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Tuomas Komulainen and Johanna Lukkarila

What drives financial crises in emerging markets?

Bank of Finland
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Tuomas Komulainen and Johanna Lukkarila *

What drives financial crises in emerging markets?

Abstract

The study examines the reasons for financial crises in 31 emerging market countries during 1980-2001. It estimates a probit model using 23 macroeconomic and financial sector variables. Traditional variables such as unemployment and inflation, as well as several indicators of indebtedness such as private sector liabilities and the foreign liabilities of banks explain currency crises rather well, and it appears currency crises occur in tandem with banking crises. Indeed, in emerging market countries vulnerability to crisis is exacerbated by situations involving large liabilities that permit sudden capital outflows. Increases in indebtedness followed the liberalisation of capital flows and domestic financial sectors.

Key words: Currency crises, banking crises, emerging markets, liberalisation, probit model.

JEL classification number: F31, F32, F41, F47.

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Tuomas Komulainen and Johanna Lukkarila

What drives financial crises in emerging markets?

Tiivistelmä

Tutkimuksessa selvitetään rahoituskriisien syitä 31 kehittyvässä maassa vuosina 1980–2001. Selittävinä muuttujina tutkimuksessa on 23 makrotaloutta ja rahoitussektoria kuvaavaa indikaattoria, joiden vaikutusta kriisiin tarkastellaan probit-menetelmän avulla. Tulosten perusteella valuuttakriisejä selittävät erityisen hyvin eräät perinteiset muuttujat, kuten työttömyys ja inflaatio, ja useat maan velkaantuneisuutta kuvaavat indikaattorit, kuten yksityisen sektorin velkaantuminen ja pankkien ulkomainen velkaantuminen. Lisäksi valuutta- ja pankkikriisit näyttävät esiintyvän samanaikaisesti. Tutkimuksen perusteella kehittyvät maat ovat erityisen kriisialttiita, kun viranomaiset tai yritykset ovat laskeneet liikkeeseen huomattavan määrän velkakirjoja, mikä mahdollistaa pääomien äkillisen maastavirtauksen. Tarkastelluissa maissa velkaantuminen voimistui selvästi kotimaan rahoitussektorin ja pääomavirtojen vapauttamisen jälkeen.

Asiasanat: valuuttakriisit, pankkikriisit, kehittyvät maat, liberalisointi, probit-menetelmä

JEL -luokittelu: F31, F32, F41, F47

1 Introduction

During 1995–2001, over a dozen emerging market countries experienced severe financial crises. Arguably, these recent crises were more frequent and more painful than in the past, so it may be appropriate to ask whether something has changed in the economic environment. Are the reasons for these crises somehow different from earlier financial crises?

Although numerous empirical studies seek to identify causes for past crises and early-warning indicators that might be used to avoid future crises,[1] only few studies apply commonly used indicators simultaneously. A further shortcoming of the literature is that only a small number of studies focus solely on emerging market or developing countries. The ways in which liberalisation of capital flows and financial sectors change the economic environment – and influence the likelihood of crisis – has yet to be adequately addressed.

This study aims to contribute to the literature in various ways: We exclusively focus on emerging market countries to identify reasons for their crises, and we are able to include recent crisis episodes from 1997–2001.

We include several banking sector indicators and attempt to determine whether banking sector troubles induced the recent crises.

We apply the most commonly used macroeconomic variables. Since all these indicators are now studied simultaneously, we hope to detect the interaction of the variables and distinguish the actual causes of recent crises in emerging markets.

According to one line of argument, financial liberalisation (which occurred in the 1980s or in early 1990s in most of the countries we discuss) rendered these economies vulnerable to sudden capital outflows and crises. We thus examine how liberalisation of financial sectors and capital flows may have modified the causes for financial crises.

This study examines financial crises in 31 emerging market countries during the period 1980:1–2001:12. It estimates a probit model using 23 macroeconomic and financial sector indicators, including dummy variables for banking crises, exchange rate regime, and financial liberalisation. We find certain traditional variables, e.g. unemployment and inflation, and several indicators of indebtedness, e.g. private sector liabilities and the foreign liabilities of banks to explain currency crises rather well. Indeed, in the examined countries vulnerability to crisis is exacerbated by situations involving large liabilities that allow sudden capital outflows.

This paper is structured so that the following section presents an overview of the existing literature. Section 3 considers methodological questions, our indicators and data sets, while section 4 discusses the results. Section 5 examines the role of liberalisation in greater depth and suggests a prescription for a typical crisis. The final section concludes.

[1] See Chui (2002), Goldstein et al. (2002), and Kaminsky et al. (1998) for surveys.

2 Literature review

The empirical literature on currency and financial crises can be categorised according to three methodological approaches.[2] The first branch comprises case studies that concentrate on specific crisis episodes. These studies, while highly informative, usually do not seek to isolate general causes of crises, but rather analyse particular episodes. Notable examples are Sachs, Tornell and Velasco (1996), Glick and Rose (1998), and Blanco and Garber (1986).

The second group of studies is based on the "signal approach" devised by Kaminsky and Reinhart (1996). The basic premise is that an economy behaves differently on the eve of a financial crisis than during times of normalcy. These studies identify variables that catch systematically deviant behaviour prior to crisis episodes. The signal approach is a bilateral model - it examines one particular economic variable individually. A variable is said to issue a signal when it departs from its mean beyond a certain threshold. The threshold level is chosen for each indicator in a way that minimises the risk of false signals and the risk of missing crises, i.e. it minimises the "signal-to-noise ratio".

Kaminsky et al (1998) use the signal approach to predict currency crises for a sample of five industrial and 15 developing countries during the years 1970–1995. In their study, an indicator exceeding a specified threshold is interpreted as a warning signal that a currency crisis may take place within the following 24 months. They find that variables with the greatest explanatory power include exports, deviation of the real exchange rate from trend, the ratio of broad money to reserves, output, and equity prices.[3] The signal approach is further applied in Kaminsky and Reinhart (1999) and Kaminsky (1999). Perhaps the most careful attempt to craft an early-warning system is found in Goldstein et al (2000).

A major advantage of the signal method is the evaluation of each indicator's individual predictive power, because it provides easily understandable results for policy purposes. However, since the interaction among variables is ignored, the actual reasons for crises may be obscured. A further drawback of the signal method is that the explanatory variables, as well as the probability of a crisis, are defined as a step function. Thus, the model fails to distinguish whether the value of the variable barely or greatly exceeds the threshold.[4] Finally, standard statistical tests are inapplicable to the signal approach.

Some of the problems in the signal approach are solved with limited-dependent or discrete-choice models. This method uses logit or probit functions and the predicted outcome, i.e. probability of crises, is constrained between zero and one.[5] The overall effect of the explanatory variables is evaluated simultaneously. Standard statistical tests are also possible. Since our aim is to identify reasons for crises, i.e. select appropriate variables and control for simultaneity, we use probit model for estimating the crisis indicators.

[2] Vlaar (2000) and Schardax (2002) provide good summaries of different methodological approaches used in empirical studies.

[3] Berg and Pattillo (1999) re-estimated the approach of Kaminsky et al (1998) to see whether the Asian crises might have been predictable using their approach. They obtained varying results. Most crises were not signalled in advance, and there were several false signals. However, the predictions were still better than random guesses.

[4] The step function takes a value of zero when the indicator variable is below the threshold and a value of one if it is above the threshold.

[5] Some studies, like Tanner (2001) and Bussière – Mulder (1999), use continuous exchange market pressure index and apply then standard regression models to analyze the depreciation and loss of reserves.

Among the earliest studies of this type, Eichengreen et al (1996) use data from 1959 through 1993 for industrial countries to characterise the common causes for currency crises and illuminate the contagious nature of currency crises. Frankel and Rose (1996) use a probit model to estimate the probability of crisis in an annual sample of 105 developing countries covering the period 1971–1992. They note that currency crises tend to occur when growth of domestic credit and foreign interest rates are high, and FDI and output growth are low. Kumar et al (2002) concentrate on forecasting crises and use logit model to study currency crises in 32 developing countries during the years from 1985 to 1999. They evaluate forecasts on an out-of-sample basis, estimating the model for one part of the sample, and then forecasting crashes in the remaining sample period. Their model has relatively good forecasting power.

Nevertheless, the literature remains nearly devoid of studies that apply commonly used indicators simultaneously, so it is hard to say whether the appropriate indictors have actually been identified.[6] The exception appears to be Bussiere and Fratzscher (2002). They consider 27 commonly used indicators, but report only the six variables that were found significant.

Banking sector indicators, notably, are rarely applied in the crisis literature. Moreover, the empirical literature on banking crises is almost entirely limited to the studies of Demirgüc-Kunt and Detragiache (1997, 1999). These studies apply several variables and study how a multivariate logit model explains banking sector fragility. Examining a panel of 53 developed and developing countries over the period 1980–1995, they find that low GDP growth, high real interest rates, a high M2 to reserves ratio and the deposit insurance dummy are significant in explaining banking crises.

To improve the status of the current literature we study the causes of currency crises by estimating a probit model with 23 of the most commonly used macroeconomic and financial sector indicators. We also explore the underlying causes of banking crises.

3 Methodology and indicators

3.1 Methodology

We use a panel regression model to estimate the main reasons for financial crises in emerging markets. Given our indicators, the model estimates the probability for crisis. The estimated model takes the form

$$(1) \qquad Prob.(y_{it} = 1 \mid x_t, \beta_t) = F(x_t, \beta_t),$$

where x_t corresponds to our set of indicators and β_t is a vector of unknown parameters.[7] The observed variable y_{it} receives a value of 0 or 1 depending on whether a crisis has occurred or not. With a probit or logit model, the right-hand side of the model is constrained between 0 and 1, and is compared to the observed value y_{it}. The probit model

[6] For further probit models see e.g. Berg - Pattillo (1998), Brüggemann – Linne (2002) and Milesi-Ferretti – Razin (1998).

[7] The set-up of our estimated model somewhat resembles Brüggemann and Linne (2002).

assumes that the probability distribution function (y_{it} conditional on x_{it}) corresponds to normal distribution.[8]

Since in currency crisis situation a successful attack leads to sharp currency depreciation and substantial reserve losses, both the signal approach and limited-dependent models traditionally define a currency crisis as a discrete event. One common technique is to construct an index of exchange market pressure as a weighted average of exchange rate changes and reserves changes (as well as interest rates in some cases). The crisis is said to occur when the index exceeds a country-specific threshold level.[9]

We calculate an exchange market pressure index (EMP) for each country. The index includes exchange rate depreciation and loss of reserves, which are weighted to influence equally. The exchange market pressure index takes the form

$$EMP = \Delta e - (\sigma_e / \sigma_r) * \Delta r, \quad (2)$$

where Δe denotes the change in exchange rate and Δr in international reserves, σ_e and σ_r denote the standard deviation of exchange rate alteration and reserves respectively. We determine the values of the EMP index more than two standard deviations above the mean as a crisis.[10]

Since macroeconomic variables often worsen prior to the actual crisis, we define crisis not only by the crisis month but also the eleven months before the crisis. In other words, we use a one-year window for our variables.[11]

3.2 Indicators

The tested indicators are selected on the basis of currency crisis theories and previous empirical literature. Banking sector problems, for example, have been blamed for the recent financial crises in Asia, so, in addition to the traditional macroeconomic variables, we include several indicators describing the vulnerability of domestic banks.[12] These indicators include the growth of bank deposits, the ratio of the lending rate to the deposit rate, the ratio of bank reserves to assets, and the ratio of bank foreign liabilities to GDP. To

[8] We also applied a logit model and the results are similar to those of the probit model. The results are available upon request. Previous studies mainly use probit models. Since in probit model the conditional probability approaches one or zero with higher rate, it might yield better estimation results than the logit model when studying financial crises.

[9] One problem is that this definition disregards the depth of the crisis.

[10] We also experimented with multiplying the standard deviation by one-half and three, but the coefficient two seems to best capture actual crises. See Table A3 in the appendix for results, as well as Wyplosz (1998) for examples and discussion. We identified 139 currency crises and 78 separate crisis periods in our sample. Since the EMP index often exceeds the threshold level several times after another, there are fewer 12-month long crisis periods. With the coefficient one-half, we felt that we detected too many crises (263), and with the coefficient three, some major crises were missed, e.g. Russia in 1994-1995, the Czech Republic in 1997 and Mexico in 1985.

[11] We tested our model with a one-month crisis period. Since one month is a short period, such results are unlikely to expose variables causing the crisis. Thus, we chose twelve months as our crisis period. Earlier literature uses either one- or two-year periods to define a crisis window. See e.g. Goldstein et al. (2000).

[12] Table A1 in the appendix gives a list and explanations of our indicators.

study the twin-crisis hypothesis, i.e. whether banking and currency crises are related, we include a banking crisis dummy. The timing of banking crises is based on previous studies.[13] We also employ variables that indicate vulnerability to a sudden stop of capital inflows. These variables are short-term capital inflows, public debt, broad money to reserves, and private sector liabilities.[14]

To study foreign influences on crises, we include the US interest rate and the Standard & Poors / IFC equity market index for emerging markets.[15] As a public debate over the wisdom of the chosen exchange rate regime often ensues after a crisis, we divided the exchange rate regimes into fixed, intermediate or floating, and included dummy variables for fixed and intermediate regimes.[16]

Some scholars single out financial liberalisation as a possible cause for crises, noting most emerging markets liberalised their financial sectors and capital flows during the 1980s and early 1990s. That deregulation was followed by a period of capital inflows that reversed at the threat of an impending crisis. Thus, we include dummies to measure the internal and external liberalisation. External liberalisation is measured by liberalisation of capital account and internal by deregulation of domestic interest rates.[17]

Our study thus incorporates a total of 23 macroeconomic and financial variables, including dummy variables for exchange rate regime, banking crises, and liberalisation. Since we study all these variables simultaneously, we hope to distinguish those indicators that reflect actual causes of the recent crises in emerging markets. We further attempt to verify the correctness of findings of earlier studies.

3.3 Sample and data

The model is estimated for a panel of monthly observations for 31 emerging or developing countries and covers the period 1980:1 – 2001:12. Our sample includes those Latin American, Asian, African and European countries defined as middle-income countries under the World Bank's classification system. The data for transition countries naturally does not start before 1991.[18] While annual data gives access to a larger set of indicators and countries, monthly data better captures the sudden nature of crises and variance of indicators.[19]

[13] The timing for banking crises we have taken from studies by Kaminsky et al (2000), Lindgren et al (1996) and Mahar - Williamson (1998).

[14] We use banks' claims on the private sector to measure the liabilities or the indebtedness of the private sector. We divide the figure further by GDP.

[15] The index measures contagion indirectly, i.e. the index decreases when major crises take place in emerging markets. Unfortunately, the index starts from 1984:12, so we calculated the index from the individual markets backward to 1980:1.

[16] The distribution of exchange rate regimes is taken from Reinhart – Rogoff (2002) and from IMF country reports.

[17] The timing of liberalization is taken from Mahar – Williamson (1998), EBRD transition reports and Kaminsky et al (2000).

[18] See Table A1 in the appendix for a complete list of countries. Due to data problems, only Morocco and South Africa are included from Africa. The data for Poland and Hungary start from 1991; for other transition countries, they begin from 1993.

[19] Where monthly data was unavailable, the monthly series were generated by linear interpolation from quarterly or annual data. In some cases, the data have been garnered from IMF country reports. For some

Most data are gathered from International Financial Statistics. The data for unemployment rate are taken from ILO databases, while government debt figures come from several sources, including IFS, the World Bank's WDI and IMF country reports. The detailed description of the data is provided in Table 1 in the appendix.

First, we examine the causes of currency and banking crises occurring throughout the sample period, i.e. 1980:1 – 2001:12. Next, we divide the sample into pre- and post-liberalisation periods. Since financial liberalisation can cause problems for the countries after the initial capital inflow period, we also study liberalisation with various lags.

4 Results

This section presents the reasons for currency and banking crises received with the used method, and the following section discusses the role of liberalisation more profoundly. The main results for the entire sample 1980:1–2001:12 are summarised in Table 1.[20] The signs of our indicators are mostly as expected. Regarding the individual indicators, we find that the probability of currency crises increases along with public debt, private sector liabilities, current account deficits, the ratio of M2 to reserves, foreign liabilities of banks, inflation, unemployment, and overvaluation of the real exchange rate.[21] In addition, currency crises seem to be highly related to banking crises, which supports the twin-crisis argument proposed by Kaminsky and Reinhart (1996). Higher US interest rates and a decreasing EM market index also seem to foreshadow currency crises. The exact results are reported in Table A4 in the appendix.

Table A4 also reports the marginal effects of individual variables (column (dy/dx)X) at the point where the fundamentals are weak.[22] The results indicate that private sector liabilities, US interest rates, unemployment, foreign liabilities of banks, and inflation have the highest effect on crisis probability. The high significance of private sector indebtedness and foreign liabilities of banks is particularly interesting and supports the arguments that extensive borrowing by domestic banks or private enterprises, i.e. large financial markets, render emerging economies susceptible to crises.

The results also indicate that external liberalisation reduces the probability of currency crisis – at least, for the next twelve months. This might be expected, since a capital inflow period usually follows liberalisation of the capital account.[23] Moreover, a high interest rate

countries, unemployment figures, interest rates or government debt was unavailable for some periods. In those cases, the missing data were generated with the impute command of Stata software. Unemployment and public debt were limited to positive values. As stated above, we chose to use monthly data, because it better captures the sudden nature of crises. Also earlier studies have received better results with monthly data. See Goldstein et al (2000) for discussion.

[20] Obviously, the data for transition countries does not start until 1991. We also estimated our model without transition countries, when the sample is more balanced. The results are generally similar and available upon request.

[21] These include only those indicators where the sign is as expected and the influence is significant at the 1% level. The real exchange rate is calculated vis-à-vis the US dollar. Overvaluation is determined as the negative difference from a trend during 1980:1-2001:12.

[22] The marginal effects are calculated at a point where the fundamentals are weak, i.e. the indicators are calculated at the weakest quintile (the exact values are reported in Table 4 in column X).

[23] When interpreting the results for liberalisation of capital account, note that we simultaneously control the influence of short-term capital inflows, foreign liabilities of banks and the interest rate differential.

differential seems to reduce the probability of crises, indicating that higher domestic interest rates attract capital inflows and help avoid crises. Surprisingly, growth of exports seems to increase the probability of crisis. For the entire sample, an intermediate exchange rate regime reduces the probability of crisis.

Table 1. Probit model, 1980:1 – 2001:12, currency crises

BOP	Indicators	Expected sign	Found sign	Significance
Government	Budget balance / GDP	-	-	
	Public debt / GDP	+	+	***
	M2 / Reserves	+	+	***
Real sector	Industrial production	-	-	
+ traditional	Inflation	+	+	***
	Unemployment rate	+	+	***
	Domestic credit growth	+	+	**
	Exports	-	+	**
	Current account / GDP	-	-	***
	Real exchange rate	-	-	***
Financial sector	Banks deposits	-	-	
	Claims on private s. / GDP	+	+	***
	Bank foreign liabilities / GDP	+	+	***
	Lending rate / deposit rate	- +	-	**
	Banks reserves / assets	-	+	
	Banking crisis dummy	+	+	***
Capital flows	FDI / GDP	-	-	***
	Short-term capital inflows/ GDP	- +	-	*
	Interest rate differential	- +	-	**
Foreign	US interest rate	+	+	***
	EM index	-	-	**
Exchange rate	Fixed exchange rate		-	
	Intermediate regime		-	***
Liberalisation	Liberalisation, internal	- +	-	
	Liberalisation, external	- +	-	***

One, two, and three asterisks denote significance at the 10, 5 and 1 percent levels, respectively.

Table A4 reports also the goodness-of-fit of our model. Given the cut-off probability of 50%, the model correctly calls 32% of the crises and 98% of the tranquil periods. When the cut-off probability is lowered to 25%, the model correctly indicates 56% of the crises and 92% of the tranquil periods. These results are slightly better than those surveyed by Berg and Patillo (1999).

Comparing our results to earlier studies of Frankel and Rose (1996), Berg and Pattillo (1999), and the survey by Kaminsky et al. (2000), we notice they are largely similar to these earlier studies. The macroeconomic indicators found significant in both earlier studies and this study are overvaluation of the real exchange rate, the M2 to reserves ratio, inflation, and the current account deficit. To a lesser extent, we note low FDI and high public debt also signal impending crises. Moreover, we find significant certain financial

sector variables that were not generally included in earlier studies.[24] Our finding of strong importance of private sector liabilities, foreign liabilities of banks, and unemployment, differs from earlier studies.

Indicators deemed significant in earlier studies but not in ours are industrial production and domestic credit growth. Growth of exports had a different sign. These indicators may drop out in our study due to the fact we study many indicators simultaneously. Another plausible explanation for this difference is that we are using only emerging market countries, and the causes of crises may be different from those in developed countries.

Next we examine the reasons for banking crises, and study whether the explanatory variables are similar to currency crises. To do this, we estimate the probit model for banking crises occurring within the entire sample period 1980-2001 (Table A5). As expected, most of our banking sector indicators explain banking crises quite well.[25] The effect of low lending to deposit rate and high private sector liabilities to banking sector problems is particularly strong. Apparently, high private sector liabilities increase the probability of banking and currency crises with large magnitude. Also some macroeconomic variables and the dummy for currency crises increase the probability of banking crises.[26] The large importance of public debt and low importance of industrial production differ from earlier studies and suggest interesting areas for further investigation.

5 Liberalisation and the course of a typical crisis

To study whether the liberalisation of capital flows has changed the reasons for crises, we divide our sample into two sub-samples, whereby the data for each country is divided into pre- and post-liberalisation of capital flows. In most of the countries, the deregulation of capital flows took place in the late 1980s or early 1990s. By 1998, all countries in our sample had liberalised their capital accounts. The results are reported in Tables A6 and A7.[27] Prior to liberalisation, unemployment, current account deficits, US interest rates, and the foreign liabilities of banks have the highest effect on the probability of a currency crisis. After liberalisation, high indebtedness of the private sector, high US interest rates, high public debt, and high foreign liabilities of banks significantly increase the probability of a currency crisis. In both samples, a banking crisis substantially increases the likelihood

[24] High foreign liabilities of banks, a low lending to deposit ratio and banking crisis dummy seem to increase the probability of currency crises.

[25] The probability of banking crises increases when deposits, lending rate to deposit rate and banks' reserves to assets are decreasing, and claims on private sector are high. The sign of foreign liabilities of banks is surprisingly negative. Fluctuations in the exchange rate may play a role here.

[26] Macroeconomic variables that significantly increase the probability of banking crises are high public debt, high M2 to reserves and low FDI.

[27] The prior-liberalisation sample includes 42 crisis periods and the post-liberalisation sample 36 crisis periods (Table A3). We also estimated our model for the sub-samples 1980:1-1990:12 and 1991:1–2001:12. The results are available upon request. The results are mostly similar to the division according to liberalisation dates.

of a currency crisis. The effects of a current account deficit, inflation, and FDI are much lower after the liberalisation of capital flows than before.

The largest difference between the periods, however, is seen in private sector liabilities. Before liberalisation, private sector liabilities decrease the probability of a crisis, but after liberalisation higher private sector indebtedness increases with large magnitude the probability of a crisis. One reason for this difference is the significantly higher level of indebtedness after liberalisation. Between periods, the median of private sector liabilities increased from 16% to 29% of GDP (appendix Figure A1).[28]

Another notable difference between these periods concerns the role of exchange rate regime. In the overall sample, as well as in the pre-liberalisation period, an intermediate exchange rate regime decreases the currency crisis probability. After liberalisation, an intermediate regime significantly increases the probability of a crisis. This result supports the "two corners" hypothesis, i.e. the corner regimes (a hard fix and a floating exchange rate) are safer than intermediate regimes (e.g. a crawling peg or band).

We also examine how the overall crisis probability changed with the liberalisation of capital flows. First, for both samples we use the median level of fundamentals prevailing before liberalisation. In other words, ceteris paribus, how does the liberalisation of capital flows change the probability of crisis? With the median level of fundamentals the crisis probability turns out to be much lower in the post-liberalisation period than prior to liberalisation (1.4% and 20.9%, respectively). When we used the weak levels of fundamentals, the crisis probabilities are almost similar pre- and post-liberalisation (37% and 33%).[29] These results suggest that liberalisation of capital flows in itself did not cause the recent crises in emerging markets, but the actual cause of the crises probably were the deteriorated fundamentals.

To examine the role of liberalisation in depth, we lag the liberalisation variables (both internal and external). The most interesting results are obtained when we use a two-year lag for internal liberalisation and a four-and-a-half-year lag for external liberalisation, and examine our model for the complete sample 1980-2001 (Table A8). The results indicate that liberalisation of interest rates and capital flows decreases crisis vulnerability for a year, but crises follow approximately two years after internal liberalisation and four-and-a-half years after liberalisation of capital flows.[30] The positive effect of capital account liberalisation on crisis probability is significant and relatively large.

Our results might best be summarised with a description of a typical emerging market crisis. In this example, the capital account is liberalised approximately four to five years before the actual currency crisis strikes. Deregulation allows foreign portfolio investments into the country and a large increase in private and public sector indebtedness. Under these circumstances an intermediate exchange regime becomes fragile for crises. Approximately two years before the crisis, the domestic financial sector is also liberalised. In the final months leading up to the crisis, the level of indebtedness (private and public sector liabilities, and the foreign liabilities of banks) rise to a point where investors start to doubt

[28] Similarly foreign liabilities of banks and public sector indebtedness have increased after the liberalisation of capital flows (See Figure A1).

[29] These crisis probabilities (37% and 33%) are calculated with the weakest quintile values of the indicators (the exact values and results are reported in Table 6 and 7).

[30] The result for internal liberalisation is quite similar to Wyplosz (2002) and Kaufmann – Mehrez (2000). Our results indicate the positive effect of capital account liberalization on currency crises begins after four years and vanishes after five-and-a-half years. The exact timing of crises after liberalisation is obviously hard to estimate.

the sustainability of the system. Consequently, a sudden capital outflow from these debt instruments may follow. Simultaneously – and partly as a result of the currency depreciation – the banking crisis becomes visible. The final push precipitating the crisis might be high interest rates in the US or a knock-on effect from a crisis elsewhere in emerging markets.

6 Conclusions

The study examined the reasons for financial crises in 31 emerging market countries during 1980:1–2001:12. It estimated a probit model using 23 macroeconomic and financial sector indicators, including dummy variables for banking crises, exchange rate regime, and liberalisation. We found that the probability of currency crisis increases along with increases in private sector liabilities, public debt, foreign liabilities of banks, unemployment, and inflation. Moreover, currency and banking crises are highly linked, and US interest rates influence the occurrence of currency crises in emerging markets. Whereas problems in the banking sector are well reflected in high private sector liabilities, high public indebtedness and a low lending to deposit rate.

When we divided our sample to prior- and post-liberalisation periods, it turned out that the indicators of indebtedness are more important for crisis probability after liberalisation, whereas the significance of real variables diminish. Intermediate exchange rate regimes appear vulnerable to currency crises after liberalisation of the capital account. Moreover, we found that currency crises follow approximately two years after the liberalisation of domestic financial sectors and four-and-a-half years after the liberalisation of capital flows. Our results, however, do not support the argument that the deregulation of capital flows in itself was the cause of recent crises in emerging markets.

Clearly, private sector liabilities, foreign borrowing of banks, and public indebtedness, had a profound influence on the occurrence of financial crises in emerging markets. Indeed, crisis vulnerability arises after authorities or domestic agents have issued large amounts of financial liabilities in forms that permit a sudden capital outflow. This pattern of increasing indebtedness was seen in emerging market countries after the liberalisation of capital flows and domestic financial sectors.

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Appendix

Table A1 Countries

Latin-America	Asia	Europe	Africa
Argentina	India	Bulgaria	Morocco
Brazil	Indonesia	Czech Republic	South Africa
Bolivia	Israel	Estonia	
Chile	Korea	Hungary	
Colombia	Malaysia	Latvia	
Ecuador	Philippines	Lithuania	
Guatemala	Singapore	Poland	
Mexico	Thailand	Russia	
Peru		Slovenia	
Uruguay		Turkey	
Venezuela			

Indicators

Portfolio investment liabilities/GDP: IFS line 78bgd divided by IFS line 99b.
Foreign direct investments/GDP: IFS line 78bed divided by IFS line 99b.
Current account balance/GDP: IFS line 78ald divided by IFS line 99b.
Growth of exports: IFS line 70d.
Growth in bank deposits: IFS line 24 plus line 25.
Ratio of lending rate to deposit rate: IFS line 60p divided by IFS line 60l.
M2 / international reserves: IFS line 34 plus 35 converted to dollars (using IFS line ae) divided by IFS line 1L.d.
Domestic credit growth: IFS line 32.
Banks reserves / assets: IFS line 20 divided by the sum of lines 21 and 22a-22g.
Banks foreign liabilities/GDP: IFS line 26c.
Claims on private sector/GDP: IFS line 32d divided by IFS line 99b.
Industrial production change: IFS line 66. If unavailable, then line 66aa.
Inflation (CPI): IFS line 64.
Unemployment: IFS line 67r.
Budget deficit/GDP: IFS line 80 divide by line 99b.
Public debt/GDP: IFS line 88z divided by line 99b.
Interest rate differential: IFS line 60b for the country minus line 60b for USA
US interest rate: IFS line 60b for USA.
Overvaluation of exchange rate: IFS line ae deflated by consumer prices. Deviations from the trend were computed by HP filter.
Banking crisis dummy: Timing for banking crises determined by previous studies.
Liberalisation: Timing for internal and external liberalisation determined by Mahar–Williamson (1998), EBRD's transition reports and Kaminsky et al (2000).
EM index: Standard & Poors / IFC Emerging market index

Exchange rate regimes: We follow the classification by Reinhart and Rogoff (2002), but divide the regimes into three categories (fixed, intermediate and floating); currency board, peg and horizontal band narrower or equal to 2% were classified as fixed regimes; crawling pegs and bands narrower or equal to 5% were classified as intermediate regimes; managed and freely floating were classified as floating regimes. If Reinhart and Rogoff use a freely falling regime (e.g. inflation over 40%), we follow the classification system of IMF country reports.

Table A2 The indicators

	Indicators	**Expected sign**	**Explanation**
Government	Budget balance / GDP	-	Insolvency expectations /credit creation
Finance	Debt / GDP	+	Insolvency expectations / sudden stop
	M2 / Reserves	+	High ratio creates vulnerability
Real sector	Industrial Production	-	Recessions often accompany crisis
+ **traditional**	Unemployment	+	Creates incentives to devalue
	Inflation	+	Lowers demand for pesos
	Domestic credit growth	+	Credit expansion lowers d. for pesos
	Exports	-	Exports create demand for pesos
	Current Account / GDP	-	Surplus creates demand for pesos
	Overvaluation of RER	-	Harms competitiveness
Financial sector	Bank Deposits	-	A bank run induces capital outflows
	Claims on Private Sector/ GDP	+	Measures lending boom / sudden stop
	Banks Foreign Liabilities/ GDP	+	Vulnerable to sudden stops
	Lending rate / Deposit rate	- +	Low ratio signals unprofitable banks Banks increase lending rates in crisis
	Banks Reserves / Assets	-	High ratio indicates bank soundness
	Banking Crisis Dummy	+	BC induces capital outflows
Capital flows	Short-term capital inflows / GDP	+ -	Induce vulnerability Capital inflows are beneficial
	FDI / GDP	-	FDI more stable /increase productivity
	Interest Rate Differential	+ -	Signals devaluation expectation Attracts capital inflows
International	US interest rate	+	High US rates induce capital outflows
	EM index	-	Measures contagion
Others	Fixed exchange rate regime		
	Intermediate exchange rate		
	Liberalisation, internal	+	Post-boom crisis
	Liberalisation, external	+ -	Post-boom crisis Capital inflows can help avoid crisis

Table A3 Number of crises

	Number of crises
Currency crises, 1980-2001	
- 1,5 * st.dev.	263
- 2 * st.dev.	139
- 3 * st.dev.	72
Currency crisis periods	
- entire sample, 1980-2001	78
- before liberalization	42
- after liberalization	36
Banking crises periods	
- entire sample, 1980-2001	40

Table A4 Probit model 1980:1 – 2001:12, currency crises

Random-effects probit					Number of obs = 6828				
Group variable (i) : i					Number of groups = 31			Y = Pr (X=median)	
								0.039	
Random effects u_i ~ Gaussian					Pseudo R2 = 0.164				
								Y = Pr (X=weak)	
					Wald chi2(25) = 754.41			0.238	
Log likelihood = -2496.8887					Prob > chi2 = 0.000				
bop	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]		dy/dx X	X (weak)	
budgetbal	-.0031717	.0033316	-0.95	0.341	-.0097014	0.0033581	0.0058	-5.9	
publicdebt	.0022502	.0006724	3.35	0.001	.0009323	.0035681	0.0449	64.5	***
M2toR	.0099695	.0013993	7.12	0.000	.0072269	.0127121	0.0256	8.3	***
industprod	-.0010737	.0025993	-0.41	0.680	-.0061682	.0040207	0.0005	-1.6	
inflation	.0592954	.005083	11.67	0.000	.0493328	.069258	0.0550	3	***
unempl	.0318399	.0082605	3.85	0.000	.0156496	.0480302	0.0985	10	***
domcred	.0028668	.0013055	2.2	0.028	.000308	.0054257	0.0039	4.4	**
exports	.002004	.0009134	2.19	0.028	.0002137	.0037943	-0.0053	-8.6	**
currentacc	-.0221354	.0045858	-4.83	0.000	-.0311235	-.0131473	0.0377	-5.5	***
RER	-.0272922	.0018561	-14.70	0.000	-.0309301	-.0236544	0.0388	-4.6	***
bankdepo	-.002963	.0031795	-0.93	0.351	-.0091946	.0032687	-0.0002	0.2	
claimspriv	.0081795	.001375	5.95	0.000	.0054845	.0108745	0.1298	51.3	***
banksforliab	.0163276	.0021469	7.61	0.000	.0121197	.0205356	0.0566	11.2	***
lenddeporate	-.080989	.0405752	-2.00	0.046	-.160515	-.0014631	-0.0301	1.2	**
brestoasset	.3005097	.2179622	1.38	0.168	-.1266885	.7277078	0.0037	0.04	
bc	.8415151	.0600343	14.02	0.000	.72385	.9591801	0.3132		***
stcinflow	-.0126551	.0065	-1.95	0.052	-.025395	.0000847	0.0012	-0.3	*
FDI	-.042059	.01132	-3.72	0.000	-.0642458	-.0198723	-0.0026	0.2	***
ratediff	-1.53e-07	7.43e-08	-2.06	0.039	-2.99e-07	-7.58e-09	0.0000	0.7	**
usrate	.0380136	.007109	5.35	0.000	.0240802	.0519469	0.1053	8.95	***
EMindex	-.0074362	.0033403	-2.23	0.026	-.013983	-.0008894	0.0087	-3.8	**
fixedexr	-.0748642	.0669238	-1.12	0.263	-.2060324	.0563041	-0.0225		
intermexr	-.296749	.0533191	-5.57	0.000	-.4012525	-.1922456	-0.1007		***
libinternal	-.1306011	.1107051	-1.18	0.238	-.3475791	.0863768	-0.0385		
libexternal	-.4124916	.1393167	-2.96	0.003	-.6855473	-.139436	-0.1077		***
cons	-2.284031	.1599066	-14.28	0.000	-2.597442	-1.97062			
/lnsig2u	-1.50285	.1291191				-1.7559	1.249781		
sigma_u	.4716939	.0304524				.4156302	.53532		
rho	.1820009	.0192228				.1473022	.222738		
Likelihood ratio test of rho = 0:			chibar2(01) = 274.24		Prob >= chibar2 = 0.000				

One, two and three asterisks denote significance at the 10, 5, and 1 percent levels, respectively. For dummy variables (dy/dx)X is the discrete change from 0 to 1. The values in column X are the weakest quintiles of the variables.

Goodness-of-fit, cut-off prob. 50%

	tranquil	crisis
predicts tranquil	97.98	67.95
predicts crisis	2.02	32.05

Goodness-of-fit, cut-off prob. 25%

	tranquil	crisis
predicts tranquil	91.56	43.59
predicts crisis	8.44	56.41

Note: A pre-crisis period is correctly called when the estimated probability of crisis is above the cut-off during the 12 months window and currency crisis occurs.

Table A5 Probit model 1980:1 – 2001:12, banking crises

Random-effects probit					Number of obs = 6828				
Group variable (i) : i					Number of groups = 31			Y = Pr (X=median)	
								0.0796	
Random effects u_i ~ Gaussian					Pseudo R2 = 0.137				
								Y = Pr (X=weak)	
					Wald chi2(25) = 538.27			0.203	
Log likelihood = -1763.5199					Prob > chi2 = 0.000				
bc	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]		dy/dx X	X (weak)	
budgetbal	0.007724	0.004169	1.85	0.064	-0.000448	0.015895	-0.0129	-5.9	*
publicdebt	0.014633	0.000977	14.98	0.000	0.012718	0.016548	0.2663	64.5	***
M2toR	0.016116	0.001979	8.14	0.000	0.012237	0.019995	0.0377	8.3	***
industprod	-0.005670	0.002628	-2.16	0.031	-0.010820	-0.000520	0.0026	-1.6	**
inflation	-0.013586	0.005693	-2.39	0.017	-0.024744	-0.002427	-0.0115	3	**
unempl	-0.013757	0.008952	-1.54	0.124	-0.031302	0.003789	-0.0388	10	
domcred	-0.001661	0.000439	-3.78	0.000	-0.002521	-0.000800	-0.0021	4.4	***
exports	0.000493	0.001144	0.43	0.666	-0.001748	0.002735	-0.0012	-8.6	
currentacc	0.023817	0.005709	4.17	0.000	0.012628	0.035006	-0.0370	-5.5	***
RER	0.011992	0.001962	6.11	0.000	0.008147	0.015838	-0.0156	-4.6	***
bankdepo	-0.020820	0.004554	-4.57	0.000	-0.029745	-0.011896	-0.0012	0.2	***
claimspriv	0.009847	0.001592	6.19	0.000	0.006726	0.012967	0.1425	51.3	***
banksforliab	-0.021233	0.003126	-6.79	0.000	-0.027360	-0.015106	-0.0671	11.2	***
lenddeporate	-0.468875	0.052998	-8.85	0.000	-0.572750	-0.365000	-0.1587	1.2	***
brestoasset	-0.825377	0.242834	-3.4	0.001	-1.301323	-0.349432	-0.0093	0.04	***
bop	0.868008	0.060531	14.34	0.000	0.749369	0.986647	0.3116		***
stcinflow	-0.004567	0.008220	-0.56	0.578	-0.020677	0.011543	0.0004	-0.3	
FDI	-0.045597	0.013947	-3.27	0.001	-0.072933	-0.018260	-0.0026	0.2	***
ratediff	0.000002	0.000001	2.36	0.018	0.000000	0.000003	0.0000	0.7	**
usrate	-0.003836	0.008983	-0.43	0.669	-0.021442	0.013770	-0.0097	8.95	
EMindex	-0.001288	0.003997	-0.32	0.747	-0.009121	0.006546	0.0014	-3.8	
fixedexr	-0.068328	0.069316	-0.99	0.324	-0.204185	0.067530	-0.0187		
intermexr	0.214466	0.060923	3.52	0.000	0.095059	0.333874	0.0550		***
libinternal	-0.557856	0.155991	-3.58	0.000	-0.863592	-0.252120	-0.1204		***
libexternal	-0.253828	0.128048	-1.98	0.047	-0.504798	-0.002859	-0.0639		**
_cons	-1.342176	0.160723	-8.35	0.000	-1.657187	-1.027164			
/lnsig2u	-0.4010946	0.1066715			-0.6101669	-0.1920223			
sigma_u	0.8182828	0.0436437			0.7370619	0.9084539			
rho	0.4010494	0.0256234			0.3520211	0.4521414			
Likelihood ratio test of rho = 0:			chibar2(01) =504.53		Prob >= chibar2 = 0.000				

One, two and three asterisks denote significance at the 10, 5, and 1 percent levels, respectively. For dummy variables (dy/dx)X is the discrete change from 0 to 1. The values in column X are the weakest quintiles of the variables.

Table A6 Probit model, periods before the liberalisations, currency crises

Random-effects probit					Number of obs = 2671				
Group variable (i) : i					Number of groups = 24			Y = Pr (X=median)	
								0.2086	
Random effects u_i ~ Gaussian					Pseudo R2 = 0.1831				
								Y = Pr (X=weak)	
					Wald chi2(25) = 411.32			0.37	
Log likelihood = -1116.5438					Prob > chi2 = 0.000				
bop	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]		dy/dx X	X (weak)	
budgetbal	0.01275	0.00513	2.49	0.013	0.002698	0.022798	-0.0284	-5.9	**
publicdebt	0.00129	0.00131	0.98	0.326	-0.001278	0.003848	0.0313	64.5	
M2toR	0.00886	0.00170	5.22	0.000	0.005533	0.012179	0.0278	8.3	***
industprod	0.00703	0.00695	1.01	0.312	-0.006591	0.020646	-0.0042	-1.6	
inflation	0.05763	0.00696	8.28	0.000	0.043997	0.071271	0.0653	3	***
unempl	0.13222	0.01897	6.97	0.000	0.095051	0.169392	0.4993	10	***
domcred	0.00388	0.00255	1.52	0.128	-0.001120	0.008880	0.0064	4.4	
exports	0.00074	0.00184	0.4	0.686	-0.002858	0.004346	-0.0024	-8.6	
currentacc	-0.08133	0.00980	-8.3	0.000	-0.100532	-0.062130	0.1689	-5.5	***
RER	-0.02632	0.00250	-10.53	0.000	-0.031222	-0.021426	0.0457	-4.6	***
bankdepo	-0.00015	0.00402	-0.04	0.970	-0.008023	0.007724	0.0000	0.2	
claimspriv	-0.02098	0.00437	-4.81	0.000	-0.029531	-0.012420	-0.4064	51.3	***
banksforliab	0.02344	0.00989	2.37	0.018	0.004050	0.042833	0.0991	11.2	**
lenddeporate	-0.00366	0.08656	-0.04	0.966	-0.173315	0.165995	-0.0017	1.2	
brestoasset	-0.66103	0.29398	-2.25	0.025	-1.237221	-0.084848	-0.0100	0.04	**
bc	0.67350	0.09925	6.79	0.000	0.478971	0.868036	0.2637		***
stcinflow	0.07734	0.02629	2.94	0.003	0.025821	0.128861	-0.0088	-0.3	***
FDI	-0.18978	0.03604	-5.27	0.000	-0.260423	-0.119130	-0.0143	0.2	***
ratediff	-1.54E-07	7.44E-08	-2.07	0.038	-3.00E-07	-8.21E-09	0.0000	0.7	**
usrate	0.03202	0.01105	2.9	0.004	0.010370	0.053672	0.1082	8.95	
EMindex	-0.00168	0.00547	-0.31	0.759	-0.012395	0.009034	0.0024	-3.8	
fixedexr	0.13171	0.10528	1.25	0.211	-0.074637	0.338050	0.0507		
intermexr	-0.46744	0.09098	-5.14	0.000	-0.645765	-0.289115	-0.1580		***
_cons	-1.88376	0.28386	-6.64	0.000	-2.440117	-1.327393			
/lnsig2u	-0.6772258	0.1559094				-0.9828026	-0.371649		
sigma_u	0.7127583	0.0555629				0.6117685	0.8304193		
rho	0.3368808	0.0348289				0.2723361	0.4081426		
Likelihood ratio test of rho = 0:		chibar2(01) = 168.60			Prob >= chibar2 = 0.000				

One, two and three asterisks denote significance at the 10, 5, and 1 percent levels, respectively. For dummy variables (dy/dx)X is the discrete change from 0 to 1. The values in column X are the weakest quintiles of the variables.

Table A7 Probit model, periods after liberalisations, currency crises

Random-effects probit					Number of obs =4157			Y = Pr (X=median)	
Group variable (i) : i					Number of groups = 31			0.0088	
Random effects u_i ~ Gaussian					Pseudo R2 = 0.201			Y = Pr (X=weak)	
								0.3334	
					Wald chi2(25) = 484.00				
Log likelihood = -1126.0823					Prob > chi2 = 0.000			Y = Pr (X=medianB)	
								0.0137	
bop	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]		dy/dx X	X (weak)	
budgetbal	-0.007037	0.005008	-1.41	0.160	-0.0168534	0.002779	0.0151	-5.9	
publicdebt	0.005671	0.001487	3.81	0.000	0.0027557	0.0085859	0.1330	64.5	***
M2toR	0.032898	0.005794	5.68	0.000	0.0215425	0.0442544	0.0993	8.3	***
industprod	0.007339	0.003040	2.41	0.016	0.0013799	0.0132979	-0.0043	-1.6	**
inflation	0.058770	0.011376	5.17	0.000	0.0364737	0.0810654	0.0641	3	***
unempl	0.033431	0.012250	2.73	0.006	0.009421	0.0574403	0.1216	10	***
domcred	0.003059	0.001658	1.84	0.065	-0.0001909	0.0063094	0.0049	4.4	*
exports	0.002188	0.001120	1.95	0.051	-0.00000792	0.004384	-0.0068	-8.6	*
currentacc	-0.000627	0.005921	-0.11	0.916	-0.0122311	0.0109773	0.0013	-5.5	
RER	-0.030433	0.003105	-9.8	0.000	-0.0365191	-0.0243478	0.0509	-4.6	***
bankdepo	0.001642	0.008571	0.19	0.848	-0.0151578	0.0184411	0.0001	0.2	
claimspriv	0.032345	0.002387	13.55	0.000	0.0276667	0.0370225	0.6022	51.3	***
banksforliab	0.021282	0.002305	9.23	0.000	0.0167639	0.0257998	0.0867	11.2	***
lenddeporate	-0.032354	0.047982	-0.67	0.500	-0.1263964	0.0616891	-0.0141	1.2	
brestoasset	2.486667	0.528445	4.71	0.000	1.450934	3.522399	0.0362	0.04	***
bc	0.867673	0.088097	9.85	0.000	0.6950052	1.04034	0.3356		***
stcinflow	-0.018400	0.007122	-2.58	0.010	-0.0323587	-0.0044404	0.0002	-0.3	**
FDI	-0.020130	0.012746	-1.58	0.114	-0.0451117	0.0048526	-0.0015	0.2	
ratediff	-0.000015	0.000014	-1.08	0.280	-0.0000434	0.0000126	0.0000	0.7	
usrate	0.131947	0.015109	8.73	0.000	0.1023333	0.1615597	0.4294	8.95	***
EMindex	-0.011663	0.004809	-2.43	0.015	-0.0210887	-0.0022377	0.0161	-3.8	**
fixedexr	-0.443972	0.117946	-3.76	0.000	-0.6751419	-0.2128014	-0.1425		***
intermexr	0.219100	0.079271	2.76	0.006	0.0637314	0.3744676	0.0754		***
_cons	-5.144122	0.303335	-16.96	0.000	-5.738648	-4.549596			
/lnsig2u	-0.0024231	0.138254			-0.2733959	0.2685497			
sigma_u	0.9987892	0.0690433			0.8722336	1.143707			
rho	0.4993942	0.0345634			0.4320736	0.5667368			
Likelihood ratio test of rho = 0:			chibar2(01) =356.29		Prob >= chibar2 = 0.000				

One, two and three asterisks denote significance at the 10, 5, and 1 percent levels, respectively. For dummy variables (dy/dx)X is the discrete change from 0 to 1. The values in column X are the weakest quintiles of the variables.

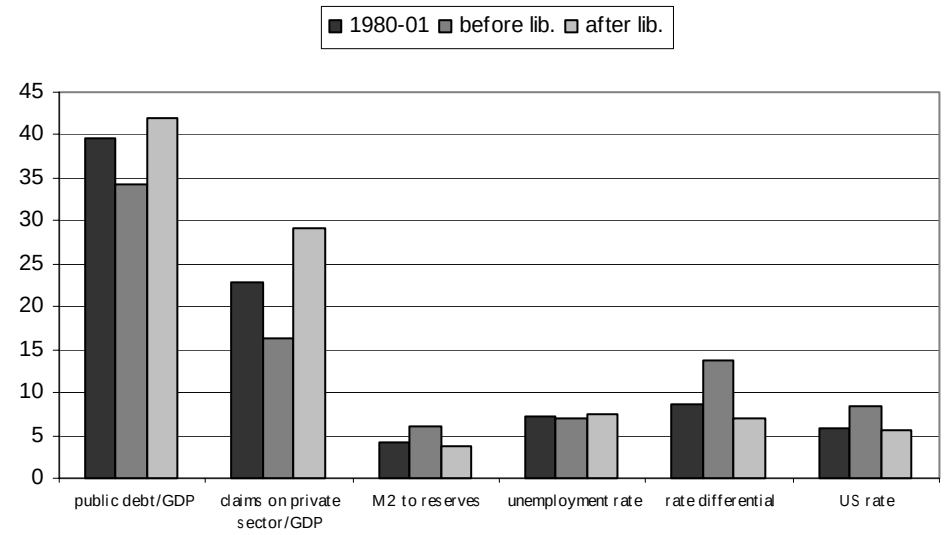
Table A8 Probit model 1980:1 – 2001:12, currency crises, liberalisation lagged

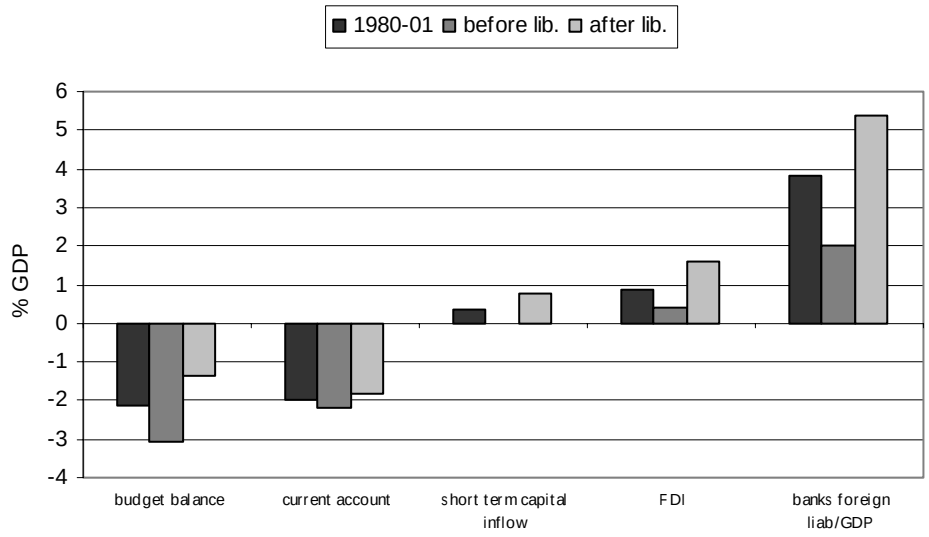
Random-effects probit					Number of obs = 6828				
Group variable (i) : i					Number of groups = 31			Y = Pr (X=median)	
								0.041	
Random effects u_i ~ Gaussian					Pseudo R2 = 0.1653				
								Y = Pr (X=weak)	
					Wald chi2(25) = 754.43			0.252	
Log likelihood = -2493.4654					Prob > chi2 = 0.000				
bop	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]		dy/dx X	X (weak)	
budgetbal	-0.004011	0.003368	-1.19	0.234	-0.010612	0.002591	0.0076	-5.9	
publicdebt	0.001469	0.000707	2.08	0.038	0.000084	0.002854	0.0303	64.5	**
M2toR	0.009087	0.001387	6.55	0.000	0.006368	0.011806	0.0241	8.3	***
industprod	-0.001298	0.002691	-0.48	0.630	-0.006571	0.003976	0.0007	-1.6	
inflation	0.064154	0.005536	11.59	0.000	0.053304	0.075005	0.0615	3	***
unempl	0.035777	0.008261	4.33	0.000	0.019586	0.051969	0.1143	10	***
domcred	0.002842	0.001304	2.18	0.029	0.000286	0.005398	0.0040	4.4	**
exports	0.001869	0.000916	2.04	0.041	0.000074	0.003663	-0.0051	-8.6	**
currentacc	-0.020248	0.004961	-4.08	0.000	-0.029971	-0.010525	0.0356	-5.5	***
RER	-0.027826	0.001916	-14.52	0.000	-0.031580	-0.024071	0.0409	-4.6	***
bankdepo	-0.001983	0.002973	-0.67	0.505	-0.007811	0.003845	-0.0001	0.2	
claimspriv	0.007880	0.001639	4.81	0.000	0.004668	0.011091	0.1291	51.3	***
banksforliab	0.016228	0.002081	7.8	0.000	0.012150	0.020306	0.0580	11.2	***
lenddeporate	-0.076783	0.040278	-1.91	0.057	-0.155727	0.002162	-0.0294	1.2	*
brestoasset	0.115676	0.226067	0.51	0.609	-0.327407	0.558759	0.0015	0.04	
bc	0.862344	0.067064	12.86	0.000	0.730901	0.993787	0.3251		***
stcinflow	-0.013382	0.006401	-2.09	0.037	-0.025928	-0.000837	0.0013	-0.3	**
FDI	-0.039854	0.011279	-3.53	0.000	-0.061961	-0.017748	-0.0025	0.2	***
ratediff	0.000000	0.000000	-1.77	0.076	0.000000	0.000000	0.0000	0.7	*
usrate	0.044422	0.007154	6.21	0.000	0.030401	0.058442	0.1270	8.95	***
EMindex	-0.007416	0.003335	-2.22	0.026	-0.013953	-0.000880	0.0090	-3.8	**
fixedexr	-0.111467	0.070114	-1.59	0.112	-0.248889	0.025954	-0.0342		
intermexr	-0.303795	0.054229	-5.6	0.000	-0.410083	-0.197508	-0.1058		***
libinternal (+2yr.)	0.213167	0.098266	2.17	0.030	0.020570	0.405765	0.0726		**
libexternal (+4,5 yr.)	0.373103	0.099417	3.75	0.000	0.178248	0.567957	0.1320		***
_cons	-2.265001	0.152578	-14.84	0.000	-2.564049	-1.965954			
/lnsig2u	-1.677301	0.1703182			-2.011119	-1.343484			
sigma_u	0.4322935	0.0368137			0.3658399	0.510818			
rho	0.1574532	0.0225947			0.1180405	0.2069377			
Likelihood ratio test of rho = 0:			chibar2(01) = 283.00		Prob >= chibar2 = 0.000				

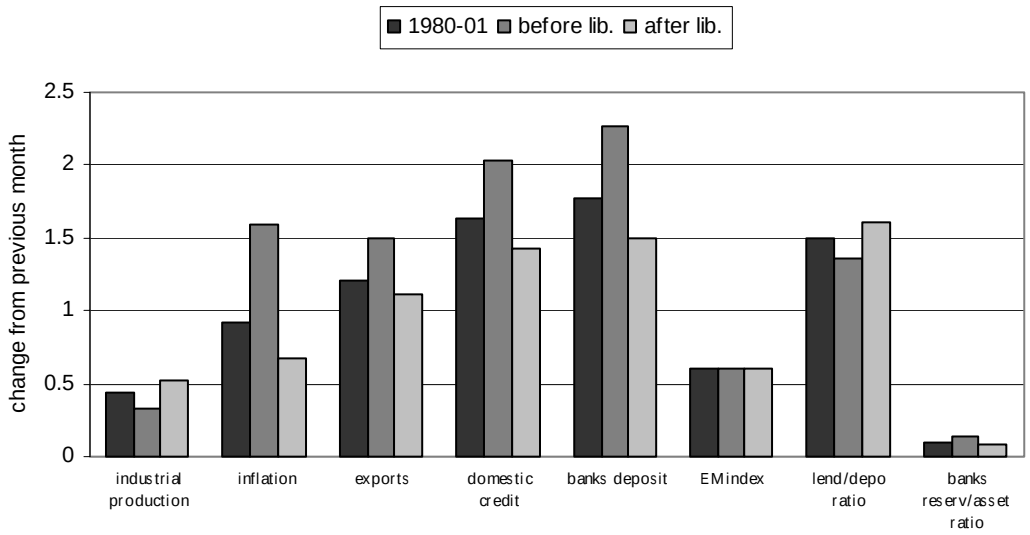
One, two and three asterisks denote significance at the 10, 5, and 1 percent levels, respectively. For dummy variables (dy/dx)X is the discrete change from 0 to 1. The values in column X are the weakest quintiles of the variables.

The internal liberalisation is lagged by two years and the external liberalisation is lagged by four and half years.

Figure A1 The median of indicators







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