European Banking Distress and EMU: Institutional and Macroeconomic Risks

Michael M. Hutchison[*]

University of California, Santa Cruz, CA 95064, USA
hutch@cats.ucsc.edu

Abstract

Financial stability in Europe has received renewed attention with the advent of EMU. This paper examines whether EU country banking systems are particularly vulnerable to systemic risk. Our approach is to explore episodes of banking sector distress for a large sample of countries, highlighting the experience of the EU. We estimate multivariate probit models linking the likelihood of banking problems to a set of macroeconomic variables and institutional characteristics such as aspects of bank supervision and regulation, restrictions on bank portfolios, and development of the banking system. Given these characteristics, the model predicts a low probability of banking sector distress in EMU countries.

Keywords: Banking crisis; financial crisis; European economy; bank regulation; bank supervision

JEL classification: *G*21; *E*44; *F*41

I. Introduction

Episodes of banking distress have become commonplace during the past two decades, but the range of experience regarding the nature of banking sector distress, its causes and effects, vary widely across countries and time periods. A review of the experiences of 18 Western European countries (EU member states, Iceland, Norway and Switzerland), reveals that 12 had some form of banking sector distress (14 episodes in total) during the past 25 years. Of these cases, most did not pose systemic risks to the entire financial system. Only the banking problems that surfaced in Finland (1991–1994), Norway (1987–1993), Spain (1977–1985) and Sweden (1990–1993) were of an order of magnitude, depth and breadth threatening the entire banking system ("crisis" episodes).[1]

Financial stability in Europe has received renewed attention with the

[1]The "significant" versus "crisis" characterization is from Lindgren, Garcia and Saal (1996). The cases of European banking distress are shown in the Appendix, Table A1.

advent of a common currency, a wave of mergers and acquisitions among financial institutions, and greater market competition; see e.g. ECB (1999), IMF (1999) and OECD (1999). Some analysts view the new environment facing European banks as particularly risky. The International Monetary Fund argues that ensuring financial stability within EMU will be particularly challenging in the early years, when systemic risks might be on the rise; see IMF (1999, p. 105). Another recent report by Danthine, Giavazzi, Vives and von Thadden (1999, p. 100) concludes that "Banks, European banks in particular, appear to be vulnerable to economic accidents such as in Asia and Russia and are, in some respects, more fragile than ever before . . ." Even the European Central Bank sees increased risks in some areas of finance as a direct consequence of EMU; see ECB (1999).

Despite these concerns, very little empirical evidence has been brought to bear on whether European banking systems are particularly vulnerable to systemic risk at this juncture. To address this issue, we build on a recent literature linking episodes of banking sector distress to economic developments using cross-country panel data sets; cf. e.g. Demirgüç-Kunt and Detragiache (1998a, 1998b), Glick and Hutchison (2001), Hutchison and McDill (1999) and Kaminsky and Reinhart (1999). Following this approach, we evaluate the extent to which previous episodes of banking sector distress in Europe appear to fit established international patterns and whether anticipated changes in the European economy associated with EMU will influence the likelihood of banking sector distress. We consider a sample of 90 countries (18 Western European) over the period 1975–1997, of which 74 had banking problems of a "significant" or "crisis" nature at some point and several had multiple episodes (90 episodes in total). We estimate probability models (probit equations) with both a panel and cross section that are designed to test the likelihood of an episode of banking sector distress occurring given macroeconomic developments and institutional characteristics.

We introduce two innovations to the general literature on the empirical determinants of banking sector distress, both of which are directly relevant to the European experience. First, we consider how institutional variables on the regulatory and financial environment facing banks in various countries, and the EMU area in particular, affect the probability that banking sector distress may arise. This type of analysis is now possible because of new internationally comparable information on institutions following the arduous data collection in the area of corporate governance, financial regulation and banking by La Porta, Lopez-de-Silanes and Shieifer (1998), Barth, Caprio and Levine (1998), Levine (1998) and Mauro (1995). Although these studies address different issues, the institutional data they use is directly relevant to the issues that we investigate. This is important because institutions are often an important distinguishing feature of industrial countries such as those in

the EMU zone and the rest of the world. Previous work has highlighted that industrial countries are "different", and have generally lower probabilities of banking sector problems arising, as found in e.g. Hutchison and McDill (1999), but has failed to isolate the reason for this empirical observation. We conjecture that differences in institutions (governmental and legal structures) are likely to be important.

Second, previous work has largely focused on episodes of banking distress where this signifies any significant banking problem. By contrast, we distinguish between banking "distress" and "crisis", where the latter indicates a banking problem posing a systemic risk to the entire financial sector. This proves to be an important distinction, as the factors contributing to major disruptions (crises) are easier to identify and demonstrate common features that are not evident otherwise. This is especially important in Europe since only four cases of major disruptions (in Finland, Norway, Sweden and Spain) have occurred since 1975, as opposed to numerous smaller cases of banking distress.

The determinants of banking crises are discussed in Section II, focusing in particular on the new institutional and legal characteristics that we investigate. In Section III we describe the data and methodology. In Section IV we analyze the key macroeconomic and institutional characteristics, highlighting those aspects that distinguish the European countries from others which experience episodes of banking sector distress. Section V reports estimates of the probit model, and considers the predictions of the model for European countries. Section VI concludes the paper and raises the question of whether Europe is particularly at risk for future systemic banking problems.

II. Determinants of Banking Sector Distress

The theoretical literature on the determinants of banking sector distress may be categorized by three groups of models: "bank-run" models, as in e.g. Diamond and Dybvig (1983), "adverse shock/credit channel" models, as in e.g. Bernanke, Gertler and Gilchrist (1992) and Gertler (1992), and "moral hazard" models. These models emphasize different determinants of banking sector problems. The bank-run model focuses on "non-fundamental" factors, multiple equilibria, and the possibility that shifts in expectations can set off a bank-run and liquidity crisis in the banking system. The adverse shock/ credit channel model focuses on adverse economic shocks, informational asymmetries between borrowers and lenders, and how recessions and collapsing asset prices may bring on credit crunches and episodes of banking distress. The moral hazard explanation focuses on how government guarantees and weak regulatory and supervisory policies may lead to excessive risk-taking (involving both domestic and foreign asset and liability positions) and a higher probability of banking sector distress.

The empirical literature has identified several variables associated with banking crises that are consistent with one or more theoretical models. Arteta and Eichengreen (2000) provide a survey of the empirical literature, focusing on 14 recent studies investigating banking crises. The four most common variables used in these studies constitute our baseline "canonical model" which forms the starting point of our study and our point of comparison with the existing empirical literature. The macroeconomic variables identified—mainly associated with the adverse shock/credit channel model—are real GDP growth, as in e.g. Demirgüç-Kunt and Detragiache (1998b) and Hutchison and McDill (1999), inflation, as in e.g. Hutchison and McDill (1999), and various measures of turbulence in foreign exchange markets, as in e.g. Eichengreen and Rose (1998), Kaminsky and Reinhart (1999) and Glick and Hutchison (2001). The main institutional variable identified for the baseline model—usually associated with the moral hazard explanation since it allows more portfolio flexibility and risk-taking on the part of banks—is financial liberalization; cf. e.g. Demirgüç-Kunt and Detragiache (1998a) and Glick and Hutchison (2001).

These four variables (real GDP, inflation, exchange rate turbulence and financial liberalization) are the explanatory variables of our base ("canonical") model of banking sector distress.[2] Our objective is to extend the canonical model, in addition to the European dimension, to focus on the institutional features capturing financial structure, development and regulation.

Legal and Regulatory Environment, Moral Hazard and Banking Sector Stability

A number of recent studies, drawing on new cross-country data sets, have attempted to measure the impact of differing legal and institutional structures on the economy. La Porta *et al*. (1998) investigate the extent to which legal rules, and their enforcement, cover protection of corporate shareholders and creditors, and how rules affect the pattern of corporate ownership. Levine (1998) investigates whether cross-country differences in the legal rights of creditors and contract enforcement explain differences in the level

---

[2]Several other macroeconomic variables were considered, but not reported since they did not contribute significantly to the explanatory power of the model. These variables are real credit growth, nominal (and real) interest rate changes, the budget position of the general government, and explicit deposit insurance. The explicit deposit insurance dummy variable is from the survey by Kyei (1995). Indices of stock prices, real estate prices and aggregate asset prices were also considered. However, the asset price data are only available for a small sample of countries and were therefore not included in the base regressions. The evolution of these variables in relation to the onset of banking crises is shown in the summary statistics, but not reported in the probit regressions.

of banking sector development and economic growth. Demirgüç-Kunt and Levine (1999) present stylized facts concerning the relationship between financial structure and economic development, as well as the links between financial structure and legal, regulatory and policy determinants for a broad cross section of countries. Barth *et al.* (1998) focus on the regulation and supervision of the banking sector and ask whether regulatory restrictions on banks are a substitute for the strength of government capacity and the bureaucratic system. They also address the link between regulatory restrictions and developments in the banking system.

These studies have not considered how the institutional characteristics of countries influence the likelihood of financial instability and banking sector distress,[3] nor have they focused on Europe. In principle, however, such institutional characteristics are important determinants of banking distress in line with the moral hazard/lax supervision theory. The way banks are regulated and supervised, accounting standards and other characteristics of the financial system bear directly on the extent to which government guarantees and moral hazard translate into higher risk-taking on the part of banks.

To address this issue, we consider several institutional characteristics which are of particular importance to the financial sector and highlight the relevance to Europe: three address the regulatory environment (and information disclosure) and three address the financial environment. The regulatory environment is measured by three factors: a composite index of the quality of the governmental/bureaucratic system ("government"); the extent that contract law is enforced ("enforcement"); and the extent that public corporations disclose financial information about their balance sheets and operations ("accounting"). We expect that a stronger governmental/bureaucratic system, more rigorous enforcement of contract law, and greater financial disclosure would all lead to greater financial stability and lower risk of a serious banking problem arising.

The financial environment is measured by two factors in addition to financial liberalization (included in the canonical model): restrictions on the activities of banks ("restrictions"), and the size and development of the banking sector ("banking"). *A priori*, liberalization of interest rates, fewer restrictions on bank portfolios, and a less developed banking system would be expected to be associated with a higher probability of banking instability.

---

[3]The only exception is Barth *et al*. (1998). They focus on the link between legal restrictions on banking activity and the likelihood of a banking crisis.

III. Data and Methodology

Defining Banking Distress

We have identified and dated episodes of banking sector distress following the criteria of Caprio and Klingebiel (1996, and updated through personal correspondence in 1999) and Demirgüç-Kunt and Detragiache (1998a). If an episode of banking distress has been identified in either study, it is included in our sample.[4] Both these studies use a combination of events to identify and date the occurrence of significant banking sector problems. Institutional events include forced closure, merger, or government intervention in the operations of financial institutions, runs on banks, or the extension of large-scale government assistance. Other indicators include measures of non-performing assets and problem loans. Given the differences in magnitude of banking crises, we define two alternative variables: banking distress and banking crisis. "Banking distress" denotes an episode that includes large-scale disruptions in the banking sector as well as problems of a smaller magnitude. The "banking crisis" variable, by contrast, includes only large-scale disruptions in the banking sector. The distinction between small to medium and large-scale disruptions in the banking sector is derived from Caprio and Klingebiel (1996, and updated through personal correspondence) and Lindgren *et al*. (1996).

Other Variables

The data appendix (Table A2) describes all of the institutional variables and sources of data in detail. The variable "restrict", adapted from Barth *et al*. (1998), measures the extent to which a country's regulatory system allows banks to engage in the following non-traditional activities: securities (underwriting, brokering, dealing and related activities), insurance (underwriting and selling), real estate (real estate investment, development and management), and non-financial firm ownership. The variable "government" is a composite index of the quality of the government/bureaucratic system. In principle, a strong system of legal enforcement could substitute for weak rules since active and well-functioning courts can step in and rescue investors abused by management. To address these issues, La Porta *et al*. (1998) examine proxies for the quality of enforcement of these rights, namely estimates of "law and order" in different countries compiled by private credit risk agencies for the use of foreign investors interested in doing business in the respective countries. We look at a weighted average of

---

[4]Almost all of the episodes are identified in both studies. There are differences in the coverage of countries, however, and our objective is to have the broadest coverage possible.

two such indices to form the "enforcement" variable. The "accounting" variable is a quantitative measure of the value of information disclosure revealed by company annual reports. Accounting plays a potentially crucial role in corporate governance. In order for investors to know anything about the companies in which they invest, basic accounting standards are needed to render company disclosures interpretable.

The institutional variable in the canonical model is "liberalization" of deposit interest rates. This variable is from Demirgüç-Kunt and Detragiache (1998b), supplemented by national and international sources. It is constructed on the basis of the beginning of observed policy changes to liberalize interest rates, taking on a value of unity during the liberalized period of market-determined rates and zero otherwise. "Exchange rate pressure", following Glick and Hutchison (2001), is constructed from "large" changes in an index defined as a weighted average of monthly real exchange rate changes and monthly (percent) reserve losses.[5] The weights are inversely related to the variance of changes in each component over the sample for each country. Large changes in exchange rate pressure are defined as changes in our pressure index that exceed the mean plus 2 times the country-specific standard deviation.[6] The source of the macro data is the International Monetary Fund's *International Financial Statistics* (CD-ROM).

Data Samples and Windows

Our data sample is determined by the availability of data on banking sector health, as well as on the determinants of bank crises, as discussed above. Following most of the literature in this area, we do not confine our analysis to countries experiencing banking crises. We also include developed and developing countries that did not experience a severe banking problem during the 1975–1997 sample period. Using such a broad control group allows us to make general statements about the conditions that have distinguished countries encountering crises from those that have not.

The minimum data requirements for inclusion in our study is that GDP data are available for a minimum of 10 consecutive years over the period 1975–1997. This requirement results in a sample of 90 countries. The baseline model, however, includes only 51 countries because of limitations on the financial liberalization variable (discussed below). The group is

---

[5]Our currency pressure measure of crises does not include episodes of defense involving sharp rises in interest rates. Data for market-determined interest rates are not available for many of the countries or for a large part of the sample period.

[6]Kaminsky and Reinhart (1999) use a three standard deviation cutoff. While the choice of cutoff point is somewhat arbitrary, Frankel and Rose (1996) suggest that the results are not very sensitive to the precise cutoff chosen in selecting crisis episodes.

comprised of the EU countries (except for Luxembourg and Portugal), Canada, Japan, New Zealand, Norway, Switzerland, Argentina, Brazil, Chile, Colombia, Ecuador, Egypt, Hong Kong, India, Indonesia, Jordan, Kenya, Korea, Malaysia, Mexico, Peru, Philippines, Sri Lanka, Thailand, Turkey, Uruguay, Venezuela, Bolivia, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mali, Nigeria, Paraguay, Syrian Arab Republic, Uganda and Zambia.

In most of our analysis we are concerned with predicting the onset of banking crises and their relative timing. To reduce the chances of capturing a continuation of the same banking episode, we impose windows on our data. In the case of multi-year banking crises, we use only the first year in a spell of banking distress, i.e., the year of the "onset" of banking sector distress. The duration of banking sector distress was greater than one year in most episodes.

We use annual observations in our study. Attempting to date banking sector distress by month, as in Kaminsky and Reinhart (1999), or by quarter seems arbitrary. We employ monthly data for our (real) exchange rate pressure index to identify currency crises and date each by the year in which it occurs. Of course, annual data may obscure or limit some insights about the relative timing of the onset of banking crises, since it does not enable us to distinguish the lead and lag timing of crises to the extent that crises occur at different points in the same year. However, we do not believe that it is possible to date banking crises with such precision as monthly data presumes. Moreover, using annual data enables inclusion of a relatively large number of countries in the analysis.

IV. Statistical Contours

Table 1 summarizes the institutional characteristics associated with Europe's financial and legal systems compared with the broader sample. From the table we observe that the EU countries, on average, are significantly different from the remainder of the sample for every institutional variable excepting the measure of accounting standards. Moreover, all of these indicators point to better-managed and more liberalized financial sectors. In particular, all of the EU countries had liberalized deposit interest rates by the early 1990s compared with 70% of the non-EU group. The EU group also had significantly fewer restrictions on the portfolio activities of banks (a rank of 4 is most restrictive). The least restrictive banking controls in the EU (values less than 1.5) are found in Austria and the United Kingdom. The EU banking sector also had more developed systems of financial intermediation, judging by the percent of loans in the financial system relative to GDP.

In terms of the regulatory environment, the EU area on average also had more competent government/bureaucracy, better enforcement of laws, and

Table 1. *Institutional summary statistics*

| | Non-EU | | EU | | |
Variable	Mean	Standard deviation	Mean	Standard deviation	Probability of different means
Financial environment					
Liberalization	0.69	0.47	1.00	0.00	99%
Restriction	2.39	0.65	1.82	0.39	99%
Banking	0.71	0.58	1.06	0.38	97%
Regulatory environment					
Government	6.14	2.27	8.27	1.31	99%
Enforcement	6.67	2.20	9.06	0.96	99%
Accounting	59.31	14.50	63.62	12.02	67%

higher accounting standards than the rest-of-the-world. Two European countries, the Netherlands and Switzerland, have a value of 10 (the maximum score possible) for the government variable. The average value of accounting is higher in the EU, but not significantly different from the non-EU sample average. This variable measures the number of disclosures (based on a set of 90 criteria) made on corporate income statements, and ranges in the sample from 24 (Egypt) to 83 (Sweden). The highest in Europe were for Sweden (83) and the United Kingdom (78), and the lowest were for Portugal (36) and Greece (55).

A graphical examination of the macroeconomic characteristics around episodes of banking sector distress is shown in Figure 1. The light solid line shows the mean value of each variable for the group of countries that did not experience banking sector distress. The dark solid line (dashed line) shows the average values for all European episodes (all episodes other than Europe) of banking sector distress. This ''event'' study alignment of dates set the data (at time zero) from the first year of the onset of an episode of banking sector distress.

In economies experiencing banking sector distress, real output growth slowed gradually prior to the onset of banking problems, dropped sharply at the onset of banking problems and gradually recovered. Two macroeconomic variables also indicate a shift over episodes of banking distress: real credit growth and stock price changes. Movements in credit growth and stock prices mirror real GDP growth: gradual decline in growth rates prior to the onset of problems, sharp drops during the first year as problems emerge, and moderate rebounds during the latter phase of the episode.

Where does Europe fit into the general pattern? Similar to most countries, declining real GDP growth, declining credit growth, and weakness in equity markets characterized the European group after the onset of banking distress.
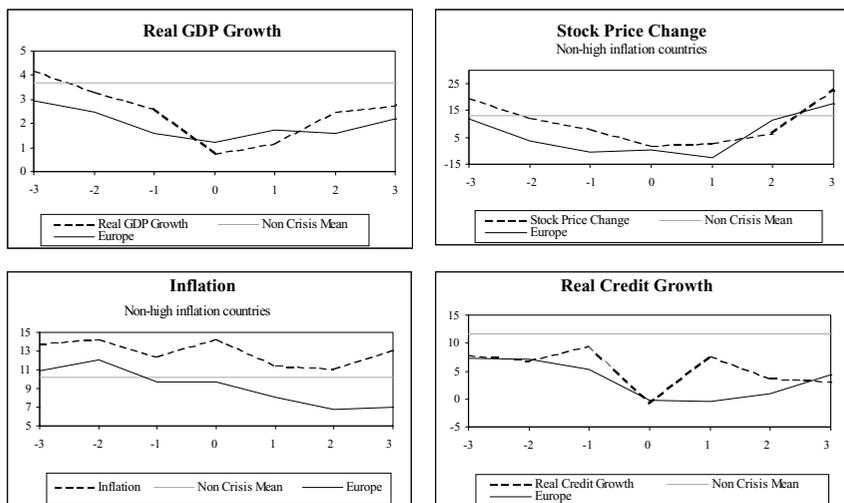
Fig. 1. Economic developments prior to and after the onset of banking distress: comparison of full sample and European episodes.

Both groups also experienced strong economic recoveries in terms of output growth and stock price developments following episodes of banking distress. The fluctuation in these variables around the onset of banking problems, however, was less in the European group than elsewhere. Real GDP and real credit growth, in particular, demonstrate less pronounced changes. Inflation tended to fall in Europe with the onset of banking problems, while increasing elsewhere.

V. Probit Estimation Results

Table 2 reports the probit panel regression results using the panel data set where the dependent variable is banking sector crisis. The results for the regressions with banking sector distress as the dependent variable are very similar and not reported.[7] The canonical model forms the baseline regression, shown in column 1, and this set of variables is also included in each subsequent equation estimated (columns 2–7). The effect of a one-unit change in each regressor on the probability of a banking crisis is reported, evaluated at the mean of the data. The number of observations ranges from 645 to 970, depending on the cross-country availability of the various institutional variables. Not surprisingly, column (7) with the largest number

---

[7] These results are reported in Hutchison (2000).

Table 2. *Determinants of banking sector crisis*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	−2.27**	−2.88**	−2.07**	−1.33**	−1.29**	−2.30**	−4.36**
	(0.19)	(0.44)	(0.34)	(0.35)	(0.43)	(0.54)	(1.21)
Macroeconomic variables:							
Inflation	0.36**	0.41**	0.38**	0.37**	0.33*	0.50**	0.49**
	(0.13)	(0.17)	(0.18)	(0.16)	(0.17)	(0.17)	(0.19)
GDP growth	−3.59*	−4.93**	−4.91*	−5.37**	−5.61**	−4.86**	−6.97**
	(1.92)	(2.46)	(2.66)	(2.27)	(2.64)	(2.59)	(2.74)
Exchange Pressure	0.38**	0.59**	0.63**	0.56**	0.63**	0.61**	0.51**
	(0.19)	(0.21)	(0.22)	(0.21)	(0.23)	(0.22)	(0.25)
Financial environment:							
Liberalization	0.60**	0.50**	0.57*	0.52**	0.67**	0.53*	0.78**
	(0.20)	(0.25)	(0.30)	(0.24)	(0.31)	(0.29)	(0.33)
Restriction		0.27*					0.54**
		(0.14)					(0.23)
Banking			−0.38				0.26
			(0.25)				(0.34)
Regulatory environment:							
Government				−0.14**			−0.28**
				(0.05)			(0.09)
Enforcement					−0.15**		
					(0.05)		
Accounting						0.00	0.04**
						(0.01)	(0.02)
Number of observations	970	743	668	778	668	685	645
Pseudo-R^2	0.099	0.141	0.163	0.160	0.194	0.149	0.230
Percentage predicted:							
Overall	23.1%	33.3%	32.0%	34.4%	48.0%	34.6%	45.8%
Europe	25.0%	25.0%	25.0%	25.0%	25.0%	50.0%	25.0%

of included explanatory variables has the fewest number of observations. Thirty-three countries are included in the regression reported in column (7)—the 51 countries listed previously and 17 that are excluded due to the limited availability of institutional variables (Bolivia, Ecuador, El Salvador, Indonesia, Jordan, Guatemala, Guyana, Honduras, Jamaica, Kenya, Sri Lanka, Mali, Paraguay, Syrian Arab Republic, Zambia, Uruguay and Venezuela).

All of the coefficients in the baseline/canonical regression (inflation, real GDP growth, exchange rate pressure and financial liberalization) are statistically significant with the expected signs. A one percentage point rise in inflation raises the likelihood of a banking crisis by about 0.4–0.5%; a one percentage point rise in the growth rate of GDP lowers the probability of a banking crisis by about 0.4–0.7%; a recent bout of severe currency pressure (or currency crisis) raises the likelihood of a banking crisis by about 4–6%;

and countries with financial liberalization have a 5–8% higher likelihood of having a banking crisis.[8]

Our focus institutional variables are statistically significant with one exception (banking sector development), and contribute significantly to the overall explanatory power of the models. The banking crisis equations (pseudo-*R*-square) explain 10–23% of the variance, and the (not reported) banking distress equations explain 11–17%; 23–48% (44–60%) of the banking crisis (distress) observations are correctly predicted.[9] A competent government/bureaucracy lowers the likelihood of a banking crisis—a one-unit rise in the index (0–10 range), evaluated at the mean, decreases the probability by 1.4–2.8%. More conscientious enforcement of legal rights, e.g. a unit rise in our index, indicates better contract enforcement and application of the rule of law (0–10 range), lowers the risk of a banking crisis by about 1.5%. Fewer restrictions on banking activities, measured as a decline in the index (1–4 range), lowers the likelihood of a banking crisis by about 2.7–5.4%.[10]

Surprisingly, greater disclosure in firms' public statements ("accounting") is positively associated with the likelihood of an episode of banking sector distress. This result, however, is consistent with La Porta *et al.* (1998) who find that laws are only weakly protective of shareholders and that good accounting standards are associated with low concentration of firm owner-ship and poor investor protection. In this way, good accounting standards may be a response to other problems likely to increase the risk of banking sector distress.

---

[8]These coefficient estimates for the "standard" variables are not surprising and are consistent with other studies. Depending on the specification of their model, for example, Demirgüç-Kunt and Detragiache (1998b) find similar magnitudes: the coefficient on inflation ranges from 0.2 to 0.4%, the coefficient on real GDP growth ranges from around −0.8 to −2.2%. They also find that financial liberalization raises the likelihood of a bank crisis by around 17% in their baseline model; cf. Demirgüç-Kunt and Detragiache (1998a). Hutchison and McDill (1999) and Glick and Hutchison (2001) report similar results for the baseline model.

[9]The threshold probability of a "successful" prediction is set at 10%, i.e., if the predicted probability is 10% or greater and a banking crisis occurs the model correctly predicts the crisis. The 10% level is not arbitrary, but set at twice the unconditional probability of a banking crisis occurring. By contrast, Demirgüç-Kunt and Detragiache (1998b) set a cutoff probability of 5% (equal to the unconditional mean of their sample). See Glick and Hutchison (2001) for a discussion of this issue and references to the literature.

[10]This result is consistent with Barth *et al*. (1998). They find that tight restrictions on the banking sector are typically found in countries with weak governmental structures and bureaucracies. They also suggest that tight legal restrictions on banking activities may be a response to weak bureaucracies, and are therefore positively associated with banking sector problems.

Robustness: Region-specific Effects, Onset of Liberalization and Endogeneity of Exchange Pressure

Table 3 reports several robustness checks and extensions of the basic models reported in Table 2. The first column includes regional effects in the equations, controlling for whether the particular observation is from a country in the European Union (EU), Latin America, Asia or Africa. (The constant term picks up the average probability for the remaining regions/

Table 3. *Determinants of banking sector crisis: extensions*

	(1) Regional dummy variables	(2) Onset of financial liberalization	(3) Endogeneity of exchange rate pressure
Constant	−2.19*	−1.83**	−1.96**
	(1.05)	(0.105)	(0.306)
Macroeconomic variables:			
Inflation	0.216	0.420**	0.201*
	(0.203)	(0.133)	(0.116)
GDP growth	−8.92**	−3.36*	−4.12**
	(2.61)	(1.77)	(1.74)
Exchange pressure	0.497*	0.338*	0.085
	(0.219)	(0.181)	(0.235)
Financial Environment:			
State of liberalization	1.02**		0.710**
	(0.314)		(0.189)
Onset of liberalization		−0.378	
		(0.460)	
Restriction	0.043		
	(0.212)		
Banking	−0.070		
	(0.263)		
Regulatory environment:			
Government	−0.160*		
	(0.092)		
Accounting	0.019		
	(0.012)		
Regional dummies			
EU	−0.295		
	(0.277)		
Latin America	−0.148		
	(0.277)		
Asian	−0.007		
	(0.45)		
African	−0.652		
	(0.769)		
Number of observations	604	970	958
Log-likelihood	−120.65	−152.56	−189.18

countries.) Regional differences in the likelihood of a banking crisis may be important and correlated with economic and political characteristics. Excluding regional fixed effects could therefore give misleading inferences. The regional dummy variables are not statistically significant, however, and the coefficient estimates are very similar to the baseline models reported in Table 2. The single exception is that inflation is no longer statistically significant. It appears that large variations in inflation are highly correlated with regions—e.g. high inflation and banking crises are an especially common phenomenon in Latin America—and do not provide additional explanatory power in the prediction of banking problems.

The second column reports the results from including the effects of a switch from financial regulation to a more liberalized regime. This is termed the "onset" of financial liberalization and attempts to capture whether countries are particularly vulnerable to a banking crisis directly following (or with a short lag after) the regime shift. The period immediately following the switch to a liberalized regime is most likely a period of transition for the banking sector—institutions face more competition and perhaps expand their operations into new markets and financial instruments—leading to greater risk. Similarly, the banking sector could face less intense scrutiny by the regulatory and supervisory authorities during a transition phase as the authorities themselves adapt to the new financial environment.

Unlike the state variable (liberalized state or regulated state), however, the onset variable is not statistically significant. (Several lags were included in the regression with similar results.) The other coefficient values are otherwise very similar to the baseline regressions. One statistical explanation for this lack of significance of the onset of financial liberalization may be the relatively few observations of a "switch" in regime. In any case, this result is consistent with Demirgüç-Kunt and Detragiache (1998a, p. 17) who find little evidence of a transitional effect and conclude "... the effect of financial liberalization on banking fragility does not appear to be characteristic of the immediate aftermath of the change in policy, but rather manifests itself over time".

The third column of Table 3, labeled "endogeneity of exchange rate pressure", reports the banking crisis equation results from a simultaneous equation estimation procedure where both banking crises and bouts of severe exchange rate pressure are treated as endogenous variables.[11] The methodology follows the two-stage structural probit equation approach of Maddala

---

[11]The exchange rate pressure equation follows the baseline model of Glick and Hutchison (2001) with five explanatory variables (constant term, the onset of a banking crisis, lagged export growth, lagged ratio of broad money to international reserves, and a lagged measure of real exchange rate overvaluation). These results are available from the author on request.

(1983, pp. 246–247), and involves a two-equation system with two binary dependent variables.[12] Estimates of the basic model, analogous to column 1 in Table 2, are reported but similar results were obtained from the other equations estimated. The coefficients on the macroeconomic variables—real GDP growth and inflation—as well as on financial liberalization have the same signs and significance levels as in the baseline model presented in Table 2. However, the coefficient estimate on the exchange rate pressure variable, at 0.085, is substantially less than the estimates in other equations and is not statistically significant.

These results suggest that, while there is a positive correlation between bank crises and bouts of severe exchange rate pressure, the latter does not appear to be a causal factor in bank crises. This result is similar to Kaminsky and Reinhart (1999) and Glick and Hutchison (2001). Both of these studies find that bank crises tend to a good leading indicator—and possibly contemporaneous causal factor—of currency crises, but not vice versa. Taking into account the endogeneity of exchange rate pressure suggests that its independent influence on the likelihood of a banking crisis is not large, but does not change our main findings.

Cross-section Regressions on Institutional Variables

The institutional variables show very little variation across time and therefore are primarily identifying cross-country differences in the likelihood of banking distress and crisis. Recognizing this data limitation, Table 4 reports probit regressions using cross-section (across countries) data where the dependent variable is banking distress (crisis). In these regressions the dependent variable takes on a value of unity if the country in question experienced an episode of banking distress (crisis) at any time during the sample period. The RHS variables are the institutional variables either individually (in the upper first and second panels) or jointly (in the third panel).

The first (second) panel of Table 4 reports the results from the bivariate regressions with banking distress (crisis) as the dependent variable regressed on each of the new institutional variables investigated in this study. (Constant terms are included in all of the regressions but not reported.) There is only weak evidence that the institutional factors play a role in the banking distress regressions, but strong evidence that they are important in distinguishing

---

[12] The procedure involves first estimating the reduced form for each endogenous crisis variable as a function of all exogenous and predetermined variables by probit, then calculating the fitted value of the endogenous variable implied by the reduced form, and lastly using the fitted value in the structural probit equation. The covariance matrices are calculated as in Maddala (1983, p. 247) and the corrected standard errors are reported.

Table 4. *Bivariate results*

Dependent variable: Banking sector distress

	Restriction	Banking	Government	Enforcement	Accounting
Coefficient	0.66	−0.78	−0.17	−0.16	0.00
p-Value	0.12	0.09	0.12	0.21	0.87
Pseudo-R^2	0.076	0.104	0.072	0.056	0.001
No. of observations	44	40	47	40	39
Percent predicted at 78%					
All countries	89.5	88.6	85.4	100	100
Europe	81.8	81.8	63.6	100	100

Dependent variable: Banking sector crisis

	Restriction	Banking	Government	Enforcement	Accounting
Coefficient	0.69	−0.95	−0.32	−0.32	−0.03
p-Value	0.03	0.03	0.00	0.00	0.06
Pseudo-R^2	0.079	0.095	0.199	0.192	0.072
No. of observations	44	40	47	40	39
Percent predicted at 52%					
All countries	69.6	65.0	76.0	75.0	55.0
Europe	25.0	0.0	0.0	0.0	0.0

countries that have experienced bouts of large-scale banking problems (crisis) from those that have not.

In particular, the second panel shows that competent government/efficient bureaucracy, enforcement of legal rules, high accounting standards and a well-developed financial system are inversely associated with the likelihood of a banking crisis erupting. Moreover, countries where banks are heavily restricted in the types of activities that they may undertake are more likely to have had an episode of banking crisis. These results are consistent with the panel probit regressions, with the exception that accounting is now significantly negative. The cross-country probit regressions suggest, in line with theoretical priors, that higher accounting standards, and presumably more public disclosure of firm operations, are inversely related to the probability of banking sector problems.

The unconditional probability of having at least one episode of banking sector distress (crisis) for this sample is 78% (52%). This unconditional probability is obviously much higher than in the panel regressions since a country is coded as having had a banking crisis if it occurred at any time during the 1975–1997 sample period. To measure a "successful" prediction, we used the unconditional sample means as our base of comparison. Judging by this criterion, the range of successful predictions based on each bivariate

probit regression ranges from 85–100% for banking distress and 55–76% for banking sector crisis. Clearly, institutional variables are helpful predictors of banking sector problems.

We also ran a log-likelihood ratio test of the joint significance of the institutional variables. This test is in the context of a multivariate probit regression with banking distress (crisis) as the dependent variable and the set of institutional characteristics as the independent variables. (Enforcement is again not included since it is so highly correlated with government competence.) The log-likelihood ratio test (with the base regression including only a constant) indicates that the variables are jointly significant (at the 99% level of confidence), helping to explain the cross-country differences in the pattern of both banking distress (0.005 significance level) and banking crises (0.0108 significance level).[13]

Predictions for Europe

The model estimates reported in Tables 2–4 cover all the episodes of banking sector crisis/distress in the sample and may or may not do well in predicting the likelihood of a problem arising in any given country at a particular point in time. That is, the model could have relatively high predictive accuracy in general but still not predict the occurrence of any particular banking problem. Our question is whether the general statistical characteristics of banking sector distress identified by the model help to explain the timing and likelihood of episodes of banking distress that have occurred in Europe.

To this end, the percentage of successful predictions of the model for the set of European countries is reported at the bottom of each table. For the European countries, reported in Table 2, the percentage of successful predictions in the panel regressions ranged from 25–50% (15–39%) for episodes of banking sector crisis (distress). In the set of cross-section regressions, the successful predictions of banking distress were in the 64–100% range for banking distress, and in the 0–25% range for banking crisis. Lower success in predicting banking sector crisis in Europe (only four occurrences) suggests that these "big" events were not so much related to legal/institutional characteristics as to macroeconomic and, perhaps, idiosyncratic factors.

Following up on this point, Figure 2 shows the predicted probabilities for the 1975–1997 period for the three Scandinavian countries that experienced the most severe banking crises. The line for each country uses the coefficient

---

[13]Due to the high correlation between institutional characteristics of each country, however, most of the individual coefficient values are not statistically significant (as with the panel regressions). The variables are jointly significant at the 99% level of confidence.
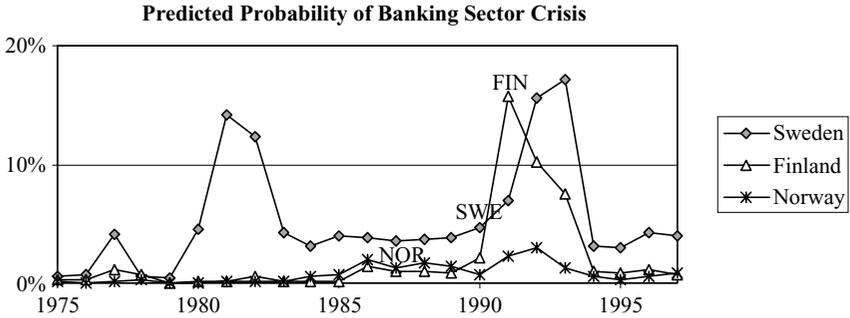
Predicted Probability of Banking Sector Crisis

Fig. 2. Predicted probability of banking sector crisis.

estimates from the model with the same independent variables as in column (7) of Table 2 to predict the probability of banking sector *distress* in each European country for each year. The country names (abbreviated) refer to the year when each particular country in the sample had a banking problem.

These results indicate that the model does reasonably well in predicting the banking problems in these countries. The predicted value for Finland, for example, peaked in 1991 (at about 18% likelihood of the onset of banking distress)—the year that problems actually became acute. The model also predicts that problems were likely in Sweden in the early 1990s, when acute banking distress did emerge. However, banking stability is predicted in Norway despite the occurrence of a banking crisis in the late 1980s. In explaining the Norwegian banking crisis, Steigum (1992) emphasizes the expansionary monetary policy followed after financial deregulation, the adoption of bad banking practices in response to increased competition in the credit market, and the 1985–1986 oil price plunge. These factors are not easily captured in a general empirical model of currency crises.

VI. Conclusions and Implications for European Banking Stability

How can our empirical work help us assess the risk of instability in European banking? The institutional characteristics of financial markets and the regulatory environment in the EU area indicate very low risk of serious banking distress. Our empirical results suggest that relatively few restrictions on banks, competent government bureaucracies, vigorous enforcement of shareholder rights, and the strength of legal systems all predict banking stability. Accounting standards and information disclosure are also higher in the EU area than most other parts of the world, and should lead to greater

banking stability.[14] Finally, all the European countries had substantially liberalized their domestic financial systems by the early 1990s (measured here as a relaxation of interest rate controls) and have presumably already adjusted to this frequently destabilizing effect on the banking system. Hence, from an institutional perspective, our results suggest that Europe is unlikely to experience a major banking crisis.

The evaluation of macroeconomic risks depends on how business cycles, inflation and exchange rate instability in Europe are likely to be affected by EMU. The conventional wisdom holds that national business cycles are likely to be larger within the EU area because of loss of the country-specific monetary stabilization instrument.[15] However, if European business cycles in the past are attributable to unstable monetary policies, both lower inflation and more stable economies could be the consequence of EMU; cf. e.g. Thygesen (1999). Moreover, it seems clear that exchange rate instability—one potential determinant of banking distress indicated by the empirical results—is likely to be reduced in Europe with the removal of the ERM. Balancing these factors in light of our regression results indicates that EU countries on average are likely to experience less macroeconomic instability. Both the macroeconomic and institutional variables therefore point to relatively low risk for banking sector distress/crisis in EMU.

---

[14]The empirical estimates give mixed results on this point. However, the argument that high accounting standards are a measure to shore-up systems with weak protection for investors does not seemingly hold in EU countries.

[15]See Eichengreen (1992) and Bergman (1999) for a review of the optimal currency area literature as it applies to Europe.

Appendix

Table A1. *Occurrences of European banking distress, foreign exchange market turmoil and domestic interest rate liberalization*

	Dates, significance (significant or crisis) and details of banking sector distress[a]	Foreign exchange market turmoil[b]	Liberalization of interest rates[c]
EU Members			
Austria			1975
Belgium		1982	1986
Denmark	1987–1992 Significant: Cumulative loan losses over 1990–1992 were 9% of loans; 40 of the 60 problem banks were merged.		1981
Finland	1991–1994 Crisis: Non-performing loans and credit losses reached 13% of total exposure at peak in 1992; liquidity crisis in September 1991. Savings sector badly affected. Govt. took over Skopbank in August 1991. Several banks suffered large losses due to bad loans and share investments.	1977-1978, 1982, 1991-1993	1986
France	1994–1995 Significant: Non-performing loans were 8.9% of total loans in 1994. 15% (US$27 billion) of Credit Lyonnais' loans were non-performing and several other banks posted large losses.	1982	1975
Germany	1978–1979 Significant: Giro institutions faced problems.		1975
Greece	1991–1995 Significant: Localized problems required large injection of public funds into specialized lending institutions.	1980, 1982–1983, 1985	1975
Ireland			1985
Italy	1990–1995 Significant: Non-performing loans system-wide 10% of total in 1995. During 1990–1994, 58 banks in difficulty and merged with other institutions; 3 of the 10 largest banks received large injection of public funds; 10 banks undercapitalized in 1994.	1976, 1992, 1995	1975
Luxembourg			NA
Netherlands			1975
Portugal	1986–1989 Significant.	1976–1978, 1982–1983, 1993, 1995	1984

Spain	1977–1985 Crisis: From 1978–1983, 51 institutions accounting for one-fifth of all deposits were rescued. In 1983, 20 small to medium-sized banks were nationalized.	1976–1977, 1982, 1992–1993	1974
Sweden	1990–1993 Crisis: 18% of total unconsolidated bank loans were reported lost and the two main banks were assisted (Govt. injected US$800 million into state-controlled Nordbanken and guaranteed US$609 million to rescue largest savings bank).	1977, 1981-1982, 1992-1993	1980
United Kingdom	1975–1976 Significant: "Secondary Banking Crisis". 1984 Significant: Johnson Matthey bank failure.	1976, 1979, 1981–1982, 1986, 1992	1974
Non-EU Members			
Iceland	1985–1986 Significant: One of three state-owned banks insolvent and merged with three private banks. 1993 Significant: Government injected capital into one of the largest state-owned commercial banks to cover its large loan losses.	1983–1984, 1988, 1992–1993	NA
Norway	1987–1993 Crisis: 6% of bank loans non-performing. Crisis at end of 1991. Govt. became principal owner in three largest banks in 1991–1992, whose share of total commercial bank assets was approximately 85%. Central bank provided special loans to six banks in 1985–1986 to supply liquidity and avoid interest rate rise.[d] State-backed Bank Insurance Fund had to increase capital.	1978, 1986, 1992	1984 (end of 1983 financial deregulation policy launched)
Switzerland		1978	1989

Notes:
[a]Sources of banking distress data and characterizations: Caprio and Klingebiel (1996), Demirgüç-Kunt and Detragiache (1998a) and Lindgren *et al.* (1996).
[b]See text for calculation of measure of foreign exchange market pressure.
[c]Characterization and dating of domestic interest rate liberalization: Demirgüç-Kunt and Detragiache (1998b).
[d]Part of the characterization of the Norwegian crisis is from Steigum (1992).

Table A2. *Data for institutional variables*

Variable	Description	Scale	Sources
Accounting	Accounting standards index created by examining and rating companies' 1990 annual reports on their inclusion or omission of 90 items.	1–90 A higher ranking indicates more information disclosure.	International accounting and auditing trends; Center for International and Financial Research; reported in La Porta *et al*. (1998).
Rule of law	Assessment of the law and order tradition in a country produced by the country risk rating agency International Country Risk (ICR). Average of the months of April and October of the monthly index between 1982 and 1995.	0–10 Lower scores indicate less tradition for law and order.	International Country Risk Guide; reported in La Porta *et al*. (1998).
Corruption	ICR's assessment of the corruption of government. Lower scores indicate that "high government officials are likely to demand special payments" and "illegal payments are generally expected throughout lower levels of government". Average values of the months of April and October of the monthly index between 1982 and 1995.	0–10 Lower scores indicate greater corruption.	International Country Risk Guide; reported in La Porta *et al*. (1998).
Red tape	Business International's (BI) assessment of "the regulatory environment foreign firms must face when seeking approvals and permits. The degree to which it represents an obstacle to business" Simple average over 1980–1983 period.	0–10 Lower scores indicate more red tape (more obstacles to business).	Business International (Economist Intelligence Unit); reported in Mauro (1995).
Repudiation	Likelihood of repudiation of contracts by government. ICR's assessment of the "risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down" due to a budget cutback, government action or a policy change. Average of the months of April and October of the monthly index between 1982 and 1995.	0–10 Lower scores indicate higher risk.	International Country Risk Guide; reported in La Porta *et al*. (1998).
Government	Average value of rule of law, corruption and red tape (defined above). Composite index of the quality of government/bureaucratic system.	0–10 Higher scores indicate a better functioning government.	International Country Risk Guide and Business International; index also used in Barth *et al*. (1998).

Enforcement	Average value of the rule of law and repudiation of contracts by government.	0–10 Lower scores indicate higher risk.	Constructed variable from data reported by International Country Risk Guide; also used in Levine (1998).
Restrictions	Restrictions on banking. Average value of three indices measuring the ability of banks to engage in: (1) securities underwriting, brokering, dealing and all aspects of the mutual fund business; (2) real estate investment, development and management; (3) insurance underwriting and selling; (4) ownership and control of non-financial firms.	1–4 Lowest value is unrestricted, highest value is prohibited. Higher values indicate more restrictions on bank activities.	Constructed by Barth, Caprio and Levine (2000); original data sources reported are Barth *et al*. (1998), Kyei (1995), Akamatsu (1995), Institute of International Bankers (*Global Survey*, various years), Euromoney (*Banking Yearbook*, 1995), and various central bank and government sources.
Banking	Banking sector development. Value of loans by commercial banks and other deposit-taking banks to the private sector divided by GDP. Average over 1976–1993 period.	Zero is lower bound. Data range is 0.1 to 2.7.	Reported in Levine (1998).

References

Akamatsu, N. (1995), Enterprise Governance and Investment Funds in Russian Privatization, in Aoki, M. and Kim, H.-K. (eds.), *Corporate Governance in Transitional Economies: Insider Control and the Role of Banks*, World Bank, Washington, DC.

Arteta, C. and Eichengreen, B. (2000), Banking Crises in Emerging Markets: Presumptions and Evidence, Center for International and Development Economics Research (CIDER) Working Paper no. C00-115 (August), Haas School of Business, University of California, Berkeley.

Barth, J. R., Caprio, G. and Levine, R. (1998), Financial Regulation and Performance: Cross-country Evidence, mimeo, available at World Bank website.

Barth, J. R., Caprio, G. and Levine, R. (2000), Banking Systems around the Globe: Do Regulation and Ownership Affect Performance and Stability? mimeo, available at World Bank website.

Bergman, M. (1999), Do Monetary Unions Make Economic Sense? Evidence from the Scandinavian Currency Union, 1873–1913, *Scandinavian Journal of Economics 101*, 363–377.

Bernanke, B., Gertler, M. and Gilchrist, S. (1992), The Financial Accelerator and the Flight to Quality, *Review of Economics and Statistics 78* (1), 1–15.

Caprio, G. and Klingebiel, D. (1996), Bank Insolvencies: Cross-country Experiences, World Bank Policy Research Paper no. 1620, Washington, DC.

Danthine, J.-P., Giavazzi, F., Vives, X. and von Thadden, E.-L. (1999), *The Future of European Banking*. Centre for Economic Policy Research, London.

Demirgüç-Kunt, A. and Detragiache, E. (1998a), Financial Liberalization and Financial Fragility, in Boris Pleskovic and Joseph Stiglitz (eds.), *Annual World Bank Conference on Development Economics 1997*, World Bank, Washington, DC.

Demirgüç-Kunt, A. and Detragiache, E. (1998b), The Determinants of Banking Crises in Developing and Developed Countries, *IMF Staff Papers 45*, 81–109.

Demirgüç-Kunt, A. and Levine, R. (1999), Bank-based and Market-based Financial Systems: Cross-country Comparisons, mimeo, available at World Bank website.

Diamond, D. and Dybvig, P. (1983), Bank Runs, Deposit Insurance, and Liquidity, *Journal of Political Economy 91*, 401-419.

Eichengreen, B. (1992), Should the Maastricht Treaty Be Saved? *Princeton Studies in International Finance 74*, Princeton University.

Eichengreen, B. and Rose, A. (1998), Staying Afloat When the Wind Shifts: External Factors and Emerging-market Banking Crises, NBER Working Paper no. 6370.

European Central Bank (1999), *Possible Effects of EMU on the EU Banking Systems in the Medium to Long Term*, Frankfurt am Main.

Frankel, J. and Rose, A. (1996), Currency Crashes in Emerging Markets. An Empirical Treatment, *Journal of International Economics 41*, 351–366.

Gertler, M. (1992), Financial Capacity and Output Fluctuations in and Economy with Multi-period Financial Relationships, *Review of Economic Studies 59*, 455–472.

Glick, R. and Hutchison, M. (2001), Banking and Currency Crises: How Common Are Twins? in R. Glick, R. Moreno and M. M. Spiegel (eds.), *Financial Crises in Emerging Markets*, Cambridge University Press, Cambridge, UK, Chapter 2.

Hutchison, M. M. (2000), European Banking Distress and EMU: Institutional and Macroeconomic Determinants, Working Paper no. 2000-04, Economic Policy Research Unit, University of Copenhagen.

Hutchison, M. M. and McDill, K. (1999), Are All Banking Crises Alike? The Japanese Experience in International Comparison, *Journal of the Japanese and International Economies 13*, 155–180.

International Monetary Fund (1999), *World Economic Outlook*, Chapter 5: Selected Issues in Mature Financial Systems: EMU, Banking System Performance, and Supervision and Regulation, Washington, DC.

Kaminsky, G. and Reinhart, C. (1999), The Twin Crises. The Causes of Banking and Balance-of-payments Problems, *American Economic Review 89*, 473–500.

Kyei, A. (1995), Deposit Protection Arrangements: A Survey, International Monetary Fund Working Paper no. WP/95/134, Washington, DC.

La Porta, R., Lopez-de-Silanes, F. and Shleifer, A. (1998), Law and Finance, *Journal of Political Economy 106* (6), 1113–1155.

Levine, R. (1998), The Legal Environment, Banks, and Long-run Economic Growth, *Journal of Money, Credit and Banking 30* (3), 596–620.

Lindgren C.-J., Garcia, G. and Saal, M. I. (1996), *Bank Soundness and Macroeconomic Policy*, International Monetary Fund, Washington, DC.

Maddala, G. S. (1983), Methods of Estimation for Models of Markets with Bounded Price Variation, *International Economic Review 24* (2), 361–378.

Mauro, P. (1995), Corruption and Growth, *Quarterly Journal of Economics 105* (3), 681–712.

Organisation for Economic Co-operation and Development (1999), EMU and the Evolution of Financial Structure, *Financial Market Trends 72*, 39–55.

Steigum, E. (1992), Financial Deregulation, Credit Boom and Banking Crisis: The Case of Norway (in Finnish), *PTT Katsas 4*, 10–31.

Thygesen, N. (1999), Fiscal Implications in EMU and the Stability Pact, in A. Hughes Hallet, M. M. Hutchison and S. E. H. Jensen (eds.), *Fiscal Aspects of European Monetary Integration*, Cambridge University Press, Cambridge, UK.