author's construction based on indexes of capital restrictions computed by Quinn (2003) and Mody and Murshid (2002), and on country specific data, Lane and Milesi-Ferreti (2006) and Miniane (2004) |
| Capital flow contractions (CFC) | Reduction in net capital flows of at least 3% of GDP in one year. Initial condition could be one of positive or negative net flows. | Author's construction based on data of current account deficit (World Development Indicators) |
| Sudden Stop | Reduction of net capital inflows of at least 3% of GDP in one year. The country in question must have received an inflow of capital larger to its region's third quartile during the previous two years prior to the "sudden stop." | Author's construction based on data of financial account (World Development Indicators) |
| Change in terms of trade | Change in terms of trade-exports as capacity to import (constant LCU) | World Development Indicators |
| Reserves to Liabilities | Net international reserves over total external liabilities | Constructed from data in Lane and Milesi-Ferreti (2006) |
| Exchange Rate Regime | Takes a value of one if the de facto regime is flexible | Levy-Yeyati and Stuzenegger (2003) |
| Contagion | Incidence of CFCs in the country's region or reference group | Constructed by author. |
| FDI to GDP | Ratio of FDI to GDP | World Development Indicators |
| World interest rates | Real US Treasury notes rates | Computed from data obtained from the IFS |
| Current account to GDP | Measured as a deficit | World Development Indicators |

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**FIGURE 1**

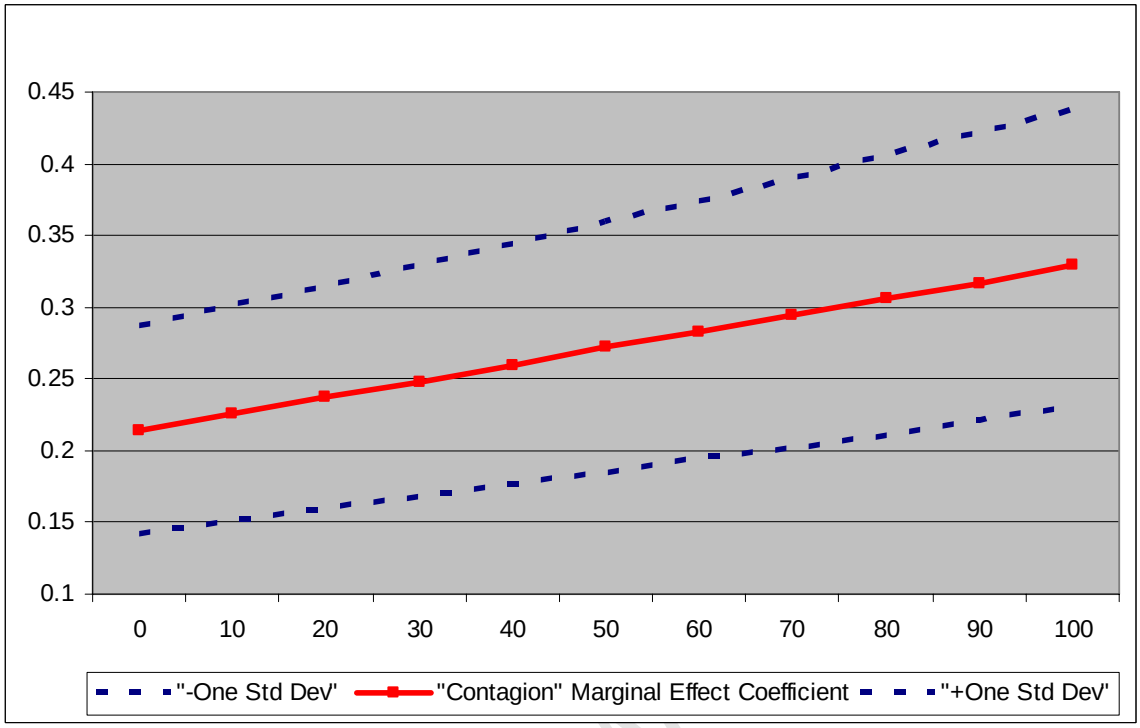

Figure 1 caption: Marginal Effect of Contagion CoefficientFor Different Values of the Capital Mobility Index

**Table 1**
**Incidence of Sudden Stops, 1970-2004**

| | **CAPITAL FLOW CONTRACTIONS** | | **SUDDEN STOPS** | |
|---|---|---|---|---|
| | *No CFC* | *CFC* | *No Sudden Stops* | *Sudden Stops* |
| Industrial Countries | 0.8852 | 0.1148 | 0.9438 | 0.0562 |
| Latin American and Caribbean | 0.7801 | 0.2199 | 0.8883 | 0.1117 |
| Asia | 0.8634 | 0.1366 | 0.9317 | 0.0683 |
| Africa | 0.8003 | 0.1997 | 0.9198 | 0.0802 |
| Middle East | 0.7426 | 0.2574 | 0.8713 | 0.1287 |
| Eastern Europe | 0.7561 | 0.2439 | 0.8943 | |
| Total | 0.8118 | 0.1882 | 0.9128 | 0.0872 |
| Observations | 2030 | | | 2030 |
| Pearson | | | | |
| Uncorrected $\chi^2(5)$ | 27.9304 | | | 13.3663 |
| Design-based F(5,18210) | 5.5833 | | | 2.61719 |
| *p-value* | 0.0000 | | | 0.0203 |

**Table 2**
**Random Effect Probit Estimates for Capital flow contractions, 1970-2004: Capital Mobility (*CM*) Index of International Financial Integration**

| | Eq.(2.1) | Eq.(2.2) | Eq.(2.3) | Eq.(2.4) | Eq.(2.5) | Eq.(2.6) |
|---|---|---|---|---|---|---|
| CAD to GDP | 0.036 | 0.042 | 0.043 | 0.051 | 0.043 | -- |
| | (9.4) *** | (9.12) *** | (7.23) *** | (9.28)*** | (7.18)*** | |
| Contagion | 0.008 | 0.011 | 0.011 | .0011 | 0.014 | 0.009 |
| | (2.53) ** | (3.04) *** | (2.61) *** | (2.92)*** | (3.36)*** | (2.37) ** |
| Terms of Trade Change | -0.003 | -0.003 | -0.003 | -0.003 | -0.003 | -0.005 |
| | (-1.69) * | (-1.58) | (-1.06) | (-1.29) | (-1.34) | (-2.16) ** |
| Advanced | -0.225 | -0.122 | -0.126 | -0.159 | -0.092 | -0.318 |
| | (-1.94) * | (-0.95) | (-0.9) | (-1.14) | (-0.65) | (-2.27) ** |
| Capital Mobility | 0.005 | 0.004 | 0.004 | 0.006 | 0.005 | 0.004 |
| | (3.07) *** | (2.41) ** | (2.24) ** | (2.96)*** | (2.42)*** | (2.05) ** |
| World Interest Rate | 0.033 | 0.035 | 0.040 | 0.035 | 0.024 | 0.032 |
| | (2.29) ** | (1.89) * | (1.98) ** | (1.85)* | (1.91)* | (1.61) |
| Flexible | -- | -0.304 | -0.283 | -0.296 | -0.338 | -0.301 |
| | | (-3.37) *** | (-2.95) *** | (-3.2)*** | (-3.5)*** | (-3.17) *** |
| Fiscal Deficit to GDP | -- | -- | 0.008 | -- | -- | 0.021 |
| | | | (1.03) | | | (2.86) *** |
| FDI to GDP | -- | -- | -- | -0.032 | -- | -- |
| | | | | (-3.5)*** | | |
| Reserves to Liabilities | -- | -- | -- | -- | 0.001 | -- |
| | | | | | (0.19) | |
| Log – Likelihood | -1389.30 | -895.82 | -726.59 | -855.229 | -745.048 | -754.69 |
| $\sigma_v$ | 0.315 | 0.225 | 0.262 | 0.283 | 0.278 | 0.279 |
| $\rho$ | 0.090 | 0.048 | 0.064 | 0.074 | 0.072 | 0.072 |
| Likelihood-ratio test of $\rho$ =0 (p - value) | 0.000 | 0.008 | 0.003 | 0.000 | 0.001 | 0.001 |
| Number of Observations | 3009 | 2030 | 1671 | 1974 | 1179 | 1671 |
| Number of Countries | 150 | 136 | 121 | 130 | 115 | 121 |

*Notes*: Absolute value of z statistics is reported in parentheses. All regressors are one period lagged. Constant term is included, but not reported. *** significant at 1%; ** significant at 5%; * significant at 10%. $\rho$ is $\sigma^2_v$ /( $\sigma^2_v$ + 1).

**Table 3**
**Random Effect Probit Estimates for Capital flow contractions, 1970-2004:**
***LMF* Index of International Financial Integration**

| | Eq.(3.1) | Eq.(3.2) | Eq.(3.3) | Eq.(3.4) | Eq.(3.5) | Eq.(3.6) |
|---|---|---|---|---|---|---|
| CAD to GDP | 0.033 | 0.041 | 0.046 | 0.049 | 0.042 | -- |
| | (6.82) *** | (7.05) *** | (6.2) *** | (7.33)*** | (7.05)*** | |
| Contagion | 0.009 | 0.013 | 1.268 | 0.013 | 0.013 | 0.012 |
| | (2.72) *** | (3.3) *** | (2.97) *** | (3.04)*** | (3.32)*** | (2.87) *** |
| Terms of Trade Change | -0.002 | -0.003 | -0.001 | -0.002 | -0.002 | -0.003 |
| | (-0.89) | (-1.23) | (-0.37) | (-0.89) | (-1.22) | (-1.19) |
| Advanced | -0.126 | 0.035 | 0.052 | 0.008 | 0.041 | -0.125 |
| | (-1.07) | (0.27) | (0.38) | (0.06) | (0.32) | (-0.95) |
| LMF | 0.061 | 0.043 | 0.047 | 0.002 | 0.001 | 0.041 |
| | (3.42) *** | (2.12) ** | (2.23) ** | (2.87)*** | (2.17)*** | (2.05) ** |
| World Interest Rate | 0.028 | 0.018 | 0.028 | 0.017 | 0.019 | 0.021 |
| | (1.8) * | (0.9) | (1.28) | (0.80) | (0.96) | (1.00) |
| Flexible | -- | -0.332 | -0.311 | 0.319 | 0.331 | -0.313 |
| | | (-3.4) *** | (-3.1)*** | (-3.3)*** | (-3.4)*** | (-3.1)*** |
| Fiscal Deficit to GDP | -- | -- | 0.005 | -- | -- | 0.019 |
| | | | (0.54) | | | (2.09) ** |
| FDI to GDP | -- | -- | -- | -0.029 | -- | -- |
| | | | | (-2.8)*** | | |
| Reserves to Liabilities | -- | -- | -- | -- | 0.001 | -- |
| | | | | | (0.47) | |
| Log – Likelihood | -1155.83 | -745.92 | -640.02 | -722.296 | -745.814 | -661.23 |
| $\sigma_\nu$ | 0.343 | 0.267 | 0.297 | 0.307 | 0.265 | 0.286 |
| $\rho$ | 0.105 | 0.066 | 0.081 | 0.086 | 0.086 | 0.065 |
| Likelihood-ratio test of $\rho$ =0 (p - value) | 0.000 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 |
| Number of Observations | 2620 | 1769 | 1528 | 1743 | 1769 | 1528 |
| Number of Countries | 126 | 115 | 105 | 111 | 115 | 105 |

*Notes*: Absolute value of z statistics is reported in parentheses. All regressors are one period lagged. Constant term is included, but not reported. *** significant at 1%; ** significant at 5%; * significant at 10%. $\rho$ is $\sigma^2_\nu$ /( $\sigma^2_\nu$ + 1).

**Table 4**
**Random Effect Probit Estimates for Capital flow contractions, 1970-2004:**
***MI* Index of International Financial Integration**

| | Eq.(4.1) | Eq.(4.2) | Eq.(4.3) | Eq.(4.3) | Eq.(4.3) | Eq.(4.6) |
|---|---|---|---|---|---|---|
| CAD to GDP | 0.043 | 0.051 | 0.050 | 0.052 | 0.060 | -- |
| | (1.94) * | (2.00) ** | (1.95) * | (2. 5) ** | (2. 4) ** | |
| Contagion | 0.011 | 0.017 | 0.016 | 0.017 | 0.018 | 0.014 |
| | (1.2) | (1.64) | (1.59) | (1.67)* | (1.75)* | (1.36) |
| Terms of Trade Change | 0.017 | 0.009 | 0.008 | 0.006 | 0.006 | 0.005 |
| | (1.77) * | (0.79) | (0.72) | (0.77) | (0.57) | (0.45) |
| Advanced | -0.650 | -0.592 | -0.596 | -0.585 | -0.565 | -0.674 |
| | (-1.84) * | (-1.65) * | (-1.63)* | (-1.77)* | (-1.71)* | (-1.86) * |
| Miniane Index | -0.922 | -0.961 | -0.988 | -0.911 | -1.331 | -0.886 |
| | (-1.98) ** | (-1.89) * | (-1.9) * | (-1.8) * | (-2.6) ** | (-1.72) * |
| World Interest Rate | -0.020 | -0.017 | -0.015 | -0.018 | 0.057 | -0.014 |
| | (-0.3) | (-0.24) | (-0.22) | (-0.26) | (0.57) | (-0.2) |
| Flexible | -- | -0.590 | -0.584 | -0.590 | -0.579 | -0.515 |
| | | (-2.7) *** | (-2.7) *** | (-2.8) *** | (-2.8) ** | (-2.4) ** |
| Fiscal Deficit to GDP | -- | -- | 0.0001 | -- | -- | -0.003 |
| | | | (0.01) | | | (-0.14) |
| FDI to GDP | -- | -- | -- | 0.013 | -- | -- |
| | | | | (0.50) | | |
| Reserves to Liabilities | -- | -- | -- | -- | 0.046 | -- |
| | | | | | (1.85) * | |
| Log – Likelihood | 181.15 | -147.95 | -146.35 | -147.83 | -140.75 | -148.30 |
| $\sigma_\nu$ | 0.557 | 0.471 | 0.454 | 0.458 | 0.342 | 0.455 |
| $\rho$ | 0.237 | 0.182 | 0.171 | 0.174 | 0.105 | 0.172 |
| Likelihood-ratio test of $\rho$ =0 (p - value) | 0.000 | 0.002 | 0.006 | 0.004 | 0.040 | 0.005 |
| Number of Observations | 516 | 448 | 423 | 448 | 448 | 423 |
| Number of Countries | 30 | 30 | 28 | 30 | 30 | 28 |

*Notes*: Absolute value of z statistics is reported in parentheses. All regressors are one period lagged. Constant term is included, but not reported. *** significant at 1%; ** significant at 5%; * significant at 10%. $\rho$ is $\sigma^2_\nu$ / ($\sigma^2_\nu$ + 1).

**Table 5**
**Marginal Effects and Predicted Probabilities of Capital flow contractions Under Alternative Degrees of Capital Mobility**

| | ***Low Capital Mobility*** | ***Intermediate Capital Mobility*** | ***High Capital Mobility*** |
|---|---|---|---|
| | Eq.(5.1) | Eq.(5.2) | Eq.(5.3) |
| CAD to GDP | 0.009 | 0.010 | 0.012 |
| | (7.00) *** | (9.03) *** | (7.88) *** |
| Contagion | 0.00229 | 0.00279 | 0.00329 |
| | (2.96) *** | (3.04) *** | (2.97) *** |
| Terms of Trade Change | -0.001 | -0.001 | -0.001 |
| | (-1.57) | (-1.58) | (-1.56) |
| Advanced | -0.024 | -0.029 | -0.035 |
| | (-1.03) | (-0.99) | (-0.96) |
| Capital Mobility | 0.001 | 0.001 | 0.001 |
| | (3.08) *** | (2.42) ** | (2.11) ** |
| World Interest Rate | 0.007 | 0.009 | 0.01 |
| | (1.87) * | (1.89) * | (1.88) * |
| Flexible | -0.057 | -0.07 | -0.084 |
| | (-3.40) *** | (-3.63) *** | (-3.54) *** |
| Predicted Probability | 0.123 | 0.165 | 0.216 |

*Notes*: For details on the computations in each column, see the text. Absolute value of z statistics are reported in parentheses. Sample means are: 4.3 for current account deficit to GDP, 0.196 for contagion, 4.3 for changes in terms of trade, 0.21 for advance, 2.06 for world interest rate and 0.263 for flex. Capital mobility is set at 12.5, 56 and 100 in Eq.(5.1), Eq.(5.2) and Eq.(5.3) respectively. * significant at 10%; ** significant at 5%; *** significant at 1%

**Table 6**
**Marginal Effects and Predicted Probabilities of Capital flow contractions**
**Under Alternative levels of the Current Account Deficit**

| | ***Moderate Deficits*** | ***Large Deficits*** |
|---|---|---|
| | Eq.(6.1) | Eq.(6.2) |
| CAD to GDP | 0.009 | 0.012 |
| | (9.86) *** | (7.97) *** |
| Contagion | 0.00253 | 0.00331 |
| | (3.04) *** | (3.04) *** |
| Terms of Trade Change | -0.001* | -0.001* |
| | (-1.57) | (-1.58) |
| Advanced | -0.027 | -0.035 |
| | (-0.99) | (-0.99) |
| Capital Mobility | 0.001 | 0.001 |
| | (2.41) ** | (2.41) ** |
| World Interest Rate | 0.008 | 0.010 |
| | (1.89) * | (1.89) * |
| Flexible | -0.063 | -0.085 |
| | (-3.63) *** | (-3.61) *** |
| Predicted Probability | 0.143 | 0.219 |

*Notes*: For details on the computations in each column, see the text. Absolute value of z statistics are reported in parentheses. Sample means are: 0.196 for contagion, 4.3 for changes in terms of trade, 0.21 for advance, 56.7 for capital mobility, 2.06 for world interest rate and 0.263 for flex. Current account deficit to GDP is set at 2.0 in Eq.(6.1) and 9.0 in Eq.(6.2). * significant at 10%; ** significant at 5%; *** significant at 1%

**Table 7**
**Marginal Effects and Predicted Probabilities of Capital flow contractions Under Alternative Degrees of Capital Mobility and of Current Account Deficits**

| | ***Moderate Deficits*** | | ***Large Deficits*** | |
|---|---|---|---|---|
| | Low Capital Mobility | High Capital Mobility | Low Capital Mobility | High Capital Mobility |
| ` | Eq.(7.1) | Eq.(7.2) | Eq.(7.3) | Eq.(7.4) |
| CAD to GDP | 0.008 | 0.011 | 0.011 | 0.014 |
| | (8.25) *** | (8.08) *** | (7.3) *** | (7.63) *** |
| Contagion | 0.00217 | 0.00303 | 0.00295 | 0.00376 |
| | (3.00) *** | (2.96) *** | (3.02) *** | (2.99) *** |
| Terms of Trade Change | -0.001 | -0.001 | -0.001 | -0.001 |
| | (-1.57) | (-1.56) | (-1.58) | (-1.57) |
| Advanced | -0.023 | -0.032 | -0.031 | -0.04 |
| | (-1.02) | (-0.96) | (-1.01) | (-0.96) |
| Capital Mobility | 0.001 | 0.001 | 0.001 | 0.001 |
| | (2.88) *** | (2.08) ** | (2.74) *** | (2.17) ** |
| World Interest Rate | 0.007 | 0.009 | 0.009 | 0.012 |
| | (1.88) * | (1.87) * | (1.89) * | (1.88) * |
| Flexible | -0.054 | -0.077 | -0.075 | -0.097 |
| | (-3.48) *** | (-3.53) *** | (-3.54) *** | (-3.54) *** |
| Predicted Probability | 0.114 | 0.188 | 0.181 | 0.278 |

*Notes*: For details on the computations in each column, see the text. Absolute value of z statistics are reported in parentheses. Sample means are: 0.196 for contagion, 4.3 for changes in terms of trade, 0.21 for advance, 2.06 for world interest rate and 0.263 for flex. Current account deficit to GDP is set at 2.0 in Eq.(7.1) and Eq.(7.2), and at 9.0 in Eq.(7.3) and Eq.(7.4). Capital Mobility is set at 25 in Eq.(7.1) and Eq.(7.3), and at 100 in Eq.(7.2) and Eq.(7.4). * significant at 10%; ** significant at 5%; *** significant at 1%

**Table 8**
**Random Effect Probit Estimates for Capital flow contractions, 1970-2004, Under Two Alternative Definitions of Contagion (Regional and Other)**

| | Eq.(8.1) | Eq.(8.2) |
|---|---|---|
| CAD to GDP | 0.042 | 0.0414 |
| | (9.11) *** | (7.05) *** |
| Contagion Regional | 0.0117 | 0.0136 |
| | (3.15) *** | (3.34) *** |
| Contagion Other | -0.8235 | -0.4102 |
| | (-1.23) | (-0.58) |
| Terms of Trade Change | -0.003 | -0.0025 |
| | (-1.59) | (-1.23) |
| Advanced | -0.0999 | 0.0469 |
| | (-0.77) | (0.36) |
| World Interest Rate | 0.0431 | 0.0221 |
| | (2.19) ** | (1.04) |
| Flexible | -0.3055 | -0.3323 |
| | (-3.38) *** | (-3.44) *** |
| Capital Mobility | 0.0044 | -- |
| | (2.45) ** | |
| LMF | -- | 0.0429 |
| | | (2.14) ** |
| Log – Likelihood | -895.0618 | -745.7535 |
| $\sigma_v$ | 0.227 | 0.267 |
| $\rho$ | 0.049 | 0.067 |
| Likelihood-ratio test of $\rho$ =0 (p - value) | 0.007 | 0.002 |
| Number of Observations | 2030 | 1769 |
| Number of Countries | 136 | 115 |

*Notes*: Absolute value of z statistics is reported in parentheses. All regressors are one period lagged. Constant term is included, but not reported. *** significant at 1%; ** significant at 5%; * significant at 10%. $\rho$ is $\sigma^2_v$ / ($\sigma^2_v$ + 1).

**Table 9**
**Random Effect Probit Estimates for Capital flow contractions, 1970-2004, For Alternative Samples: Emerging (and Transition) Countries and Large Countries**

| | ***Emerging Countries*** | | ***Large Countries*** | |
|---|---|---|---|---|
| | Eq.(9.1) | Eq. (9.2) | Eq. (9.3) | Eq. (9.4) |
| CAD to GDP | 0.043 | 0.043 | 0.046 | 0.05 |
| | (9.20) *** | (7.10) *** | (2.92) *** | (3.16) *** |
| Contagion | 0.0119 | 0.0142 | 0.0139 | 0.0152 |
| | (3.13) *** | (3.37) *** | (2.21) ** | (2.39) ** |
| Terms of Trade Change | -0.004 | -0.003 | 0.001 | 0.001 |
| | (-1.86) * | (-1.49) | (0.19) | (0.17) |
| World Interest Rate | 0.036 | 0.016 | 0.043 | 0.033 |
| | (1.75) * | (0.72) | (1.37) | (1.03) |
| Flexible | -0.236 | -0.274 | -0.332 | -0.326 |
| | (-2.35) ** | (-2.49) ** | (-2.36) ** | (-2.33) ** |
| Advanced | -- | -- | -0.281 | -0.152 |
| | | | (-1.39) | (-0.91) |
| Capital Mobility | 0.005 | -- | 0.005 | -- |
| | (2.60) *** | | (1.54) | |
| LMF | -- | 0.036 | -- | 0.132 |
| | | (1.70) * | | (2.32) ** |
| Log – Likelihood | -746.69 | -598.62 | -300.37 | -294.57 |
| $\sigma_v$ | 0.190 | 0.254 | 0.299 | 0.257 |
| $\rho$ | 0.035 | 0.061 | 0.082 | 0.062 |
| Likelihood-ratio test of $\rho$ =0 (p - value) | 0.051 | 0.010 | 0.020 | 0.072 |
| Number of Observations | 1603 | 1342 | 789 | 783 |
| Number of Countries | 115 | 94 | 43 | 42 |

*Notes*: Absolute value of z statistics is reported in parentheses. All regressors are one period lagged. Constant term is included, but not reported. *** significant at 1%; ** significant at 5%; * significant at 10%. $\rho$ is $\sigma^2_v$ /($\sigma^2_v$ + 1).

**Table 10**
**Random Effect Probit Estimates for Capital flow contractions and Sudden Stops, 1970-2004: Alternative Definitions of Capital Flows Declines**

| | **Dependent Variable:** ***CFC*** Eq.(10.1) | ***CFC w/windows*** Eq.(10.2) | ***Sudden Stops*** Eq.(10.3) |
|---|---|---|---|
| CAD to GDP | 0.051 | 0.052 | 0.071 |
| | (6.89)*** | (8.23) *** | (10.04) *** |
| Contagion Regional | 0.013 | 0.0116 | 0.0105 |
| | (3.24)*** | (2.77) *** | (2.15) ** |
| Terms of Trade Change | -0.002 | -0.003 | -0.0025 |
| | (-1.01) | (-1.00) | (-1.01) |
| Advanced | -0.92 | -0.0835 | 0.195 |
| | (-0.61) | (-0.55) | (1.11) |
| World Interest Rate | 0.022 | 0.0238 | 0.0221 |
| | (1.70)* | (1.88) * | (1.04) |
| Flexible | -0.323 | -0.3161 | -0.3323 |
| | (-3.31)*** | (-3.08) *** | (-3.44) *** |
| Capital Mobility | 0.006 | 0.0053 | 0.005 |
| | (2.86)*** | (2.47) *** | (2.00)** |
| NIIP | -0.001 | -- | -- |
| | (-0.97) | | |
| FDI to GDP | -- | -0.306 | -0.002 |
| | | (-3.23)*** | (-2.73)*** |
| Log – Likelihood | -721.785 | -716.252 | -484.350 |
| $\sigma_v$ | 0.327 | 0.315 | 0.334 |
| $\rho$ | 0.097 | 0.090 | 0.100 |
| Likelihood-ratio test of $\rho$ =0 (p - value) | 0.000 | 0.000 | 0.002 |
| Number of Observations | 1743 | 1663 | 1974 |
| Number of Countries | 111 | 130 | 130 |

*Notes*: Absolute value of z statistics is reported in parentheses. All regressors are one period lagged. Constant term is included, but not reported. *** significant at 1%; ** significant at 5%; * significant at 10%. $\rho$ is $\sigma^2_v$ / ($\sigma^2_v$ + 1).

**Table 11**
**Marginal and Cross Effects of Capital flow contractions Equations with Interactive Covariates: Alternative Degrees of Capital Mobility**

| | ***Low Capital Mobility*** | ***Intermediate Capital Mobility*** | ***High Capital Mobility*** |
|---|---|---|---|
| | Eq.(11.1) | Eq.(11.2) | Eq.(11.3) |
| Capital Mobility | 0.001 | 0.001 | 0.001 |
| | (3.17) *** | (2.51) ** | (2.24) ** |
| Contagion | 0.001 | 0.0025 | 0.0054 |
| | (2.73) ** | (2.39) ** | (2.52) * |
| Cross Effect | 0.000041 | 0.00004 | 0.00006 |
| | (1.61) | (1.09) | (1.56) |
| Predicted Probability | 0.125 | 0.164 | 0.208 |

*Notes*: For details on the computations in each column, see the text. Absolute value of z statistics are reported in parentheses. Sample means are: 4.3 for current account deficit to GDP, 0.196 for contagion, 4.3 for changes in terms of trade, 0.21 for advance, 2.06 for world interest rate and 0.263 for flex. Capital mobility is set at 12.5, 56 and 100 in Eq.(5.1), Eq.(5.2) and Eq.(5.3) respectively. * significant at 10%; ** significant at 5%; *** significant at 1%

**Table 12**
**Random Effect Probit Estimates for Capital flow contractions, 1970-2004, Results from Instrumental Variables (*IVPROB*)**

| | All Countries | | Emerging Countries | |
|---|---|---|---|---|
| | Eq.(12.1) | Eq.( 12.2) | Eq.( 12.3) | Eq.( 12.4) |
| CA to GDP | 0.048 | 0.049 | 0.045 | 0.048 |
| | (8.57) *** | (8.34) *** | (6.50) *** | (6.33) *** |
| Contagion | 0.0131 | 0.0129 | 0.0125 | 0.0145 |
| | (3.31) *** | (3.17) *** | (3.36) *** | (3.37) *** |
| World Interest Rate | 0.027 | 0.027 | 0.004 | 0.005 |
| | (1.45) | (1.25) | (0.2) | (0.23) |
| Terms of Trade Change | -0.004 | -0.005 | -0.003 | -0.004 |
| | (-1.62) | (-2.13) ** | (-1.04) | (-1.45) |
| Flexible | -0.362 | -0.236 | -0.306 | -0.239 |
| | (-3.99) *** | (-2.21) ** | (-3.28) *** | (-2.15) ** |
| Capital Mobility | 0.006 | 0.012 | -- | -- |
| | (2.24) ** | (2.16) ** | | |
| LMF | -- | -- | 0.173 | 0.132 |
| | | | (3.78) *** | (2.97) *** |
| Number of Observations | 1735 | 1308 | 1590 | 1163 |

*Notes*: Absolute value of z statistics is reported in parentheses. All regressors are one period lagged. Constant term is included, but not reported. *** significant at 1%; ** significant at 5%; * significant at 10%. For the list of instruments, see the text.