ON THE DURATION OF FINANCIAL SYSTEM STABILITY UNDER LIBERALIZATION

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Abstract: This paper represents an econometric attempt to deal with the issue of financial system stability in the framework of duration models, using macroeconomic data. A salient result is that the hazard for stability duration is time increasing. The results also reveal that factors such as real GDP growth, high ratio of net foreign direct investment to GDP are in favor of the persistence of the duration of financial system stability, while high inflation rates, high rate of growth of the share of domestic credit in GDP, the experience of past crisis, and contagion phenomenon imperil it. Moreover, evidence suggests that the existence of explicit deposit insurance system appears to endanger the financial system stability, while a stronger legal environment reinforces the stability duration.

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1. Introduction

The last three decades were marked by waves of financial liberalization, following the influential works of McKinnon (1973) and Shaw (1973). According to them, financial repression, by forcing financial institutions to pay low and often negative real interest rates, reduces private financial savings, and thereby decreasing the resources available to finance capital accumulation. On the contrary, financial liberalization, by easing or lifting interest rates control, lowering compulsory reserve requirements and dismantling entry barriers, reducing government action in banking sector (allocation of credit, ownership of banks and insurance companies, etc.), stimulates domestic savings and economic growth.

However, it is now widely recognized that financial liberalization process has also generated financial and macroeconomic instabilities. Indeed, the recent financial crises as a whole and banking crises, in particular, that have rattled most of the emerging market

economies from Asia, Europe, and South America were deeply related to the process of financial liberalization, and broadly speaking, to financial globalization.

There is a growing body of research that attempts to evaluate econometrically precursors and causes of banking weakness or crisis. Gonzalez-Hermosillo, Pazarbasioglu, and Billings (1997) use an econometric model to predict bank failures using Mexican data for 1991-95. Kaminsky and Reinhart (1997) examine the behavior of various macroeconomic variables during the episodes of crises in a sample of 20 countries.

Demirguc-Kunt and Detragiache (1998) analyze the factors associated with the emergence of systemic banking crisis in a large sample of developed and developing countries in 1980-94 using a multinomial logit model. They show that a crisis tends to erupt when the macroeconomic environment is weak, particularly when growth is low and inflation is high. On the other hand, Demirguc-Kunt and Detragiache (1998) have investigated the connection between financial liberalization and financial fragility using a multinomial model over 53 countries during 1980-95. Their results show that financial liberalization increases the probability of a banking crisis, but less so where the institutional environment is strong.

Hardy and Pazarbasioglu (1999) analyze the determinants and leading indicators of banking crises, by differentiating by region or severity of banking crisis. Their analysis, based on a multinomial model, show that full-blow banking crises are showed to be associated more with external developments, whereas domestic variables are the main indicators of severe but contained banking distress.

Komulainen and Lukkarila (2003) examine the reasons for financial crises in 31 emerging market countries during 1980-2001. They estimate a probit model using 23 macroeconomic and financial sector variables. They find 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 U.S. interest rates influences the occurrence of currency crises in emerging markets.

Notwithstanding the interesting results of previous studies, they do not account for the influence of time on the probability of crises. The present paper is an attempt to fill this gap. To tell things in other words, we investigate how the probability that a crisis occurs, changes over time further to the financial liberalization process. In so doing, we apply the

duration models in analyzing the duration spells of financial system stability in a liberalized environment.

The main results of the present paper are the following. On the one hand, the hazard is time increasing owing to "*financial stability fatigue*", that is maintaining financial stability gets harder over time. On the other hand, macroeconomic fundamentals, contagion phenomenon, structural characteristics, and "bad history" play an important role in the eruption of banking crises.

The remaining of the paper is organized as follows: section 2 sets up the theoretical framework. Section 3 depicts the estimation strategy. Section 4 describes the data set. Section 5 is dedicated to the estimation results, while section 6 concludes the paper.

2. Theory

The twentieth century was characterized by an intensive financial repression. Governments attempted to fix interest rates well below markets levels and to control the allocation of credit through directive or ownership of the banks. Such decisions were not without drawbacks. Indeed, the economic performance of many countries deteriorated progressively under financial repression, financial systems contracted or remained small and, the efficiency of lending and collection and their operations were low. Moreover, financially repressed systems misallocated much of their fund, with credit often flowing to inefficient public enterprises and to favored private borrowers. At the same time, projects with higher returns are squeezed out, use self-finance, or forgo efficient technology. This policy led to a widespread bank insolvency and capital flight. Growth and macroeconomic stability were also impaired.

The work of McKinnon (1973) and Shaw (1973) gave the theoretical foundations for the widespread adoption of financial liberalization and reform measures, in particular in developing countries in the 1980s. The main potential benefit of liberalization for developing countries is the development of their financial system. Indeed, financial liberalization implies financial globalization, which in turn implies more sources of capital and more capital become available to countries to better smooth consumption, funding innovative activities, and increasing the degree of market discipline. In other words, the deregulation of interest rates was intended to increase volatility of interest rates and asset prices, increased

competition in financial services (mobilizing savings, allocating capital funds, monitoring the uses of funds, managing risk), thanks to the entry of foreign banks to local markets, and thereby supporting economic growth.[1]

However, the new freedom often led to an initial scramble to retain or gain market share, with banks seeking new business in unfamiliar territory whose risks they often underestimated. The moral hazard of their behavior was either unconscious or motivated by the presence of implicit or explicit government guarantees to depositors (Caprio, G., Hanson, J.A., and honohan, P., 2001).

As emphasized by Caprio and Summers (1993) and Hellmann, Murdock and Stiglitz (1998), another factor that contribute to moral hazard is the erosion of bank franchise value in a liberalized environment: as monopolistic profits disappear due to increased bank competition, the cost of losing a banking license when the bank becomes insolvent is reduced, and incentives to choose a riskier loan portfolio increase.

Yet financial liberalization by speeds up financial globalization, which can also lead to crises due to imperfections in international financial markets. The imperfections in world financial markets can generate, among other things, credit rationing , bubbles, irrational behavior, herding behavior, speculative attacks, and crashes. Thus a crisis can occur even in country with sound fundamentals, because another country, elsewhere, is experiencing a crisis. This phenomenon is called contagion in the literature. The crises in Latin America (1994), Asia (1997), and Russia (1998) are typical examples of contagion: shocks spread from one country to another. The reasons underlying contagion are manifold. First, given imperfect information, investors who see problems in one country may anticipate the realization of similar events in other countries, and consequently reduce their exposure to these countries. Second, real linkages play an important role through import substitution or upstream effects on suppliers on inputs. Third, financial linkages also play an important role through bank lending and bank and corporate ownership. Fourth, the "wake-up call" hypothesis according to which market participants would seek to reduce their exposure to countries that are seen as having similar vulnerabilities, even in the absence of direct spillovers (Collyns, C. and Kincaid, G.R., 2003). Contagion may also be risen from policies

[1] See also among others, Beck and Levine (2002), King and Levine (1993), Levine (1997),Levine (2000), Levine, Loayza, and Beck (2000), Levine and Zervos (1998).

aimed to stem a crisis – such as competitive devaluations, trade protection, and fiscal tightening.

The empirical literature of contagion was limited and it has been growing since the financial crisis hit the Asian region. Individual papers dealing with the issue have suggested that strong trade linkages, common macroeconomic weakness, important macroeconomic similarities, and financial markets linkages were very much at play in the propagation of crisis from one country to the entire region in Latin America, during the Tequila crisis sparked by the collapse of the Mexican peso in 1994[2], or Asia, during the Asian flu triggered by the collapse of the Thai bath in July 1997[3].

We sum up by emphasizing that interest rates liberalization, like other liberalization goes hand in hand with a greater risk of financial crises, and particularly banking crises. The following section is attributed to the theoretical framework for analyzing the duration spells of financial systems stability.

3. Duration models

3.1 The hazard function

The theoretical framework of the duration models is based on two main functions which are the survivor function and the hazard function. The survivor function is the probability that the random variable T (the spell length for the individual under observation) will equal or exceed t:

$$S(t) = \text{Prob}(T \geq t) = 1 - F(t) \tag{1}$$

$$F(t) = \text{Prob}(T \leq t) = \int_0^t f(s)ds\,, \tag{2}$$

where $f(t)$ is the density function.

[2] Sachs, Tornell and Velasco (1996).
[3] Edwards (2000), Glick and Rose (1999), Rijckeghem and Weder (1999), Forbes and Rigobon (1999), Fratzcher (1998).

The hazard rate is rate at which spells will be completed at duration t, given that they last until t. In other words, the hazard function is the probability that the spell will end in the next short interval time Δ, given it has lasted until time t. The hazard function is[4]

$$\lambda(t) = \frac{f(t)}{S(t)} \tag{3}$$

or[5] $\lambda(t) = \dfrac{-d \ln S(t)}{dt}$ (3')

Another useful function in practice is the integrated hazard function, $\Lambda(t)$:

$$\Lambda(t) = \int_0^t \lambda(s)ds \tag{4}$$

$$S(t) = \exp[-\Lambda(t)] \text{ or } \Lambda(t) = -\ln S(t) \tag{5}$$

Two main methods allow to estimate the hazard rate and the survivor function. There are the nonparametric and parametric methods which are surveyed in the following subsections.

3.2 Nonparametric method

To estimate the hazard rate and the survivor function, the commonly used nonparametric approach is the Kaplan-Meier product limit estimator. Suppose the completed durations in the sample of size n are sorted in ascending order so that $t_1 < t_2 < \ldots < t_K$. The number of completed durations K is less than n because some observations are censored and because of ties (ties occur when two or more observations have the same duration). Let h_k denote the number of spells completed at time t_k, for $k = 1, \cdots, K$; m_k the number of observations censored between t_k and t_{k+1}, and n_k the number of completed spells of duration of at least t_k

$$n_k = \sum_{i \geq k}^{K} (m_i + h_i). \tag{6}$$

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[4] A precise definition in terms of probabilities is $\lambda(t) = \lim_{\Delta \to 0} \text{Prob}(t \leq T < t + \Delta) | T \geq t) / \Delta$

[5] $\lambda = f/S = (dF/dt)/S = (-dS/dt)/S$.

A natural estimator for the hazard function is

$$\hat{\lambda}(t_k) = \frac{h_k}{n_k}, \tag{7}$$

the number of "failures" (number of countries that slip into crisis) at duration t_k divided by the number "at risk" at duration t_k.

The estimator of the cumulated hazard function is then

$$\hat{\Lambda}(t_k) = \sum_{i \le k} \hat{\lambda}(t_i)$$

The estimator of the survivor function is

$$\hat{S}(t_k) = \prod_{i=1}^{k} \frac{n_i - h_i}{n_i} = \prod_{i=1}^{k} (1 - \hat{\lambda}_i), \tag{8}$$

The application of this method to our analysis allows to determine for each period the probability that the financial system be disrupted by the occurrence of a crisis, given that the system has been stable (absence of a crisis) until the preceding period. Estimations may also be performed by stratification and, one can test for the equality of the survivor functions.

However, the Kaplan-Meier approach ignores exogenous variables on which survivor functions may depend. To deal with such an issue, we rescue to the parametric specification analysis that impose a structure (distribution function) on the data.

3.3 Parametric method

The literature offers a wide range of duration models: Exponential, Weibull, Normal, Inverse normal (inverse Gaussian), Gamma and many others[6]. The simpler ones are Exponential, Weibull, Lognormal and Loglogistic, which are presented in appendix 1. The hazard function for the exponential distribution is constant, that for the Weibull is monotonically increasing or decreasing depending on the parameter p, and the hazards for lognormal and loglogistic distributions first increase and then decrease.

[6] See Kalbfleisch and Prentice (1980); Cox and Oakes (1985), and Lancaster (1990).

For the purpose of the present analysis, we focus attention on only the Weibull distribution which, we think, is best suited to our hypothesis. Indeed, intuition might suggest that the longer the duration of financial system stability persists, the less likely a crisis occurs, other things being equal. The same intuition might suggest that the longer the stability duration of financial system persists, the more likely it is that it will end within the next period, by the eruption of a crisis. Thus less financial systems are likely immune to crises. In other words, the hazard for stability duration is either upward or downward slopping.

The Weibull distribution is a two parameter ($\gamma>0$ and $p>0$) family with hazard, survivor, distribution and density functions as follows

$$\lambda(t) = \gamma\, p(\gamma t)^{p-1} \tag{9}$$

$$S(t) = \exp[-(\gamma t)^{p}] \tag{10}$$

$$F(t) = 1 - \exp(-\gamma t^{p}) \tag{11}$$

$$f(t) = \gamma\, p t^{p-1} \exp(-\gamma t^{p}) \tag{12}$$

The hazard function is increasing in duration if $p>1$, decreasing if $p<1$, and constant if $p=1$[7].

To account for the effects of explanatory variables on the hazard function, for a practical matter, we specify

$$\gamma = \exp(\mathrm{X}'\beta), \tag{13}$$

where X is a vector of explanatory variables with unknown parameter β to be estimated. The effect of explanatory variables is to rescale time directly. For this reason, these models are sometimes called "accelerated failure time" or "accelerated lifetime" models.

After a bit of manipulation, (9) and (13) allow us to rewrite the accelerated lifetime models as

$$\ln(t) = \alpha + \mathrm{X}'\beta + \sigma W, \tag{14}$$

where σ is a parameter and W a random variable that follows a Weibull distribution.
In practice it is usual to estimate the parameters by the maximum likelihood. The log-likelihood is

$$\ln L(\theta) = \sum_{i=1}^{n} \delta_i \ln f(t_i, \theta) + \sum_{i=1}^{n} (1-\delta_i) \ln S(t_i, \theta), \tag{15}$$

[7] This case corresponds to the exponential distribution. See appendix 1.

with $\theta = (\gamma, p)$; $\delta_i = 1$ if the i th spell is uncensored and $\delta_i = 0$ if censored.

3.4 Estimation with unobservable heterogeneity[8]

The parametric estimation takes for granted the absence of heterogeneity. Heterogeneity refers to difference remaining in the distributions after controlling for observed effects. The problem of heterogeneity in duration models stems from misspecification, and leads to misinterpretation of the effects of included explanatory variables. Indeed, there exist many unobservable variables that may affect the results. Thus, to handle the problem caused by heterogeneity, we pose a survival function conditioned on the individual specific effect ν_i , that is $S(t_i | \nu_i)$, and add to that a model for the unobserved heterogeneity $f(\nu_i)$. Then, the unconditional distribution is

$$S(t) = E_\nu[S(t|\nu)] = \int_\nu S(t|\nu) f(\nu) d\nu \tag{16}$$

Typically, ν is assumed to have a gamma distribution with mean 1 and variance $\theta = 1/k$. Formally

$$f(\nu) = \frac{k^k}{\Gamma(k)} \exp(-k\nu)\nu^{k-1} \tag{17}$$

and $S(t|\nu) = \exp[-(\nu\gamma t)^p]$. (18)

Then, we can rewrite the unconditional distribution as follows

$$S(t) = \int_0^\infty S(t|\nu) f(\nu) d\nu = \left[1 + \theta(\gamma t)^p\right]^{-1/\theta} \tag{19}$$

To incorporate heterogeneity into the Weibull model, the following hazard function is specified

$$\lambda(t) = \gamma p(\gamma t)^{p-1} [S(t)]^\theta \tag{19}$$

In case where no heterogeneity exists, $\theta = 0$ an $Var[\nu] = 0$. This corresponds to the Weibull hazard.

4. Data

We are interested in examining the duration of the financial system stability under liberalization, that is the liberalization of interest rates. The data set covers 68 countries listed in appendix 2. A country is selected on the basis of the availability of interest rates liberalization dates. The beginning of data collection, which is assumed to be the origin of the financial system stability, is the starting year of interest rate liberalization. The end of data collection is year 2001 so that some spells are right-censored. The banking crises reported in annex 2 are severe banking crises[9]. Countries like Australia, Belgium, Morocco, and Tunisia have experienced any severe banking crises since the liberalization of their interest rates. While countries like Argentina, Brazil, Chile, Indonesia, and Malaysia have experienced, at least, one severe banking crisis.

4.1 Dependent variable

The dependent variable, which we denote *DURATION* , is the duration of the stability spell before a country slipping into a banking crisis. The spells (in years) of stability are recorded in appendix 2. By construction, the shortest spell is one and the longest spell is 21 (censored).

4.2 Exogenous variables

Most of the exogenous variables are collected from the existing literature on banking crises, and are classified as follows:

- *Traditional macroeconomic variables*: these are the growth rate of GDP (GROWTH), the consumer price index (INFLATION), the real interest rate (INTEREST), the share of current account balance in GDP (CAB), and the ratio of export of goods and services to GDP (EXPORT). A higher GROWTH is likely to be in favor of financial system stability through the level of non performing loans. The higher the growth rate, the better the

[8] See Greene, W. (2000)

[9] Countries that experienced bank runs or other substantial portfolio shifts, collapses of financial firms, or other massive government recapitalization are recorded as severe crisis countries (as classified in Lindgren, Garcia, and Saal, 1996).

performance of banks via the reduction of the level of non performing loans. On the other hand, an increase in the interest rate causes a rise in the costs to bank and a decrease in investment, thereby reduces the growth rate. Thus, an excessive jump in the interest rate has a negative effect on banking stability and financial stability as a whole. Indeed, an improvement in CAB and EXPORT, independently, are a priori, favorable to financial system stability (see appendix 5).

• *Banking variables*: the ratio of bank cash and reserves to bank assets (LIQUIDITY), and the growth rate of the share of domestic credit in GDP (CREDIT). An increase in LIQUIDITY reinforces the financial system stability since it allows banks to meet depositors withdrawals and prevent bank runs, whereas a higher CREDIT hurts banking system stability because an over expansion of credit creates bubbles whose burst triggers a crisis (see appendix 5).

• *Capital flows variables*: the ratio of M2 to foreign exchanges reserves captures the vulnerability to sudden capital outflows (M2/RESERVES), and the ratio of net foreign direct investment to GDP (NFDI) captures the inflows of capital favorable to growth and banking stability (see appendix 5).

• *Exchange rate regime variables*: to size the impact of the exchange rate regime (ERR) on financial system stability, we include in the regressions the dummies variables FLEXIBLE, FIXE, and INTERM which stand for flexible, fixed and intermediate exchange rate system, respectively (see appendix 5).

• *Institutional quality variables*: due to the lack of data on banking supervision, we use indexes of institutional quality to capture the effect of banking supervision on financial stability. Indeed, we assume that the stronger the legal environment, the more effective the banking supervision, and the lower the likelihood of banking crises. Hence, BUR, DEM, LAW, and CORRUP stand for the quality of the bureaucracy, the level of democracy, the quality of contract enforcement, and the degree of corruption, respectively (see appendix 5).

• *Other variables of interest*: the neighborhood contagion index, CONTAGION, equals one divided by n_i - the number of countries belonging to the region i -, if a neighboring country has experienced a crisis within the last three years or zero otherwise. This variable captures the extension of a crisis from an initial country to others countries which do not have initially macroeconomic imbalances (high deficit, for instance). The dummy variable

PASTCRISIS equals one if the country has a past experience of crises or zero otherwise. Lastly, the dummy variable DIS takes the value one if the country has an explicit deposit insurance system or zero, in the contrary case (see appendix 5). Lastly, each of the dummy variable DEVELOPED, EMERGING, and DEVELOPING takes the value one or zero if the country in question is developed, emerging or developing.

5. Estimation results

5.1 Nonparametric method

The estimated hazard and survivor functions for the sample of duration (in years) of financial system stability are shown in figure 1 and 2. A quick look at the figures reveals that the hazard- the probability that a country slips into a crisis at time t, given that it has been stable until the preceding period- first, appears to have an upward slope, and then remains constant. In line with an increasing hazard, the survivor function is time decreasing.

The estimates of the hazard and survivor are reported in table 1. For instance, in a financially liberalized environment, the probabilities that any country faces a banking crisis at the end of one year and six years of stability are 10.29 and 39.59 percent, respectively. The same probability is 63.37 percent at the end of thirteen years of stability, and then remains constant.

Figure 1 : Hazard (Kaplan-Meier)

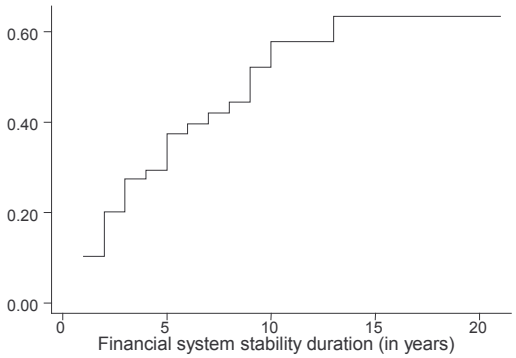


Figure 2 : Survivor (Kaplan-Meier)

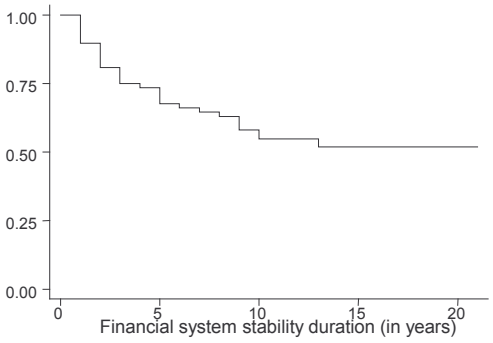


Table 1 : Nonparametric Hazard and Survivor Estimates

Duration in years , t_k	n_k	h_k	Hazard $\hat{\lambda}(t_k)$ (in percent)	$\hat{\Lambda}(t_k)$ (in percent)	Survivor $\hat{S}(t_k)$ (in percent)
1	68	7	10.29	10.29	89.71
2	61	6	9.84	20.13	80.88
3	55	4	7.27	27.40	75.00
4	51	1	1.96	29.36	73.53
5	50	4	8.00	37.36	67.65
6	45	1	2.22	39.59	66.14
7	42	1	2.38	41.97	64.57
8	41	1	2.44	44.41	62.99
9	39	3	7.69	52.10	58.15
10	35	2	5.71	57.81	54.83
11	26	0	0.00	57.81	54.83
12	20	0	0.00	57.81	54.83
13	18	1	5.55	63.37	51.78
14	17	0	0.00	63.37	51.78
15	16	0	0.00	63.37	51.78
16	13	0	0.00	63.37	51.78
17	12	0	0.00	63.37	51.78
19	11	0	0.00	63.37	51.78
20	10	0	0.00	63.37	51.78
21	8	0	0.00	63.37	51.78

Note: n_k is the number of countries "at risk", and h_k is the number of failure at time t_k

The results of Kaplan-Meier analysis sheds light on the evolution of the sample that might contain some differences. To capture these differences that might exist in the sample, we perform the same analysis by subgroups of the durations of financial stability according to some threshold values (arbitrary determined) of a number of abovementioned exogenous variables. Thus we have split the sample into subgroups according to whether GROWTH is greater than 3 percent or not, whether INFLATION is below 15 percent, between 15 and 35 percent, or higher than 35 percent; whether CAB is positive or not, whether EXPORT is higher or lower than 3 percent, whether CREDIT is below or above 4 percent, whether the exchange rate regime is FLEXILE, FIXE or INTERM, whether CORRUP is below or above 3; Indeed, whether each of the dummies CONTAGION, PASTCRISIS, and DIS takes the value one or zero.

Then, we perform log-rank and wilcoxon tests. These tests are appropriate for testing the equality of survivor functions across the subgroups defined above. The null

hypothesis is that the survivor functions of the subgroups are the same. The results are reported in table 3.

The log-rank test statistics show that we reject the null hypothesis that the survivor functions are the same, at 5 percent confidence level, for the stratification based on CREDIT, and at 1 percent significance level, for stratifications based on CONTAGION and PASTCRISIS. On the other hand, the wilcoxon test statistics show that we reject the null hypothesis that the survivor functions are the same for stratifications based on CREDIT, CONTAGION, and PASTCRISIS (at 1 percent confidence level), and CORRUP (at 5 percent confidence level).

Table 2 : Tests for equality for survivor functions across the groups

Stratification Variables	Rank tests			Wilcoxon tests		
	Events observed	Events expected	statistics	Events observed	Events expected	statistics
GROWTH < 3%	15	17,61	$\chi 2(1) = 0,95$	15	17,61	$\chi 2(1) = 0,78$
GROWTH > 3%	16	13,39	$Pr > \chi 2(1) = 0,329$	16	13,39	$Pr > \chi 2(1) = 0,378$
INFLATION < 15%	22	21,99	$\chi 2(1) = 2,86$	18	21,99	$\chi 2(1) = 3,73$
INFL. Between 15-35%	6	4,58	$Pr > \chi 2(1) = 0,239$	6	4,58	$Pr > \chi 2(1) = 0,155$
INFLATION > 35%	11	4,43		7	4,43	
CAB < 0	24	21,01	$\chi 2(1) = 1,41$	24	21,01	$\chi 2(1) = 1,63$
CAB > 0	7	9,99	$Pr > \chi 2(1) = 0,235$	7	9,99	$Pr > \chi 2(1) = 0,202$
EXPORT < 3%	6	6,21	$\chi 2(1) = 0,01$	6	6,21	$\chi 2(1) = 0,02$
EXPORT > 3%	25	24,79	$Pr > \chi 2(1) = 0,922$	25	24,79	$Pr > \chi 2(1) = 0,899$
CREDIT < 4 %	14	22,98	$\chi 2(1) = 6,42^{**}$	14	22,98	$\chi 2(1) = 7,57^{***}$
CREDIT > 4 %	17	8,02	$Pr > \chi 2(1) = 0,011$	17	8,02	$Pr > \chi 2(1) = 0,006$
ERR = FLEXIBLE	20	17,83	$\chi 2(1) = 0,78$	20	17,83	$\chi 2(1) = 0,64$
ERR = FIXED	4	4,12	$Pr > \chi 2(1) = 0,676$	4	4,12	$Pr > \chi 2(1) = 0,724$
ERR = INTERM	7	9,05		7	9,05	
CORRUP < 3	15	11,26	$\chi 2(1) = 2,15$	15	11,26	$\chi 2(1) = 2,94^{*}$
CORRUP > 3	15	18,74	$Pr > \chi 2(1) = 0,143$	15	18,74	$Pr > \chi 2(1) = 0,087$
CONTAGION = 0	8	24,68	$\chi 2(1) = 60,27^{***}$	8	24,68	$\chi 2(1) = 45,77^{***}$
CONTAGION = 1	23	6,32	$Pr > \chi 2(1) = 0,000$	23	6,32	$Pr > \chi 2(1) = 0,000$
PASTCRISIS = 0	4	16,47	$\chi 2(1) = 22,25^{***}$	4	16,47	$\chi 2(1) = 18,74^{***}$
PASTCRISIS = 1	27	14,53	$Pr > \chi 2(1) = 0,000$	27	14,53	$Pr > \chi 2(1) = 0,000$
DIS = 0	11	14,13	$\chi 2(1) = 1,36$	11	14,13	$\chi 2(1) = 1,77$
DIS = 1	23	16,87	$Pr > \chi 2(1) = 0,243$	23	16,87	$Pr > \chi 2(1) = 0,183$

Note: *,**,*** means 10, 5, and 1 percent confidence level, respectively.

Figures 3 through 12 depict the hazard of the subgroups according to the stratification variables. The figures 7, 9, 10, and 11 are those associated with the wilcoxon tests that are judged significant.

Figure 7 shows that the hazard line associated with "CREDIT > 4 percent" is above that of "CREDIT ≤ 4 percent". In other words, countries where the rate of growth in domestic credit exceeds 4 percent are likely to slip into crisis. In addition, the hazard is time increasing. For example, countries where "CREDIT > 4 percent" have a probability of 20 percent to plunge into a crisis at the end of one year of stability, which shift to 77.01 percent at the end of five years of stability[10]. While the corresponding probabilities, for countries where "CREDIT ≤ 4 percent", are 6.25 percent and 22.95 percent for one and five years of completed stability duration, respectively. Thus, there is evidence that the explosion of credit in a liberalized environment is harmful to financial system stability.

Figure 9 reveals that stronger institutions-measured by the level of corruption (CORRUP > 3)- fosters financial stability. For instance, countries with low corruption level (CORRUP > 3) have 17 percent of probability to face a banking crisis at the end of three years of stability. Yet countries with high level of corruption (CORRUP ≤ 3) have 38.19 percent of probability to be hit by a crisis at the end of three years of stability.

Figure 10 reveals that the hazard line for "CONTAGION = $1/n_i$" lies above that of "CONTAGION = 0", which means that countries which have, at least, one neighboring country that has faced a crisis within the last three years are likely to experience a crisis. For a matter of illustration, countries have about 73 percent of probability to experience a crisis at the end of three years of stability if, at least, one neighboring country has slipped into a crisis in the last three years. However, the probability that a country plunges into a crisis at the end of three years of stability is about 13 percent, if any neighboring country has faced a crisis within the last three years.

Figure 11 shows that countries that have experienced a crisis (PASTCRISIS = 1) in the past have a time increasing hazard to slip back into a crisis. For purposes of illustration, the hazard that a crisis erupts in countries which have experienced crises in the past is 62 percent at the end of five years of stability. Yet the same hazard is 11 percent if the country had not experienced a crisis in the past.

On the other hand, let note that the estimated hazards using the stratification based on GROWTH, INFLATION, CAB, EXPORT, ERR, and DIS are not significantly different.

Figure 3 : Hazard (Kaplan-Meier)
Stratification : GROWTH

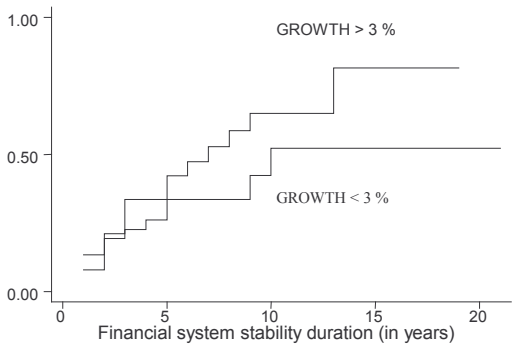


Figure 4 : Hazard (Kaplan-Meier)
Stratification : INFLATION

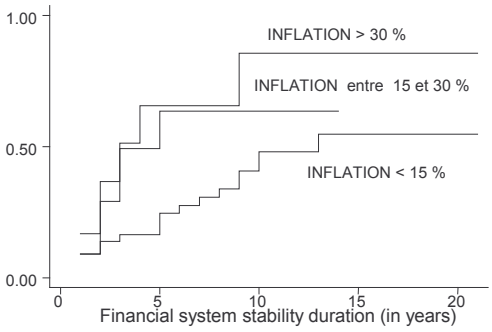


Figure 5 : Hazard (Kaplan-Meier)
Stratification : CAB

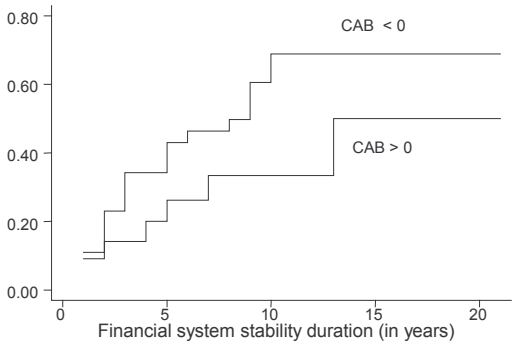


Figure 6 : Hazard (Kaplan-Meier)
Stratification : EXPORT

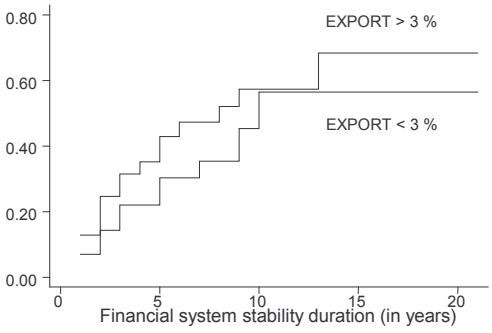


Figure 7 : Hazard (Kaplan-Meier)
Stratification : CREDIT

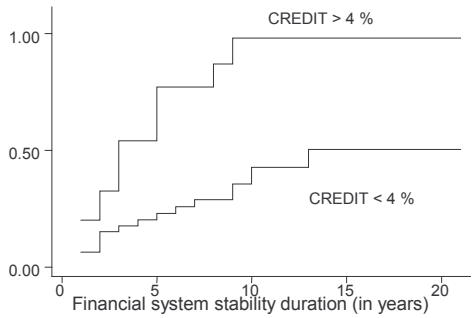


Figure 8 : Hazard (Kaplan-Meier)
Stratification : ERR

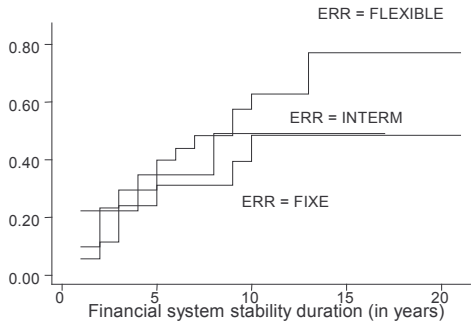


Figure 9 : Hazard (Kaplan-Meier)
Stratification : CORRUP

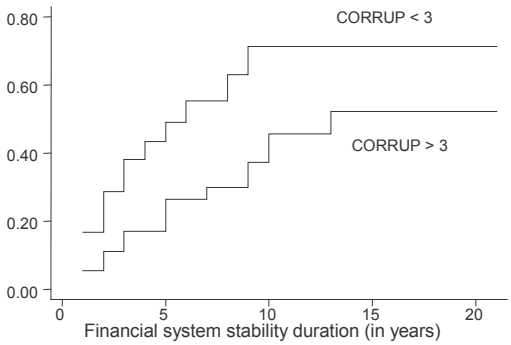


Figure 10 : Hazard (Kaplan-Meier)
Stratification : CONTAGION

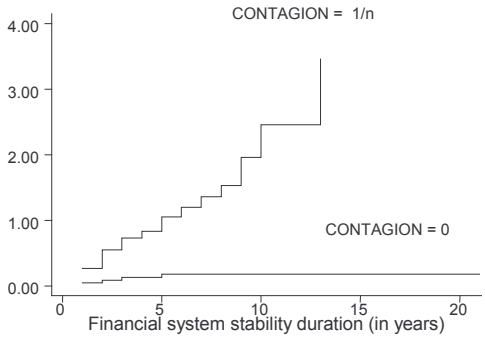


Figure 11 : Hazard (Kaplan-Meier)
Stratification : PASRCRISIS

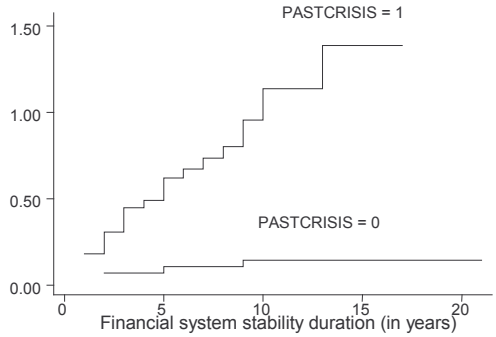
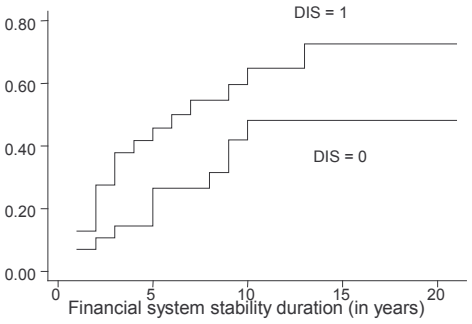


Figure 12 : Hazard (Kaplan-Meier)
Stratification : DIS



To sum up, the present subsection using nonparametric analysis have dealt with the duration of financial system stability. More precisely the analysis shows that the explosion of domestic credit, regional contagion, and the past experience of a crisis are the factors that hurt the stability of financial system, while a stronger legal environment captured by a lower level of corruption contributes to the persistence of the stability. More interestingly, the results also suggest that about every ten years, the world financial system is likely to experience a banking crisis, given that it has been stable during the preceding years.

Although the results seem interesting, the nonparametric method has a limit. Indeed, it does not take into account the interaction effects of the exogenous variables on the

duration of the stability of the financial system or equivalently on the hazard. To tackle this issue, we extend the analysis to the parametric method.

5.2 Parametric method

The present method contrary to the previous poses that the duration of survival (measured in years) depends on fundamentals, which are also measured in years. The survival duration of banks are regressed on all the exogenous variables mentioned above in order to compute the predicted survival hazard function (i.e., the coefficients for the model). The results are reported in table 3. To determine the model that best fits the data, we apply Akaike Information Criterion (AIC) computed as follows

$$AIC = -2(\log - likelihood) + 2(c + m + 1), \tag{20}$$

where c is the number of model covariates and m the number of model-specific ancillary parameters which equals one for the Weibull distribution. The appropriate model is the one that has the minimum value of AIC, that is the model 2.

The results, in accordance with the nonparametric predictions, suggest that the hazard is upward slopping ($p = 1.536 > 1$). The results are also in favor of our hypothesis according to which in a financially liberalized environment the probability that a country be hit by a banking crisis increases as time elapses, since it becomes more integrated with the international financial markets. Indeed, in an increasingly financially integrated world, countries are more prone to crises regardless of their fundamentals. A country with sound fundamentals can experience a crisis due to the contagion phenomenon. Thus, the longer an economy remains stable by devoting much effort to resist to external shocks, the more likely it tumbles in crisis due to "financial stability fatigue" (that is maintaining financial stability gets harder over time). The relevant probability is influenced by exogenous variables which are highlighted in the following paragraphs.

The coefficient of GROWTH is positive and significant at 1 percent confidence level, suggesting that an increase in the rate of real GDP fosters financial system stability. Indeed, the higher the growth rate the lower the level of non performing loans, a factor of vulnerability.

INFLATION has a negative coefficient that is statistically significant at 5 percent confidence level. This result shows that inflation is harmful to financial system stability, owing to the fact that it distorts prices, erodes savings, discourages investment, stimulates capital flight and paralyzes economic growth. Thus, a higher rate of inflation is associated with a lower survival duration of financial system.

We can also notice that the coefficient of CREDIT is significantly negative at 1 percent confidence level, reflecting the detrimental effect of an over-expansion of domestic credit on the stability of the banking system, and the financial system as a whole. Indeed, because of the lack of perfect information, each agent observes the actions of others agents judged well-informed and uses Bayesian updating to derives her own subjective probabilities of future returns for her investment decisions. When the resulting gregarious behavior picks up, it amplifies movements in prices and feeds a bubble that triggers a financial crisis when it bursts.

The coefficient of NFDI is positive and statistically significant at 10 percent confidence level. Thus, the results emphasis that an increase in NFDI helps prolong the duration of financial system stability. This results may be explained by the fact that foreign direct investment, intended to long term investment, are less volatile or speculative than short term capital flows which are prone to sudden outflow. This result highlight the extent to which the kind of capital flow is determinant for the recipient country.

As far as DEM and LAW are concerned, their coefficients are positive and significant at 1 and 10 percent confidence level, respectively. These results are supportive to the significant role that plays a stronger legal environment in sustaining financial system stability. That is, the stronger the legal environment, the longer the survival duration.

More interesting is the statistically significant at 1 percent confidence level and high negative coefficient of CONTAGION, testifying that the phenomenon of contagion plays an important role for the eruption of banking crises. As emphasized above crises can spillover to other countries through real links, financial links, or capital markets imperfections such as herding behavior or panics.

For the purpose of contagion phenomenon illustration, let remind that the Mexican crisis (1994-95) had a significant impact on other Latin American countries (notably Argentina) plus Turkey; the 1997 Thai crisis spread to a number of other countries, notably Indonesia, Korea, Malaysia, and the Philippines; the 1998 Russian crisis led to wave of

market unrest that within a few months threatened a generalized collapse of emerging markets- triggering pressures on Brazil and exacerbate Ukraine's liquidity problems, which were triggered in the wake of Asian crisis (Collyns, C. and Kincaid, G.R., 2003)[11].

Moreover, a "bad history", that is the experience of past crisis, jeopardizes the stability of financial system by increasing the likelihood of crisis or equivalently by reducing the survival duration. This striking result is shown by the negative and significant coefficient of PASTCRISIS. In other words, countries that have experienced a crisis in the past are more likely to face a banking crisis again.

Another salient result is that the coefficient of DIS is negative and significant at 1 percent confidence level. Thus, in contrast to the economic theory according to which deposit insurance system may increase the banking stability by reducing self-fulfilling or information-driven deposit runs, evidence here shows that the existence of explicit deposit insurance system has a damaging effect on the duration of financial system stability. Indeed, deposit insurance system encourages banks to finance high-risk, high-return projects, and consequently leads to more bank failures and thereby to systemic banking crises if risks taken by banks are correlated.

On the other hand, INTEREST and M2/RESERVES have, independently, a negative, but not significant effect on the survival duration. Surprisingly, an improvement in CAB has a negative effect on the survival duration; but this coefficient is not significant. Moreover, fixed exchange rate regime (FIXED) increases the survival duration, while intermediate exchange rate regime (INTERM) appears to increase the failure risk. But these results are not significant. In addition, neither the negative coefficient of EMERGING nor the positive coefficient of DEVELOPING is significant.

[11] It is important to note that due to the geographical situation of Russia and Brazil, in this case, contagion operated via financial markets.

Table 3: Accelerated lifetime model estimations: weibull distribution

Dependent variable: $\ln(DURATION)$

Exogenous variables	Model 1		Model 2	
	coefficients	t student	coefficients	t student
GROWTH	0.127**	2.43	0.130***	2.86
INFLATION*10^{-3}	-0.8374	-1.51	-0.7355**	-2.20
INTEREST	-0.009	-0.70	-0.008	-1.13
CAB	0.016	0.52	-0.010	-0.45
EXPORT	-0.000	-0.02		
LIQUIDITY	0.004	0.14		
CREDIT	-1.199**	-2.00	-1.632***	3.33
M2/RESERVES	-0.009	-0.57	-0.015	-1.27
NFDI	0.055	0.62	0.064*	1.98
FIXED	0.472	0.76	0.318	0.80
INTERM	-0.298	-0.57	-0.764	-1.31
BUR	0.115	0.49		
DEM	0.311***	2.86	0.275***	3.06
LAW	0.053	0.33	0.142*	1.83
CORRUP	-0.047	-0.26		
CONTAGION	-15.268***	-5.09	-16.559***	-5.37
PASTCRISIS	-0.903*	-1.84	-1.197***	-2.91
DIS	-0.658	-1.34	-0.703**	-2.35
EMERGING	-0.049	-0.08		
DEVELOPING	0.746	0.96		
Constante	1.999	1.35	2.354***	3.91
Episodes (crisis)	68 (31)		68 (31)	
Observations	73		73	
p	1.603		1.536	
Log-likelihood	-46.291		-48.591	
Wald test	346.65***		279.68***	
AIC	136.852		129.182	

Note: ***, **, * means significance at 1%, 5%, and 10% confidence level respectively.

5.2.3 Parametric method with unobservable heterogeneity

Table 4 reports the results obtained from Weibull estimation with unobservable heterogeneity control. The results reveal that the parameter θ that captures the presence of unobservable heterogeneity is null, suggesting that there is no unobservable heterogeneity. Moreover, the results are similar to those obtained from the estimations without unobservable heterogeneity control. This may be explained by the fact that the former regressions have included a large number of exogenous variables so that the remaining heterogeneity that is unobservable is negligible.

Table 4: Accelerated lifetime model estimations: weibull distribution with heterogeneity correction

Dependent variable: $\ln(DURATION)$

Exogenous variables	Model 1'		Model 2'	
	coefficients	t student	coefficients	t student
GROWTH	0.127**	2.43	0.130***	2.86
INFLATION*10^{-3}	-0.837	-1.51	-0.735**	-2.20
INTEREST	-0.009	-0.70	-0.008	-1.13
CAB	0.016	0.52	-0.010	-0.45
EXPORT	-0.000	-0.02		
LIQUIDITY	-0.004	-0.14		
CREDIT	-1.199**	-2.00	-1.632***	-3.33
M2/RESERVES	-0.009	-0.57	-0.014	-1.27
NFDI	0.055	0.62	0.064*	1.98
FIXED	0.472	0.76	0.318	0.80
INTERM	-0.298	-0.57	-0.763	-1.31
BUR	0.115	0.49		
DEM	0.311***	2.86	0.275***	3.06
LAW	0.053	0.33	0.142*	1.83
CORRUP	-0.047	-0.26		
CONTAGION	-15.268***	-5.09	-16.559***	-5.37
PASTCRISIS	-0.903*	-1.84	-1.197***	-2.91
DIS	-0.658	-1.34	-0.703***	-2.35
EMERGING	-0.049	-0.08		
DEVELOPING	0.746	0.96		
Constante	1.999	1.35	2.354***	3.91
Episodes (crises)	68 (31)		68 (31)	
Observations	73		73	
p	1.603		1.536	
Heterogeneity θ	0.000		0.000	
Log-vraisemblance	-46.291		-48.591	
Wald test	346.65***		279.67***	
Akaike	136.852		129.182	

Note: ***, **, * means significance at 1%, 5%, and 10% confidence level respectively.

Note that figures in this table differ slightly from that of table 3, beyond three digit number after the comma.

6. Conclusion

The paper has paved the way for future research by tackling the issue of financial system stability in the duration models setting. The results reveal that factors such as real GDP growth, high ratio of foreign direct investment to GDP lengthen the stability duration of financial system, while high inflation rates, over-expansion of domestic credit, and contagion phenomenon imperil it. The results also suggest that structural characteristics such implicit deposit insurance and legal environment play an important role. While the existence of explicit deposit insurance appears to endanger financial system, a stronger legal environment reinforces the stability duration of financial system.

Another striking result is that the hazard for the stability duration is an increasing function of time. A plausible explanation is that financial liberalization favors financial globalization. And, the more an economy becomes integrated with international financial markets, the more it becomes exposed to external shocks and contagion phenomenon. So, the longer it remains stable by devoting much effort to resist to external shocks and contagion phenomenon, the more likely it tumbles into crisis due to "financial stability fatigue".

However, it is important to note that, in this paper, we do not cast doubts on the positive effects of financial liberalization, and broadly speaking, financial globalization. We simply emphasize that the short-circuited stabilities (each lasting about ten years) that experiences the financial system is the cost to grasp these positive effects.

Market participants and policy-makers should not loose sight of the fact that financial system stability is not an everlasting process. Consequently, they should prepare themselves for facing a banking crisis around every ten years. The main challenge for policy-makers is therefore to manage the integration process under liberalization in order to take full advantage of beneficial effects, while minimizing the risks that it carries. To achieve this goal, an international financial coordination in prudential supervision and regulation policies is required. For, under globalization, fewer policy tools are available to individual country's policy-makers.

References

Aghion, P., P. Bacchetta and A. Banerjee, 1999, "Capital Markets and the Instability of Open Economies", in The Asian Financial Crises: Causes, Contagion and Consequences, ed.by P.R. Agenor, M.Miller, D.Vines, A.A. Weber (Cambridge, UK: Cambridge University Press), 167-190.

Ahaony, J. and I. Swary, 1993, "Contagion Effects of Bank Failures: Evidence from Capital Markets", Journal of Business, 56(3), 305-317.

Allen, F. and D. Gale (1998a), "Optimal Financial Crises", Journal of Finance, 53(4), 1245-1284.

Allen, F. and D. Gale (2000), "Financial Contagion", Journal of Political Economy, 108(1), 1-33.

Caprio, G., Hanson, J.A., and Honohan, P. (2001), " Introduction and Overview: The case for Liberalization and Some Drawbacks" in Caprio, G., Honohan, P., and Stiglitz, J.E. (2001) "Financial Liberalization: How Far, How Fast?", Cambridge University Press.

Collyns, C. and Kincaid, G.R. (2003), "Managing Financial Crises: Recent Experience and Lessons for Latin America", Occasional Paper 217 (Washington: International Monetary Fund).

Cox, David R. (1972) "Regression Models and Life Tables", Journal of the Royal Statistical Society, series B 34, 187-220.

————(1975) "Partial Likelihood", Biometrika 62, 269-276.

Demirguc-Kunt, Ash, and Enrica Detragiache, 1998, "Financial Liberalization and Financail Fragility", IMF Working Paper 98/83 (Washington: International Monetary Fund).

Demirguc-Kunt, Ash, and Enrica Detragiache, 1998, "The Dterminants of Banking Crises in Developing and Developed Countries", IMF Staff Papers, No.43, pp.81-109.

Edwards, S. (2000, March), "Contagion" National Bureau Research Paper.

Forbes, K., and and Rigobon, R. (1999), "No contagion, only interdependence: measuring stock market co-movements." NBER Working paper No. 7267.

Garcia, Gillian G.H. (1999), « Deposit Insurance : A survey of actual and Best Pratices » IMF Working Paper WP/99/54.

Glick, R., and Rose, A. (1999), "Contagion and Trade: why are currency crisis regional. Journal of International Money and Finance, 18, 603-617.

Gonzalez-Hermosillo, Brenda, (1999), « Determinants of Ex-Ante Banking System Distress : A Macro-Micro Empirical Exploration of Some Recent Episodes", IMF Working Paper 99/33 (Washington: International Monetary Fund).

Gonzalez-Hermosillo, Brenda, Ceyla Pazarbasioglu, and Robert Billings, 1997, "Determinants of Banking System Fragility: A case study of Mexico", Staff Papers, International Monetary Fund, Vol.44 (Spetember), pp.295-314.

Greene, William, 1990, Econometric Analysis (New York: Macmillan).

Kaminsky, Graciela, and Carmen Reinhart, 1996, "The Twin Crises: The Causes of Banking and Balance of Payments Problems", nternational Finance Discussion Papers No.544 (Washington: Board of Governors of the Federal Reserves System).

Kiefer, Nicholas M (1988), "Economic Duration Data and Hazard Functions", Journal of Economic Literature vol. XXVI, 646-679.

King, R., and Levine, R. (1993), "Finance and Growth: Schumpeter Might Be Right.", Quarterly Journal of Economics, 108: 3, 717-37.

Komulainen, T. and Lukkarila, J. (2003), "What Drives Financial Crises in Emerging Markets?",

Lancaster, Tony (1979) "Econometric Methods for the Duration of Unemployment", Econometrica, July 1979, 47 (4), 939-56.

Levine, Ross (1997), "Financial Development and Economic Growth: Views and Agenda", Journal of Economic Literature, Vol.73 (June), 688-726.

Levine, R. (2000), "International Financial Liberalization and Economic Growth." Review of International Economics, 9:4, 688-702.

Levine, R., Loayza, N., and Beck, T. (2000), "Financial Intermediation and Growth: Causality and Causality.", Journal of Monetary Economics, 46: 1, 31-77.

Levine, R. and Zervos, S. (1998), "Stock Markets, Banks, and Economic Growth." American Economic Review, 88:3, 537-558.

Lindgren Carl-Johan, Gillian Garcia, and Matthew I. Saal, 1996, Bank Soundness and Macroeconomic Policy (Washington: International Monetary Fund).

McKinnon, Ronald I. (1973), "Money and Capital in Economic Development", Washington, D.C: Brookings Institution.

Powell, A., (2002)"Safety-First Monetary and Financial Policies for Emerging Economies" in "Financial Risks, Stability, and Globalization", International Monetary Fund, Washington, D.C. (2002).

Sachs, J., Tormell, A., and Velasco, A. (1996), "Financial crises in emerging markets: the lessons from 1995." NBER Discussion Paper No.5576.

Shaw, Edward S. (1973), "Financial Deepening in Economic Development", New York: Oxford University Press.

Standard & Poor's (2000), "Emerging Stock Markets Factbook 2000.

Van Rijckeghem, C., and Weber, B. (1999), "Sources of contagion: finance or trade", IMF Working paper No. WP/99/146.

Appendix 1: Some survival distributions

Distribution	Hazard Function	Survival Function
Exponential	$\lambda(t)=\gamma$	$S(t)=\exp[-(\gamma t)]$
Weibull	$\lambda(t) = \gamma\, p\, (\gamma t)^{p-1}$	$S(t) = \exp[-(\gamma t)^{p}]$
Log-normal	$\lambda(t)=f(t)/S(t)$, with $f(t)=(p/t)\phi[p\ln(\gamma t)]$	$S(t)=\Phi[-p\ln(\gamma t)]$ $\Phi(\bullet)$ is the standard normal distribution function
Log-logistic	$\lambda(t) = \gamma\, p(\gamma t)^{p-1}/[1+(\gamma t)^{p}]$	$S(t) = 1/[1+(\gamma t)^{p}]$

Note. Source: William, H. Greene (2000), "Econometric Analysis", Fourth Edition.

Appendix 2: Interest rate liberalization, banking crisis dates and episodes of stability

Country Name	Periods of interest rates liberalization 1/	Banking Crisis date 2/	Stability periods	Duration of banking stability	Censored periods (yes=0,no=1)
Algeria	1990-95		1990-2001	11	0
Argentina	1977	1980-82, 1989-90,	1977-1980	3	1
Argentina		1995, 2001	1982-1989	7	1
Argentina			1990-1995	5	1
Argentina			1995-2001	6	1
Australia	1982-95		1982-2001	19	0
Austria	1980-95		1980-2001	21	0
Bangladesh	1984	1980	1984-2001	17	0
Belgium	1986-95		1986-2001	15	0
Botswana	1991		1991-2001	10	0
Brazil	1989	1998-99	1989-1998	9	1
Brazil			1999-2001	2	0
Canada	1980-95		1980-2001	21	0
Chile	1980-95	1981-87	1980-1981	1	1
Chile			1987-2001	14	0
Colombia	1980-95	1982-85	1980-1982	2	1
Colombia			1985-2001	16	0
Congo, Dem. Rep.	1980-95		1980-2001	21	0
Denmark	1981-95		1981-2001	20	0
Ecuador	1986-87, 1992-95		1986-2001	15	0
Egypt, Arab Rep.	1991-95		1991-2001	10	0
El Salvador	1991-95	1989	1991-2001	10	0
Finland	1986-95	1991-94	1986-1991	5	1
Finland			1994-2001	7	0
France	1980-95		1980-2001	21	0

Appendix 2 (continued): Interest rate liberalization, banking crisis dates and episodes of stability

Country Name	Periods of interest rates liberalization 1/	Banking Crisis date 2/	Stability periods	Duration of banking stability	Censored periods (yes=0,no=1)
Gambia, The	1986		1986-2001	15	0
Germany	1980-95		1980-2001	21	0
Ghana	1987		1987-2001	14	0
Greece	1980-95		1980-2001	21	0
Guatemala	1989-95		1989-2001	12	0
Guyana	1991-95	1993-95	1991-1993	2	1
Guyana			1995-2001	6	0
Honduras	1990-95		1990-2001	11	0
Hungary	1990		1990-2001	11	0
India	1991-95	1991-94	1991-1991	1	1
India			1994-2001	7	0
Indonesia	1983-95	1992-94, 1997-98	1983-1992	9	1
Indonesia			1994-1997	3	1
Indonesia			1998-2001	3	0
Ireland	1985-95		1985-2001	16	0
Israel	1990-95		1990-2001	11	0
Italy	1980-95	1990-94	1980-1990	10	1
Italy			1994-2001	7	0
Jamaica	1991-95		1991-2001	10	0
Japan	1985-95	1992-94	1985-1992	7	1
Japan			1994-2001	7	0
Jordan	1988-95	1989-90	1988-1989	1	1
Jordan			1990-2001	11	0
Kenya	1991-95	1993	1991-1993	2	1
Kenya			1994-2001	7	0
Korea, Rep.	1984-88, 1991-95	1980, 1997-98	1984-1997	13	1
Korea, Rep.			1998-2001	3	0
Malaysia	1980-95	1985-88, 1997-98	1980-1985	5	1
Malaysia			1988-1997	9	1
Malaysia			1998-2001	3	0
Mali	1991	1987-89	1991-2001	10	0
Mexico	1989-95	1982, 1994-95	1989-1994	5	1
Mexico			1995-2001	6	0
Morocco	1991-96		1991-2001	10	0
Netherlands	1980-95		1980-2001	21	0
New Zealand	1980, 1984-95		1980-2001	21	0
Nigeria	1990-93	1991-95	1990-1991	1	1
Nigeria			1995-2001	6	0
Norway	1985-95	1987-93	1985-1987	2	1
Norway			1993-2001	8	0
Pakistan	1995		1995-2001	6	0
Papua New Guinea	1980-95	1989-95	1980-1989	9	1

Appendix 2 (concluded): Interest rate liberalization, banking crisis dates and episodes of stability

Country Name	Periods of interest rates liberalization 1/	Banking Crisis date 2/	Stability periods	Duration of banking stability	Censored periods (yes=0,no=1)
Paraguay	1990-95	1995	1990-1995	5	1
Peru	1980-84, 1990-95	1983-90	1980-1983	3	1
Peru			1990-2001	11	0
Philippines	1981-95	1981-87, 1997-98	1981-1981	1	1
Philippines			1987-1997	10	1
Philippines			1998-2001	3	0
Poland	1990		1990-2001	11	0
Portugal	1984-95	1986-89	1984-1986	2	1
Portugal			1986-2001	15	0
Russian Federation	1995	1998	1995-2001	6	0
South Africa	1980	1985	1980-1985	5	1
South Africa			1986-2001	15	0
Spain	1974-81	1977-85	1974-1977	3	1
Spain			1985-2001	16	0
Sri Lanka	1980-95	1989-93	1980-1989	9	1
Sri Lanka			1993-2001	8	0
Sweden	1980-95	1990-93	1980-1990	10	1
Sweden			1993-2001	8	0
Switzerland	1989-95		1989-2001	12	0
Tanzania	1993-95	1988-95	1995-2001	6	1
Thailand	1989-95	1983-87, 1997-98	1989-1997	8	1
Thailand			1998-2001	3	1
Togo	1993-95		1993-2001	8	0
Tunisia	1990-1994		1990-2001	11	0
Turkey	1980-82,1984-95	1982	1980-1982	2	1
Turkey		1991	1982-1991	9	1
Turkey		1994	1991-2001	10	1
Uganda	1991-95		1991-2001	10	0
United Kingdom	1981		1981-2001	20	0
United States	1980-95	1980-92	1980-1980	1	1
United States			1992-2001	9	0
Uruguay	1980-95	1981-85	1980-1981	1	1
Uruguay			1981-2001	20	0
Venezuela, RB	1989-95	1993-95	1989-1993	4	1
Venezuela, RB			1995-2001	6	0
Zambia	1992-95		1992-2001	9	0

Sources. 1/ and 2/ : Demirguc-Kunt, Ash, and Enrica Detragiache (1998), and Lindgren Carl-Johan, Gillian Garcia, and Matthew I. Saal (1996).

Note: Note that only severe crisis dates are reported here. Countries that experienced bank runs or other substantial portfolio shifts, collapses of financial firms, or other massive government recapitalization are recorded as severe crisis countries (Lindgren, Garcia, and Saal, 1996).

Appendix 3: countries, exchange rate regime, and deposit insurance system

Algeria (I, 4), Argentina (II, IV, 3), Australia (I, 1), Austria (II, IV, 6), Bangladesh (III, IV, 4), Belgium (II, IV, 6), Botswana (III, 5), Brazil (I, IV, 3), Canada (I, IV, 7), Chile (III, I, IV, 3), Colombia (I, IV, 3), Congo,D.Rep (I, 5), Denmark (II, IV, 2), Ecuador (III→I, IV, 3), Egypt (III, 4), El Salvador (I→ III, IV, 3), Finland (II, IV, 2), France (II, IV, 6), Gambia (I, 5), Germany (II, IV, 6), Ghana (I, 5), Greece (II, IV, 6), Guatemala (I, 3), Guyana (I, 3), Honduras (I, 3), Hungary (I, IV, 2), India (I, IV, 4), Indonesia (I, 1), Ireland (II, IV, 6), Italy (II, IV, 6), Israel (I, 4), Jamaica (I, 3), Japan (I, IV, 1), Jordan (II, IV, 4), Kenya (I, IV, 5), Korea (I, IV, 1), Malaysia (I, 1), Mali (II, 5), Mexico (I, IV, 3), Morocco (III, 4), Netherlands (II, IV, 6), New Zeeland (I, 1), Nigeria (III→I, IV, 5), Norway (I, IV, 2), Pakistan (I, 4), Papua New Guinea (I, 1), Paraguay (I, 3), Peru (I, IV, 3), Philippines (I, IV, 1), Poland (I, IV, 2), Portugal (II, IV, 6), Russia (I, 2), South Africa (I, 5), Spain (II, IV, 5), Sri Lanka (I→III, 4), Sweden (I, IV, 2), Switzerland (I, IV, 6), Tanzania (I, IV, 5), Thailand (III, I, 1), Togo (II, 5), Tunisia (I, I→III, 4), Turkey(I→III, IV, 2), Uganda (I, IV, 5), United Kingdom (I, IV, 7), United States (I, IV, 7), Uruguay (I→III, 3), Venezuela (III, 3), Zambia (I, 5).

(I) means flexible exchange regime; (II) means fixed exchange rate regime; (III) means intermediate exchange rate regime; (IV) means explicit deposit insurance system; → means shifts from…to…

Sources: (I), (II), and (III) from Powell A. (2000) (IV) from Garcia, Gillian G.H. (1999)

(1), (2), (3), (4), (5), (6), and (7) stand for the respective regions: East Asia and Pacific, Europe (II) and Central Asia, Latin America and the Caribbean, Middle East and North Africa, Sub-Saharan Africa, Europe (I), and North America. Source: our classification.

Appendix 4: Definition and sources of variables included in the regressions

Variables	Definition	Sources
GROWTH	Rate of growth of real GDP	World Development Indicators (2002)
INFLATION	Change in consumer price index	World Development Indicators (2002)
CAB	The of Current account balance to GDP	World Development Indicators (2002)
EXPORT	Ratio of export of goods and services to GDP	World Development Indicators (2002)
LIQUIDITY	Ratio of bank cash and reserves to bank assets	World Development Indicators (2002)
CREDIT	Rate of growth of domestic credit provided by the banking sector	World Development Indicators (2002)
M2/RESERVES	Ratio of M2 to foreign exchange reserves of the Central Bank	World Development Indicators (2002)
NFDI	Ratio of net foreign direct investment to GDP	World Development Indicators (2002)
FLEXIBLE	Flexible exchange rate system	Powell, A., (2002)
FIXE	Fixed exchange rate system	Powell, A., (2002)
INTERM	Intermediated exchange rate system	Powell, A., (2002)
BUR	Bureaucracy index ranging from 0 to 4	International Country Risk Guide (2003)
DEM	Democracy index ranging from 0 to 4	International Country Risk Guide (2003)
LAW	Law and order ranging from 0 to 4	International Country Risk Guide (2003)
CORRUP	Corruption index ranging from 0 to 6	International Country Risk Guide (2003)
CONTAGION	Equals $1/n_i$ (n_i is the number of countries belonging to the same region i), if a neighboring country has experienced a crisis in the last three the years, or zero otherwise	Author
PASTCRISIS	Dummy variable taking the value one if the country has experienced a crisis in the past, or zero otherwise	Author
DIS	Dummy variable taking the value one if the country has an explicit deposit insurance system	Garcia, Gillian G.H. (1999)
DEVELOPED	Dummy variable taking the value one if the country is high income country or zero otherwise.	World Development Indicators (2002)
EMERGING	Dummy variable taking the value one if the country is emerging country or zero otherwise.	Standard & Poor's (2000)
DEVELOPING	Dummy variable taking the value one if the country is developing country or zero otherwise.	World Development Indicators (2002)