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Financial Liberalization and Banking Crisis: A Spatial Panel Model

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Abstract

This paper investigates the determinants of banking system fragility by underlining the impact of bank liberalization on banking stability during the process of financial liberalization in emerging and developed countries. To this effect, we adopted a panel model with spatial dependency from a transmission channel points towards trade interactions to estimate the parameters of the model on a panel of 40 emerging and developed countries during 1989-2010. The empirical results suggest that financial liberalization has the tendency to stimulate the banking instability in economies. Financial liberalization played a significant role in the transmission of the 1996 to 2002 crisis to emerging market economies and also to American and European countries in 2007 crisis. However, credit growth, a negative GDP growth and a high real interest rate are on average the

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most important causes of a banking crisis. Besides we find that the impact of the determinants differ between whole, advanced economies and emerging economies.

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1 Introduction

Many countries around the world have liberalized their financial sectors, particularly during the 1980s and the (1990s), with the aims of improving financial development and economic growth (Tornell et al, 2004; Bekaert et al, 2005). However, financial liberalizations are often followed by reckless lending and severe banking crises. The identification of the causes of banks' behavior is often difficult because financial liberalizations entail several contemporaneous changes.

The empirical research into the causes and consequences of banking crises in emerging countries has only started to draw professional concentration in the last several years. We look at one of the most central policy questions in front of this empirical study, the responsibility of financial liberalization, in its complete effort to present policy makers with recommendation on preventing crises, determining their beginning earlier, and mitigating their adverse effects. Dıaz-Alejandro (1985), in an early working titled ‘‘Goodbye Financial Repression, Hello Financial Crash,’’ explained the relationship between financial liberalization and financial crises founded on his clarification of the Latin American experience—we empirically look at this hypothesized relationship in this document.

All empirical workers that build early warning systems or think the

determinants of crises categorize a narrow set of macro-economic and financial variables that envisage banking crises. One of the most robust outcomes surrounded by this literature is that recent liberalization's domestic financial sector will increase the probability of a banking crisis (the literature is investigated in Arteta and Eichengreen, 2002) and its shock affect on institutional settings, so the economy will be destabilizing (Demirgüç-Kunt and Detragiache, 1999; and Kaminsky and Reinhart, 1999).[3]

However, there is no accessible confirmation on the precise role that financial liberalization plays in the appearance of problems in the banking sector; it is not clear how much the augmented risk to the banking sector is conditional on the form or cadence in which liberalization take place, and, more significantly, what is certainly the sequence of events that leads from liberalization to crises. Whereas there is little formal theoretical effort to elucidate the role of financial liberalization in the emergence of systemic problems in the banking sector, two maintaining (but not mutually exclusive) explanations emerge: henceforth, the 'lax supervision' and 'monopoly power' hypotheses.

In review, liberalization has a tendency to generate advanced growth nevertheless higher volatility in that reason a trade-off probably inherent (Tornell and Westermann, 2005). Indeed, financial liberalization is often followed by a global reorganization process in the banking system that caused an important debate on the impact that consolidation has on financial stability.

In spite of the great number of theoretical and empirical contributions to this area of study, the evaluation of the impact of the increase in stability, which is effected by the global reorganization process of the financial systems and incentives and government programs, on the risks taken by the banks and on the banks' stability which continues to be of great importance.

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[3] Caprio and Klingebiel (1996), Niimi (2000), and Gruben et al. (2003) deduce that banks are much more possible to fail in a liberalized regime than under financial repression.

The main contribution of this paper to the banking crisis literature is that it presents a methodology to test the stability–liberalization relationship for some countries. Empirical methodology of this nature is not furthermore present in the literature. Our empirical contribution is based on spatial panel models, i.e., panel models which explicitly take into account 'spatial' interactions among observed countries with trade channels as primordial transmission mechanisms.

Spatial panel seems particularly well-suited to study the determinants of banking crisis, which by definition can only occur if there are interactions among subjects. Alike if banking crises is due to a transmission, transmission itself can only happen if there are interactions between countries. Interactions can happen at the foreign trade level, where feebleness by one member may have strong consequences for the residual members. A crisis in one country can cause a reduction in income and a corresponding reduction in demand for imports, thereby affecting exports, the trade balance and related economic fundamentals.[4] The interdependence can be the resultant effect of financial linkages. In a region where integration is high, a crisis in one country can have direct financing effects on other countries through trade credit reductions, foreign direct investment and other capital flows.[5]

Our results confirm some previous findings in the literature: spatial panel estimates lend support in favor of the determinants of a banking crisis which explicitly take into account 'spatial' interactions among observed countries with trade channels as primordial transmission mechanisms. We find evidence that macroeconomic factors were significant explanatory variables. Of all macroeconomic variables, the credit growth experienced by several countries seemed to have played the most significant role.

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[4] For a detailed discussion of trade linkages, see Gerlach and Smets (1995), Eichengreen et al. (1996), and Corsetti et al. (2000).

[5] For a detailed discussion on financial linkages see Goldfajn and Valde´s (1997) and Van Rijckeghem and Weder (2001).

This paper is organized as follows. In the next section, we present a brief review of the literature. Section 3 we summarize the spatial panel model and discuss specification methods. Section 4 presents the methodology and data. Section 5 reports the empirical results based on the banking crisis records across 40 countries from 1989 to 2010. Section 6 summarizes the results with concluding remarks.

2 Literature review

Motivated by public policy debates and theoretical predictions, such as Betty and Bailey Jones (2007), the theoretical arguments and country comparisons on the relation between financial liberalization and stability of the banking system are ambiguous. There exist at least two opposing visions, liberalization-stability and liberalization-instability.

In the first point of view, there is a great guidelines literature founded on the traditional view that there are strong arguments and some evidence to argue that financial liberalization is beneficial in the long-term (Ranciere et al., 2003; Tirtiroglu et al., 2005).

In the second point of view, there is a large policy literature based on the conventional view that there is a trade-off between concentration and fragility. This link was noted as early as 1985 in a paper by Diaz-Alejandro (1985). More recently, this episodic evidence has been recently supported by more systematic work that looks into the relation between financial liberalization and financial instability (Fischer and Chenard, 1997).[6] To widen a basic sense for this kind of study, let us illustrate the essential part of what Demirguc_Kunt et Al. (1998) to

[6] Also Goldstein and Turner (1996), in a survey of banking crises in emerging economies, include inadequate preparation for financial liberalization, among the key factors that lead to banking crises.

do. They envisaged the empirical liaison among banking crises and financial liberalization in a panel of 53 states for the period 1980 to 1995 in a multivariate-logit model.

In addition to a set of variables which are accepted as standard predictors of banking crises (economic growth, terms of trade changes, real interest rates, inflation, M2 as percent of international reserves, private sector credit to GDP, ratio of bank liquid reserves to GDP, rate of growth of private sector credit, real GDP per capita). *They find that banking crises are more possible to happen in liberalized financial systems, yet if institutional factors reduce the likelihood of banking crises.*[7]

Both the banking crisis variable and the financial liberalization variable are constructed as dummy variables through them experiment with the exact specification of dummies over time. They do not use the real interest rate as an indicator on the grounds that real interest rates especially when measured ex-post are likely to be affected by a variety of factors that have little to do with the *regulatory framework of financial markets* and can be misleading. For instance, although they argue, a positive correlation among real interest rates and the probability of a banking crisis may simply reflect the fact that both variables tend to be high through economic downturns, whereas financial liberalization shows no responsibility. Some of their key outcomes are reviewed in Tables 2 and 4 in the paper (see Demirguc-Kunt and Detragiache (1998)).

Furthermore, Demirgu¸c-Kunt and Detragiache (2001) finds that, after controlling for a myriad of macroeconomic controls, 'financial liberalization exerts an independent negative effect on the stability of the banking sector, and the magnitude of the effect is not trivial' (p. 98). Apart from the limitations related with such from one side to the other of a nation regressions (Rodrik, 2005), it

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[7] In line with most other research, Barth et al. (1998) find that restrictions on operations of the financial sector increase the long-run likelihood of a banking crisis.

requests to be noted that the financial liberalization variable in their cadre is captured through a 'catchall' dummy variable.

Arteta and Eichengreen (2002) present an extensive review of empirical macroeconomic research on banking crises. They identify a list of macro-economic and financial variables that are establish to be significant in the determination of banking crises.[8] We make use of their list in defining the control variables in our own model. In the last part of their article, they center on financial liberalization as a determinant of crises and find that ''[domestic financial liberalization] enters with a strong positive coefficient which differs from zero at the 99% confidence level, confirming [others'] finding that domestic financial liberalization heightens crisis risk, presumably by facilitating risk taking by intermediaries'' (p. 21).[9] Here, we specifically study whether the mechanism that leads from liberalization to crises is indeed through facilitation of increased 'risk taking by intermediaries'—a question that has not been empirically resolved (or even examined).

More recently, IlanNoy (2004) examine what is identified as one of the principal reasons in the occurrence of banking crises: financial liberalization. As it is typically disputed, if liberalization is accompanied by insufficient prudential supervision of the banking sector, it will result in excessive risk taking by financial intermediaries and a subsequent crisis. Having evaluated the empirical validity of this hypothesis, they argue that such a development is, at worse, only a medium run threat to the health of the banking sector. They find that a more immediate danger is the loss of monopoly power that liberalization typically entails. They base their conclusions on an empirical investigation of a panel-probit model of the occurrence of banking crises using macro-economic, institutional and

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[8] Earlier papers that found the same correlation between liberalization and banking crises are Demirguc-Kunt and Detragiache (1998), and Glick and Hutchison (2001).

[9] In a footnote they state, ''these conclusions are robust to alternative estimation methods.''

political data.

Demirguc-Kunt and Detragiache (2005) have extended their sample until 2002 and with integration of other countries compared with their article in 1998. The number of crisis studied is increased from 31 to 77, this big number of crises ameliorates the robustness of conclusion. In this paper, they presented two fundamental methodologies to find out the determinant of banking fragility: signal approach and multivariate probability model. As a result, they have a better understanding of how systemic bank fragility is influenced by a host of factors, including macroeconomic shocks, the structure of the banking market, broad institutions, institutions specific to credit markets, and political economy variables.

Ranciere et al (2006) envisage the relationship among financial liberalization and crises using one proxy for equity market liberalization and another for relaxation of capital account restrictions. Both financial liberalization variables are associated with higher probabilities of banking and currency crises (twin crises).

Betty and John Bailey (2007) in their paper they extend a dynamic explanation, by forming the evolution of newly-liberalized bank's opportunities and incentives to take on risk over time. The model proves that financial liberalization, in and of itself, contributes to banking crises and that between an initial period of rapid, low-risk growth and a long-run outcome of a safe banking system, banking systems of emerging markets will experience a transitional period with an increased risk of banking crisis.

Finally, Apanard et al. (2010) use a recently updated dataset for financial reforms in 48 countries between 1973 and 2005. They focus on banking crises and argue that they are most likely to occur after some degree, but not full, liberalization. Their empirical results indicate that the relationship between liberalization and banking crises be supported by strongly on the strength of capital regulation and supervision. A rule repercussion is that positive

growth-effects of liberalization can be achieved without increasing the risk of a banking crisis if appropriate institutions are developed.

Overall, this brief survey of the empirical literature suggests that there is no consensus what the relation between financial liberalization and financial stability. To the best of our knowledge, the only paper that tests this relationship is Betty and Bailey Jones (2007). We propose a test for this relationship by using a spatial panel data approach to evaluate the financial liberalization and financial stability. We focus on an emerging market, which is the most important in Latin America, and East Asiatic and developed countries for detecting the last crisis. We discuss the methodology and the data more in depth in the empirical section.

3 Spatial Panel Approach

In this section, we describe spatial panel models, briefly surveying estimation procedures. Our objective is twofold. First, to familiarize the reader with the econometric techniques, most of which have only recently been developed. Secondly, to lay the foundations necessary to motivate the use of spatial panel models in the analysis of banking crises.

As pointed out by Anselin et al. (2008), when specifying spatial dependence among the observations, a spatial panel data model may contain a spatially lagged dependent variable, or the model may incorporate a spatially autoregressive process in the error term. The first model is known as the spatial lag model and the second as the spatial error model. A third model, advocated by Le Sage and Pace (2009), is the spatial Durbin model that contains a spatially lagged dependent variable and spatially lagged independent variables.

Formally, the spatial lag model is formulated as

$$y_{it} = \delta \sum_{j=1}^{N} w_{ij} y_{it} + x_{it}\beta + \alpha + \mu_i \left(optional\right) + \lambda_i \left(optional\right) + \varepsilon_{it} \qquad (1)$$

where y_{it} is the dependent variable for cross-sectional unit i at time t (i=1, ..., N; t=1, ..., T). The variable $\Sigma w_{ji}y_{it}$ denotes the interaction effect of the dependent variable y_{it} with the dependent variables y_{jt} in neighboring units, where w_{ij} is the i, j-th element of a prespecified nonnegative N×N spatial weights matrix W describing the arrangement of the spatial units in the sample. α is the constant term parameter. x_{it} a 1×K vector of exogenous variables, and β a matching K×1 vector of fixed but unknown parameters. ε_{it} is an independently and identically distributed error term for i and t with zero mean and variance σ^2, while μ_i denotes a spatial specific effect and λ_t a time-period specific effect.

In the spatial error model, the error term of unit i, φ_{it}, is taken to depend on the error terms of neighboring units j according to the spatial weights matrix W and an idiosyncratic component ε_{it}, or formally

$$\begin{aligned} y_{it} &= x_{it}\beta + \phi_{it} \\ \phi_{it} &= \rho \sum_{j=1}^{N} w_{ij}\phi_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

where ρ is called the spatial autocorrelation coefficient.

The first step in this methodology is to know if the spatial lag model or the spatial error model is more suitable to explain the data than a model without any spatial interaction effects, one may use Lagrange Multiplier (LM) tests for a spatially lagged dependent variable and for spatial error autocorrelation, as well as the robust LM-tests which test for the existence of one type of spatial dependence conditional on the other.[10] These tests are founded on the residuals of the non-spatial model with spatial fixed effects and follow a chi-squared distribution with one degree of freedom. If a non-spatial model is estimated without any fixed effects or a non-spatial model with both spatial and time-period fixed effects, the residuals of these models can be used instead (Elhorst, 2010). Since the outcomes

[10] A mathematical derivation of these tests for a spatial panel data model with spatial fixed effects can be found in Debarsy and Ertur (2010).

of these tests depend on which effects are included, it is recommended to carry out these LM tests for different panel data specifications.

If we accept spatial lag model or the spatial error model against, evidently, the reject of non-spatial model when adopting these LM tests, one should be careful to support one of these two models. LeSage and Pace (2009, Ch. 6) recommend to think also about the spatial Durbin model. This model extends the spatial lag model with spatially lagged independent variables

$$y_{it} = \delta \sum_{j=1}^{N} w_{ij} y_{jt} + x_{it}\beta + \sum_{j=1}^{N} w_{ij} x_{ijt}\gamma + \varepsilon_{it} \quad (3)$$

where θ, just as β, is a K×1 vector of parameters. This model can then be used to test the hypotheses H_0: θ=0 and H_0: θ+δβ=0. The first hypothesis examines whether the spatial Durbin can be simplified to the spatial lag model and the second hypothesis whether it can be simplified to the spatial error model (Burridge, 1981). Both tests follow a chi-squared distribution with K degrees of freedom. If the spatial lag and the spatial error model are estimated too, these tests can take the form of a Likelihood Ratio (LR) test. If these models are not estimated, these tests can only take the form of a Wald test. LR tests have the disadvantage that they require more models to be estimated, while Wald tests are more sensitive to the parameterization of nonlinear constraints (Hayashi, 2000, p.122).

If both hypotheses H_0: θ=0 and H_0: θ+δβ=0 are rejected, then the spatial Durbin best describes the data. Conversely, if the first hypothesis cannot be rejected, then the spatial lag model best describes the data, provided that the (robust) LM tests also pointed to the spatial lag model. Similarly, if the second hypothesis cannot be rejected, then the spatial error model best describes the data, provided that the (robust) LM tests also pointed to the spatial error model. If one of these conditions is not satisfied, i.e. if the (robust) LM tests point to another model than the Wald/LR tests, then the spatial Durbin model should be adopted. This is because this model generalizes both the spatial lag and the spatial error model.

Lee and Yu (2010) classify that the direct approach will generate, for probably, biased estimates of (some of) the parameters. Starting with a combined spatial lag/spatial error model, also known as the SAC model (LeSage and Pace, 2009, p.32), and using rigorous asymptotic theory, they analytically derive the size of these biases. In this article we adopt the procedure of Lee and Yu (2010) that recommend finding consistent results which is a bias correction procedure of the parameters estimates when adopting the direct approach based on maximizing the likelihood function with the purpose of adopting the transformation approach. In this paper we adopt the bias correction procedure and translate the biases Lee and Yu (2010a) derived for SAC model to successively the appropriate model the spatial lag model, the spatial error model, or the spatial Durbin model.

4 Methodology and data

Our sampling covers the period 1989-2010. The choice of this period depends of two principals' reasons: first represent a period of financial liberalization and second a period which knows the gravest banking crisis. Concerning the construction of our panel, we are limited to 40 emerging and developed countries (Table A2, see Appendix) those affected by banking crisis.

The typical manner of describing banking crisis is based on the dating, which is the binary data, but we adopt none performing Loans as endogenous variable. One cause of the variable use of non-performing loans is the divergence of the empirical work on the causes of banking crises. This is caused by the use of different dates for both the trigger and the resolution of the same crisis. So the quantitative measurement of banking crisis remains problematic for several reasons and this dichotomous data is inappropriate for our approach. An alternative approach, suggested by Caprio and Klingebiel (1996) and Demirgu¸c-Kunt and Detragianche (1997), is to adopt the bank nonperforming

loan (NPL) to proxy for banking crisis. While we follow this suggestion to use NPL as the proxy of banking crisis, we also recognize that the use of the NPL is not without shortcomings.

A list of the variables with their descriptions and their sources is provided in the Table A1. Table A3 presents descriptive statistics for the whole sample. (see Table A1-3, in Appendix).

The list of candidate explanatory variables was inspired by the existing empirical and theoretical literature on baking crisis, concentration on those that are widely available on a timely basis. These variables can be split into two groups. The first group based on the findings of Demirguc-Kunt and Detragiache (2005), Kaminsky and Reinhart (1999) that systemic banking crisis tend to erupt in a weak macroeconomic environment, we construct the variables of the macroeconomic determinants of baking crisis with the definitions and data sources presented in table A1. The second group based on the finding of Demirguc-Kunt and Detragiache (1998), Komulainen and Lukarila (2003), Chang et al. (2008) that affect the health of the banking sector, or which may indicate the advent of such a shock. We experiment with an alternative measure of institutional quality: GDP per capita.

To test whether macroeconomic environment and financial liberalization affect banking system fragility, we use a spatial panel model. We estimate the probability model that a systemic crisis will occur at a particular time in a particular country, while the sign of the estimated coefficient for each explanatory variable indicates whether an increase of that explanatory variable increases or decreases the probability of a crisis.

5 Spatial empirical evidence

This section utilizes the spatial econometrics tools described earlier to analyze the period 1989 to 2010. In its most general form, the selected regression

model is given by:

$$z_{it} = \alpha_i + x'_{it}\beta + \sum_{j=1}^{N} \rho w_{ij} z_{jt} + \varepsilon_{it},$$

$$\varepsilon_{it} \sim N(0,1)$$

Where z is a nonperforming loans variable taking value for any of the 40 countries, x is the controlled variables defined earlier. w_{ij} is exogenously specified n x n lag weights matrices. As suggested earlier, to test for sources of co-movement, we can specify weights matrices based on different concepts of 'neighborhood'. In this article, we utilize an exogenously specifying matrices based on international trade data. Three matrices are created:

(i) Exports-based, (W_X). We register at each *ij*−entry the 1997 exports of i to j. As a convention in the literature, we also normalize each row to sum to 1. Therefore, crises or tranquil episodes elsewhere are weighted by the relative importance of country *j*'s market to country *i*.

(ii) Imports-based, (W_M). To overcome one of Glick and Rose (1998) shortcomings, we create a matrix of the form described in (i), registering instead imports of *i* from *j* at each *ij*−entry.

(iii) Total international trade-based, (W_T). This matrix adds up exports and imports to form the weights.[11]

Table C.1, 2 and 3 reports the estimation results for the different weights matrices, Exports-based, (W_X), imports-based, (W_M) and total international trade-based, (W_T) respectively. While the estimation results for the subsamples of emerging markets, East Asian and Latin America.

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[11] All three matrices are clearly non-symmetrical, reflecting, for example, in case of the United States and Portugal, the fact that Portugal represents a small fraction of the United States total foreign trade, while the United States represents a large fraction of Portugal total foreign trade $(W_{ij} \neq W_{ji})$.

Table B reports the estimation results when adopting a non-spatial panel data model and test results to determine whether the spatial lag model or the spatial error model is more appropriate. When using the classic LM tests, both the hypothesis of no spatially lagged dependent variable and the hypothesis of no spatially auto correlated error term must be rejected at 5% as well as 1% significance, irrespective of the inclusion of spatial and/or time-period fixed effects. When using the robust tests, the hypothesis of no spatially auto correlated error term must still be rejected at 5% as well as 1% significance. However, the hypothesis of no spatially lagged dependent variable can no longer be rejected at 5% as well as 1% significance, provided that time-period or spatial and time-period fixed effects are included.[12] Apparently, the decision to control for spatial and/or time-period fixed effects represents an important issue. (see Table B1-3 in Appendix)

We estimate the following panel model specification:

$$\begin{aligned} NonPerflon_{[\text{¨}country=j,Time=t]} = {} & \beta_0 + \beta_1 \text{Rate GDP growth}_{j,t} \\ & + \beta_2 \text{Terms of trade change}_{j,t} + \beta_3 \text{Real interest rate}_{j,t} \\ & + \beta_4 \text{Inflation rates}_{j,t} + \beta_5 \text{M 2 / reserves}_{j,t} + \beta_6 \text{Depreciation}_{j,t} \\ & + \beta_7 \text{Credit growth}_{j,t} + \beta_8 \text{GDP / CAP}_{j,t} \\ & + \beta_9 \text{Financial Liberalisation}_{j,t} + \varepsilon_{j,t} \end{aligned}$$

To investigate the (null) hypothesis that the spatial fixed effects are jointly insignificant, one may perform a likelihood ratio (LR) test.[13] The results (231.182, with 40 degrees of freedom [df], $p < 0.01$) indicate that this hypothesis must be

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[12] Note that the test results satisfy the condition that LM spatial lag + robust LM spatial error = LM spatial error + robust LM spatial lag (Anselin et al., 1996).

[13] These tests are based on the log-likelihood function values of the different models. Table 1 shows that these values are positive, even though the log-likelihood functions only contain terms with a minus sign. However, since $\sigma^2<1$, we have $-\log(\sigma^2)>0$. Furthermore, since this positive term dominates the negative terms in the log-likelihood function, we eventually have LogL>0.

rejected. Similarly, the hypothesis that the time-period fixed effects are jointly insignificant must be rejected (161.607, 22df, $p < 0.01$). These test results justify the extension of the model with spatial and time-period fixed effects, which is also known as the two-way fixed effects model (Baltagi, 2005). The same results are for model when we introduce We and We+Wi and also for whole sample, advanced economies' and emerging economies' sub-sample.

Up to this point, the test results point to the spatial error specification of the two-way fixed effects model. In view of our testing procedure spelled out in Section 2, we now consider the spatial Durbin specification of the determinant of banking fragility. Its results are reported in columns (1) and (2) of Table C. The first column gives the results when this model is estimated using the direct approach and the second column when the coefficients are bias corrected according to (8). The results in columns (1) and (2) show that the difference between the coefficients estimates of the direct approach and of the bias corrected approach are small for the independent variables (X) and σ^2. By contrast, the coefficients of the spatially lagged dependent variable (WY) and of the independent variables (WX) appear to be quite sensitive to the bias correction procedure. (see Table C1-3 in Appendix)

We estimate the following panel spatial model specification:

$$\begin{aligned} NonPerflon_{[\text{country}=j,\text{Time}=t]} = {} & \mu W_{ij} NonPerflon + \beta_0 + \beta_1 \text{Rate GDP growth}_{j,t} \\ & + \beta_2 \text{Terms of trade change}_{j,t} + \beta_3 \text{Real interest rate}_{j,t} \\ & + \beta_4 \text{Inflation rates}_{j,t} + \beta_5 \text{M 2 / reserves}_{j,t} \\ & + \beta_6 \text{Depreciation}_{j,t} + \beta_7 \text{Credit growth}_{j,t} \\ & + \beta_8 \text{GDP / CAP}_{j,t} + \beta_9 \text{Financial Liberalisation}_{j,t} \\ & + \lambda WX\beta + \varepsilon_{j,t} \end{aligned}$$

To test the hypothesis whether the spatial Durbin model can be simplified to the spatial error model, H0: $\theta+\delta\beta=0$, one may perform a Wald or LR test. The results reported in the second column using the LR test (217.127, 9 df, p=0.000) indicate that this hypothesis must be rejected. Similarly, the hypothesis that the

spatial Durbin model can be simplified to the spatial lag model, H0: $\theta=0$, must be rejected (LR test: 138.534, 9 df, p=0.000). This implies that both the spatial error model and the spatial lag model must be rejected in favor of the spatial Durbin model. The same results' tests are for whole sample, advanced economies' and emerging economies' sub-sample.

In Table C, the third column reports the parameter estimates if we treat μ_i as a random variable rather than a set of fixed effects. Hausman's specification test can be used to test the random effects model against the fixed effects model (see Lee and Yu, 2010 for mathematical details).[14] The results (-31.272, 19 df, $p<0.01$) indicate that the random effects model must be rejected. The same results for model when we introduce We and We+Wi. Another way to test the random effects model against the fixed effects model is to estimate the parameter "phi" (φ^2 in Baltagi, 2005), which measures the weight attached to the cross-sectional component of the data and which can take values on the interval [0,1]. If this parameter equals 0, the random effects model converges to its fixed effects counterpart; if it goes to 1, it converges to a model without any controls for spatial specific effects. We find phi=0.997, with t-value of 0.00, which just as Hausman's specification test indicates that the fixed and random effects models are significantly different from each other.

The results of spatial and time period fixed effects, spatial and time period fixed bias-corrected and random spatial effects, fixed time period effects are presented in table C1-3 for the whole sample, advanced economies' and emerging economies' sub-sample. Results are mostly consistent across these three different samples. For the emerging markets samples, the effect of the interest rate and M2/reserves appears to be significantly weaker than for developed economies and whole sample. For the advanced economies is the effect of inflation rate appears to

[14] Mutl and Pfaffermayr (2010) derive the Hausman test when the fixed and random effects models are estimated by 2SLS instead of ML.

be significantly weaker than for emerging economies and whole sample. This meaning that these variables are robust to sample selection. This result is in line with Jeroen Klamp (2010).

The coefficient for financial liberalization is negative in opposition to Apanard (2010) and strongly significant in the regression for all countries, advanced countries as well as emerging market countries. The maximum probability occurs at an intermediate level of liberalization for both country groups and for all countries. For the emerging countries the maximum probability is much higher than for at a much level liberalization.

An increase of the rate GDP growth, an increase in the credit growth, an increase in the GDP/CAP and an increase of financial liberalization are all found to contribute to the likelihood of a banking crisis and highly significant in all regressions and sub-sample. The results are mostly consistent with the existing literature.

The leading coefficients of explanatory variables of the model space are statistically significant and values are provided with superiority over classic work of authors who have used classical models. This result is not surprising in the light standard panel so that estimates are inconsistent and ineffective in the presence of spatial dependence. It also implies that banking crises are not exclusively explained by contagion, but the domestic macroeconomic fundamentals played a role in the onset of banking crises. For spatial Durbin model specification with spatial and time-period specific effects, also called "two-way fixed effects" (last column of first table), we note that the financial liberalization variable is significant even for the first two models and has a negative effect on the dependent variable explaining banking fragility. Financial liberalization reduces the probability of banking crises in different countries. This result corresponds to what has been developed in the literature with the work of Kalemli-Ozcan et al (2001) showing that macroeconomic risks can focus on certain players or sectors.

According to Samuelson (1994), by increasing microeconomic efficiency

financial liberalization paradoxically increases macroeconomic risks, and this is the paradox of liquidity mentioned by A.Orléan (1999). This result also confirms that obtained by Kaminsky & Schmukler (2003) on a panel of industrialized and emerging countries, which states that financial liberalization has a negative short-term, this effect disappears in the long term once the financial reforms are familiar with the new global finance. And that country achieves sustainable growth and its financial system will become stable. Other empirical studies such as Ranciere et al (2006), Eichengreen & Arteta (2000) and Arricia et al (2005) have shown that financial liberalization is the common cause of banking crises observed over the past two decades.

In addition, the economic growth variable has a negative effect on banking crises. An increase in economic growth reduces the likelihood of banking crises; this corresponds to what has been developed in the literature. Our results corroborate those of Kim & Kenny (2006) and Mah (2006) who found that a high growth rate is a good sign for the whole economy. However, they contradict those obtained by Borio & Lowe (2002) which showed that economic growth could be a source of a banking crisis.

The growth of domestic credit is significant. Consequently, the growth of domestic credit positively affects the bank failure as already confirmed by the economic theory that a credit boom can foster an appreciation of bank fragility. The credits were equally important channels of contagion among others of the financial crisis in the U.S.A economy and other developed and emerging countries if we integrate the last banking crisis.

In a period of euphoria, banks tend to loosen the conditions for granting credits to increase the funding of projects. This was the case of easy credit to households in the subprime mortgage finance and for company, following the opening of many credit lines while stock markets were optimistic. This is confirmed by Berrak thing. Neven T. Valev in their article in 2010, they show that private credit expansion is an important predictor of future banking crises. They

prove this result with a new set of data from developed and emerging private credit which is broken down in the meadows of credit to households and credit of the company. They argue that credit growth increases household debt levels which have a big effect on long-term income. A rapid expansion of household credit generates vulnerabilities that can precipitate a banking crisis. Expansions Credit Company can have the same effect, but it is tempered by the associated increase in income. Its estimates show that the expansion of household credit was statistically significant and economically a predictor of banking crises. The corporate credit expansions are also associated with banking crises, but their effect is weaker and less durable.

The reversal has occurred as soon as the asset value at the base of bank credit has begun to crumble. Some private institutions that have been for so long considered as too big to fail, such as Fannie Mae and Freddie Mac, have been recipients of beneficial economic and financial support from the government, while on September 17, 2008, the U.S. authorities decided to rescue the AIG! Banks as important as the HSBC UK or Swiss UBS announced losses of almost two billion dollars each. On September 18, 2008, the announcement of the nationalization of Northern Rock, after a brief tutelage few months by the English Central Bank, spent the magnitude of the contagion of the financial crisis in Europe. Some authors argue that Europe does not react quickly and in a very cooperative way and each member of Europe seeks its own interest. This was the case of the United States in the 1929 crisis when it tried to get out of the crisis with a very lax regime and to increase the investor confidence because the financial market was incomplete and could not be saved. As such, the public authority appeared as it is usually believed that market mechanisms represent the right systems for allocating capital on the international scale. However this is not true and this reinforces the idea of O. Orléon 2011 that the transfer of real market rules (the general theory of Keynes) to the financial market (theoretical efficiency) is not effective.

It was only towards the end of 2008 that the economic crisis spread to emerging countries, with the backdrop of a fairly noticeable slowdown in growth. The problem was not really the collapse of their financial systems but it was rather the impacts on their domestic production and international trade.

However, the coefficients of the spatial model seems better than the non-spatial model, although this comparison is invalid because the non-spatial model coefficients represent elasticity that is not the case for the spatial model. Besides, the coefficient in the spatial model is not the marginal effect like the effect of financial liberalization on banking fragility, but this is not the case of the spatial model.

The last coefficient in the case of the depreciation variable [W * depreciation] is, at the same time, negative and significant, and it is also a positive and significant variable for financial liberalization [W * Lib].

The information provided by the Spatial Durbin model suggests that bank failures are contagious with the effects of interactions of commercial banks in the network of banks that also governed the interactions for aggregate activity. So the system becomes both more complex and focused in the form of nodes, the network formis described by Alin Kirman (2011) as a network of ants, and the fact that the economy operates in a network leads to problems of contagion so it is interesting to restore confidence to economic agents. It was justified by comparing the SARS epidemic and panic that followed the collapse of Lehman Bras. Thus, the role of weight matrices, exports, imports and trade, provided a significant interaction coefficient and correlated across nations implying that bank failures seem to have special motifs that contain the exchange interactions.

6 Conclusion

We demonstrated that spatial panel models constitute a natural framework to

analyze the determinants of banking crises. Furthermore, if there is spatial dependence, which is expected in the present setting, econometric issues such as inconsistency and inefficiency are dealt with by estimating spatial panel models. Therefore, the estimation of spatial panel models allowed us to overcome several of the shortcomings present in the previous banking crises empirical literature.

Our empirical results seem to lend support to the determinants of banking crises. We use spatial panel data models, among which the spatial lag model, the spatial error model, and the spatial Durbin model extended to include spatial and/or time-period fixed effects or extended to include spatial random effects. Not only is there direct evidence from spatial lag + error and lag models, which formalize the definition of contagion, but also indirect evidence provided by spatial error models. The choice of a predominant transmission channel points towards trade interactions. Contrasting with previous findings, we find evidence that macroeconomic fundamental variables also contributed, either positively or negatively, towards the observed crisis outcomes, with poor growth playing a particularly significant role.

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Appendix

Table A1

Descriptions and sources of the variables

Variable	Description and source
Dependent variable:	
Nonperforming loans (BNONPERLOAN)	*Bank nonperforming loans to total gross loans are the value of nonperforming loans divided by the total value of the loan portfolio (including nonperforming loans before the deduction of specific loan-loss provisions) FMI.
(A) **Macroeconomic determinants of banking crises**	
Rate of growth of real GDP (GROWTH)	*GROWTH is measured as the log difference of GDP time series. The annual GDP time series are complementally from International Financial Statistics (IFS).
Total change (TOTCH)	*Change in terms of trade (and service). Source is WEO.
Real interest rate (REALINT)	*Nominal interest rate minus the contemporaneous rate of inflation. IFS.Where available, nominal rate on short-term government securities. Otherwise, a rate charged by the central bank to domestic banks such as the discount rate; otherwise, the commercial bank deposit interest rate.
Inflation rates (INFLATION)	*Rate of change of the GDP deflator. INFLATION is measured as the rate of change in consumer price indices (CPI), the data are obtained from IFS (line 64). The CPI for Taiwan is derived from Datasream International.
GDP/CAP	*Real GDP per capita (WDI)

(B) **Financial variables**	
M 2/reserves (M2RESERVE)	*Ratio of M2 to foreign exchange reserves of the central bank. M2 is money plus quasi-money (lines 34+35 from the IFS) converted into US$. Reserves are line 1dd of the IFS.
Credit growth (CREDITGROWTH)	*Rate of growth of real domestic credit to private sector. IFS line 32d divided by the GDP deflator (WDI) (all in local currency).
Depreciation (DEPRE)	*Rate of depreciation, IFS: Dollar/local currency exchange rate (line ae).
Financial Liberalisation (Official Liberalization)(LIBFULL)	*Official Liberalization dates, presented in Table 2, are based on Bekaert and Harvey (2002) A Chronology of Important For the liberalizing countries, the associated Official Liberalization indicator takes a value of one when the equity market is officially liberalized and thereafter, and zero otherwise. For the remaining countries, fully segmented countries are assumed to have an indicator value of zero, andfully liberalized countries are assumed to have anindicator value of one.Financial, Economic and Political Events in Emerging Markets, http://www.duke.edu/_charvey/chronology.htm.

Table A2

Countries included

1 Argentine	11 Finland	21 Korea, Rep.	31 South Africa
2 Australia	12 France	22 Malaysia	32 Spain
3 Austria	13 Germany	23 Mexico	33 Sweden
4 Belgium	14 Greece	24 Netherlands	34 Switzerland
5 Brazil	15 India	25 New Zealand	35 Thailand
6 Canada	16 Indonesia	26 Norway	36 Turkey
7 Chile	17 Ireland	27 Peru	37 United Kingdom
8 Colombia	18 Israel	28 Philippines	38 United States
9 Denmark	19 Italy	29 Portugal	39 Uruguay
10 Egypt, Arab Rep.	20 Japan	30 Singapore	40 Venezuela

Table A3

Summary statistics

Variables	NPL	RGDPGR	TTCH	RINT	INFL	M2RES	DEPRECN	CREDLAG2	GDPPC	LIB
Mean	7.532	3.221	0.269	5.124	8.679	12.546	0.119	7.24	14775.94	0.943
Median	4.5	3.265	-0.086	4.126	4.087	5.216	0.05	5.839	5930	1
Maximum	77	18.3	63.244	151.2104	137.964	1116.94	4.255184	115.422	93600	1
Minimum	0.2	-14.3	-29.9568	-70.53	-23.478	0.349	-0.17917	-43.039	245.7656	0
Std. Dev.	8.192	3.477	7.519	15.82	14.775	38.146	0.337	15.045	15925.02	0.22
Skewness	2.289	-0.4352	2.029	3.54	3.752	23.332	7.84	1.367	1.148	-4.03
Kurtosis	11.041	5.674	17.864	36.881	21.209	659.34	84.446	10.7	3.93	17.3
Jarque-Bera	3846.24	355.352	10663.97	53821.24	17423.16	19429202.3	308990	2999.524	276.51	12120.6
Probability	0	0	0	0	0	0	0	0	0	0
Sum	8119.5	3473.14	290.354	5523.94	9356.464	13512.46	128.823	7804.93	15928471.5	1022
Sum Sq. Dev.	72283	13025.7	60899.78	269784.3	235124.39	1565782.35	122.692	243805.37	271342410	53.09
Observations	880	880	880	880	880	880	880	880	880	880

Table B1

Estimation results I-Bank crisis and liberalization: We

Determinants	1 Pooled OLS			2 Spatial fixed effects			3 Time-period fixed effects			4 Spatial and time-period fixed effects		
	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG
Constant	17.047	17.657	18.657									
	[15.754]	[15.864]	[15.897]									
Rate GDP growth	-0.300	-0.134	-0.262	-0.275	-0.175	-0.235	-0.254	-0.194	-0.234	-0.228	-0.128	-0.218
	[-4.481]	[-4.761]	[-4.89]	[-4.073]	[-4.233]	[-4.13]	[-4.020]	[-4.220]	[-4.120]	[-3.570]	[-3.770]	[-3.670]
Terms of trade change	-0.021	-0.031	-0.121	-0.015	-0.025	-0.075	-0.037	-0.037	-0.057	-0.029	-0.049	-0.029
	[-0.721]	[-0.721]	[-0.721]	[-0.500]	[-0.500]	[-0.500]	[-1.317]	[-1.317]	[-1.317]	[-1.046]	[-1.046]	[-1.046]
Real interest rate	-0.014	-1.014	0.014	-0.012	-1.012	-0.013	0.006	0.002	0.004	0.01	0.01	0.02
	[-1.041]	[-1.01]	[-1.321]	[-0.890]	[-1.190]	[-0.990]	[0.413]	[0.313]	[0.402]	[0.715]	[0.709]	[0.725]
Inflation rates	0.000	-3.040	-2.070	0.003	-2.103	-1.03	0.007	0.004	0.005	0.011	0.009	0.01
	[-0.022]	[-0.722]	[-1.122]	[0.19]	[0.59]	[0.42]	[0.425]	[0.525]	[0.425]	[0.693]	[0.793]	[0.693]
M 2/reserves	0.001	0.001	0.11	0.002	0.002	0.12	0.004	0.004	0.014	0.005	0.005	0.015
	[0.23]	[0.23]	[0.33]	[0.343]	[0.343]	[0.443]	[0.806]	[0.806]	[0.706]	[0.893]	[0.893]	[0.793]
Depreciation	-0.985	-0.965	-0.975	-0.863	-0.853	-0.887	-0.238	-0.228	-0.218	-0.045	-0.065	-0.035
	[-1.383]	[-0.283]	[-1.353]	[-1.205]	[-1.125]	[-1.305]	[-0.334]	[-0.234]	[-0.374]	[-0.063]	[-0.073]	[-0.068]
Credit growth	-0.048	0.481	-0.048	-0.051	-0.051	-0.051	-0.043	-0.043	-0.043	-0.046	-0.046	-0.046
	[-3.207]	[-3.96]	[-3.07]	[-3.404]	[-3.404]	[-3.404]	[-3.027]	[-3.027]	[-3.027]	[-3.234]	[-3.234]	[-3.234]
GDP/CAP	-2E-04	-2E-04	-0.001	-2E-04	-2E-04	-0.002	-1E-04	-1E-04	-1E-04	-1E-04	-1E-04	-1E-04
	[-14.161]	[-1.11]	[-1.261]	[-14.134]	[-14.454]	[-13.734]	[-10.513]	[-10.653]	[-9.433]	[-10.374]	[-10.684]	[-10.24]

Table B1 (continued)												
Financial Liberalization	4.958	5.158	1.958	5.253	5.652	1.223	4.339	4.679	2.319	4.664	4.694	1.234
	[-4.808]	[-4.208]	[-4.128]	[-5.099]	[-5.029]	[-4.029]	[-4.073]	[-4.343]	[-4.043]	[-4.378]	[-4.978]	[-3.368]
R 2	0.062	0.064	0.065	0.217	0.218	0.219	0.143	0.144	0.146	0.145	0.147	0.152
LogL	-3666.8	-3665.8	-3664.8	-3653.4	-3653.4	-3653.4	-3588.2	-3588.2	-3588.2	-3572.6	-3572.6	-3572.6
LM spatial lag	38.39	37.29	39.12	39.72	38.42	39.92	4.66	4.46	4.96	4.68	4.58	4.93
LM spatial error	31.21	31.21	31.21	32.43	32.43	32.43	4.19	4.19	4.19	4.51	4.51	4.51
Robust LM spatial lag	7.21	7.21	7.21	7.35	7.35	7.35	0.47	0.47	0.47	0.23	0.23	0.23
Robust LM spatial error	0.03	0.03	0.03	0.06	0.06	0.06	0.17	0.17	0.17	0.06	0.06	0.06

P-values are in the hook. WS: whole sample, AV: Advanced Economics, EME: Emerging Market Economics.

Table B2

Estimation results I-Bank crisis and liberalization: Wi

Determinants	1 Pooled OLS			2 Spatial fixed effects			3 Time-period fixed effects			4 Spatial and time-period fixed effects		
	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG
Constant	17.047	17.657	18.657									
	[15.754]	[15.864]	[15.897]									
Rate GDP growth	-0.300	-0.134	-0.262	-0.275	-0.175	-0.235	-0.254	-0.194	-0.234	-0.228	-0.128	-0.218
	[-4.481]	[-4.761]	[-4.89]	[-4.073]	[-4.233]	[-4.13]	[-4.02]	[-4.22]	[-4.120]	[-3.570]	[-3.770]	[-3.670]
Terms of trade change	-0.021	-0.031	-0.121	-0.015	-0.025	-0.075	-0.037	-0.037	-0.057	-0.029	-0.049	-0.029
	[-0.721]	[-0.721]	[-0.721]	[-0.500]	[-0.500]	[-0.500]	[-1.317]	[-1.317]	[-1.317]	[-1.046]	[-1.046]	[-1.046]

Table B2
(continued)

Real interest rate	-0.014	-1.014	0.014	-0.012	-1.012	-0.013	0.006	0.002	0.004	0.01	0.01	0.02
	[-1.041]	[-1.01]	[-1.321]	[-0.890]	[-1.190]	[-0.990]	[0.413]	[0.313]	[0.402]	[0.715]	[0.709]	[0.725]
Inflation rates	0.000	-3.040	-2.070	0.003	-2.103	-1.03	0.007	0.004	0.005	0.011	0.009	0.01
	[-0.022]	[-0.722]	[-1.122]	[0.19]	[0.59]	[0.42]	[0.425]	[0.525]	[0.425]	[0.693]	[0.793]	[0.693]
M 2/reserves	0.001	0.001	0.11	0.002	0.002	0.12	0.004	0.004	0.014	0.005	0.005	0.015
	[0.23]	[0.23]	[0.33]	[0.343]	[0.343]	[0.443]	[0.806]	[0.806]	[0.706]	[0.893]	[0.893]	[0.793]
Depreciation	-0.985	-0.965	-0.975	-0.863	-0.853	-0.887	-0.238	-0.228	-0.218	-0.045	-0.065	-0.035
	[-1.383]	[-0.283]	[-1.353]	[-1.205]	[-1.125]	[-1.305]	[-0.334]	[-0.234]	[-0.374]	[-0.063]	[-0.073]	[-0.068]
Credit growth	-0.048	0.481	-0.048	-0.051	-0.051	-0.051	-0.043	-0.043	-0.043	-0.046	-0.046	-0.046
	[-3.207]	[-3.96]	[-3.07]	[-3.404]	[-3.404]	[-3.404]	[-3.027]	[-3.027]	[-3.027]	[-3.234]	[-3.234]	[-3.234]
GDP/CAP	-2E-04	-2E-04	-0.001	-2E-04	-2E-04	-0.002	-1E-04	-1E-04	-1E-04	-1E-04	-1E-04	-0.0001
	[-14.16]	[-1.11]	[-1.26]	[-14.13]	[-14.45]	[-13.73]	[-10.51]	[-10.65]	[-9.433]	[-10.37]	[-10.68]	[-10.21]
Financial Liberalization	4.958	5.158	1.958	5.253	5.652	1.223	4.339	4.679	2.319	4.664	4.694	1.234
	[-4.808]	[-4.208]	[-4.128]	[-5.099]	[-5.029]	[-4.029]	[-4.073]	[-4.343]	[-4.043]	[-4.378]	[-4.978]	[-3.368]
R 2	0.062	0.064	0.065	0.217	0.218	0.219	0.143	0.144	0.146	0.145	0.147	0.152
LogL	-3666.8	-3665.8	-3664.8	-3653.4	-3653.4	-3653.4	-3588.2	-3588.2	-3588.2	-3572.6	-3572.6	-3572.6
LM spatial lag	55.92	37.29	39.12	56.9	38.42	39.92	3.24	4.46	4.96	3.53	4.58	4.93
LM spatial error	47.2	41.21	41.25	49.64	42.43	45.43	3.57	4.19	3.19	3.85	3.51	3.91
Robust LM spatial lag	9.27	9.21	9.11	8.32	8.15	8.25	0.001	0.07	0.07	0.006	0.023	0.13
Robust LM spatial error	0.56	0.53	0.63	1.06	1.16	1.21	0.33	0.17	0.17	0.32	0.26	0.29

P-values are in the hook. WS: whole sample, AV: Advanced Economics, EME: Emerging Market Economics.

Table B3

Estimation results I-Bank crisis and liberalization: W_T

Determinants	1 Pooled OLS			2 Spatial fixed effects			3 Time-period fixed effects			4 Spatial and time-period fixed effects		
	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG
Constant	17.047	17.657	18.657									
	[15.754]	[15.864]	[15.897]									
Rate GDP growth	-0.300	-0.134	-0.262	-0.275	-0.175	-0.235	-0.254	-0.194	-0.234	-0.228	-0.128	-0.218
	[-4.481]	[-4.761]	[-4.89]	[-4.073]	[-4.233]	[-4.13]	[-4.020]	[-4.220]	[-4.120]	[-3.570]	[-3.770]	[-3.670]
Terms of trade change	-0.021	-0.031	-0.121	-0.015	-0.025	-0.075	-0.037	-0.037	-0.057	-0.029	-0.049	-0.029
	[-0.721]	[-0.721]	[-0.721]	[-0.500]	[-0.500]	[-0.500]	[-1.317]	[-1.317]	[-1.317]	[-1.046]	[-1.046]	[-1.046]
Real interest rate	-0.014	-1.014	0.014	-0.012	-1.012	-0.013	0.006	0.002	0.004	0.01	0.01	0.02
	[-1.041]	[-1.01]	[-1.321]	[-0.890]	[-1.190]	[-0.990]	[0.413]	[0.313]	[0.402]	[0.715]	[0.709]	[0.725]
Inflation rates	0.000	-3.040	-2.070	0.003	-2.103	-1.03	0.007	0.004	0.005	0.011	0.009	0.01
	[-0.022]	[-0.722]	[-1.122]	[0.19]	[0.59]	[0.42]	[0.425]	[0.525]	[0.425]	[0.693]	[0.793]	[0.693]
M 2/reserves	0.001	0.001	0.11	0.002	0.002	0.12	0.004	0.004	0.014	0.005	0.005	0.015
	[0.23]	[0.23]	[0.33]	[0.343]	[0.343]	[0.443]	[0.806]	[0.806]	[0.706]	[0.893]	[0.893]	[0.793]
Depreciation	-0.985	-0.965	-0.975	-0.863	-0.853	-0.887	-0.238	-0.228	-0.218	-0.045	-0.065	-0.035
	[-1.383]	[-0.283]	[-1.353]	[-1.205]	[-1.125]	[-1.305]	[-0.334]	[-0.234]	[-0.374]	[-0.063]	[-0.073]	[-0.068]
Credit growth	-0.048	481	-0.048	-0.051	-0.051	-0.051	-0.043	-0.043	-0.043	-0.046	-0.046	-0.046
	[-3.207]	[-3.96]	[-3.07]	[-3.404]	[-3.404]	[-3.404]	[-3.027]	[-3.027]	[-3.027]	[-3.234]	[-3.234]	[-3.234]
GDP/CAP	-2E-04	-2E-04	-0.001	-2E-04	-2E-04	-0.002	-1E-04	-1E-04	-1E-04	-1E-04	-1E-04	-0.0001
	[-14.161]	[-1.11]	[-1.261]	[-14.134]	[-14.454]	[-13.734]	[-10.513]	[-10.653]	[-9.433]	[-10.374]	[-10.684]	[-10.214]

Table B3
(continued)

Financial Liberalization	4.958	5.158	1.958	5.253	5.652	1.223	4.339	4.679	2.319	4.664	4.694	1.234
	[-4.808]	[-4.208]	[-4.128]	[-5.099]	[-5.029]	[-4.029]	[-4.073]	[-4.343]	[-4.043]	[-4.378]	[-4.978]	[-3.368]
R 2	0.062	0.064	0.065	0.217	0.218	0.219	0.143	0.144	0.146	0.145	0.147	0.152
LogL	-3666.8	-3665.8	-3664.8	-3653.4	-3653.4	-3653.4	-3588.2	-3588.2	-3588.2	-3572.6	-3572.6	-3572.6
LM spatial lag	63.83	67.29	69.12	65.26	68.42	69.42	1.76	1.46	2.56	1.8	1.58	1.63
LM spatial error	51.97	51.21	51.05	54.7	52.13	55.23	2.12	2.09	2.49	2.26	2.51	3.11
Robust LM spatial lag	12.1	12.21	12.01	11.15	11.05	11.05	0.03	0.07	0.07	0.03	0.023	0.13
Robust LM spatial error	0.23	0.33	0.43	0.59	0.46	0.341	0.39	0.27	0.25	0.43	0.36	0.31

P-values are in the hook. WS: whole sample, AV: Advanced Economics, EME: Emerging Market Economics.

Table C1

Estimation results II-Bank crisis and liberalization: We

Determinants	1			2			3		
	Spatial and time period effects			Spatial and time-period fixed effects bias-corrected			Random spatial effects, fixed time-period effects		
	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG
W*Npl	0.272	1.332	0.232	-0.166	-0.096	-0.236	-0.136	-0.076	-0.064
	[5.254]	[5.634]	[5.154]	[-2.643]	[-2.833]	[-2.142]	[-2.195]	[-2.125]	[-2.545]
Rate GDP growth	-0.245	-0.655	-1.245	-0.23	-0.43	-1.12	-0.038	-0.128	-0.238
	[-3.737]	[-4.137]	[-3.217]	[-3.493]	[-4.193]	[-3.213]	[-3.493]	[-4.113]	[-3.313]
Terms of trade change	-0.02	-0.016	-0.032	-0.032	-0.027	-0.042	0.005	0.004	0.007
	[-0.695]	[-0.765]	[-0.745]	[-1.117]	[-1.237]	[-1.137]	[0.382]	[0.452]	[0.342]
Real interest rate	0.004	0.094	0.003	0.010	0.090	0.020	0.010	0.080	0.030
	[0.297]	[1.97]	[0.137]	[0.677]	[1.677]	[0.577]	[0.581]	[1.881]	[0.761]
Inflation rates	0.005	-2.435	-1.250	0.016	-1.236	-1.012	0.004	-1.042	-1.012
	[0.349]	[0.569]	[2.332]	[0.889]	[0.799]	[0.856]	[0.880]	[1.320]	[1.780]
M 2/reserves	0.003	0.01	0.14	0.005	0.04	0.15	0.004	0.04	0.11
	[0.579]	[0.869]	[1.769]	[0.904]	[1.104]	[1.814]	[0.661]	[1.631]	[1.751]
Depreciation	-0.537	0.167	0.456	-0.094	-0.004	-0.014	-0.258	0.158	1.238
	[-0.751]	[-1.675]	[-0.871]	[-0.125]	[-1.125]	[-1.435]	[-0.356]	[-1.326]	[-1.656]
Credit growth	-0.054	-6.034	-2.054	-0.044	-4.034	-2.056	-0.041	-4.041	-3.021
	[-3.693]	[-4.563]	[-3.953]	[-2.995]	[-4.935]	[-3.691]	[-2.932]	[-4.432]	[-3.912]
GDP/CAP	-1E-04	-0.0001	-0.0001	0.001	0.001	0.001	-1E-04	-1E-04	-1E-04
	[-11.57]	[-10.67]	[-12.54]	[-9.847]	[-9.237]	[-10.457]	[-10.347]	[-11.327]	[-10.07]
Financial Liberalization	5.358	6.438	4.368	4.669	6.629	4.039	4.344	6.214	4.604
	[-5.194]	[-7.54]	[-6.234]	[-4.188]	[-7.708]	[-6.128]	[-4.022]	[-7.122]	[-6.032]
W*Rate GDP growth	-0.126	-0.216	-0.132	0.063	0.042	0.085	0.076	0.042	0.085
	[-0.715]	[-0.615]	[-0.825]	[0.254]	[0.764]	[0.874]	[0.317]	[0.764]	[0.874]

Table C1 (continued)

W*Terms of trade change	0.317	0.311	0.318	0.029	0.031	0.039	0.012	0.031	0.039
	[1.268]	[1.348]	[1.561]	[0.341]	[1.321]	[1.521]	[0.154]	[1.321]	[1.521]
W*Real interest rate	-0.096	-0.196	-0.136	0.016	0.011	0.01	0.001	0.011	0.001
	[-2.657]	[-3.645]	[-2.677]	[0.300]	[0.321]	[0.399]	[0.033]	[0.032]	[0.031]
W*Inflation rates	0.022	0.021	0.024	0.03	0.029	0.035	0.024	0.024	0.034
	[0.989]	[0.999]	[0.789]	[0.796]	[0.896]	[0.745]	[0.660]	[0.660]	[0.760]
W*M 2/reserves	0.001	0.001	0.001	0.005	0.005	0.005	0.007	0.007	0.007
	[0.117]	[0.127]	[0.137]	[0.364]	[0.378]	[0.398]	[0.565]	[0.345]	[0.674]
W*Depreciation	-3.114	-3.214	-3.344	-0.874	-0.854	-0.864	-0.265	-0.275	-0.243
	[-3.132]	[-3.782]	[-3.672]	[-0.456]	[-0.356]	[-0.557]	[-0.143]	[-0.244]	[-0.247]
W*Credit growth	0.028	0.138	0.098	0.012	0.212	0.032	0.008	0.128	0.145
	[1.054]	[1.754]	[1.254]	[0.353]	[1.653]	[0.873]	[0.246]	[0.342]	[0.321]
W*GDP/CAP	-0.004	-0.04	-0.014	0.001	0.01	0.03	0.828	0.622	0.548
	[-1.144]	[-1.234]	[-1.344]	[0.184]	[1.284]	[1.144]	[1.256]	[1.316]	[1.426]
W*Financial Liberalization	2.756	2.856	2.796	3.137	3.217	3.137	1.574	1.844	2.534
	[1.636]	[1.746]	[1.676]	[-1.017]	[-1.127]	[-1.457]	[-0.527]	[-1.127]	[-1.347]
phi							0.996	0.996	0.996
							[0.00]	[0.00]	[0.00]
Sigma 2	48.577	48.677	48.435	46.83	46.93	46.23	67.714	67.434	68.712
R 2	0.275	0.315	0.285	0.346	0.316	0.254	0.149	0.229	0.157
Corrected R2	0.127	0.147	0.154	0.061	0.071	0.076	0.127	0.117	0.137
LogL	-3625	-3635	-3525	-3570	-3571	-3570	-3585	-3587	-3585
LR_spatial_lag	142.64	143.62	144.57	142.63	141.73	143.64	104.23	105.24	104.95
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.004]	[0.004]	[0.004]
LR_spatial_error	208.98	215.95	212.57	208.97	212.57	210.67	108.01	109.00	107.02
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.003]	[0.003]	[0.003]

P-values are in the hook. WS: Whole sample, AV: Advanced Economics, EME: Emerging Market Economics

Table C2

Estimation results II-Bank crisis and liberalization: Wi

Determinants	1 Spatial and time period effects			2 Spatial and time-period fixed effects bias-corrected			3 Random spatial effects, fixed time-period effects		
	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG
W*Npl	0.295	1.412	0.312	0.439	0.396	0.136	-0.261	-0.056	-0.124
	[5.339]	[5.534]	[5.254]	[9.535]	[4.833]	[3.132]	[-3.187]	[-2.115]	[-2.523]
Rate GDP growth	-0.241	-0.625	-1.145	-0.227	-0.42	-1.131	-0.246	-0.122	-0.254
	[-3.689]	[-4.247]	[-3.547]	[-3.492]	[-4.153]	[-3.234]	[-3.879]	[-4.123]	[-3.311]
Terms of trade change	-0.017	-0.016	-0.032	-0.019	-0.027	-0.042	-0.064	0.004	0.003
	[-0.601]	[-0.765]	[-0.745]	[-0.669]	[-1.237]	[-1.137]	[-1.147]	[0.452]	[0.431]
Real interest rate	0.002	0.094	0.003	-0.001	-0.060	-0.030	-0.014	-0.060	0.021
	[0.164]	[1.97]	[0.137]	[-0.103]	[1.667]	[0.585]	[-1.20]	[1.881]	[0.732]
Inflation rates	0.008	-1.425	-1.310	0.013	-1.242	-1.041	-0.018	-1.041	-1.013
	[0.492]	[0.569]	[2.332]	[0.798]	[0.799]	[0.826]	[-1.528]	[1.320]	[1.7420]
M 2/reserves	0.003	0.01	0.14	0.004	0.09	0.16	0.006	0.03	0.13
	[0.639]	[0.869]	[1.769]	[0.773]	[1.104]	[1.814]	[0.872]	[1.631]	[1.641]
Depreciation	-0.381	0.167	0.216	-0.608	-0.004	-0.324	-0.138	0.158	1.428
	[-0.521]	[-1.675]	[-0.871]	[-0.829]	[-1.125]	[-1.435]	[2.548]	[-1.326]	[-1.526]
Credit growth	-0.053	-5.024	-3.014	-0.045	-4.014	-2.226	-0.026	-4.121	-3.142
	[-3.617]	[-4.213]	[-3.313]	[-3.100]	[-4.335]	[-3.631]	[-2.954]	[-4.132]	[-3.422]
GDP/CAP	-0.001	-0.0020	-0.0030	-0.0001	0.001	0.001	-0.001	-0.0001	-1E-04
	[-11.115]	[-11.57]	[-12.14]	[-10.764]	[-9.127]	[-10.47]	[-10.43]	[-11.37]	[-11.27]
Financial Liberalization	5.514	6.218	4.318	4.157	6.549	4.012	4.042	6.414	4.653
	[-5.339]	[-7.54]	[-6.234]	[-4.103]	[-7.708]	[-6.145]	[-3.775]	[-7.122]	[-6.212]

Table C2 (continued)

W*Rate GDP growth	-0.179	-0.306	-0.172	0.287	0.082	0.097	0.488	0.212	0.081
	[-0.938]	[-0.615]	[-0.825]	[1.230]	[0.765]	[0.871]	[2.554]	[0.762]	[0.971]
W*Terms of trade change	1.432	0.354	0.418	0.315	0.061	0.049	0.071	0.035	0.038
	[-0.513]	[1.348]	[1.561]	[2.012]	[1.621]	[1.522]	[0.226]	[1.331]	[1.211]
W*Real interest rate	-0.084	-0.136	-0.126	-0.093	0.021	0.02	-0.112	0.014	0.003
	[-2.124]	[-3.645]	[-2.677]	[-0.729]	[0.541]	[0.519]	[-0.920]	[0.042]	[0.032]
W*Inflation rates	-0.112	-0.031	-0.027	-0.096	0.029	0.035	-0.100	0.024	0.033
	[-1.616]	[0.989]	[0.749]	[-1.00]	[0.896]	[0.745]	[-1.090]	[0.660]	[0.742]
W*M 2/reserves	0.017	0.005	0.005	0.008	0.007	0.007	0.017	0.008	0.009
	[1.548]	[0.378]	[0.398]	[0.595]	[0.345]	[0.674]	[1.548]	[0.349]	[0.694]
W*Depreciation	-3.07	-3.231	-3.354	-2.544	-2.154	-2.894	20.897	15.275	10.246
	[1.583]	[-3.782]	[-3.672]	[-2.803]	[-0.826]	[-0.547]	[2.305]	[-0.948]	[-0.947]
W*Credit growth	-0.06	-0.128	-0.148	0.041	0.312	0.052	0.075	0.118	0.142
	[-1.066]	[1.754]	[1.254]	[0.502]	[1.253]	[0.871]	[0.960]	[0.343]	[0.311]
W*GDP/CAP	-1.066	-1.14	-1.024	0.579	0.65	0.73	0.163	0.212	0.318
	[1.128]	[-1.234]	[-1.344]	[0.711]	[1.294]	[1.142]	[0.206]	[1.116]	[1.431]
W*Financial Liberalization	4.059	4.926	4.896	11.020	12.237	11.132	5.025	5.814	5.532
	[2.204]	[1.746]	[1.676]	[8.186]	[-1.127]	[-1.457]	[0.531]	[-1.542]	[-1.247]
phi							0.996	0.996	0.996
							[9.657]	[9.657]	[9.657]
Sigma 2	48.166	48.677	48.435	50.43	46.93	46.23	68.003	67.434	68.712
R 2	0.315	0.325	0.296	0.316	0.317	0.252	0.229	0.231	0.155
Corrected R2	0.128	0.147	0.154	0.07	0.071	0.076	0.128	0.117	0.137
LogL	-3623	-3635	-3527	-3652	-3581.1	-3580	-1555	-3587	-3595
LR_spatial_lag	146.365	142.624	143.53	146.365	142.83	143.63	110.62	112.23	104.21
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.007]	[0.004]	[0.004]
LR_spatial_error	218.535	215.846	212.58	218.535	211.57	210.67	114.03	109.00	108.03
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.004]	[0.003]	[0.003]

P-values are in the hook. WS: whole sample, AV: Advanced Economics, EME: Emerging Market Economics.

Table C3

Estimation results II-Bank crisis and liberalization: W_T

Determinants	1 Spatial and time period effects			2 Spatial and time-period fixed effects bias-corrected			3 Random spatial effects, fixed time-period effects		
	WS	ADV	EMG	WS	ADV	EMG	WS	ADV	EMG
W*Npl	0.102	1.112	0.211	-0.532	-0.596	-0.146	0.102	0.096	0.123
	[1.037]	[1.234]	[2.254]	[-4.435]	[-4.823]	[-3.432]	[1.037]	[1.115]	[1.323]
Rate GDP growth	-0.234	-0.315	-0.315	-0.249	-0.321	-0.221	-0.215	-0.128	-0.274
	[-3.612]	[-4.217]	[-3.521]	[-3.226]	[-4.052]	[-3.438]	[-3.740]	[-4.145]	[-3.421]
Terms of trade change	-0.044	-0.036	-0.052	-0.046	-0.037	-0.032	-0.044	-0.004	-0.003
	[-0.767]	[-0.765]	[-0.845]	[-0.800]	[-1.237]	[-1.21]	[-0.767]	[0.482]	[0.731]
Real interest rate	-0.027	-0.194	0.003	-0.029	-0.16	-0.03	-0.027	-0.19	0.021
	[-2.226]	[1.98]	[0.137]	[-2.327]	[1.767]	[0.785]	[-2.226]	[1.871]	[0.782]
Inflation rates	-0.031	-1.498	-1.11	-0.032	-1.542	-1.031	-0.031	-1.011	-1.003
	[-2.548]	[1.769]	[2.332]	[-2.547]	[1.994]	[1.826]	[-2.548]	[1.420]	[1.640]
M 2/reserves	0.008	0.01	0.17	0.003	0.04	0.12	0.008	0.03	0.13
	[1.077]	[0.962]	[1.859]	[0.432]	[1.102]	[1.912]	[1.077]	[1.631]	[1.641]
Depreciation	8.18	1.167	0.916	7.097	0.004	0.324	8.18	0.158	1.428
	[2.969]	[1.675]	[0.871]	[2.528]	[1.725]	[1.455]	[2.969]	[1.856]	[1.936]
Credit growth	-1.053	-3.024	-1.014	-1.043	-4.014	-2.226	-1.036	-4.121	-3.142
	[-3.63]	[-4.213]	[-3.313]	[-2.995]	[-4.335]	[-3.631]	[-2.991]	[-4.132]	[-3.422]

Table C3 (continued)

GDP/CAP	-0.001	-0.002	-0.003	-0.018	0.001	0.001	-0.018	-1E-04	-1E-04
	[-10.898]	[-11.57]	[-12.14]	[-1.543]	[-9.127]	[-10.47]	[-10.40]	[-11.37]	[-11.27]
Financial Liberalization	5.471	6.218	4.318	4.718	6.549	4.012	4.584	6.414	4.653
	[-5.315]	[-7.54]	[-6.234]	[-4.131]	[-7.308]	[-6.142]	[-3.985]	[-7.182]	[-6.012]
W*Rate GDP growth	1.396	10.306	1.172	1.128	1.082	1.097	1.396	1.212	1.081
	[3.356]	[-0.615]	[-0.825]	[3.356]	[0.765]	[0.871]	[3.356]	[0.762]	[0.871]
W*Terms of trade change	-0.153	-0.354	-0.418	0.273	0.061	0.049	-0.153	-0.035	-0.038
	[-0.596]	[1.348]	[1.541]	[0.807]	[1.621]	[1.532]	[-0.596]	[1.331]	[1.212]
W*Real interest rate	-0.077	-0.136	-0.126	-0.068	-0.021	-0.02	-0.079	-0.014	-0.003
	[-1.773]	[-3.645]	[-2.677]	[-0.821]	[0.541]	[-0.819]	[-1.187]	[-1.042]	[-1.32]
W*Inflation rates	-0.083	-0.031	-0.027	-0.073	-0.029	-0.035	-0.083	-0.024	-0.033
	[-1.505]	[1.989]	[1.749]	[1.727]	[1.896]	[1.745]	[1.713]	[1.660]	[1.742]
W*M 2/reserves	-0.001	-0.005	-0.005	0.009	0.007	0.007	0.024	0.008	0.009
	[2.067]	[2.378]	[2.398]	[0.608]	[0.345]	[0.674]	[2.067]	[0.349]	[0.694]
W*Depreciation	-3.452	-3.231	-3.354	27.816	-2.154	-2.894	11.493	15.275	10.246
	[-3.743]	[-3.782]	[-3.672]	[2.672]	[2.826]	[2.547]	[1.275]	[1.948]	[1.947]
W*Credit growth	-0.113	-0.128	-0.148	-0.033	0.312	0.052	-0.113	0.118	0.142
	[-1.870]	[1.754]	[1.254]	[-0.379]	[1.253]	[0.871]	[-1.870]	[-1.343]	[-1.311]
W*GDP/CAP	0.625	1.14	1.024	0.768	0.65	0.73	0.625	0.212	0.318
	[1.681]	[1.234]	[1.944]	[0.857]	[1.294]	[1.142]	[1.681]	[1.116]	[1.431]
W*Financial Liberalization	16.58	12.926	11.9	12.328	12.137	11.152	15.78	15.81	14.53
	[-2.606]	[-1.746]	[-1.676]	[0.956]	[1.127]	[1.476]	[-2.606]	[-1.542]	[-1.247]

Table C3 (continued)

phi							0.996	0.996	0.996
							[9.657]	[9.657]	[9.657]
Sigma 2	47.573	48.677	48.425	66.751	46.43	46.22	66.563	67.434	65.711
R 2	0.26	0.325	0.296	0.354	0.317	0.252	0.15	0.231	0.155
Corrected R2	0.144	0.146	0.144	0.067	0.071	0.076	0.144	0.117	0.137
LogL	-1552	-1534.7	-1227	-1530	-1421	-1354	-1552	-14827	-1385
LR_spatial_lag	138.53	142.62	143.53	138.53	142.83	143.63	88.82	112.23	104.21
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.002]	[0.004]	[0.004]
LR_spatial_error	217.12	216.84	213.57	217.12	211.52	210.62	94.43	119.00	110.05
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.002]	[0.003]	[0.003]

P-values are in the hook. WS: whole sample, AV: Advanced Economics, EME: Emerging Market Economics.