Moral Hazard, Financial Crises, and the Choice of Exchange Rate Regimes

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Abstract

We study the effect of the choice of exchange rate regimes on the likelihood of financial crises for a sample of emerging market and developing countries during 1990-2003. This relationship is tested through several channels of possible influences of exchange rate regimes on crises. We find that soft pegs and other intermediate regimes are associated with higher probabilities of financial crises than do the corner regimes, since they create incentives for unhedged foreign currency borrowings and excessive domestic credit expansion. We also test this effect through the channel of currency crises due to many evidence of a strong relationship between financial and currency crises, and find soft pegs being the most crisis prone type regimes. These indirect effects of exchange rate regimes on banking crises are robust primarily for a group of emerging market economies.

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1. Introduction

The currency and financial crises of the past decade or so have generated considerable interest in the possible relationships between exchange rate regimes and crises. While the greater part of the recent debate has focused on the role of exchange rate regimes in generating currency crises, a small literature has examined the relationships between exchange rate regimes and financial (banking) crises. To date, however, little consensus about these relationships has been developed in either the theoretical or the empirical literature.

The lack of consensus in the theoretical literature is not surprising as several different channels of possible influences of exchange rate regimes on financial crises have been identified and some of these run in opposite directions. The lack of agreement among empirical studies can be explained on several grounds. Likely one of the most important is that there have been serious problems with some of the measures of exchange rate regimes that have been used. Some of the studies have not clearly distinguished between hard fixed and adjustable pegged rates, while theoretical analysis suggests that the effects of these regimes could be quite different.

In this paper we make use of a new set of exchange rate regime classifications developed by the International Monetary Fund that is based on staff judgments of the practices that countries actually follow, as opposed to the older IMF classifications that were based on countries stated policies. While the new IMF classifications are not free from criticism, our overall judgment is that they are the most reliable of the new sets of classifications that have recently been promulgated (see Angkinand, Chiu, and Willett, 2005, ACW thereafter). We use a sample of 111 emerging market and developing countries during 1990-2003 to test the effect of exchange rate regimes on the onset of banking crises (the new IMF classifications go back only

to 1990). We also explicitly test several different channels through which it has been posited that exchange rate regimes may influence the likelihood of banking crises.

When exchange rate regimes are directly entered in banking crisis regressions, the results do not suggest a substantial difference in the probability of banking crises under different types of fixed and intermediate regimes (i.e. hard pegs, adjustable parities, crawls, tightly managed, and other managed floats). This finding is consistent with Eichengreen and Rose (2000) and Eichengreen and Arterta (2002) who find that that exchange rate regimes have no impact on the likelihood of banking crises. However, by distinguishing among different types of managed float regimes, we find that the least managed independent floats (termed by the IMF) are the least crisis prone regimes.

Since the effects of exchange rate regimes on banking crises are generally assumed to be indirect rather than direct, we explore three major channels that have been hypothesized for such indirect effects. These are foreign currency borrowing, domestic credit expansion, and currency crises. Overborrowing and excessive domestic credit creation are found in many studies to be significant factors that predict the onset of banking crises (see, for example, Demirgüç-Kunt and Enrica Detragiache, 1997). High levels of unhedged short-term foreign currency borrowings can also increase the vulnerability of domestic banking systems. We also examine the effect of regimes on banking crises through the currency crisis channel since recent studies find a strong relationship between exchange rate regimes and currency crises and between currency and banking crises (or twin crises).

By considering these indirect channels, we find that soft pegs and other intermediate exchange rate regimes (crawls, tightly managed) are associated with higher probabilities of banking crises than the corner regimes (i.e. hard fixed and flexible regimes). The results,

however, do not suggest that either corner of fixed or flexible regimes is associated with a substantial difference in the frequency of banking crises. Dividing the sample between developing and emerging market countries, we find that the differences across exchange rate regimes occur primarily for the latter group. This is what we would expect as the hypotheses focus heavily on the role of international capital flows which are much more important for the emerging market countries.

In the following section we provide an overview of various arguments which have been put forward concerning the possible ways in which alternative exchange rate regimes may influence the likelihood of banking crises. In section 3 we offer a brief review of previous empirical studies, focusing particularly on the issue of classifying exchange rate regimes. Section 4 describes the model specifications, the test of direct and indirect effects of exchange rate regimes on the onset of banking crises, and the data. Section 5 discusses our grouping of exchange rate regimes. Empirical results are reported in section 6, and conclusions and policy implications are discussed in the last section.

2. The Channels of Relationships between Exchange Rate Regimes and Financial Crises

Perhaps the most frequently heard argument relating exchange rate regimes to financial crises concerns the potential for pegged exchange rates to lead the private sector to underestimate the risk of unhedged foreign currency borrowing. The resulting overborrowing due to moral hazard generated by government's guarantee on exchange rate fixed is frequently pointed to as one of the major causes of the Asian financial crises.[1] Since much of the borrowing tends to be short term, such a subsidy creates a worsened liquidity situation both for the private sector and for the country as a whole. Furthermore the availability of "cheap" funds from abroad can lead to

[1] See, for example, the analysis and references in Willett et al. (2005).

incentives for excessive domestic credit creation by the domestic financial sector, worsening its liquidity position and likely leading to an increase in the proportion of loans that turn bad.

Of course, such arguments assume that perverse incentives are not fully offset by wise prudential regulation, but for many countries this seems a safe assumption. On this view, both pegged rates and hard fixes would generate such incentives. Hard fixes should create greater incentives for unhedged foreign borrowing, but hard pegs are also less likely to be changed so it is not clear a priori which types of regimes would tend to generate greater incentives for "excessive" foreign borrowing. Conceptually, the amount of perverse incentive would be measured by the differences between the risk perceived by market actors and the "true" risk. Clearly it would be difficult to get general agreement on operational measures of this difference, but in particular cases a strong consensus of experts might be found.[2]

The importance of such exchange rate-related moral hazard problems has been the subject of considerable debate. Eichengreen and Hausmann (1999) point out that excessive unhedged foreign borrowing may also be the result of "original sin" due to insufficient trust in the ability of domestic authorities to sufficiently enforce contracts and avoid national defaults, and/or inflationary bursts. In the case of such original sin, while individual actors may be able to obtain cover, the country as a whole cannot. This analysis implies that while the moral hazard cause of unhedged borrowing can be addressed by moving to more flexible exchange rates, the original sin problem would obtain under any exchange rate regime. As with moral hazard, the importance of original sin considerations has been the subject of considerable controversy. Some of this has been generated by sometimes posing these are mutually exclusive hypotheses (see for example Hausmann and Panizza, 2003 and the criticism by Willett, 2001).

[2] See, for example, Willett and Auerbach (2002).

Not surprisingly, our study of recent crises has convinced us that both hypotheses have explanatory power and that neither is the full story (see Willett et al., 2005). One channel about which we can be somewhat less agnostic involves linkages with currency crises. There has been considerable recent interest in the interrelationships among twin (financial and currency) crises. As discussed by Obstfeld and Rogoff (1995), banking problems may be triggered by speculative attacks against the domestic currency.[3] In countries with a fixed exchange rate where banks borrow abroad in foreign-denominated currency and lend in local currency, an expected devaluation of the domestic currency could lead to bank runs.

We have considerable reason to believe that soft pegs make currency crises more likely, especially for countries that face substantial international capital mobility. This is the unstable middle hypothesis. There is considerable debate, however, about how far way from the dead center of adjustably pegged exchange rate regimes one has to go to substantially reduce the probability of currency crises. The two corners or bipolar hypothesis, which holds that one needs to go all the way to one or the other of the extremes of hard fixes or floating rates, is not strongly supported by the data, but the high crisis propensity of soft pegs is confirmed.[4]

Another important channel for possible relationships between exchange rate regimes and financial crises involves issues of bailouts and the lender of last resort function. One argument is that crises will be more likely under hard fixes because there will be less (and perhaps even no) scope for national lender of last resort activities. The counter is that for this very reason, greater discipline would be imposed on the private sector and perhaps also over national authorities.

[3] Note, however, that while currency devaluation associated with overborrowing in foreign-denominated currency was clearly one of the major causes of the 1997 banking crises in Asia, Kaminsky and Reinhart (1999) and Glick and Hutchison (2001) find that in general banking crises increase the probability of currency crises but not vice versa. Their findings, however, are based on a sample from 1970-1995 (Kaminsky and Reinhard) and from 1975-1997 (Glick and Hutchison).

[4] See the analysis and references in ACW (2005) and Willett et al. (2005).

There is a long tradition to the debate over the possible discipline effects of fixed exchange rates. We can summarize the conclusion of much of this vast literature with three propositions. First, it is important to distinguish between hard fixes and soft pegs, as their effects can be quite different. Second, fixed rates are likely to provide different degrees of discipline over different types of policies. It is likely to exert much stronger discipline over monetary than over fiscal policies. The effects on financial policies have been analyzed much less, but we suspect that they will prove more akin to fiscal than to monetary policies. Third, there are examples where the discipline effect of fixed rates has worked and others where it has failed, and we are still at only a very early stage of developing an understanding of the major potential economy factors that determine success or failure.[5]

The role of national and international bailouts in both preventing and generating serious crises has likewise been the subject of much controversy. For example, Dooley (2000) suggests that the prospects of international bailouts were a major cause of the capital inflow surges to developing countries in the 1990s and the subsequent currency and financial crises. Nonetheless, Eichengreen and Hausmann (1999), Sachs and Radelet (1998), and Willett et al. (2005) all find the evidence for Dooley's argument to be less than persuasive as the major story line, although it quite likely has some explanatory power.

Miller (2003) makes the argument that flexible rates can make bank runs less likely than under fixed rates. She assumes away government bailouts through taxation or borrowing, leaving bank failures or inflation as the only possible policy responses to a bank run. She plausibly argues that the inflation option is more likely under flexible than fixed rates. Since being toward the head of the queue brings benefits in the case of bank failure, but not with inflation responses, she concludes that there are less incentives for bank runs to start under flexible than under fixed

[5] For recent analysis and references to the literature on this topic, see Willett (1998) and (2000).

rates. While admiring the ingenuity of this argument, we should perhaps not put too much faith in its explanatory power. Financial crises typically are accompanied by higher inflation, but government bailouts by both taxation and borrowing are often quite substantial.[6]

Our review of a number of arguments concerning possible linkages between different exchange rate regimes and the frequency of financial crises indicates that there are a number of conflicting considerations. This makes it difficult, if not impossible, to draw strong prior conclusions about the likely correlations between financial crises and alternative exchange rate regimes. This is clearly an empirical issue to whose investigation we now turn.

In addition to looking at the overall correlations between exchange rate regimes and financial crises, we also investigate some of the major mechanisms through which exchange rate regimes have been hypothesized to influence the behavior of governments and the private sector, in ways that are likely to affect the likelihood of financial crises. In other words, we test for both direct and indirect relationships.

3. Empirical Studies on Exchange Rate Regimes and Financial Crises

Only a few studies so far have examined the effects of the choice of exchange rate regimes on banking crises. These studies use the different classifications of exchange rate regimes from various sources in their empirical testing and find different results.

Eichengreen and Rose (2000) use a sample of developing countries to study the determinants of banking crises including exchange rate regimes during the period of 1975-1992[7]. They use exchange rate regime data from Ghosh et al. (1997), who aggregate data from the official classification reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*, and classify them into three regime categories: fixed regimes (pegs to a

[6] See, for example, Hoggarth et al. (2002).
[7] Eichengreen and Arteta (2002) extend the period to 1997 and reach similar conclusions.

single foreign currency, to a basket, and to the SDR), intermediate regimes (managed floats), and floating regimes. As an alternative, they construct an exchange rate dummy from the actual variability of the nominal rate. This dummy takes a value of one if the exchange rate is changed by less than 5% (and 10% for the robustness check) in the last year before a crisis. The results show that while the coefficients of Ghosh et al.'s regime dummies are not statistically significant in the banking crisis regressions, the exchange rate stability dummies are significant and negative, suggesting that countries with relatively stable currencies have a lower likelihood of banking crises.

In a later study, Eichengreen (2002) notes that his previous results were dependent on the classification of exchange rate regimes. He finds that when hard pegs (currency boards and dollarization) are distinguished from soft pegs (other fixed arrangements) and the data is updated to 1997, hard pegs are more crisis prone than soft pegs. However, since there are only a small number of countries in his sample that had adopted hard peg regimes (Argentina and Hong Kong with currency boards, and Panama with dollarization), he notes that ones should not strongly rely on this result. In addition, he finds robust results that intermediate regimes (limited flexibility and managed float) are the most prone to banking crises, supporting his "two corners" or "bipolar" hypothesis (Eichengreen, 1994). The dummy variable for countries with intermediate regimes is positive and significant in the banking crisis regressions regardless of whether it is entered separately or together with other regime dummies.

Demaç and Martinez Peria (2003) study the relationship between exchange rate regimes and banking crises by focusing on the role of fixed rates vis-à-vis all other regimes. They combine a sample of emerging market and developing countries together and find strong evidence that fixed exchange rate regimes significantly lowered the probability of banking crises

during 1980-1997. This result is robust over several alternative sources of data for fixed regimes including the IMF's *Annual Report on Exchange Rate Arrangements and Exchange Rate Restrictions* and the *de facto* exchange classification developed by Levy-Yeyati and Sturzenegger (2005) (LYS, thereafter). They also construct a dummy for exchange rate stability based on the nominal exchange rate changes of less than 5%. In addition, they study an indirect effect by including an interaction term between the exchange rate regime dummy and various economic variables. They find that the interaction term between pegs and the ratio of foreign liabilities to foreign assets is positive and significant, indicating that for a country with a pegged regime, high foreign liabilities are more likely to have a larger impact in increasing the likelihood of crises. Demaç and Martinez Peria also study the effect of exchange rate regimes on output costs and durations of banking crises. Although a pegged regime is found to lower the likelihood of crises, it increases the fiscal costs of crises. However, it does not have a statistically significant impact on the duration of crises.

Since there is an argument that pegged exchange rate regimes might cause financial fragility by increasing banks' incentives of excessive foreign currency borrowing (e.g. Burnside et al., 2001), we review whether this is found in existing empirical studies. Recent studies have constructed different variables to capture the extent of banks' borrowings in international capital markets and currency mismatches (i.e. the mismatch between banks' liabilities, which are in foreign-denominated currency, and banks' assets, which are in local currency) to test whether they lead to financial instability. For instance, Levy-Yeyati (2005) uses the extent of banks' liability dollarization, measured by the ratio of banks' foreign currency deposits to total deposits in local currency, and the ratio of foreign liabilities to foreign assets. Hausmann and Panizza

(2003) construct variables called the Original Sin Indexes[8] (or liability dollarization), and Arteta (2002) uses the extent of currency mismatch, which is the ratio of the difference between dollar deposits and dollar credits to total bank liabilities.

The purpose of both Levy-Yeyati's and Hausmann and Panizza's studies is to discover the determinants of the extent of banks' borrowing in foreign-denominated currency. They look at various macroeconomic variables, domestic macroeconomic policies, political institutions, as well as the choice of exchange rate regimes. Both studies reach similar conclusions. Levy-Yeyati does not find a significant impact of the regimes on the extent of liability dollarization, and Hausmann and Panizza do not find a significant relationship between the regimes and their Original Sin index for a sample of 91 countries during 1993-2000. The latter study notes that the authors expected to find a higher extent of domestic debt denominated in foreign currency in countries with a fixed exchange rate system. However, they find an insignificant relationship between exchange rate regimes and the extent of foreign currency borrowing. They suggest that this could indicate that international borrowers and lenders prefer transactions not only in countries with exchange rate stability, but also with interest rate stability. The latter is unlikely to occur in a fixed exchange rate system, since international reserves and/or interest rates are used to defend any change in a pegged rate level. The only factor found to significantly and robustly affect the extent of foreign currency borrowing is the size of country, which is measured by GDP, total trade, or domestic credit. Large economies do not suffer from the currency mismatch problem as much, since their currencies are important components of the world portfolio diversification. For the exchange rate regime, Hausmann and Panizza use LYS's classification, and Levy-Yeyati uses both the *de jure* regime classification from Ghosh et al. and the *de facto*

[8] These variables are constructed from the extent of debt denominated in foreign currency relative to in local currency. The components used to construct the indexes are from the BIS dataset which contains information on debt instruments disaggregated by nationality of issuer and by currency.

classification from LYS. A major limitation of both of these studies is that they use two-way classification of exchange regimes, i.e. whether a country has fixed or non-fixed regimes. Both studies also find that their measures of banks' excessive borrowings have significant impacts on the likelihood of banking crises.

Jeanneau and Micu (2002) find that fixed and intermediate exchange rate regimes for emerging market economies encourage banks in OECD countries to lend to them, while floating regimes lower such lending. They suggest that fixed and tightly managed exchange rate regimes tend to encourage lending flows, since domestic investors can speculate the profits from the interest rate differential between domestic and international rates when a government guarantees the stability of the exchange rate (they call this the moral hazard effect). The data for aggregate total bank loans by lending countries (the U.S., Japan, UK, Germany, France, Italy and Spain) during 1985-2000 is from the BIS consolidated international banking statistics. The types of exchange rate regime are divided into fixed, intermediate, and floating regimes following Calvo and Reinhart (2002)'s methodology. Jeanneau and Micu focuses on the determinants of the extent of short-run and long-run international bank lending, not particularly on currency mismatches.

Contrary to the standard view, Arteta (2002) finds that floating exchange rate regimes are consistently associated with greater currency mismatches in a sample of developing and transition economies from the early 1990s to 2000. He uses exchange rate regime data from the *IMF Annual Report on Exchange Arrangements and Exchange Restrictions*, and divide them into three groups: fixed (single pegs or basket pegs), intermediate (limited flexibility, cooperative arrangements, crawling pegs or bands, or managed floats following a predetermined set of indicators) and floating regimes (managed floats with no pre-announced path for the exchange

rate or independent floats). A new de facto IMF classification (then available only from 1999 onwards) and LYS's classification were also used to check for robustness. He also disaggregates a floating regime dummy into managed and independent floats and finds that both managed and independent float are associated with larger mismatches. He does not, however, distinguish between hard fixes and soft pegs.

4. Model Specification, Direct and Indirect Effects, and Data

We test both the direct and indirect effects of exchange rate regimes on the onset of banking crises. One is the possible influence of exchange rate regimes on the extent of banks' foreign currency borrowing. "Overborrowing" can make a banking crisis more likely. The two other indirect channels considered are effects on domestic credit expansion and on the occurrence of currency crises.

The model specifications are defined as follows:

$$BC_{i,t} = \alpha_0 + \sum_{j=1}^{5} \alpha_{1,j} ER_{i,t-1,j} + \sum_{k=1}^{n} \alpha_{2,k} x_{i,t-1,k} + \varepsilon_{i,t-1} \qquad (1)$$

$$FLFA_{i,t} = \gamma_0 + \sum_{j=1}^{5} \gamma_{1,j} ER_{i,t-1,j} + \sum_{k=1}^{n} \gamma_{2,k} z_{i,t-1,k} + u_{i,t-1} \qquad (2)$$

$$BC_{i,t} = \beta_0 + \sum_{j=1}^{5} \beta_{1,j} ER_{i,t-1,j} + \beta_2 FLFA_{i,t-1} + \sum_{k=1}^{n} \beta_{3,k} x_{i,t-1,k} + v_{i,t-1} \qquad (3)$$

$BC_{i,t}$ is the banking crisis dummy variable, which takes a value of 1 in years of banking crises for a country i at time t, and 0 if there is no crisis. Banking crises dates and definitions are taken from Caprio and Klingebiel (2002).[9] $ER_{i,t,j}$ is an exchange rate regime dummy variable,

[9] Caprio and Klingebiel (2002) compile the data from published financial sources and interviews with experts. They differentiate between two kinds of banking crises; a systemic banking crisis is defined as the situation when much or all of bank capital is exhausted; a borderline banking crisis is identified when there is evidence of significant banking problems such as government intervention in banks and financial institutions.

which has six categories: hard pegs, adjustable parities, crawls, tightly managed floats, other managed floats, and independent floats (see section 5).[10] The exchange rate regimes data, which is available for all IMF member countries over the period 1990-2003, is taken from Bubula and Otker-Robe (2003) from the International Monetary Fund (IMF). *x* and *z* are economic and financial variables. All independent variables are lagged by one year to reduce problems of simultaneity bias. A lag of regimes is used since a crisis often leads to changes in regimes. $\varepsilon_{i,t-1}$, $u_{i,t-1}$, $v_{i,t-1}$ are error terms.

Equation (1) presents a simple relationship between banking crises and exchange rate regimes with α_1 referred to the *total or direct effect* of *ER* on *BC*. The indirect effects of exchange rate regimes on banking crises are examined by equations (2) – (3)[11]. Three indirect channels are examined. The first channel is *FLFA* or the ratio of Foreign Liabilities to Foreign Assets, which proxies the extent of banks' foreign borrowings.[12] This indirect effect needs to be considered if exchange rate regimes significantly affect the extent of foreign borrowing ($\gamma_1 \neq 0$), and foreign borrowing prior to a crisis significantly predicts the onset of crisis after controlling for the regimes ($\beta_2 \neq 0$). A similar analysis will be applied for the other two indirect channels: domestic credit expansion and currency crises (see figure 1).

[10] To avoid the problem of perfect multicollinearity, one regime is alternately dropped in each regression, resulting in six regressions in each analysis. In the dummy analysis, the coefficients and their significance levels are calculated in comparison to the benchmark or omitted category. By doing this way, we can test the differences in the estimated coefficients across different types of exchange rate regimes.

[11] From equations (2)-(3), the total effect after considering the indirect effect can be calculated as follows:

Total Effect of *ER* on *BC* = Direct Effect + Indirect Effect = $\beta_{1,j} + \beta_{2,j}\gamma_{1,j}$

[12] The shortcoming of using this ratio of FL/FA is that banks may hold foreign currencies to hedge or offset open positions from their other activities; therefore, this ratio may be slightly inaccurate to estimate banks' overall foreign exchange exposure or the extent of currency mismatch. However, this variable is also used by Demaç and Martinez Peria (2003) and Levy Yeyati (2005) to capture the extent of currency mismatch.

Equations (1) and (3) are estimated by using the logit model. For equation (2), when the dependent variable is a currency crisis dummy[13], the logit estimation is used as well.

The logit model is defined as (based on equation 3):

$$L_{i,t} = \ln\left[\frac{P_{i,t}}{1-P_{i,t}}\right] = \beta_0 + \sum_{j=1}^{5}\beta_{1,j}ER_{i,t-1,j} + \beta_2 FL_{i,t-1} + \sum_{k=1}^{n}\beta_{3,k}x_{i,t-1,k} + v_{i,t-1}$$

$$\text{, where } P_{i,t} = \text{prob}(BC_{i,t} = 1 \mid x_{i,t-1,k}, ER_{i,t-1}) = \frac{1}{1+e^{-(\beta_0+\sum\beta_1 ER_{t-1}+\beta_2 FL_{t-1}+\sum\beta_3 x_{t-1})}}$$

In a pooled regression analysis, error terms or unobserved country-specific components are likely to be correlated for the same country over time and likely to be correlated with the observable country characteristics or explanatory variables, and these could lead to the biasness of estimated coefficients. In a binary cross-section time-series model, we address this problem by first running the regressions including only the first crisis year within each crisis episode, and second, clustering the standard errors of estimates by country. The use of the onset of each crisis episode and exclusion of the crisis observations following the first year should alleviate problems of both the lack of independent observations and the reverse causality when a crisis lasts for more than one year. We also perform the country-fixed and random effects logit models to check for robustness of results.

For equation (2), when the dependent variables are the ratio of foreign liabilities to foreign assets (FL/FA) and domestic credit expansion, we estimate the regressions by using fixed effect models.[14]

[13] Follow Eichengreen, et al. (1994), currency crisis indices are computed from the exchange market pressure (EMP), which is a weighted average of the percentage change in exchange rates vis-à-vis the anchor country, the percentage change in international reserves, and the change in the domestic interest rates. A currency crisis dummy is assigned a value of one if the EMP index exceeds two times standard deviations above its mean. We also use the currency crisis indices from Bubula and Otker-Robe. (2003).

[14] The Hausmann test suggests the use of fixed over random effects models. However, for fixed effects logit models, countries that have only 0s (or 1s) on the dependent variable are dropped because they provide no information for

For our set of control variables, we include real GDP per capita, the ratio of money supply to international reserve, and the rate of inflation. The ratio of the money supply to international reserves is a frequently used measure of bank exposure to foreign exchange risk.[15] Inflation is a proxy for poor macroeconomic management. These latter two variables are expected to have a positive relationship with the onset of banking crises. As economic determinants of foreign currency borrowing, we also include the OECD growth rate and interest rate differential. Banks' borrowing from abroad is expected to be higher when OECD growth rate is high since OECD countries as lending countries have more capacity to lend.[16] The interest rate differential is the nominal short-term market interest rate of the domestic country minus the foreign interest rate. This is expected to have a positive relationship with the extent of foreign borrowing since domestic banks tend borrow more from abroad if external finance is cheaper (appendix I provides definitions and sources of all variables used in the analysis).

We investigate the effects of exchange rate regimes on banking rises by using a sample of 36 emerging market and 75 developing countries during 1990-2003 (see appendix II for the list of countries). A sample of emerging market economies is largely drawn from Fischer (2001) who defines countries in this group based on J.P. Morgan's Emerging Markets Bond Index Plus (EMBI+) and the Morgan Stanley Capital International Index (MSCI). We also include Eastern European countries (Croatia, Estonia, Lithuania, Slovenia, and Ukraine) due to their recent increasing degree of capital mobility, and Hong Kong and Singapore in our sample of emerging market countries.

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the likelihood. In other words, by using the conditional fixed effects logit model, the relationship between exchange rate regimes and crises is limited to a sample of countries that experienced at least one crisis. We thus use the random effects logit models to test for the sensitivity of results as well.

[15] The other frequently used measure is the ratio of foreign short-term debt to international reserves. We did not use this measure because of problems of data availability for the full sample.

[16] Based on Jeanneau and Micu (2002), the most important lending countries to Asia and Latin America are include the US, Japan, the UK, Germany, France, Italy, and Spain; therefore, the average growth rates of only these countries are used to calculate OECD growth rate.

Table (1) reports the annual frequency of the onset of banking crises under each type of exchange rate regimes. The frequency of crises is calculated by taking the total number of crisis episodes under a particular regime divided by the total annual observations across 111 countries over 1990-2003. This table shows that the frequency of crises under different types of regimes varies substantially with independent floats having the lowest frequency. However, the analysis of the relationship between independently floats and the occurrence of banking crises needs to be conducted with caution since the results are based only on two crisis observations in developing countries.[17] This table also shows that the frequency of crises is higher among emerging market countries that adopt hard pegged and intermediate regimes. The hypothesis testing of the effect of exchange rate regimes on the onset of banking crises will be performed in section 6 and the first look at the frequency of crises suggests that this relationship should be examined for both the total sample and separated sample between emerging markets and developing countries.

In addition, summary statistics in table 2 show that the average ratio of banks' foreign liabilities to foreign assets and the growth rate of the ratio of domestic credit to GDP in emerging market economies are substantially higher than those of developing countries. Since exchange rate regimes might have differently explanatory powers on these variables between a group of emerging markets and developing countries, we also test the indirect effects separately between these two country groups.

5. Classification of Exchange Rate Regimes

The basic data for exchange rate regimes is taken from Bubula and Otker-Robe (2003), BOR thereafter, from the International Monetary Fund (IMF). They improve the old IMF de jure

[17] Uganda experienced a banking crisis in 1994-2003 and Zambia experienced a banking crisis in 1995. Based on BOR's classification of exchange rate regimes, independently floats have been adopted in Uganda from 1992-present and in Zambia from 1992-2000.

exchange rate regimes by classifying de facto exchange rate regimes for all IMF member countries over the period 1990-2003 into three broad categories and thirteen sub-categories[18]. Their classification is more accurate than the old IMF classifications since its uses a combination of quantitative and qualitative analysis in constructing the database, but it has some flaws. One potential problem in their study is that the dividing line between tightly managed floats and other managed floats is not transparent. Ideally, we want to distinguish between heavily managed floats and lightly managed floats in a more systematic manner depending on the degree of government interventions. However, there is no common agreement on how to distinguish between them. We regroup BOR's 13 categories of exchange rate regimes data into six groups (see also appendix III).

1. Hard Pegs (1-3)
2. Adjustable Parities (4-6)
3. Crawls (7-10)
4. Tightly Managed Floats (11)
5. Other Managed Floats (12)
6. Independent Floats (13)

Hard pegs include regimes of dollarization, currency unions, and currency board arrangements. A horizontal band, while offering somewhat more flexibility than a narrow band

[18] In this paper, we primarily focus on BOR's *de facto* exchange rate regimes, which are based upon governments' actual behavior of exchange rate policy. We also performed the tests using Reinhart and Rogoff (RR) (2001)'s *de jure* classification systems and Levy-Yeyati and Sturzenegger (2005)'s *de facto* classification. Unfortunately, the effects of exchange rate regimes become less significant. We are still in the process of exploring the limitations of their classifications. One drawback of RR, for instance, is that they do not adequately classify countries which have nominally free floating exchange rate regimes but engage in heavy intervention in practice (e.g. Japan was classified as adopting a floating regime from 1977-present and South Korea for having a freely floating regime after 1997, but it is known that both countries intervene heavily in their foreign exchange markets, particularly after the Asian crisis). Please see more discussions and the sensitivity tests using these alternative regime classifications in ACW (2006.)

adjustable peg, would seem closer to the adjustable peg than to various types of crawling pegs and bands; therefore we include both wide and narrow bands to all adjustably fixed parities.

The various types of crawling pegs and bands form another type of natural grouping. However, close analysis of the role of exchange rate regimes in the Asian crisis revealed that *de jure* managed floats were often operated as *de facto* crawling bands and that for countries such as India, Indonesia, and Singapore, it was quite difficult to judge whether crawling bands or managed floats were better descriptions. Furthermore, there is no general agreement on whether managed floats should be considered intermediate or corner regimes. Our intuition is that heavily managed floats should be intermediate and lightly managed floats should be at the corner, but we do not have generally agreed-upon criteria for making this distinction. The IMF's new *de facto* classification has three types of floats: tightly managed, other managed, and independent floats in descending order of management, but the analytical basis for their distinctions is not clear and their conclusions sometimes conflict with the classification system of Reinhart and Rogoff (2002) and other analysts. We refer to a group of adjustable parities (or soft pegs), crawls, tightly and other managed floats as intermediate regimes, and hard fixes and independent floats as the corner regimes.

6. Empirical Results

Table 3 reports the direct effect of exchange rate regimes on the onset of banking crises. The indirect effects of regimes on crises through the channels of banks' foreign currency borrowing, domestic credit expansion, and currency crises are reported in tables 4-7. We classify exchange rate regimes into six groups, and alternately drop one regime in each regression to avoid the perfect multicollinearity. This results in six regressions for each analysis. Although the coefficients for the regime dummies in the regressions will give the same conclusions in

identifying the crisis prone type regimes regardless of a dropped regime dummy, we report all six regressions in order to see whether the average probabilities of crises under the different regimes are statistically significantly different from each other. In the dummy analysis, the coefficients and their significance levels are calculated in comparison to the benchmark or excluded category.

Tables 3A-3B report the marginal effects of the exchange rate regime dummies, which gives the discrete effect of the change in a value of the dummy variable from 0 (an omitted regime) to 1, on the onset of banking crises. By looking at the direct effect, the estimates of hard and soft pegs as well as other intermediate regime dummies are insignificant at conventional levels, indicating that banking crises are equally likely across these regimes (regressions 1-5, table 3A). However, regression 6 in table 3A suggests that independent floats are the least crisis prone type regimes. Moving from hard pegs, adjustable parities, or other managed floats to independent floats will statistically significantly reduce the probability of the onset of banking crises by 3.5, 3.9, or 3.0 percent a year, respectively. A country with crawls and tightly managed floats will even be better off, since the probability of crises will be further reduced by 7.1 and 7.5 percent a year when moving to independent floats.[19] Nevertheless, this finding is based on only two crisis observations from developing countries that are defined as having independently floating regimes (see table 1).

Regressions in table 3B test the effect of regimes on banking crises separately for a sample of emerging market and developing countries. The finding of flexible exchange rate regimes being associated with the lowest probability of banking crises holds for emerging

[19] These differences in the probabilities across regimes can also be found in the row of indepdnent floats.

market[20], but not for developing countries. This finding is consistent with recent findings by Rogoff et al. (2003) of differences between developing and emerging market countries and likely reflects that emerging market countries have greater access to international financial markets than developing countries.

For economic and financial variables in tables 3A-3B, the high growth rate of domestic credit lending, the ratio of money supply to reserves, and the rate of inflation are good predictors of the onset of banking crises. The coefficients of these variables are statistically significant at conventional levels. The statistical significance of Wald chi-square statistics also suggests a good fit of the overall model and the importance of exchange rate regimes in explaining the onset of banking crises.

Tables 4-7 explore the indirect effects of the choice of exchange rate regimes on the onset of banking crises through three different channels: banks' foreign currency borrowing (measured by the ratio of banks' foreign liabilities to foreign assets), domestic credit expansion, and the occurrence of currency crises.[21] These findings are also summarized in table 8. We can conclude that exchange rate regimes indirectly generate banking crises if the exchange rate regimes significantly affect any of these three variables (tables 5-7), and the affected variables in turn are statistically significant in the banking crisis regressions (table 4). For the latter link, we find the estimated coefficients of all three variables that capture the indirect effects are positive and significant in banking crisis regressions for the total sample and emerging market countries (regressions 1-8, table 4). The estimated coefficients of the growth rate of domestic credit are

[20] For a sample of emerging market economies, none of these countries have expereinced banking crises after the adoption of independently floating regimes; therefore, the analysis of the likelihood that independently floats might generate banking crises has to be left out from table 3B. Emerging market countries that adopt independently floats (based on BOR's de facto classification of exchange rate regimes) include Mexico from 1994-present, Indonesia, South Korea, and the Philippines from 1997-present, and Turkey after 2000.

[21] Table 4 reports only regressions that independently floating regimes are omitted. For emerging market economies, other managed floating regimes are omitted (there are no banking crisis observations under independently floating regimes).

statistically significant at the one percent level (regressions 2 and 6, table 4). The ratio of banks' foreign liabilities to foreign assets (FL/FA) is positive, although less significant with p-values of 0.287 and 0.224 (regressions 1 and 5).[22] For the effect of currency crisis, we find that the coefficients of contemporaneous currency crisis dummy is highly significant, indicating a strong association between banking and currency crises (regressions 3 and 7). However, the occurrence of currency crisis is not a necessary indicator for predicting the onset of a banking crisis.[23] These findings are consistent when we perform the estimations using country fixed and random effects logit models (see appendix IV). The results also show that these three variables are not significant in banking crisis regressions for a sample of developing countries (regressions 9-11), suggesting that the problems of overborrowing and excessive domestic lending generating banking crises as well as currency crises are more relevant for emerging market economies than developing countries.

When considering these indirect channels, we find that there is a substantial difference in banking crisis probabilities among hard fixed, soft pegged, other intermediate, and floating regimes. These findings are summarized in table 8.

First, we compare the effect of hard pegs and other regimes. Some theoretical studies suggest that the likelihood of banking crises should be highest under hard pegs, because its unchanged nominal exchange rate will increase banks' moral hazard incentive. We, however, do not find evidence supporting this argument, particularly among emerging market economies. We find that by comparing the effects of adjustable parities with hard pegs, adjustable parities generate a higher extent of foreign borrowing (FL/FA) (regression 1, tables 5A-5B) and a higher

[22] This variable can be considered as being significant at an acceptable level, since its estimated coefficient value falls outside one standard deviation of the estimate.
[23] When we perform the robustness check by using a currency crisis variable from Bubula and Otker-Robe (2003), we find that the estimated coefficient of a lag of currency crisis dummy is positive and signficiant (see regressions 7-8 in table appendix IV).

likelihood of currency crises (regression 1, tables 7A and 7C). Similar results are found when comparing the effects of hard pegs and other intermediate regimes. Since both FL/FA and currency crises are positively significant in banking crisis regressions, we then conclude that both soft pegs and other intermediate exchange rate regimes are indirectly associated with the higher likelihood of banking crises than do corner regimes. This supports the bipolar or two corner hypotheses.

However, whether the probability of banking crises is lower under a hard fixed or flexible corner is unclear. By looking at the channel of FL/FA, the insignificance of the independently floating regime dummy in regressions 1 and 6, tables 5A-5B, indicates that the probability of banking crises under floats is not statistically significantly different from hard fixed regimes. For the channel of domestic credit expansion, hard fixes are associated with the higher likelihood of banking crises when compared to floats (regressions 1 and 6, table 6A and 6B). For the channel of currency crises, the results are mixed and dependent on the measures of currency crises (regressions 1 and 6, tables 7A-7C).

Second, we compare the crisis proneness between soft pegs and other intermediate regimes. The result in regression 2, table 5A shows that adjustable parities are statistically significantly less crisis prone than crawls through the channel of FL/FA. Regression 3 in this table also suggests crawls as the most crisis prone type regime. Moving away from crawls to fixed (hard fixed or adjustable parities) or flexible (other managed and independently floating) regimes significantly reduces the ratio of FL/FA and thus the likelihood of banking crises. However, this adverse effect of crawls is not found for the other indirect channels. When we look at the currency crisis channel, we find that from some model specifications currency crises are more likely under adjustable parities than other intermediate regimes (regression 2 in table 7A

and regressions 2 and 8 in tables 7B and 7C) [24] Adjustable parities are also found to be associated with large domestic credit expansion than tightly managed floats (regression 2, table 6B)

Third, we compare the crisis proneness under tightly managed, other managed, and independent float regimes. The ratio of FL/FA (table 5) and domestic credit expansion (table 6) will substantially reduce when a country moves away from adjustable parities and crawls to other managed and independent floats. Independently floating regime also works better than the other types of exchange rate regimes (regression 6, tables 5A-5B and 6A-6B) in reducing banks' foreign currency borrowing and domestic lending and then the probability of banking crises. In other words, independently floating regimes indirectly reduce the likelihood of banking crises by lowering the extent of banks' foreign borrowing as well as domestic lending. For the channel of currency crises, the estimated coefficient of other managed float dummy is insignificant in regressions that omitted the independently floating regime dummy (regression 6, tables 7A and 7B). This suggests that there is no significant difference of crisis probability between these two flexible regimes, or that other managed floats work as well as independent floats in reducing the probability of currency crises (see ACW, 2005).

7. Conclusions

We test both direct and indirect effects of the choice of exchange rate regimes on the likelihood of the onset of financial crises using a sample of emerging market and developing countries during 1990-2003. We use a new set of *de facto* exchange rate regime classifications developed by the International Monetary Fund. Our empirical findings point to the importance of

[24] We also use a weaker criterion in rejecting the null hypothesis that exchange rate regimes have no impact on banking crises (i.e. the null hypothesis will be rejected if the coefficient value falls outside one standard deviation of the estimate). Due to the limited number of banking crisis observations under each regime, important "true" differences of the probability of banking crises under different regimes may not be statistically significant at conventional levels. The regressions can still give useful information for policy makers, since policy choices cannot be postponed until more data points are available.

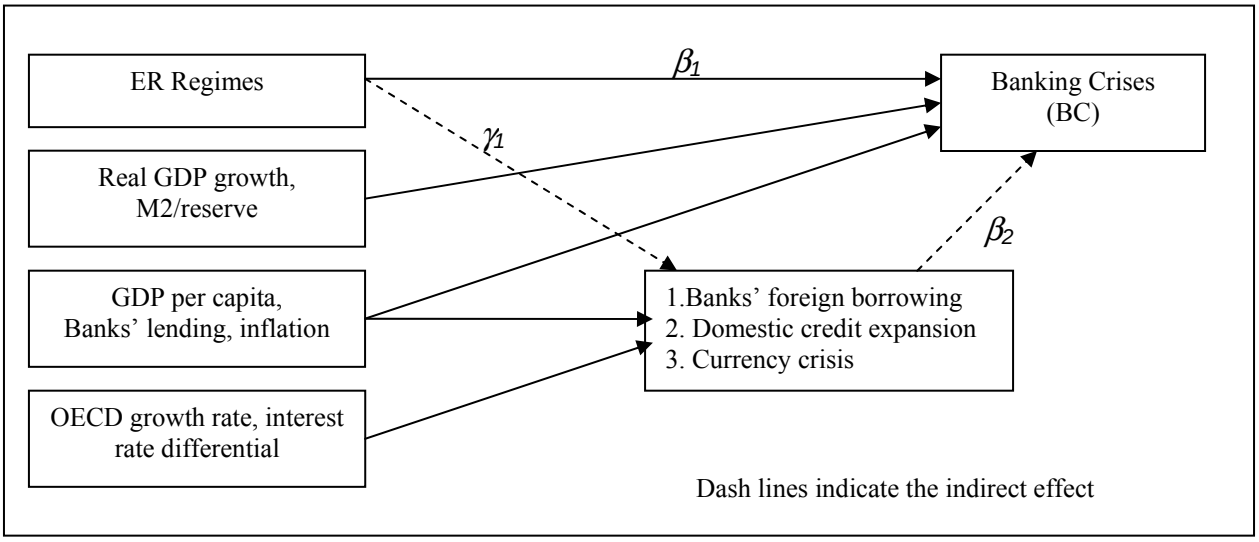
distinguishing between hard fixes and soft pegs as well as different types of floating regimes (tightly managed, other managed, and independent floats) since each has different impacts on the likelihood of crises.

First, we enter the exchange rate regime variables directly into banking crisis regressions to explore which types of regimes are the most crisis prone. The results do no suggest a substantial difference in the probabilities of banking crises under different types of regimes. We then investigate the possible channels that exchange rate regimes may influence the likelihood of banking crises. Three major channels we explore for such indirect effects are foreign currency borrowing (proxied by the ratio of banks' foreign liabilities to assets), domestic credit expansion, and currency crises. The first two factors have significant powers in predicting the onset of banking crises. The latter factor has a strong linkage with banking crises.

The results suggest that soft pegs and other intermediate regimes (crawls and tightly managed floats) are associated with a higher amount of banks' borrowing in foreign-denominated currency and the creation of domestic credit than do the corner regimes of hard fixes and independent floats. In other words, intermediate regimes indirectly increase the likelihood of financial crises by adversely influencing banks' activities in borrowing and lending. One plausible explanation of intermediate regimes likely to generate greater incentives for banks' excessive foreign borrowing (and these cheap funds are excessively lent in local currency) is due to moral hazard generated by government's guarantee on the exchange rate stability. We can also argue that fixed rates are likely to provide different degrees of discipline over different types of policies, and flexible rates increase incentives of hedged foreign currency borrowings. For the indirect channel of currency crises, we find a strong relationship between banking and currency crises and a significant impact of exchange rate regimes on currency

crises. The results suggest that intermediate regimes are prone to currency crises, and then banking crises, than do other types of exchange rate regimes. We also perform these analyses separately between a group of emerging market and developing countries, and find that these results being supported primarily for a sample of emerging market countries, which face substantial international capital mobility.

Figure (1) Direct and Indirect Effects of Exchange Rate Regimes on Banking Crises



Note: Banks' foreign borrowing is measured by the ratio of banks' foreign liability to foreign asset (FL/FA), domestic credit expansion is measured by the growth rate of the ratio of private domestic credit to GDP.

Table (1) the annual frequency of the onset of banking crises (%) under each type of exchange rate regime during 1990-2003

	Emerging Markets & Developing Countries	Emerging Markets	Developing Countries
Hard pegs $_{t-1}$	5.29 (11,208)	11.36 (5,44)	3.66 (6,164)
Adjustable parities $_{t-1}$	5.52 (16,287)	8.86 (8,56)	3.46 (8,231)
Crawls $_{t-1}$	8.47 (15,177)	10.59 (9,89)	6.82 (6,88)
Tightly Managed $_{t-1}$	8.33 (8,96)	14.29 (7,53)	2.33 (1,43)
Other Managed $_{t-1}$	4.89 (9,184)	4.35 (2,62)	5.74 (7,122)
Independent Floats $_{t-1}$	1.39 (2,144)	0.00 (0,39)	1.90 (2,105)

Note: The first number in parentheses is the number of the onset of crisis observations under each regime. The second number is the total observations under each regime during 1990-2003.

Table (2) Summary Statistics

Variable	Obs	Mean	Std.Dev	Min	Max
Emerging Market Economies					
The Onset Banking Crisis	335	0.096	0.294	0.000	1.000
FL/FA $_{t-1}$	341	1.653	2.204	0.034	21.260
Growth of Domestic Credit $_{t-1}$	335	0.086	0.675	-0.852	11.566
Currency Crisis dummy	354	0.107	0.310	0.000	1.000
GDP per Cap $_{t-1}$	335	4.705	5.783	0.312	24.951
M2/Reserve $_{t-1}$	335	4.864	5.414	0.778	63.949
Inflation $_{t-1}$	341	0.888	5.403	-0.040	74.817
CA/GDP $_{t-1}$	354	-1.185	5.683	-14.050	22.681
OECD Growth $_{t-1}$	437	2.083	0.851	0.197	3.458
Interest Rate Differential$_{t-1}$	437	0.975	8.401	-0.003	157.701
Developing Countries					
The Onset Banking Crisis	745	0.038	0.190	0.000	1.000
FL/FA $_{t-1}$	769	1.031	1.509	0.000	21.068
Growth of Domestic Credit $_{t-1}$	745	0.029	0.225	-0.862	2.065
Currency Crisis dummy	811	0.094	0.292	0.000	1.000
GDP per Cap $_{t-1}$	745	1.664	2.514	0.075	19.796
M2/Reserve $_{t-1}$	745	6.512	19.254	0.191	327.975
Inflation $_{t-1}$	745	0.280	1.939	-0.117	41.292
CA/GDP $_{t-1}$	811	-6.533	10.574	-132.796	43.399
OECD Growth $_{t-1}$	847	2.101	0.844	0.197	3.458
Interest Rate Differential$_{t-1}$	847	0.174	0.238	-0.062	2.958

Table (3) the Choice of Exchange Rate Regimes and Banking Crises

Dependent variable: the onset of banking crisis dummy
Methodology: Logit model

3A Emerging Market and Developing Countries (report marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Hard pegs $_{t-1}$		-0.003 (0.850)	-0.035 (0.156)	-0.039 (0.234)	0.005 (0.781)	0.035** (0.040)
Adjustable parities $_{t-1}$	0.003 (0.850)		-0.032 (0.178)	-0.036 (0.258)	0.009 (0.644)	0.039** (0.010)
Crawls $_{t-1}$	0.035 (0.156)	0.032 (0.178)		-0.001 (0.908)	0.041* (0.090)	0.071** (0.002)
Tightly Managed $_{t-1}$	0.039 (0.234)	0.036 (0.258)	0.004 (0.908)		0.045 (0.175)	0.075** (0.016)
Other Managed $_{t-1}$	-0.005 (0.781)	-0.009 (0.644)	-0.041* (0.090)	-0.045 (0.175)		0.030* (0.080)
Independent Floats $_{t-1}$	-0.035** (0.040)	-0.039** (0.010)	-0.071** (0.002)	-0.075** (0.016)	-0.030* (0.080)	
GDP per Cap $_{t-1}$	-0.001 (0.417)	-0.001 (0.417)	-0.002 (0.434)	-0.002 (0.441)	-0.001 (0.419)	0.000 (0.487)
Growth of Domestic Credit $_{t-1}$	0.019** (0.000)	0.020** (0.000)	0.031** (0.002)	0.032** (0.011)	0.017** (0.018)	0.005 (0.213)
M2/Reserve $_{t-1}$	0.001** (0.000)	0.001** (0.000)	0.001** (0.004)	0.001** (0.010)	0.001** (0.013)	0.000 (0.204)
Inflation $_{t-1}$	0.002** (0.021)	0.002** (0.021)	0.003** (0.041)	0.003* (0.064)	0.001* (0.068)	0.000 (0.157)
No. of obs.	1085	1085	1085	1085	1085	1085
Wald Chi-Square Test	40.19	40.19	40.19	40.19	40.19	40.19
Prob > Chi-Square	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R2	0.052	0.052	0.052	0.052	0.052	0.052

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

3B Separate regressions for emerging markets and developing countries (report marginal effects)

	Emerging Market Economies					Developing Countries					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Hard pegs $_{t-1}$		0.023 (0.656)	0.044 (0.390)	0.010 (0.876)	0.116** (0.012)		-0.002 (0.912)	-0.032 (0.185)	0.005 (0.867)	-0.014 (0.503)	0.012 (0.459)
Adjustable parities $_{t-1}$	-0.023 (0.656)		0.021 (0.617)	-0.014 (0.774)	0.093** (0.006)	0.002 (0.912)		-0.031 (0.206)	0.006 (0.819)	-0.013 (0.571)	0.014 (0.405)
Crawls $_{t-1}$	-0.044 (0.390)	-0.021 (0.617)		-0.034 (0.476)	0.072** (0.032)	0.032 (0.185)	0.031 (0.206)		0.037 (0.265)	0.018 (0.520)	0.044* (0.079)
Tightly Managed $_{t-1}$	-0.010 (0.876)	0.014 (0.774)	0.034 (0.476)		0.106** (0.011)	-0.005 (0.867)	-0.006 (0.819)	-0.037 (0.265)		-0.019 (0.567)	0.008 (0.786)
Other Managed $_{t-1}$	-0.116** (0.012)	-0.093** (0.006)	-0.072** (0.032)	-0.106** (0.011)		0.014 (0.503)	0.013 (0.571)	-0.018 (0.520)	0.019 (0.567)		0.026 (0.229)
Independent Floats $_{t-1}$	–	–	–	–	–	-0.012 (0.459)	-0.014 (0.405)	-0.044* (0.079)	-0.008 (0.786)	-0.026 (0.229)	
GDP per Cap $_{t-1}$	-0.009* (0.078)	-0.007** (0.024)	-0.006* (0.077)	-0.008** (0.044)	-0.002 (0.200)	-0.003 (0.206)	-0.003 (0.206)	-0.006 (0.253)	-0.002 (0.424)	-0.004 (0.206)	-0.002 (0.344)
Growth of Domestic Credit $_{t-1}$	0.050** (0.035)	0.043** (0.005)	0.036** (0.023)	0.047** (0.007)	0.011 (0.193)	-0.017 (0.487)	-0.018 (0.478)	-0.034 (0.475)	-0.014 (0.593)	-0.025 (0.490)	-0.010 (0.446)
M2/Reserve $_{t-1}$	0.003 (0.670)	0.002 (0.650)	0.002 (0.663)	0.002 (0.657)	0.001 (0.662)	0.000** (0.003)	0.000** (0.003)	0.001** (0.038)	0.000 (0.320)	0.001* (0.073)	0.000 (0.214)
Inflation $_{t-1}$	0.000 (0.985)	0.000 (0.985)	0.000 (0.985)	0.000 (0.985)	0.000 (0.985)	0.002** (0.000)	0.002** (0.000)	0.004** (0.009)	0.002* (0.332)	0.003** (0.000)	0.001* (0.154)
No. of obs.	335	335	335	335	335	745	745	745	745	745	745
Wald Chi-Square Test	22.910	22.910	22.910	22.910	22.910	161.48	161.48	161.48	161.48	161.48	161.48
Prob > Chi-Square	0.004	0.004	0.004	0.004	0.004	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R2	0.067	0.067	0.067	0.067	0.067	0.058	0.058	0.058	0.058	0.058	0.058

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

Table (4) The Indirect Effect of Exchange Rate Regimes on Banking Crises

Dependent variable: the onset of banking crisis dummy; Methodology: Logit model

	Emerging Market & Developing Countries				Emerging Market Economies				Developing Countries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Hard pegs $_{t-1}$	1.292 (0.106)	1.335* (0.099)	1.805 (0.131)	1.666 (0.152)	2.305** (0.002)	2.229** (0.003)	2.047** (0.016)	2.119** (0.004)	0.558 (0.497)	0.537 (0.512)	0.249 (0.837)
Adjustable parities $_{t-1}$	1.361* (0.076)	1.407* (0.070)	1.672 (0.145)	1.646 (0.140)	2.115** (0.010)	1.987** (0.011)	2.158** (0.027)	1.965** (0.029)	0.561 (0.488)	0.594 (0.465)	0.763 (0.499)
Crawls $_{t-1}$	1.875** (0.016)	1.918** (0.016)	2.205* (0.057)	2.239** (0.046)	1.776** (0.013)	1.806** (0.011)	1.404* (0.082)	1.540** (0.041)	1.416* (0.082)	1.304 (0.118)	2.024* (0.066)
Tightly Managed $_{t-1}$	1.913** (0.020)	1.970** (0.018)	2.500** (0.035)	2.436** (0.035)	2.180** (0.005)	2.127** (0.005)	1.789** (0.042)	2.029** (0.010)	0.289 (0.812)	0.368 (0.771)	–
Other Managed $_{t-1}$	0.901 (0.277)	1.211 (0.139)	1.568 (0.195)	1.515 (0.194)	–	–	–	–	0.599 (0.482)	0.943 (0.264)	1.460 (0.211)
Indep Floats $_{t-1}$											
FL/FA $_{t-1}$	0.056# (0.287)				0.072# (0.224)				-0.043 (0.736)		
Growth of Domestic Credit $_{t-1}$		0.400** (0.000)				0.418** (0.009)				-0.585 (0.478)	
Currency Crises $_{t}$			0.867** (0.031)				1.661** (0.001)				
Currency Crises $_{t-1}$				0.248 (0.563)				0.222 (0.648)			0.140 (0.862)
GDP per Cap $_{t-1}$	-0.028 (0.439)	-0.030 (0.417)	-0.046 (0.262)	-0.045 (0.311)	-0.072** (0.045)	-0.072* (0.041)	-0.074* (0.065)	-0.068* (0.053)	-0.098 (0.192)	-0.101 (0.206)	-0.308** (0.028)
M2/Reserve $_{t-1}$	0.011** (0.001)	0.013** (0.001)	0.003 (0.636)	0.004 (0.462)	0.018 (0.686)	0.027 (0.532)	-0.005 (0.873)	-0.000 (0.997)	0.012** (0.005)	0.013** (0.003)	0.012** (0.039)
Inflation $_{t-1}$	0.030 (0.116)	0.035** (0.021)	0.032 (0.175)	0.025 (0.219)	0.001 (0.980)	-0.006 (0.916)	0.018 (0.543)	0.010 (0.732)	0.086 (0.196)	0.060* (0.000)	-1.118** (0.240)
Constant	-4.337** (0.000)	-4.340** (0.000)	-4.467** (0.000)	-4.392** (0.000)	-3.933** (0.000)	-3.821** (0.000)	-3.651** (0.000)	-3.442** (0.000)	-3.873** (0.000)	-3.938** (0.000)	-3.655** (0.001)
No. of obs.	1084	1080	743	734	341	335	282	278	743	745	438
Wald Chi-Square Test	24.39	40.19	17.30	10.43	14.88	28.19	21.46	13.79	29.86	161.48	21.12
Prob > Chi-Square	0.004	0.000	0.044	0.317	0.062	0.000	0.006	0.087	0.001	0.000	0.007
Pseudo R2	0.042	0.052	0.047	0.033	0.097	0.095	0.128	0.067	0.048	0.058	0.066

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. # indicates the coefficient value zero that falls outside one standard deviation of the estimate. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

Table (5) The Indirect Effect of Exchange Rate Regimes on Banking Crises Through the Ratio of Foreign Liabilities to Foreign Assets (FL/FA)

Dependent variable: the ratio of foreign liabilities to foreign assets (FL/FA)
Methodology: Fixed effects estimation

5A Emerging Market and Developing Countries

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.792** (0.043)	1.538** (0.000)	2.069** (0.000)	1.769** (0.000)	1.261** (0.000)	0.549** (0.004)
Hard pegs $_{t-1}$		-0.746 (0.126)	-1.277** (0.007)	-0.977** (0.048)	-0.469 (0.333)	0.243 (0.614)
Adjustable parities $_{t-1}$	0.746 (0.126)		-0.531** (0.016)	-0.232 (0.284)	0.277* (0.084)	0.988** (0.000)
Crawls $_{t-1}$	1.277** (0.007)	0.531** (0.016)		0.300 (0.258)	0.808** (0.000)	1.519** (0.000)
Tightly Managed $_{t-1}$	0.977** (0.048)	0.232 (0.284)	-0.300 (0.258)		0.509** (0.018)	1.220** (0.000)
Other Managed $_{t-1}$	0.469 (0.333)	-0.277* (0.084)	-0.808** (0.000)	-0.509** (0.018)		0.711** (0.000)
Independent Floats $_{t-1}$	-0.243 (0.614)	-0.988** (0.000)	-1.519** (0.000)	-1.220** (0.000)	-0.711** (0.000)	
Growth of Domestic Credit $_{t-1}$	0.008 (0.931)	0.008 (0.931)	0.008 (0.931)	0.008 (0.931)	0.008 (0.931)	0.008 (0.931)
Inflation $_{t-1}$	-0.007 (0.556)	-0.007 (0.556)	-0.007 (0.556)	-0.007 (0.556)	-0.007 (0.556)	-0.007 (0.556)
OECD Growth $_{t-1}$	-0.038 (0.389)	-0.038 (0.389)	-0.038 (0.389)	-0.038 (0.389)	-0.038 (0.389)	-0.038 (0.389)
Interest Rate Differential $_{t-1}$	-0.003 (0.757)	-0.003 (0.757)	-0.003 (0.757)	-0.003 (0.757)	-0.003 (0.757)	-0.003 (0.757)
No. of obs.	1264	1264	1264	1264	1264	1264
F(9,1140)	7.82	7.82	7.82	7.82	7.82	7.82
Prob > F-Statistics	0.000	0.000	0.000	0.000	0.000	0.000
R-Square	0.0581	0.0581	0.0581	0.0581	0.0581	0.0581

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

5B Separate regressions for emerging markets and developing countries

	Emerging Market Economies						Developing Countries					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	0.129 (0.829)	0.129 (0.829)	0.129 (0.829)	0.129 (0.829)	0.129 (0.829)	0.129 (0.829)	2.792** (0.000)	2.792** (0.000)	2.792** (0.000)	2.792** (0.000)	2.792** (0.000)	2.792** (0.000)
Hard pegs $_{t-1}$		-2.103** (0.002)	-2.639** (0.000)	-1.797** (0.009)	-1.792** (0.007)	-0.388 (0.557)		2.155** (0.015)	2.147** (0.009)	1.621* (0.074)	2.450** (0.006)	2.596** (0.004)
Adjustable parities $_{t-1}$	2.103** (0.002)		-0.535 (0.135)	0.306 (0.426)	0.312 (0.276)	1.715** (0.000)	-2.155** (0.015)		-0.008 (0.981)	-0.533* (0.037)	0.295 (0.121)	0.442* (0.056)
Crawls $_{t-1}$	2.639** (0.000)	0.535 (0.135)		0.841* (0.052)	0.847** (0.013)	2.250** (0.000)	-2.147** (0.009)	0.008 (0.981)		-0.525 (0.164)	0.303 (0.375)	0.450 (0.200)
Tightly Managed $_{t-1}$	1.797** (0.009)	-0.306 (0.426)	-0.841 (0.052)		0.006 (0.988)	1.409** (0.001)	-1.621* (0.074)	0.533** (0.037)	0.525 (0.164)		0.829** (0.001)	0.975** (0.001)
Other Managed $_{t-1}$	1.792** (0.007)	-0.312 (0.276)	-0.847** (0.013)	-0.006 (0.988)		1.404** (0.000)	-2.45** (0.006)	-0.295 (0.121)	-0.303 (0.375)	-0.829** (0.001)		0.147 (0.505)
Independent Floats $_{t-1}$	0.388 (0.557)	-1.715** (0.000)	-2.250** (0.000)	-1.409** (0.001)	-1.404** (0.000)		-2.596** (0.004)	-0.442* (0.056)	-0.450 (0.200)	-0.975** (0.001)	-0.147 (0.505)	
Growth of Domestic Credit $_{t-1}$	0.007 (0.955)	0.007 (0.955)	0.007 (0.955)	0.007 (0.955)	0.007 (0.955)	0.007 (0.955)	-0.058 (0.703)	-0.058 (0.703)	-0.058 (0.703)	-0.058 (0.703)	-0.058 (0.703)	-0.058 (0.703)
Inflation $_{t-1}$	-0.007 (0.716)	-0.007 (0.716)	-0.007 (0.716)	-0.007 (0.716)	-0.007 (0.716)	-0.007 (0.716)	-0.002 (0.910)	-0.002 (0.910)	-0.002 (0.910)	-0.002 (0.910)	-0.002 (0.910)	-0.002 (0.910)
OECD Growth $_{t-1}$	-0.128 (0.159)	-0.128 (0.159)	-0.128 (0.159)	-0.128 (0.159)	-0.128 (0.159)	-0.128 (0.159)	0.003 (0.955)	0.003 (0.955)	0.003 (0.955)	0.003 (0.955)	0.003 (0.955)	0.003 (0.955)
Interest Rate Diff $_{t-1}$	-0.004 (0.760)	-0.004 (0.760)	-0.004 (0.760)	-0.004 (0.760)	-0.004 (0.760)	-0.004 (0.760)	0.229 (0.399)	0.229 (0.399)	0.229 (0.399)	0.229 (0.399)	0.229 (0.399)	0.229 (0.399)
No. of obs.	417	417	417	417	417	417	847	847	847	847	847	847
F-Statistics	7.62	7.62	7.62	7.62	7.62	7.62	2.44	2.44	2.44	2.44	2.44	2.44
Prob > F-Statistics	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.010	0.010	0.010	0.010	0.010
R-Square	0.155	0.155	0.155	0.155	0.155	0.155	0.028	0.028	0.028	0.028	0.028	0.028

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

Table (6) The Indirect Effect of Exchange Rate Regimes on Banking Crises Through the Rate of Domestic Credit Expansion

Dependent variable is the growth rate of domestic credit
Methodology: Fixed effects estimation

6A Emerging Market and Developing Countries

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.039 (0.568)	0.005 (0.895)	0.031 (0.490)	-0.004 (0.919)	-0.075* (0.077)	-0.113** (0.012)
Hard pegs $_{t-1}$		0.033 (0.649)	0.008 (0.915)	0.043 (0.559)	0.114 (0.116)	0.152** (0.035)
Adjustable parities $_{t-1}$	-0.033 (0.649)		-0.026 (0.464)	0.010 (0.769)	0.081** (0.002)	0.119** (0.000)
Crawls $_{t-1}$	-0.008 (0.915)	0.026 (0.464)		0.035 (0.393)	0.106** (0.002)	0.144** (0.000)
Tightly Managed $_{t-1}$	-0.043 (0.559)	-0.010 (0.769)	-0.035 (0.393)		0.071** (0.034)	0.109** (0.003)
Other Managed $_{t-1}$	-0.114 (0.116)	-0.081** (0.002)	-0.106** (0.002)	-0.071** (0.034)		0.038 (0.208)
Independent Floats $_{t-1}$	-0.152** (0.035)	-0.119** (0.000)	-0.144** (0.000)	-0.109** (0.003)	-0.038 (0.208)	
GDP per Cap $_{t-1}$	0.021* (0.087)	0.021* (0.087)	0.021* (0.087)	0.021* (0.087)	0.021* (0.087)	0.021* (0.087)
Inflation $_{t-1}$	0.000 (0.912)	0.000 (0.912)	0.000 (0.912)	0.000 (0.912)	0.000 (0.912)	0.000 (0.912)
OECD Growth $_{t-1}$	-0.002 (0.780)	-0.002 (0.780)	-0.002 (0.780)	-0.002 (0.780)	-0.002 (0.780)	-0.002 (0.780)
Interest Rate Differential $_{t-1}$	-0.001 (0.478)	-0.001 (0.478)	-0.001 (0.478)	-0.001 (0.478)	-0.001 (0.478)	-0.001 (0.478)
No. of obs.	1269	1269	1269	1269	1269	1269
F(9,1144)	3.54	3.54	3.54	3.54	3.54	3.54
Prob > F-Statistics	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
R-Square	0.0271	0.0271	0.0271	0.0271	0.0271	0.0271

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

6B Separate regressions for emerging markets and developing countries

	Emerging Market Economies						Developing Countries					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	0.014 (0.888)	0.005 (0.946)	-0.021 (0.776)	-0.045 (0.525)	-0.106 (0.149)	-0.189** (0.020)	-0.025 (0.844)	0.022 (0.752)	0.060 (0.426)	0.056 (0.454)	-0.017 (0.810)	-0.039 (0.597)
Hard pegs $_{t-1}$		0.009 (0.917)	0.036 (0.684)	0.059 (0.504)	0.120* (0.175)	0.203** (0.021)		-0.047 (0.764)	-0.085 (0.557)	-0.082 (0.609)	-0.008 (0.960)	0.014 (0.931)
Adjustable parities $_{t-1}$	-0.009 (0.917)		0.026 (0.601)	0.050 (0.313)	0.111** (0.006)	0.194** (0.000)	0.047 (0.764)		-0.038 (0.512)	-0.035 (0.444)	0.039 (0.271)	0.061 (0.139)
Crawls $_{t-1}$	-0.036 (0.684)	-0.026 (0.601)		0.024 (0.686)	0.084* (0.081)	0.168** (0.000)	0.085 (0.557)	0.038 (0.512)		0.004 (0.957)	0.077 (0.200)	0.099* (0.114)
Tightly Managed $_{t-1}$	-0.059 (0.504)	-0.050 (0.313)	-0.024 (0.686)		0.061 (0.231)	0.144** (0.014)	0.082 (0.609)	0.035 (0.444)	-0.004 (0.957)		0.074 (0.107)	0.095* (0.055)
Other Managed $_{t-1}$	-0.120 (0.175)	-0.111** (0.006)	-0.084* (0.081)	-0.061 (0.231)		0.083* (0.091)	0.008 (0.960)	-0.039* (0.271)	-0.077 (0.200)	-0.074 (0.107)		0.022 (0.580)
Independent Floats $_{t-1}$	-0.203** (0.021)	-0.194** (0.000)	-0.168** (0.000)	-0.144** (0.014)	-0.083* (0.091)		-0.014 (0.931)	-0.061 (0.139)	-0.099 (0.114)	-0.095* (0.055)	-0.022 (0.580)	
GDP per Cap $_{t-1}$	0.023 (0.121)	0.023 (0.121)	0.023 (0.121)	0.023 (0.121)	0.023 (0.121)	0.023 (0.121)	0.026 (0.363)	0.026 (0.363)	0.026 (0.363)	0.026 (0.363)	0.026 (0.363)	0.026 (0.363)
Inflation $_{t-1}$	0.007** (0.014)	0.007** (0.014)	0.007** (0.014)	0.007** (0.014)	0.007** (0.014)	0.007** (0.014)	-0.001 (0.584)	-0.001 (0.584)	-0.001 (0.584)	-0.001 (0.584)	-0.001 (0.584)	-0.001 (0.584)
OECD Growth $_{t-1}$	-0.003 (0.809)	-0.003 (0.809)	-0.003 (0.809)	-0.003 (0.809)	-0.003 (0.809)	-0.003 (0.809)	-0.001 (0.897)	-0.001 (0.897)	-0.001 (0.897)	-0.001 (0.897)	-0.001 (0.897)	-0.001 (0.897)
Interest Rate Diff $_{t-1}$	-0.003** (0.049)	-0.003** (0.049)	-0.003** (0.049)	-0.003** (0.049)	-0.003** (0.049)	-0.003** (0.049)	-0.052 (0.247)	-0.052 (0.247)	-0.052 (0.247)	-0.052 (0.247)	-0.052 (0.247)	-0.052 (0.247)
No. of obs.	437	437	437	437	437	437	832	832	832	832	832	832
F-Statistics	3.50	3.50	3.50	3.50	3.50	3.50	1.24	1.24	1.24	1.24	1.24	1.24
Prob > F-Statistics	0.000	0.000	0.000	0.000	0.000	0.000	0.266	0.266	0.266	0.266	0.266	0.266
R-Square	0.074	0.074	0.074	0.074	0.074	0.074	0.015	0.015	0.015	0.015	0.015	0.015

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

Table (7) The Indirect Effect of Exchange Rate Regimes on Banking Crises Through the Channel of Currency Crises

Dependent variable: currency crisis dummy
Methodology: Logit model

7A Emerging Market and Developing Countries (report marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Hard pegs $_{t-1}$		-0.051*	-0.032	-0.098*	0.029	0.022
		(0.090)	(0.320)	(0.056)	(0.364)	(0.473)
Adjustable parities $_{t-1}$	0.051*		0.019	-0.047	0.080**	0.073**
	(0.090)		(0.589)	(0.363)	(0.017)	(0.034)
Crawls $_{t-1}$	0.032	-0.019		-0.066	0.061*	0.054*
	(0.320)	(0.589)		(0.209)	(0.082)	(0.088)
Tightly Managed $_{t-1}$	0.098*	0.047	0.066		0.127**	0.120**
	(0.056)	(0.363)	(0.209)		(0.011)	(0.013)
Other Managed $_{t-1}$	-0.029	-0.080**	-0.061*	-0.127**		-0.007
	(0.364)	(0.017)	(0.082)	(0.011)		(0.826)
Independent Floats $_{t-1}$	-0.022	-0.073**	-0.054*	-0.120**	0.007	
	(0.473)	(0.034)	(0.088)	(0.013)	(0.826)	
M2/Reserve $_{t-1}$	0.001**	0.002**	0.001*	0.002*	0.001	0.001
	(0.042)	(0.046)	(0.065)	(0.061)	(0.118)	(0.105)
Growth of Domestic Credit $_{t-1}$	-0.048	-0.072	-0.063	-0.091	-0.033	-0.036
	(0.199)	(0.208)	(0.213)	(0.218)	(0.262)	(0.249)
CA $_{t-1}$	-0.001	-0.001	-0.001	-0.002	-0.001	-0.001
	(0.264)	(0.285)	(0.269)	(0.305)	(0.343)	(0.288)
No. of obs.	887	887	887	887	887	887
Wald Chi-Square Test	18.95	18.95	18.95	18.95	18.95	18.95
Prob > Chi-Square	0.015	0.015	0.015	0.015	0.015	0.015
Pseudo R2	0.0322	0.0322	0.0322	0.0322	0.0322	0.0322

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

7B Separate regressions for emerging markets and developing countries (report marginal effects)

	Emerging Market Economies						Developing Countries					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Hard pegs $_{t-1}$		-0.027 (0.660)	-0.068 (0.231)	-0.136* (0.073)	0.050 (0.324)	-0.026 (0.711)		-0.045 (0.182)	0.028 (0.468)	0.006 (0.915)	0.026 (0.492)	0.049* (0.071)
Adjustable parities $_{t-1}$	0.027 (0.660)		-0.041 (0.453)	-0.110 (0.128)	0.076 (0.129)	0.000 (0.999)	0.045 (0.182)		0.073* (0.093)	0.052 (0.389)	0.072* (0.056)	0.094** (0.004)
Crawls $_{t-1}$	0.068 (0.231)	0.041 (0.453)		-0.068 (0.322)	0.117** (0.005)	0.041 (0.502)	-0.028 (0.468)	-0.073* (0.093)		-0.022 (0.739	-0.002 (0.970)	0.021 (0.585)
Tightly Managed $_{t-1}$	0.136* (0.073)	0.110 (0.128)	0.068 (0.322)		0.186** (0.004)	0.110 (0.174)	-0.006 (0.915)	-0.052 (0.389)	0.022 (0.739)		0.020 (0.739)	0.042 (0.428)
Other Managed $_{t-1}$	-0.050 (0.324)	-0.076 (0.129)	-0.117** (0.005)	-0.186** (0.004)		-0.076 (0.235)	-0.026 (0.492)	-0.072* (0.056)	0.002 (0.970)	-0.020 (0.739)		0.022 (0.485)
Independent Floats $_{t-1}$	0.026 (0.711)	0.000 (0.999)	-0.041 (0.502)	-0.110 (0.174)	0.076 (0.235)		-0.049* (0.071)	-0.094** (0.004)	-0.021 (0.585)	-0.042 (0.428)	-0.022 (0.485)	
M2/Reserve $_{t-1}$	0.007* (0.097)	0.009** (0.002)	0.011** (0.013)	0.015** (0.002)	0.003 (0.151)	0.009 (0.106)	0.001* (0.090)	0.001 (0.107)	0.001 (0.233)	0.001* (0.095)	0.001 (0.187)	0.000 (0.135)
Growth of Domestic Credit $_{t-1}$	-0.012 (0.497)	-0.015 (0.527)	-0.020 (0.517)	-0.026 (0.509)	-0.006 (0.543)	-0.015 (0.543)	-0.100 (0.114)	-0.143 (0.123)	-0.071 (0.162)	-0.093 (0.132)	-0.072 (0.212)	-0.048 (0.213)
CA $_{t-1}$	-0.005 (0.216)	-0.006 (0.120)	-0.008* (0.081)	-0.010* (0.086)	-0.002 (0.230)	-0.006 (0.152)	-0.001 (0.235)	-0.002 (0.270)	-0.001 (0.255)	-0.001 (0.263)	-0.001 (0.357)	-0.001 (0.330)
No. of obs.	344	344	344	344	344	344	543	543	543	543	543	543
Wald Chi-Square Test	37.79	37.79	37.79	37.79	37.79	37.79	20.05	20.05	20.05	20.05	20.05	20.05
Prob > Chi-Square	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.010	0.010	0.010	0.010	0.010
Pseudo R2	0.072	0.072	0.072	0.072	0.072	0.072	0.045	0.045	0.045	0.045	0.045	0.045

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

7C Using BOR Crisis Measures (report marginal effects)

Dependent variable: BOR currency crisis dummy

	Emerging Market and Developing Countries						Emerging Market Economies					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Hard pegs $_{t-1}$		-0.095** (0.000)	-0.077** (0.000)	-0.102** (0.006)	-0.030 (0.134)	-0.059** (0.009)		-0.147** (0.009)	-0.082** (0.004)	-0.091* (0.099)	0.014 (0.589)	-0.047 (0.388)
Adjustable parities $_{t-1}$	0.095** (0.000)		0.018 (0.502)	-0.007 (0.854)	0.065** (0.007)	0.036 (0.180)	0.147** (0.009)		0.065* (0.257)	0.056 (0.393)	0.161** (0.005)	0.100 (0.158)
Crawls $_{t-1}$	0.077** (0.000)	-0.018 (0.502)		-0.025 (0.524)	0.047* (0.071)	0.018 (0.507)	0.082** (0.004)	-0.065* (0.257)		-0.008 (0.871)	0.096** (0.000)	0.035 (0.514)
Tightly Managed $_{t-1}$	0.102** (0.006)	0.007 (0.854)	0.025 (0.524)		0.072* (0.071)	0.043 (0.300)	0.091* (0.099)	-0.056 (0.393)	0.008 (0.871)		0.105** (0.037)	0.044 (0.548)
Other Managed $_{t-1}$	0.030 (0.134)	-0.065** (0.007)	-0.047* (0.071)	-0.072* (0.071)		-0.029 (0.256)	-0.014 (0.589)	-0.161** (0.005)	-0.096** (0.000)	-0.105** (0.037)		-0.061 (0.248)
Independently Floats $_{t-1}$	0.059** (0.009)	-0.036 (0.180)	-0.018 (0.507)	-0.043 (0.300)	0.029 (0.256)		0.047 (0.388)	-0.100 (0.158)	-0.035 (0.514)	-0.044 (0.548)	0.061 (0.248)	
M2/Reserve $_{t-1}$	0.001** (0.000)	0.002** (0.000)	0.002* (0.000)	0.003** (0.001)	0.001** (0.002)	0.002** (0.001)	0.002 (0.321)	0.010** (0.031)	0.007* (0.049)	0.007* (0.100)	0.001 (0.369)	0.005 (0.197)
Growth of Domestic Credit $_{t-1}$	0.000 (0.984)	0.001 (0.984)	0.001 (0.984)	0.001 (0.984)	0.000 (0.984)	0.000 (0.984)	-0.023 (0.462)	-0.126 (0.385)	-0.085 (0.384)	-0.091 (0.388)	-0.011 (0.466)	-0.060 (0.412)
CA $_{t-1}$	-0.001** (0.033)	-0.002* (0.049)	-0.002** (0.041)	-0.002* (0.073)	-0.001* (0.052)	-0.002* (0.050)	-0.002 (0.257)	-0.012** (0.017)	-0.008** (0.026)	-0.009* (0.085)	-0.001 (0.361)	-0.006 (0.175)
No. of obs.	1165	1165	1165	1165	1165	1165	354	354	354	354	354	354
Wald Chi-Square Test	29.71	29.71	29.71	29.71	29.71	29.71	24.64	24.64	24.64	24.64	24.64	24.64
Prob > Chi-Square	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002	0.002	0.002	0.002
Pseudo R2	0.034	0.034	0.034	0.034	0.034	0.034	0.113	0.113	0.113	0.113	0.113	0.113

The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).

Table 8 Summary Findings of Indirect Of Effects of Exchange Rate Regimes on the Onset of Banking Crises
(a sample of emerging markets and developing countries, 1990-2003)

Compared regimes	Indirect Channels	Indirect effect of ER regimes on the probability of banking crises (based on the majority of indirect channels)
1. hard pegs & other regimes		
• hard pegs & soft pegs	FL/FA (hard pegs) < FL/FA (soft pegs) LB(hard pegs) = LB(soft pegs) P_{CC}(hard pegs) < P_{CC}(soft pegs)	P_{BC}(hard pegs) < P_{BC} (soft pegs)
• hard pegs & other intermediate	FL/FA(hard pegs) < FL/FA(other intermediate) LB(hard pegs) = LB(other intermediate) P_{CC}(hard pegs) ≤ P_{CC}(other intermediate) †	P_{BC}(hard pegs) < P_{BC}(other intermediate)
• hard pegs & floating	FL/FA(hard pegs) = FL/FA (indep floats) LB(hard pegs) > LB(indep floats) P_{CC} (hard pegs) < P_{CC}(indep floats)	unclear
2. soft pegs & other intermediate	FL/FA(soft pegs) < FL/FA (other intermediate) LB(soft pegs) = LB(other intermediate) P_{CC} (soft pegs) ≥ P_{CC}(other intermediate) †	unclear
3. tightly managed & other managed & independent floats		
• indep floats & other managed	FL/FA(indep floats) < FL/FA (other managed) LB(indep floats) < LB(other managed) P_{CC}(indep floats) = P_{CC}(other managed)	P_{BC}(indep floats) < P_{BC}(other managed)
• indep floats & tightly managed	FL/FA(indep floats) < FL/FA(tightly managed) LB(indep floats) < LB(tightly managed) P_{CC}(indep floats) < P_{CC}(tightly managed)	P_{BC}(indep floats) < P_{BC}(tightly managed)
• other managed & tightly managed	FL/FA (other managed) < FL/FA (tightly managed) LB(other managed) < LB(tightly managed) P_{CC}(other managed) < P_{CC}(tightly managed)	P_{BC}(other managed) < P_{BC}(tightly managed)

Notes: "Indirect Channels" indicate the effect of exchange rate regimes on 1. the ratio of foreign liabilities to assets (FL/FA), 2. domestic credit expansion or lending boom (LB), and the probability of currency crises (P_{CC}). P_{BC} = the probability of banking crises. Exchange rate regimes are classified into six groups: hard pegs, soft pegs or adjustable parities, crawls, tightly managed floats, other managed floats, and independent floats. Intermediate regimes include soft pegs and other intermediate regimes (crawls, tightly managed and other managed floats).
† The results depend on currency crisis indices used in the estimation.

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Appendix I Data Descriptions

Variable	Description	Source
The Onset Banking Crisis	The onset of banking crisis dummy, which is equal to 1 in a first year of each banking crisis episode (both systemic and nonsystemic banking crises), and 0 otherwise	Caprio and Klingebiel (2002)
FL/FA	The ratio of banks' foreign liabilities to foreign assets	IFS (line 7b÷line 7a)
Domestic Credit Expansion	The growth rate of domestic credit to private sector (% of GDP)	WDI
Currency Crisis dummy	A currency crisis is identified and assigned a value of one if the exchange market pressure index (EMP) exceeds two times standard deviations plus its country-specific sample mean. EMP is a weighted average of the percentage change in exchange rate vis-à-vis the anchor country, the percentage change in international reserves, and change in the domestic market interest rate.	Authors' calculation based on Eichengreen et al. (1994)'s methodology
BOR Currency Crisis Dummy	A currency crisis dummy has a value of one the EMP index exceeds three times standard deviations plus its country-specific sample mean. A currency crisis dummy is constructed based on the combination of a weighted average of monthly percentage change in exchange rate vis-à-vis the anchor country and monthly variation in percentage points in the domestic interest rate (exclude the percentage change in international reserves)	Bubula and Otker-Robe. (2003)
Real GDP Per Capita	Real GDP per capita (constant 2000 US$). The data is in 1,000 U.S.$	WDI
Real GDP Growth Rate	Real GDP growth (annual %)	WDI
M2 to Reserve	The ration of money and quasi money (M2) to gross international reserves ratio	WDI
Inflation	Inflation, consumer prices (annual %)	WDI
CA to GDP	Current account balance (% of GDP)	WDI
OECD Growth $_{t-1}$	The average growth rates of Germany, Japan, France, Italy, and Spain, UK, and US.	WDI
Interest Rate Differential$_{t-1}$	The nominal short-term market interest rates of domestic countries minus the foreign interest rate, which is the average short-term rate of France, Germany, Japan, Switzerland, UK, and US. Eichengreen and Arteta (2002) use the interest rates of these developed countries to calculate Northern interest rates.	WDI and IFS

IFS = International Financial Statistics
WDI = World Development Indicators from the World Bank

Appendix II List of Countries

Emerging Markets	Developing Countries	
Argentina	Albania	Latvia
Brazil	Algeria	Lesotho
Bulgaria	Armenia	Macedonia
Chile	Azerbaijan	Madagascar
China	Bangladesh	Malawi
Colombia	Belarus	Maldives
Croatia	Benin	Mali
Ecuador	Bolivia	Mauritania
Egypt	Botswana	Mauritius
Estonia	Burkina Faso	Moldova
Hong Kong	Burundi	Mongolia
Hungary	Cambodia	Morocco
India	Cameroon	Mozambique
Indonesia	Cape Verde	Nepal
Israel	Central Africa	Nicaragua
Jordan	Chad	Niger
Kenya	Congo, Republic	Oman
Korea	Costa Rica	Panama
Lithuania	Cote d´Ivoire	Papua New Guinea
Malaysia	Dominican Republic	Rwanda
Mexico	El Salvador	Saudi Arabia
Nigeria	Ethiopia	Senegal
Pakistan	Fiji	Sierra Leone
Paraguay	Gabon	Solomon Islands
Peru	Gambia	St. Lucia
Philippines	Georgia	Sudan
Poland	Ghana	Swaziland
Russia	Grenada	Tanzania
Singapore	Guatemala	Togo
Slovenia	Guinea Bissau	Trinidad and Tobago
South Africa	Haiti	Tunisia
Sri Lanka	Honduras	Uganda
Thailand	Jamaica	Uruguay
Turkey	Jordan	Vietnam
Ukraine	Kazakhstan	Yemen
Venezuela	Kuwait	Zambia
	Kyrgyz Republic	Zimbabwe
	Laos	

Appendix III Description of Bubula and Otker-Robe (BOR)'s exchange rate regime classifications

Classifications	**BOR**	**This paper**
Exchange Regimes with another Currency as Legal Tender (Dollarization)	1	1
Exchange Regimes with No Separate Legal Tender (Currency Unions)	2	1
Currency Board Arrangements (CBAs)	3	1
Conventional Fixed Peg to a Single Currency	4	2
Conventional Fixed Peg to a Basket	5	2
Horizontal Bands	6	2
Forward looking Crawling Peg	7	3
Backward looking Crawling Peg	8	3
Forward looking Crawling Band	9	3
Backward looking Crawling Band	10	3
Tightly managed Floating	11	4
Other managed Floating	12	5
Independently Floating	13	6

Note: In their paper, Bubula and Otker-Robe (2003) classify exchange rate regimes into 13 categories and categorized 1-3 as hard pegged regimes, 4-11 as intermediate regimes, and 12-13 as floating regimes. In this paper, we categorize regimes into 6 groups: hard pegs (1-13), adjustable parities (4-6), crawls (7-10), tightly managed floats (11), other managed floats (12), and independent floats (13).

Appendix IV Sensitivity Tests of Empirical Results (based on table 4)

Dependent variable: the onset of banking crisis dummy
Sample: emerging market and developing countries

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Methodology	Fixed effects logit model			Random effects logit model			Logit model	
Hard pegs $_{t-1}$	-0.074 (0.959)	-1.195 (0.574)	0.946 (0.578)	1.292 (0.106)	1.335* (0.096)	1.810 (0.105)	1.208 (0.129)	1.326 (0.108)
Adjustable parities $_{t-1}$	1.382 (0.157)	1.916 (0.133)	1.466 (0.252)	1.361* (0.078)	1.407* (0.069)	1.665 (0.125)	1.365* (0.066)	1.512** (0.049)
Crawls $_{t-1}$	1.456 (0.130)	2.213* (0.066)	1.490 (0.226)	1.875** (0.016)	1.918** (0.014)	2.194** (0.044)	1.732** (0.025)	1.873** (0.020)
Tightly Managed $_{t-1}$	1.252 (0.244)	1.753 (0.194)	2.351 (0.111)	1.913** (0.019)	1.970** (0.016)	2.488** (0.027)	1.911** (0.017)	2.065** (0.013)
Other Managed $_{t-1}$	0.160 (0.865)	1.015 (0.417)	0.688 (0.575)	0.901 (0.277)	1.211 (0.132)	1.565 (0.167)	1.199 (0.130)	1.277 (0.123)
Independent Floats $_{t-1}$								
FL/FA $_{t-1}$	0.076 (0.437)			0.056 (0.346)				
Growth of Domestic Credit $_{t-1}$		0.360 (0.111)			0.400* (0.077)			
Currency Crises $_{t}$			0.850** (0.043)			0.863** (0.021)		
BOR Currency Crises $_{t}$							0.768* (0.059)	
BOR Currency Crises $_{t-1}$								0.659* (0.089)
GDP per Cap $_{t-1}$	0.147 (0.693)	0.188 (0.633)	0.515 (0.295)	-0.028 (0.462)	-0.030 (0.435)	-0.047 (0.262)	-0.032 (0.410)	-0.031 (0.427)
M2/Reserve $_{t-1}$	0.013* (0.050)	0.015** (0.026)	-0.008 (0.638)	0.011** (0.023)	0.013** (0.015)	0.003 (0.764)	0.010** (0.007)	0.011** (0.001)
Inflation $_{t-1}$	-0.006 (0.891)	-0.035 (0.445)	0.012 (0.820)	0.030 (0.301)	0.035 (0.160)	0.032 (0.316)	0.026 (0.146)	0.027* (0.082)
Constant				-4.337** (0.000)	-4.340** (0.000)	-4.452** (0.000)	-4.131** (0.000)	-4.248** (0.000)
No. of obs.	491	473	345	1084	1080	738	916	915
Wald Chi-Square Test	13.735	17.140	12.017	17.46	19.643	15.256	26.78	25.56
Prob > Chi-Square	0.132	0.047	0.212	0.042	0.020	0.084	0.045	0.042

Note: BOR currency crisis is currency crisis dummy that is taken from Bubula and Otker-Robe. (2003). They construct currency crisis indices from the components of only changes in exchange rate and interest rates (changes in international reserves are excluded). The numbers in parentheses are the probability values. ** and * indicate the significance levels of 5% and 10%, respectively. The standard error of estimates is robust standard error and adjusted within cluster (or within a country).