Asset price crises and banking crises: some empirical evidence

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1. Introduction

The aim of this paper is to see whether, for a range of countries and time periods, there is any systematic relationship between stock market collapses and banking system crises. This is intended to be a first step in a larger study, one which aims ultimately to see whether asset price movements have any implications for the stability of the banking system in developed countries. The present paper, however, largely confines itself to an atheoretical examination of the data, so as to explore what there is to be explained. Three decades of equity and banking data, drawn from 14 countries, are examined.

Three questions in particular are put to these data. First, is there any evidence of association between stock market crashes and banking crises? Second, insofar as there is any association, does the depth or the length of stock market falls affect the severity of banking sector problems? Third, have the size and frequency of either stock market crashes or banking crises shown any sign of varying over time?

With this paper, we hope to contribute to the debate on the role of central banks with respect to asset price volatility. While it is generally acknowledged that central banks should focus in the first instance on price stability in product markets, there is now a growing acceptance that they should at least monitor price developments in asset markets.[2] One reason for doing so is that asset prices can affect aggregate demand directly or via the balance sheet channel (i.e. through their effects on household and business balance sheets). A second reason is that overvaluation in asset markets could lead to financial fragility. In particular, there is widespread concern that the growth of asset price bubbles and their subsequent bursting could create systemic risk. A third reason for central banks to be concerned about asset price volatility is that this may be a manifestation of poorly implemented financial reforms that lead to excessive lending and risk-taking, and to asset price booms and subsequent collapses.[3]

Financial institutions in particular are vulnerable to asset price collapses, because of the decline in the value of collateral they hold, and also because of the general increase in uncertainty that may lead to a flight to quality and to a widespread reduction in lending that could affect even solvent financial institutions.[4] If asset price collapses were to lead to bank failures, further financial stability problems could arise as a result of contagion. This in turn could lead to business failures, unemployment and a fully fledged economic downturn. Moreover, the costs associated with banking crises are high, both in terms of declines in real output and in terms of transfers from the public to distressed banks and their creditors (Kaufman (1999)). For example, recent research by the IMF (1998) into the occurrence of banking crises estimates that the cumulative actual and potential losses in output associated with 54 banking crises across developed and emerging markets (pre-dating the Asia crisis) averaged 11.6% of GDP.

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[2] See, for example, Greenspan (1999), Vickers (1999), Bernanke and Gertler (1999) and Gertler et al. (1998).

[3] See, for example, Borio et al. (1994) and Schinasi and Hargraves (1993).

[4] See, for example, Kaufman (1998).

Recently, significant progress has been made towards studying the relationship between banking and currency crises in a more systematic way.[5] In contrast, the study of the relationship between banking and equity crises is largely limited to case studies. Hence, we do not know whether banking crises systematically precede or follow equity market crises. Likewise, we do not know how severe a crisis has to be in order to spill over into other parts of the financial sector. As a result, we remain quite uncertain when asked to define the financial stability consequences of a sharp fall in equity valuations.

The main results of this paper can be summarised as follows. First, we do not find any evidence of a systematic association between equity market crises and banking crises within countries. In particular, we cannot establish that equity price collapses necessarily lead to banking crises. Second, we find that if there is an association, the length or severity of the equity price decline is irrelevant. Third, we find that both equity market and banking crises have become less severe over time: crises in the 1970s were on average longer and led, in the case of the former, to bigger price falls than in the following decades. Fourth, we cannot establish that periods of large stock market increases are more likely to lead to simultaneous crises in either the equity market or the banking sector.

When looking at the effect of banking crises on the equity market, we observe mixed evidence of banking crises leading to large equity price falls. But we cannot conclude that banking crises systematically cause large-scale liquidations of equity. Finally, we find weak evidence of increased bank lending prior to equity market crises.

The paper further illustrates the difficulty of accurately measuring banking crises. Qualitative measures used in the currency crisis literature are not without flaws, yet alternative measures proposed in the present paper turn out to be inconsistent with existing measures in several instances. This in turn affects the observed relationship between banking and equity market crises.

The remainder of the paper is organised as follows. In Section 2, we review the recent literature on the relationship between asset market crises and banking crises. Then in Section 3, the data are outlined, and the method by which equity market crises and banking crises can be identified are set out. In Section 4, we present our main results regarding the relationships between equity price and banking crises. Section 5 concludes.

2. Literature review

2.1 Theoretical models of banking crises and asset price crises

The views expressed in the literature on banking crises fall broadly into two groups. The first view is that banking crises are random events, unrelated to changes in the real economy. Banking crises can arise from self-fulfilling expectations, as modelled by Diamond and Dybvig (1983), among others. In their model, two possible equilibria can emerge. In the first equilibrium, a depositor may believe that a banking crisis is about to occur and that all other depositors will try to obtain liquid funds. As a result, his optimal strategy is to withdraw his own liquid assets immediately. A speculative attack follows and banks run out of liquid funds. An alternative equilibrium is one in which no one believes that a bank run will occur and banks have sufficient funds to meet true liquidity demands, such that no crisis develops. Unfortunately, while conceptually quite plausible, these multiple equilibrium models have received weak support from historical data (see e.g. Gorton (1988)).

The second view is that banking crises are related to the real business cycle and are triggered by sudden changes in aggregate risk.[6] As an economic downturn is likely to reduce the value of a bank's assets, signals about an impending downturn may induce depositors to consider withdrawing their funds. For example, Kaufman (1998) argues that banks fail through exposure to the same common shock (e.g. downturns in the economy or in the stock and real estate markets) rather than through

[5] See, for example, Kaminsky et al. (1998) and Berg and Pattillo (1999).

[6] See Allen and Gale (1998a) for a review of business cycle papers.

exposure to other bank failures that were the result of idiosyncratic factors. Relying on historical case studies rather than a formal model, he concludes that "to the extent contagion exists in the banking sector, at least in the United States, it appears to be rational and information based ignited by a common shock."

Recent papers combine the speculative attack view and the business cycle view. Chari and Jagannathan (1988) consider a model where informed agents observe a negative signal about the performance of a risky investment. Uninformed agents, however, are unclear about the motivation for these withdrawals (i.e. whether they are information-based or not) and may make decisions similar to the ones described in Diamond and Dybvig (1983). Hence, bank runs can occur either because the fundamentals look bad or because investors believe liquidity demands to be excessive.

Common to all papers is the insight that asymmetric information is a key factor in triggering a banking crisis. At the same time, asymmetric information problems (both adverse selection and moral hazard) are generally intensified during periods of sharp asset price falls, as lenders' collateral values and borrowing firms' net worth decline. This in turn increases the possibility of a banking crisis. Mishkin (1994) argues that a large number of US financial crises that occurred in the 19th and early 20th centuries can be explained using this asymmetric information framework, and that they typically started with stock market crashes.

In a series of theoretical papers, Allen and Gale formally relate asset price declines and banking crises. In Allen and Gale (1998b), they model a representative bank which holds illiquid assets with risky returns. A bank run will occur if depositors expect low returns on the risky asset. The crisis will spill over into asset markets if banks attempt to sell their risky assets in order to meet depositors' demands for liquidity. In a related model, Allen and Gale (1999) consider banks with cross-holdings of deposits. In this model, contagion and eventually bankruptcies occur when banks liquidate their claims on other banks in order to meet liquidity demands from their customers.

Marshall (1998) argues that asset price declines may lead to banking crises if investors believe stock prices to be a function of the probability of future crises. As in Diamond and Dybvig (1983), Marshall considers a model with two equilibria, with the "bad one" leading to a self-fulfilling liquidity crisis in the banking sector. Contagion arises when defaults are viewed as a signal that the economy is about to shift to the bad equilibrium. Of course, a single default could be a firm-specific event and should not necessarily lead to a reduction in capital provision by investors. Yet, when investors are imperfectly informed, they may erroneously attribute the default of a single firm to a widespread reduction in investor confidence. This mechanism could in turn lead to a (further) decline in equity prices.

The above models show how problems in the banking sector can affect asset prices or how signals about lower future asset returns may cause bank runs. But the banking crisis literature does not incorporate the possibility of a bubble in asset prices, nor does it model the mechanism by which the bursting of the bubble would lead to a full-blown liquidity crisis. This is clearly a gap in the theoretical literature. Allen and Gale (1998a) go some way towards modelling this issue, by linking sudden changes in credit availability and asset price movements. In their model, investors build their expectations about future credit supply into their decisions about how much to borrow from a representative bank and how much to pay for a risky asset. An agency problem exists because investors can default on their debt when asset returns are low, but keep the surplus when returns are high. A bubble develops when investors are willing to bid up the price of the risky asset above the price they would be willing to pay if they were not able to shift the risk as described. If the credit expansion is suddenly less than expected, investors may not be able to repay their loans, and may have to sell their risky assets instead. This may lead to a collapse in asset prices. Allen and Gale (1998a) do not, however, model the generalised collapse of the banking sector described in the multiple equilibrium models mentioned above.

A further criticism is that the banking crisis models are less relevant in countries where the banking sector has relatively low holdings of risky assets, such as equity or property. But, arguably, banks' exposure to corporate or household defaults through their loan books could give rise to qualitatively similar transmission mechanisms. A sharp fall in equity or property prices could also cause banks to

liquidate relatively liquid assets such as bonds. In this case, the association between asset price and banking crises could result from a flight to quality or to liquidity.

2.2 Empirical questions raised by the theory

The theoretical papers mentioned in the previous section suggest a number of empirical questions worth examining:

(i) Are bank runs preceded by periods of deteriorating equity returns?

(ii) Do bank runs contribute to a further fall in equity prices (as banks attempt to sell their assets in order to meet the sudden liquidity demands)?

(iii) Are equity price bubbles associated with rapidly expanding credit provision by banks (which in the long run could make the latter more vulnerable to default risk)?

The literature is unclear, however, on the exact timing of these events, or on the severity of the fall in equity prices required for a bank run to occur. The literature also does not provide any empirical predictions regarding the impact of equity price bubbles (both their growth and their subsequent bursting) on the banking sector. Based on these observations, we put the following questions to the data:

(Q1) Are banking crises preceded by equity price crises, or are equity price crises preceded by banking crises?

(Q2) Insofar as there is any association, does the nature of the equity price crisis (length, intensity) matter?

(Q3) Do equity prices decline during a banking crisis?

(Q4) Has the size or frequency of either equity crises or banking crises shown any sign of varying over time?

(Q5) Are equity market crises preceded by periods of unusually large equity price increases (possible evidence of asset price bubbles)?

(Q6) Is there evidence of an increase in bank lending prior to equity price crises (possible evidence of asset price bubbles)?

3. Data and methodology

3.1 Identifying equity market crises

We use a data set of monthly price data for Morgan Stanley Capital International (MSCI) stock indices of 14 developed countries.[7] For most countries, they span the period January 1970 to July 1999. To identify equity crises, we closely follow the methodology of Patel and Sarkar (1998). First, we will work with the ratio CMAX, defined as follows:

$CMAX_t$ = index level at time *t*/maximum index over the past 24 months.

The advantage of using this measure is that sharp price declines are more visible, and as such easier to date, than if we were to work with the raw index data. The rolling maximum in the denominator was defined over a relatively short period (24 months) to avoid losing too many data points. We experimented with periods of up to five years. While the resulting series looks smoother, the identification of the key dates ((i) to (iv) below) was unaffected.

[7] We also collected data for 14 emerging markets that we plan to examine in future research.

Also following Patel and Sarkar (1998), we define the following concepts:

(i) The beginning of the crisis: this is the month in which the CMAX reaches its (local) maximum prior to the month in which the crash (defined in (ii) below) was triggered.

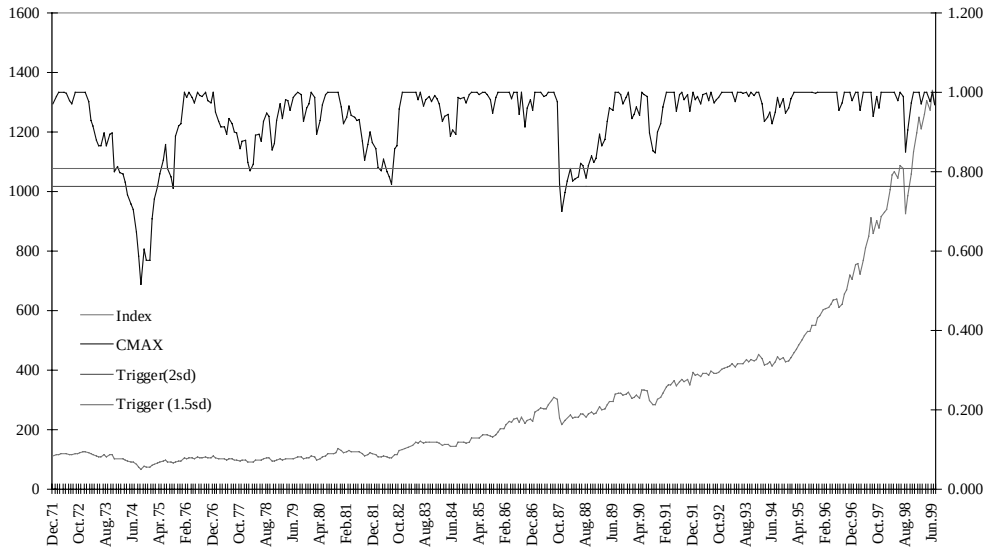
(ii) The beginning of the crash: this is the month in which the CMAX falls below a trigger level, defined below.

(iii) The trough: this is the month in which the CMAX reaches its minimum during the crisis.

(iv) The recovery: this is the month in which the CMAX reaches its pre-crash maximum.

We used two trigger points, defined as 1.5 and 2 standard deviations below the mean of the CMAX series. We further calculate the length of the crisis, measured from the beginning of the crisis to the end, and the magnitude of the price decline between the beginning of the crisis and the trough.

Figure 1
US equity market index



Source: Datastream.

An example of these definitions is given below, where we calculated CMAX for the US market. Using the 2 standard deviation trigger, we identify two crisis periods, from December 1972 to January 1976 and from August 1987 to July 1989. Crashes occurred in April 1974 and November 1987 (see Figure 1).[8] The crises lasted 36 and 22 months, respectively, and the respective price declines were 48% and 30%. A 1.5 standard deviation crisis is registered in the early 1980s, from November 1980 to November 1982. In this instance, the market crashed in September 1981 and prices fell by 23%. This crisis lasted for 23 months. Using the CMAX method and a trigger of 2 standard deviations, we identified a total of 28 equity market crises. When using the 1.5 standard deviation trigger, we identified a further 10 crises. The full list of equity crises is reproduced in Appendix A.

3.2 Identifying banking crises

In contrast to equity crises, banking crises are more difficult to measure precisely. This follows from the difficulty in capturing the complexity of a crisis with a single variable and from a lack of suitable data.[9] In this section, we first consider the measures that have been used in the fast growing empirical

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8 Recall that we are using monthly returns (based on beginning-of-month prices) to construct the CMAX series. So the market fall of 19–20 October 1987 will show up in the November 1987 return.

9 Davis (1999) discusses the difficulty of measuring financial instability in general.

literature on the determinants of banking and currency crises. It should be noted that this literature is primarily concerned with assessing the probability of a crisis. As such, its objective is to develop a set of indicators that could predict a banking or currency crisis, and less time is devoted to defining the crisis itself. For example, a number of studies define the onset of a banking crisis by the first official intervention, even though the banking sector may have become increasingly fragile in the preceding months or years.[10] In addition to these qualitative measures, we propose two alternative indicators, one based on bank equity prices and one based on aggregate bank balance sheet data.

The banking and currency crisis literature starting with Kaminsky and Reinhart (1999) typically employs a combination of events to define the beginning of a banking crisis. These may include: i) bank runs that lead to a closure, merger or takeover by the public sector of one or more financial institutions; and ii) in the absence of runs, the closure, merger, takeover or large-scale government assistance of an important financial institution that marks the beginning of a string of similar outcomes for similar institutions. More recent papers combine this qualitative approach with a limited number of quantitative criteria. Examples are Lindgren et al (1996), Demirgüç-Kunt and Detragiache (1998a) and (1998b), and Glick and Hutchinson (1999). They define a banking crisis as a situation where at least one of the following conditions holds: i) the ratio of non-performing assets to total assets is greater than 2% of GDP; ii) the cost of the rescue operation is at least 2% of GDP; iii) banking sector problems result in large-scale nationalisation of banks; and iv) extensive bank runs lead to emergency measures.

In this paper, we use the Glick and Hutchinson list as it is more selective than those produced by earlier studies.[11] A drawback is that they limit themselves to reporting annual data. In their view, it is not possible to date banking crises with more precision. For our sample, the Glick and Hutchinson method produces 13 banking crises, listed in Appendix B. Unfortunately, the qualitative methods do not always distinguish between problems encountered by single banks that have no systemic implications and banking crises that involve several banks of systemic importance. From Appendix B it can be seen that Glick and Hutchinson correctly identify the banking crises in the Nordic countries in the early 1990s, but fail elsewhere. For example, the 1984 UK banking crisis reported by them reflects the failure of an individual bank rather than a systemic banking crisis.[12]

An alternative way of defining a banking crisis is to use aggregate balance sheet data. If a banking crisis were the result of bank runs, namely the simultaneous withdrawal of deposits from one or more banks, then one could interpret a sharp fall in aggregate bank deposits as the beginning of a banking crisis. But Glick and Hutchinson (1999) point out that in recent years most banking problems in developed countries have not been associated with bank runs, but rather with problems on the asset side of the balance sheet. Moreover, a bank run (or a large-scale government intervention to prevent a potential bank run) is likely to have been preceded by a period of deterioration in the quality of a bank's assets. This is confirmed by Hardy and Pazarbasioglu (1998), who find that bank deposits in their large sample of banking crises in both developed and emerging markets start falling in real terms before a banking crisis is fully acknowledged, and continue to fall during the crisis. Another problem with using deposits is that changes in aggregate deposit growth may reflect macroeconomic factors rather than critical problems in the banking sector.

The banking and currency crisis literature frequently uses two other measures to identify bank balance sheet problems: the stock of non-performing loans as a percentage of total assets and bank lending as a percentage of GDP. With respect to the latter, it is assumed that if bank lending expands rapidly in a relatively short period of time, banks' screening is likely to be imperfect. This in turn may lead to a relatively high proportion of non-performing loans in the future (see, for example, Sachs et al. (1996)). Hardy and Pazarbasioglu (1998) report a boom and bust pattern in bank lending to the private sector

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[10] See, for example, Kaminsky and Reinhart (1999) and Hardy and Pazarbasioglu (1998).

[11] For banking distress to be included in their study, it has to be mentioned in both Lindgren et al. (1996) and Demirgüç-Kunt and Detragiache (1998a).

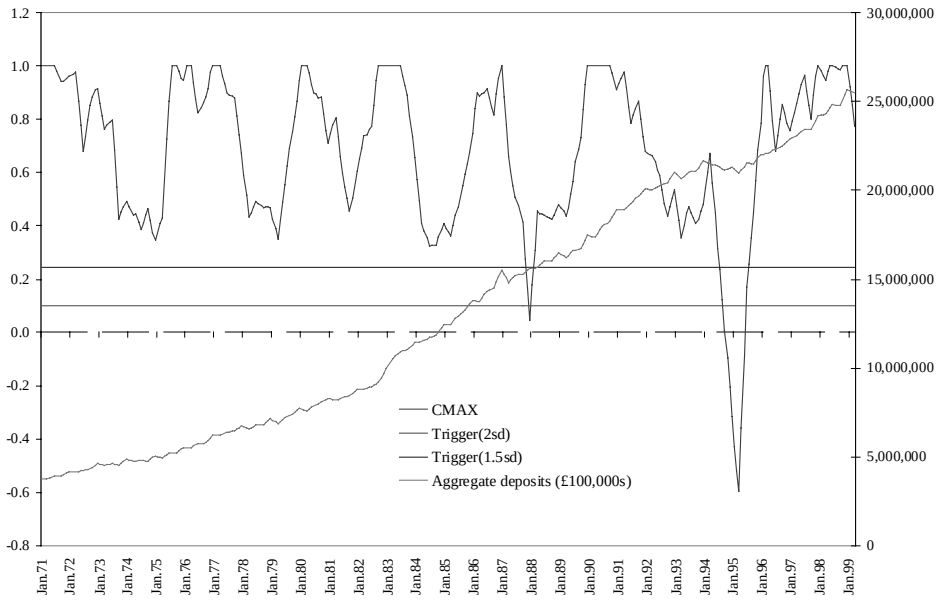
[12] See, for example, Davis (1995).

prior to banking crises, with a further decline during the crisis. Some authors also suggest looking at increased bankruptcies as signals of an impending banking crisis. Unfortunately, for many countries, such data are often available only at low frequencies or not available at all.

Keeping in mind these conceptual limitations, we collected data on aggregate bank deposits and aggregate bank lending. All data were taken from the International Financial Statistics (IFS) database. Bank deposits are the sum of demand deposits (line 24) and time, savings and foreign currency deposits (line 25). Aggregate bank lending is measured by claims on the private sector by deposit money banks (line 22d). The remaining variables discussed above (non-performing loans or bankruptcies) were not available in the IFS database. Monthly data were available for both deposit and lending series, but in many instances the data spanned a shorter sample period than the equity price data. For all variables, we first computed the percentage change in the level of the variable compared to a year earlier. This procedure ensures stationarity in the data and removes possible seasonal effects.

To identify the start of a banking crisis, we examine the aggregate deposit growth series.[13] By analogy with the equity price data, we employ the CMAX method to identify "unusual" movements in aggregate deposit growth, and we define the trigger level to be either 1.5 or 2 standard deviations below the mean of the series. To illustrate this crisis measure, we look again at the US case. Figure 2 shows two periods with very large changes in deposit growth, from December 1986 to December 1989 and from September 1990 to February 1996. During each crisis, the series fell through the 2 standard deviation trigger, in November 1987 and July 1984, respectively. The crises lasted 36 and 65 months, respectively. In each case, deposit growth fell by about 11% from the beginning of the crisis to the trough.

Figure 2
US aggregate bank deposits



Source: Datastream.

In total, this method identified 24 banking crises when using the 2 standard deviation trigger, and 39 crises when using the 1.5 standard deviation trigger. The full list of crises is presented in Appendix C. Note that the overlap with the qualitative indicators is weak, highlighting the problems with defining banking crises described above. For example, it is likely that the observed falls in aggregate deposit growth of several countries in the early 1990s reflect tightening monetary conditions and the onset of the recession in the relevant economies, rather than crises in their banking sectors.

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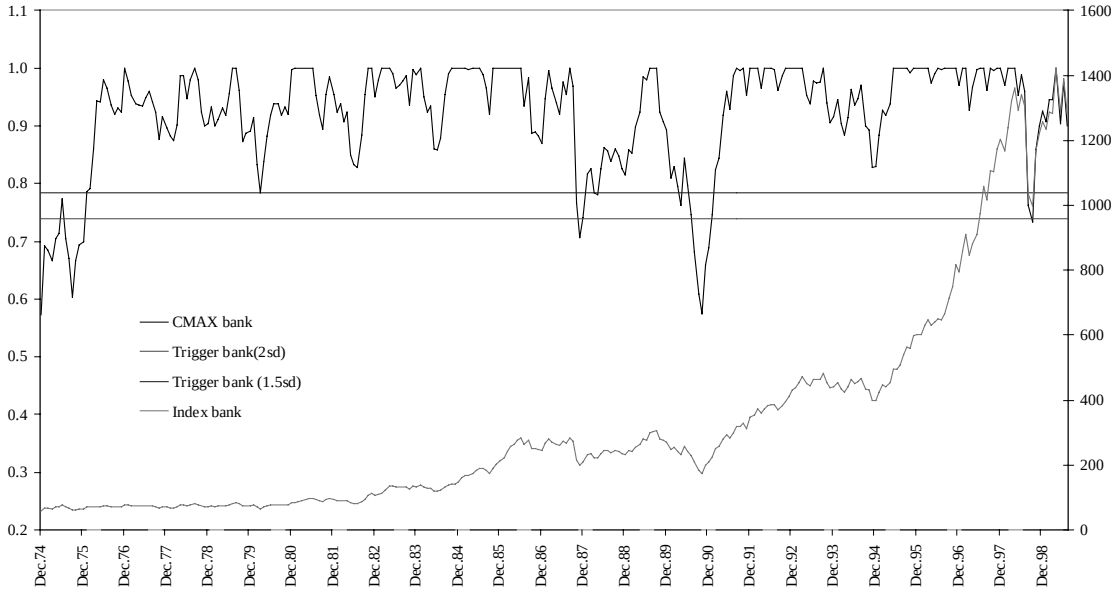
[13] The CMAX method is less suitable for the lending variable, as this variable is reported to first rise and then decline prior to a banking crisis (see, for example, Hardy and Pazarbasioglu (1998)).

Another indicator of banking problems and/or crises is bank equity. Falling equity prices could be seen as an indication of the increased perceived riskiness of individual banks or the banking sector as a whole. One advantage of using bank equity is that the beginning and end of the banking crisis can easily be defined. Unfortunately, in many countries banks are not traded publicly, or banking indices have only been constructed fairly recently. Probably for this reason, the banking and currency crisis literature tends not to use this measure. A further complication that arises when using bank equity price data is that one needs to distinguish between general market movements and idiosyncratic movements that are the result of rising required rates of return for the banking sector only.[14]

We calculated the CMAX measure (together with relevant trigger points) for a country's banking sector index, where available (again using MSCI indices). Figure 3 shows these measures for the United States. Using either the 1.5 or 2 standard deviation triggers, we identify three crisis periods for the banking sector, from August 1987 to July 1989, from September 1989 to August 1991 and from April 1998 to April 1999.[15] These crises lasted 23, 23 and 12 months, respectively, and caused declines in the banking index of 29%, 42% and 26%.

Figure 3
US bank equity index



Source: Datastream.

The CMAX results for the entire sample are summarised in Appendix D. Using the 1.5 standard deviation trigger, we identify 38 banking crises. It should be noted, however, that in many cases our data start much later than for the equity indices. This data limitation is likely to lead us to underestimate the frequency of associated banking and asset price crises. A second problem is that, as noted earlier, a number of crisis periods reflect general market declines rather than banking sector crises, which will lead us to overestimate the frequency of association. This measurement problem may also explain the lack of consistency across our three banking crisis measures that are apparent from Appendices B–D.

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[14] Clare and Priestley (1999) do so in their study of nine Norwegian banks: they use bank equity prices to estimate a CAPM model with time-varying volatility and obtain market-based estimates of the probability of failure.

[15] Unfortunately, most banking price series start after 1973, so in many instances the results in Appendix D do not contain the 1973/4 equity market crisis, to give but one example.

4. Equity price crises and banking crises: empirical results

In this section, we present the empirical results for hypotheses (Q1) to (Q6) as identified in Section 2. Unless otherwise specified, we employ the broadest definition of a crisis (i.e. based on the 1.5 standard deviation trigger). To identify twin asset price and banking crises, it is useful to examine the following matrix, adapted from the banking and currency crisis literature.

	Asset price crisis at *t*	No asset price crisis at *t*
Bank crisis at *t*	$A_{t, t}$	$B_{t, t}$
No bank crisis at *t*	$C_{t, t}$	$D_{t, t}$

For example, we can use this matrix to learn in how many instances an asset price crisis occurring during period *t* was accompanied by a banking crisis in period *t* ($A_{t, t}$), or not accompanied by a banking crisis ($C_{t, t}$). A similar matrix could be constructed to tabulate the number of instances in which an asset price crisis in period *t* was preceded or followed by a banking crisis in period *t*–1 or *t*+1, respectively. In what follows, we look for within-country associations only, but a similar matrix could be constructed to identify associations across countries.

Table 1 sheds light on the first question, using all three criteria to define a banking crisis. In each case, the table presents the number of twin banking and equity market crises, defined as episodes where the *onset* of an equity market crisis is either followed *or* preceded by the onset of a banking crisis within 12 months. We also looked at instances where the banking crisis began within a 24-month period surrounding the start of the stock market crisis. Unless otherwise specified, our discussion focuses on the former window.

Table 1
Measuring the association between banking and equity price crises (Q1)

	12-month window Number[1]	24-month window Number[1]
Total number of equity crises	38	
Panel I: Using bank equity		
Total number of banking crises	38	38
Asset price crises associated with banking crisis[2]	16	18
Asset price crises not associated with banking crisis	6	4
Banking crises associated with asset price crisis[3]	17	19
Banking crises not associated with asset price crisis	21	19
Panel II: Using qualitative data		
Total number of banking crises	13	13
Asset price crises associated with banking crisis[2]	4	5
Asset price crises not associated with banking crisis	34	33
Banking crises associated with asset price crisis[3]	4	5
Banking crises not associated with asset price crisis	8	6
Panel III: Using balance sheet data		
Total number of banking crises	39	
Asset price crises associated with banking crisis[2]	9	11
Asset price crises not associated with banking crisis	27	25
Banking crises associated with asset price crisis[3]	9	11
Banking crises not associated with asset price crisis	29	28

[1] When comparing isolated and twin crises, two numbers may not add up because of the later start of many bank data. [2] Frequency with which asset price crisis at *t* is accompanied by banking crisis in either *t*+*k* or *t*–*k*, where *k* = 12 or 24 months. [3] Frequency with which banking crisis at *t* is accompanied by asset price crisis in either *t*+*k* or *t*–*k*, where *k* = 12 or 24 months.

When using bank equity as our criterion, we find that 16 out of 38 equity market crises could be associated with a banking crisis ($A_{t,\,t}$), while six other equity crises were isolated occurrences ($C_{t,\,t}$). [16] Twin crises occurred in Hong Kong and Sweden in the 1990s, Australia, Canada, Denmark, Italy, Japan, Spain, the United Kingdom and the United States in the 1980s and the United Kingdom in the 1970s. When looking at banking crises first, we find similar numbers of banking crises associated with equity price crises ($A_{t,\,t}$: 17), but a larger number of banking crises which neither resulted in nor were preceded by equity crises ($B_{t,\,t}$: 21).

The association becomes even weaker when using the qualitative criteria, as can be seen from panel II. The Glick and Hutchinson criterion returned four twin crises (Norway, Sweden, the United Kingdom and the United States). Recall, however, that the latter method employed years rather than months to date the banking crisis. In any case, the disparity between the results from this and the previous method suggest that a fair amount of measurement error is present.

Panel III repeats the exercise, this time using the balance sheet method to identify banking crises. This time, we find that nine out of 38 equity price crises were associated with banking crises ($A_{t,\,t}$). They occurred in Australia in the 1970s, Japan, Norway, Sweden and the United States in the 1980s and Denmark, Finland, Germany and Sweden in the 1990s. This number goes up to 11 when we consider a 24-month window either way (Canada and Spain). When looking at banking crises first, we find that out of the 36 banking crises identified by the balance sheet method, nine are in fact twin crises ($A_{t,\,t}$), with the remaining 29 being banking crises that were neither preceded nor followed by asset price crises ($B_{t,\,t}$).

To conclude, Table 1 shows that irrespective of our methodology, the association between equity and banking crises is weak. In particular, the empirical evidence is too weak to provide support for the view that stock price declines always lead to banking crises.

Table 2 looks at the nature of equity price crises, namely their length (number of months) and the total price decline that occurred in the equity market. We are interested in learning whether or not twin crises are systematically preceded by more severe equity price crises. For the total sample, the average equity crisis lasted 38 months and prices fell by 43% on average. Crises varied both in their length and their intensity, however, with the longest crisis lasting 82 months (Spain, April 1974 – March 1981), and the most severe crisis entailing an 89% price decline (Hong Kong, 1973).

Table 2
Does the nature of the equity crisis affect the likelihood of twin crises (Q2)?

	12-month window		24-month window	
	Length of equity crisis (months)	Price decline (%)	Length of equity crisis (months)	Price decline (%)
All equity crises	37	–42.9		
Panel I: Using bank equity				
Equity crises associated with banking crisis	35	–39.5	36	–39.1
Equity crises not associated with banking crisis	33	–32.2	28	–33
Panel II: Using qualitative data				
Equity crises associated with banking crisis	22	–33.2	24	–29.6
Equity crises not associated with banking crisis	38	–44	36	–42.03
Panel III: Using balance sheet data				
Equity crises associated with banking crisis	33	–40.65	34	–40.66
Equity crises not associated with banking crisis	38	–41.27	38	–41.32

[16] For the remaining 16 asset price crisis episodes, no bank equity data were available.

When using bank equity data to identify banking crises, we see that equity crises associated with banking crises tend to last longer than those not associated with banking crises, and to result in larger price declines. But when using qualitative or balance sheet data to identify banking crises, we obtain the opposite result: equity price crises not associated with banking crises last longer and witness larger price declines. Hence, we cannot conclude that the more severe the equity price crisis, the more likely a banking crisis is to follow. Arguably, the results in this section are affected by the small number of twin crises that were identified in the first place.

Table 3 looks at the behaviour of equity prices during a banking crisis, both those occurring in isolation and those associated with equity price crises. Large falls in equity prices during an isolated banking crisis might suggest that investors are liquidating their equity holdings because of reduced confidence in the banking sector and/or reduced access to bank credit. Significant equity price falls during a twin crisis could reflect concerns about both overvaluation of the equity market and increased fragility in the banking sector.

Table 3 measures the percentage fall in the overall equity index from the beginning of the banking crisis to the trough. The table provides a very mixed picture. When using the bank equity criterion (panel I), we find that equity returns were indeed negative during banking crises, and even more so during twin crises. But since this method does not make an accurate distinction between general market and bank equity movements, we cannot unambiguously interpret these negative returns as a manifestation of banking sector problems. When using the bank balance sheet method (panel III), we report negative returns during twin crises only. Finally, the qualitative method (panel II) yields positive returns during both isolated and twin crises. It should be noted that since this method does not provide a trough date, the price decline was measured from the beginning of the crisis to the end. The reported positive returns may therefore mask an actual decline during the first phase of the crisis (from the beginning until the trough). Overall, the evidence seems too weak to conclude that banking problems lead to a spillover into asset markets as modelled by, for example, Allen and Gale (1998b).

Table 3
Do equity prices decline further during a banking crisis (Q3)?

	From beginning of crisis to trough	
	12-month window	24-month window
	% decline of equity index	
Panel I: Bank equity		
All banking crises	–26.03	
Banking crises associated with equity crisis	–34.12[1]	–29.00
Banking crises not associated with equity crisis	–16.78	–21.58
Panel II: Qualitative data[2]		
All banking crises	51.17	
Banking crises associated with equity crisis	109.07	117.56[1]
Banking crises not associated with equity crisis	25.44	9.68
Panel III: Bank balance sheet data		
All banking crises	23.12	
Banking crises associated with equity crisis	–4.70[1]	16.32
Banking crises not associated with equity crisis	32.06	26.60
Benchmarks		
Total sample	12.85	
1970s	6.08	
1980s	19.56	
1990s	10.98	

[1] Denotes that results for twin crisis are significantly different from those during other crises (95%). [2] Uses end-date instead.

Table 4 documents the changing nature of both equity and banking crises over time. Panel I shows that stock market crises in the 1970s were on average longer and led to bigger price falls than in the subsequent decades. In contrast, declines in bank equity prices (panel II) were longer and more pronounced in the 1980s, although this result is possibly biased because many of the data series were not available for the 1970s. Finally, panel III shows that when considering bank balance sheet data, banking crises have become shorter and characterised by smaller falls in deposit growth over time.

Table 4
Changing nature of crises (Q4)

	Total period	1970s	1980s	1990s
Panel I: Equity crises				
Number of crises	38	15	18	5
Average length of crisis	37	41	33	36
% decline to trough	–42.89	–49.97	–37.44	–41.29
Panel II: Banking crises using bank equity				
Number of crises	38	4	19	15
Average length of crisis	31	30	34	23*
% decline to trough	–39.84	–35.03	–42.09	–38.15
Panel III: Banking crises using bank balance sheet data				
Number of crises	39	6	12	21
Average length of crisis	40	53	41	37
% change in deposits	8.20	15.42	12.74	3.88
% change in deposit growth (beginning to trough)	–20.32	–34.19	–27.51	–12.91

* Most banking crises of the 1990s have not yet ended, according to this definition.

Table 5 addresses the question of whether equity market crises are preceded by periods of unusually large price increases which could be interpreted as possible evidence of asset price bubbles. The empirical literature on bubbles argues that if bubbles lead to very large price movements, both during the final periods of the bubble growth and after it has burst, the distribution of asset prices will exhibit negative skewness and large kurtosis. Unfortunately, many of the empirical tests in this literature have proved inconclusive, primarily because market fundamentals and bubbles could be characterised by similar statistical properties, and it is now widely acknowledged that asset price bubbles cannot be identified unambiguously. While keeping the shortcomings of these tests in mind, it is still worthwhile to examine the distributional properties of asset price returns before the onset of an equity price crisis, and compare them with benchmarks for "normal" periods.[17]

When considering the entire sample of 38 equity price crises, we see that average returns were higher than historical benchmarks in the three years preceding the start of the crisis, though the differences are not statistically significant. But neither skewness nor kurtosis was particularly high. Skewness measures were positive though, as one would expect in a rising market but, except for the two-year period before the crisis, remained close to zero. The kurtosis did not indicate significant departure from normality and therefore did not point to a preponderance of very large market movements in the period preceding the stock market crisis. Hence, while stock price crises seem to occur after periods of rapid price increases, insufficient evidence is available to designate these as bubble periods.

[17] Assuming normality for equity returns, negative skewness points to the occurrence of a larger number of negative returns than indicated by the symmetric normal distribution (which has zero skewness). The benchmark for our kurtosis measure (i.e. the occurrence of a larger number of very large positive or negative returns than characteristic for a normal distribution) is 0. A negative number indicates that the actual distribution of returns is flatter (has more weight in the tails) than the normal distribution.

Table 5
Are equity crises preceded by large price movements (Q5)?

	Returns before crisis			Skewness before crisis			Kurtosis before crisis		
	1 year	2 years	3 years	1 year	2 years	3 years	1 year	2 years	3 years
All equity crises	31.83	22.40	21.61	0.29	0.44	0.52	–0.21	–0.09	–0.13
Panel I: using bank equity									
12-month window:									
Equity crises associated with banking crisis	37.67	25.73	24.85	0.05	0.62	0.35	0.14	0.08	0.17
Equity crises not associated with banking crisis	15.31	17.45	13.35	0.56	0.29	0.17	–0.28	–0.47	–0.92
24-month window:									
Equity crises associated with banking crisis	34.01	24.45	24.16	0.72	0.43	0.35	0.08	0.04	0.02
Equity crises not associated with banking crisis	28.22	23.19	13.07	–0.03	0.62	0.42	–0.47	–0.68	–0.81
Panel II: Using qualitative data									
12-month window:									
Equity crises associated with banking crisis	23.08	13.26	8.60	0.48	0.43	0.50	–0.58	–0.45	0.04
Equity crises not associated with banking crisis	32.86	23.48	23.47	0.27	0.44	0.53	–0.17	–0.05	–0.16
24-month window:									
Equity crises associated with banking crisis	21.48	15.21	14.57	0.14	0.51	0.56	–0.26	–0.24	–0.04
Equity crises not associated with banking crisis	33.40	23.49	22.92	0.31	0.43	0.51	–0.21	–0.07	–0.15
Panel III: Using bank balance sheets									
12-month window:									
Equity crises associated with banking crisis	17.55*	18.27	17.88	0.43	0.30	0.37	0.18	–0.44	–0.70
Equity crises not associated with banking crisis	35.33	22.40	21.90	0.21	0.47	0.58	–0.36	–0.07	–0.05
24-month window:									
Equity crises associated with banking crisis	18.55*	18.80	18.88	0.55	0.47	0.39	0.19	–0.03	–0.50
Equity crises not associated with banking crisis	36.31	22.50	21.75	0.13	0.41	0.59	–0.41	–0.23	–0.09
Benchmarks	Returns	Skewness	Kurtosis						
Total sample	12.85	0.87	2.65						
1970s	6.08	0.67	1.41						
1980s	19.56	0.48	0.20						
1990s	10.98	0.35	–0.11						

*Indicates that results for twin crisis are significantly different from those during other crises (95%).

We repeat the same exercise for the twin crises identified earlier. In general, equity price increases in the period preceding the twin asset and banking crises were significantly higher than during our chosen benchmark periods. When using bank equity as our identification method, we find that equity price increases were slightly higher when a twin equity and banking crisis followed than when an isolated equity crisis followed, but again the difference was statistically insignificant. In contrast,

when using the qualitative or the balance sheet methods, we obtain the opposite result, with twin crises following weaker equity price increases. No remarkable pattern is observed in either skewness or kurtosis. Hence, the available evidence is too weak to conclude that bubble periods are more likely to cause simultaneous problems in both stock markets and the banking sector.

Finally, Table 6 examines bank lending in the three years prior to the onset of an asset price crisis. Evidence of expanding bank lending prior to asset crises might be an indication of a developing asset price bubble. As suggested by Allen and Gale (1998a), this bubble could burst if investors suddenly believed future credit to be lower than previously expected.

The table shows that, on average, aggregate lending growth is higher one, two and three years before the start of the asset price crisis when compared with historical benchmarks. None of the differences are statistically significant, however. When comparing twin and non-twin crises, we observe some evidence of higher lending growth prior to the former. Note, however, that both the qualitative and the balance sheet criteria yield the opposite result when using a 12-month window, and that the differences are rarely significant. Hence, our evidence to support the theoretical result of Allen and Gale (1998a) is rather weak.

Table 6
Is there evidence of increased bank lending prior to an equity price crisis (Q6)?

	Average lending growth prior to crisis		
	One year	Two years	Three years
All equity crises	14.31	14.62	14.18
Panel I: Using bank equity			
12-month window:			
Equity crises associated with banking crisis	13.70	14.86	13.94
Equity crises not associated with banking crisis	11.03	11.70	11.94
24-month window:			
Equity crises associated with banking crisis	13.24	14.70	14.01
Equity crises not associated with banking crisis	11.28	10.67	10.71
Panel II: Using qualitative data			
12-month window:			
Equity crises associated with banking crisis	19.26	21.49	20.98
Equity crises not associated with banking crisis	13.78	13.88	13.45
24-month window:			
Equity crises associated with banking crisis	19.26	21.49	20.98
Equity crises not associated with banking crisis	13.78	13.88	13.45
Panel III: Using bank balance sheets			
12-month window:			
Equity crises associated with banking crisis	13.01	13.32	13.61
Equity crises not associated with banking crisis	14.76	15.07	14.38
24-month window:			
Equity crises associated with banking crisis	15.31	15.41	15.62
Equity crises not associated with banking crisis	14.43	14.55	13.86
Benchmarks			
Total sample	11.48		
1970s	15.07		
1980s	14.20		
1990s	6.05		

5. Conclusions

This paper examined the association between equity market crises and banking crises for 14 developed countries over the period 1970–99. We find the association to be relatively weak and not to be systematically related to the severity of the equity price collapse. Our empirical results do not permit us to conclude that periods of sharp equity price increases cause problems in both equity markets and the banking sector.

When looking at the effect of banking crises on the equity market, we observe mixed evidence of banking crises leading to large equity price falls, but cannot conclude that banking crises systematically cause large-scale liquidations of equity. Finally, we find only weak evidence of increased bank lending prior to equity market crises, as suggested by theoretical models of asset price bubbles and banking crises.

An important caveat pertains to all our results, which stems from the relatively small number of banking crises that have occurred in developed countries over the past three decades, the incomplete nature of our data set and the limitations of our methodology to accurately identify banking crises. Extending our sample to emerging market economies may yield stronger associations. For example, Glick and Hutchinson (1999) find that the association between banking and currency crises is stronger for financially liberalised emerging market economies than for the remaining countries (including both developed and less developed emerging countries). It will be equally important in future research to refine our banking crisis indicators.

Appendix A

Equity crises						
Country	Start	Crisis	Trough	End	Length (in months)	Price decline (in %)
Australia	Jan. 73	June 74	Sep. 74	Apr. 76	38	–60.12
	Oct. 80	Feb. 82	Mar. 82	July 83	32	–43.23
	Sep. 87	Oct. 87	Feb. 88	Oct. 91	48	–41.8
Canada	Oct. 73	Aug. 74	Sep. 74	May 78	54	–38.72
	Nov. 80	Feb. 82	June 82	May 83	29	–43.04
	July 87	Oct. 87	Nov. 87	Aug. 89	24	–24.26
	May 98	Aug. 98	Sep. 98	July 99	13	–25.37
Denmark	June 73	May 74	Nov. 74	Jan. 76	30	–42.11
	Jan. 84	Oct. 84	Oct. 84	June 88	52	–29.82
	July 91	Sep. 92	Oct. 92	Dec. 93	28	–33.26
France	Apr. 73	June 74	Sep. 74	Feb. 76	34	–52.67
	Feb. 76	Mar. 77	Apr. 77	May 78	26	–36.07
	Apr. 87	Nov. 87	Jan. 88	Jan. 89	20	–43.5
Finland	Apr. 89	Sep. 90	June 91	Apr. 93	47	–49.34
Germany	July 72	June 74	Sep. 74	Apr. 75	32	–34.4
	Apr. 86	Oct. 87	Jan. 88	Aug. 89	39	–47.77
	Mar. 90	Sep. 90	Sep. 90	Aug. 93	40	–33.47
Hong Kong	Feb. 73	Sep. 73	Nov. 74	Jan. 76	34	–89.53
	July 97	Jan. 98	Aug. 98	–	–	–60.09
Italy	June 73	Dec. 74	Sep. 75	Sep. 78	62	–53.29
	May 81	Oct. 81	June 82	Jan. 84	31	–40.5
	Aug. 86	Oct. 87	May 88	July 89	34	–41.53
Japan	Jan. 73	Sep. 74	Oct. 74	Jan. 76	35	–40.24
	Dec. 89	Sep. 90	Sep. 90	May 94	52	–46.65
Norway	Jan. 74	Sep. 74	Nov. 75	Mar. 79	61	–57.39
	Sep. 87	Nov. 87	Dec. 87	Mar. 89	17	–43.8
	July 90	Jan. 91	Nov. 91	Oct. 93	38	–42.83
Spain	Apr. 74	July 77	Oct. 77	Mar. 81	82	–63.01
	Sep. 89	Sep. 90	Sep. 90	July 93	44	–38.36
Sweden	Apr. 76	June 77	Nov. 77	Aug. 78	27	–36.18
	Sep. 87	Nov. 87	Nov. 87	Dec. 88	14	–32.38
	July 90	Sep. 90	Nov. 90	May 93	32	–36.79
United Kingdom	Aug. 72	Jan. 74	Nov. 74	Dec. 75	39	–68.71
	Jan. 76	Sep. 76	Oct. 76	Mar. 77	13	–28.78
	Sep. 87	Nov. 87	Nov. 87	Aug. 89	22	–33.79
United States	Dec. 72	Apr. 74	Sep. 74	Jan. 76	36	–48.39
	Nov. 80	Sep. 81	July 82	Nov. 82	23	–23.26
	Aug. 87	Nov. 87	Nov. 87	July 89	22	–30.04

Appendix B

Banking crises using qualitative identification method (after Glick and Hutchinson (1999))

	Beginning	End
Canada	1983	1985
Denmark	1987	1992
Finland	1991	1994
France	1994	1995
Germany	1978	1979
Italy	1990	1995
Japan	1992	1997
Norway	1987	1993
Spain	1977	1985
Sweden	1990	1993
United Kingdom	1975	1976
	1984	1984
United States	1980	1992

Appendix C

Identification of banking crises using balance sheet data (using aggregate deposits (lines 24 + 25 or 251 from IFS)

	Beginning of crisis	Crash	Trough	Recovery	Trigger	Duration of crisis (months)	Beginning to trough (using raw data)	Beginning to trough (using raw data)
							% change in deposits during crisis	% change in equity index
Australia	July 73	Aug. 74	Sep. 74	Apr. 79	2	68	10.65	–55.09
	Aug. 89	July 90	Dec. 91	Feb. 93	2	30	18.40	–0.25
	Mar. 93	Aug. 93	Aug. 93	Dec. 94	1.5	21	0.61	15.03
Canada	Dec. 81	Nov. 82	Feb. 84	Dec. 84	2	36	1.89	26.93
	Aug. 97	Oct. 98	Jan. 99	Apr. 99	2	20	3.27	8.68
Denmark	–	Jan. 71	Jan. 71	Nov. 71	1.5	–	–	
	Mar. 76	Mar. 78	Mar. 78	Oct. 79	1.5	31	12.54	–8.50
	Oct. 88	Dec. 89	Dec. 89	May 91	1.5	31	9.74	54.64
	July 91	Dec. 92	Dec. 92	Oct. 93	1.5	27	2.83	–30.47
	Dec. 93	Sep. 94	Mar. 95	Mar. 98	2	51	–13.04	–15.18
Finland	July 73	Sep. 74	Sep. 74	Apr. 79	2	70	23.55	.
	Aug. 89	Feb. 91	Dec. 91	Feb. 93	2	31	21.18	–54.18
	Mar. 93	Aug. 93	Aug. 93	Dec. 94	1.5	22	2.56	45.47
France	Feb. 79	Dec. 79	Dec. 80	Dec. 83	1.5	58	24.90	31.48
	Sep. 84	Mar. 88	Sep. 88	Mar. 90	1.5	66	27.65	105.24
	Mar. 90	May 91	Dec. 91	Mar. 93	2	36	3.62	–9.03
Germany	Nov. 78	June 80	July 80	Mar. 82	1.5	40	5.47	–9.07
	Sep. 90	June 91	Sep. 91	Dec. 93	1.5	39	4.27	17.71
	Jan. 94	Dec. 94	Apr. 95	Dec. 96	2	35	0.12	–8.91
Italy	May 92	Jan. 95	Mar. 95	July 96	2	50	12.26	39.55
	July 96	Mar. 97	Dec. 97	–	2	–	–4.20	66.30
Japan	Sep. 90	Apr. 91	Nov. 92	Nov. 94	2	50	0.84	–11.50
	Jan. 95	Feb. 96	Apr. 96	Aug. 96	2	19	3.29	19.10
	Aug. 96	Mar. 97	Mar. 97	Feb. 98	1.5	18	–0.86	–8.27
Norway	Dec. 84	Dec. 86	Dec. 86	Oct. 87	1.5	34	17.71	26.80
	Jan. 88	Nov. 88	Mar. 92	Oct. 92	1.5	57	18.38	67.47
	Dec. 92	Dec. 93	Dec. 93	Feb. 96	2	38	–1.86	52.15
	Dec. 96	Feb. 97	Jan. 98	Jan. 99	2	25	–7.33	14.53
Spain	Aug. 82	Jan. 83	Oct. 83	Jan. 85	2	29	–2.90	7.77
	Feb. 86	Jan. 87	Jan. 87	Jan. 89	1.5	35	4.06	60.26
	Jan. 91	Feb. 97	Oct. 97	Oct. 98	2	93	46.53	179.14
Sweden	Sep. 86	Mar. 90	Oct. 90	Mar. 91	2	54	20.93	32.69
	July 91	Sep. 92	Sep. 92	Oct. 93	2	27	–4.31	–36.05
	Oct. 93	Jan. 95	Feb. 95	Mar. 96	2	29	0.65	5.13
	May 96	Feb. 98	Mar. 98	Mar. 99	2	34	0.66	91.02
United	Nov. 89	Dec. 91	Jan. 92	Jan. 94	2	50	15.36	12.48
Kingdom	Jan. 96	Nov. 97	Mar. 98	–	1.5	–	16.71	56.09
United	Dec. 86	Nov. 87	Dec. 87	Dec. 89	2	36	0.53	0.61
States	Sep. 90	July 94	Mar. 95	Feb. 96	2	65	14.95	65.70

Appendix D

Identification of banking crises using bank equity data

	Beginning of crisis	Crash	Trough	Recovery	Trigger	Duration of crisis (months)	% price decline during crisis	% price decline during crisis
							Bank equity	Total equity
Australia	Aug. 87	Oct. 87	Nov. 87	May 88	1.5	9	–28.63	–36.65
	Jan. 90	Sep. 90	Dec. 90	June 93	2	41	–38.30	–20.41
Canada	Aug. 75	Apr. 77	May 77	Apr. 78	1.5	32	–20.06	50.20
	Nov. 80	Jan. 82	June 82	Feb. 83	2	27	–41.16	–43.04
	Apr. 83	May 84	June 84	May 85	1.5	25	–24.97	–4.54
	June 87	Oct. 87	Nov. 87	Jan. 89	1.5	19	–20.92	–20.98
	July 89	Apr. 90	Oct. 90	Nov. 81	2	28	–29.87	–19.97
	May 98	Aug. 98	Sep. 98	–	2	–	–38.02	
Denmark	Dec. 83	Mar. 84	June 84	June 85	1.5	18	–29.37	–19.64
	Dec. 85	July 86	July 86	June 88	1.5	30	–29.51	–17.90
	Nov. 89	Dec. 90	Oct. 92	Sep. 93	2	46	–55.19	–26.20
France	Apr. 90	Sep. 90	Dec. 90	Nov. 92	1.5	31	–36.71	–26.13
	Dec. 93	Aug. 95	Sep. 95	Feb. 97	1.5	50	–34.93	–16.92
	July 98	Sep. 98	Sep. 98	–	2	–	–51.31	
Germany	Apr. 86	May 87	Jan. 88	Nov. 89	2	43	–49.47	–47.77
	May 98	Sep. 98	Sep. 98	–	2	–	–35.05	
Hong Kong	July 81	Sep. 82	Nov. 82	Dec. 84	2	41	–55.79	–57.97
	Sep. 87	Nov. 87	Nov. 87	Dec. 89	1.5	27	–41.93	–45.78
	Jan. 94	Jan. 95	Jan. 95	Jan. 96	1.5	24	–42.32	–36.72
	July 97	May 98	Sep. 98	–	2	–	–54.52	
Italy	May 81	Oct. 81	June 82	July 85	2	49	–51.09	–40.50
	Mar. 86	Dec. 87	May 88	May 89	1.5	37	–51.75	–33.43
Japan	Dec. 89	Sep. 90	Sep. 90	June 96	2	77	–47.75	–46.65
	June 96	Oct. 97	Sep. 98	–	2	–	–62.98	
Spain	Aug. 89	Mar. 90	Sep. 92	July 93	2	47	–48.01	–42.33
	July 98	Sep. 98	Sep. 98	–	2	–	–42.85	
Sweden	Aug. 89	June 92	Nov. 92	Aug. 93	2	48	–87.00	–21.43
	June 96	Oct. 97	Sep. 98	–	1.5	–	–	
United	Jan. 69	July 69	Mar. 70	Mar. 71	1.5	26	–25.35	
Kingdom	Dec. 72	Feb. 74	Nov. 74	Nov. 75	2	35	–69.68	–67.76
	Jan. 76	Nov. 76	Nov. 76	Apr. 78	1.5	27	–25.03	–24.10
	Sep. 87	Oct. 87	Nov. 87	Nov. 89	2	26	–35.29	–33.79
	Jan. 90	Sep. 90	Oct. 90	Mar. 91	1.5	9	–26.28	–12.14
	Jan. 94	May 94	May 95	Sep. 95	1.5	20	–8.83	–6.07
	Feb. 98	Aug. 98	Sep. 98	Mar. 99	2	13	–35.57	–12.29
United	Aug. 87	Oct. 97	Nov. 87	July 89	2	23	–29.35	–30.04
States	Sep. 89	Apr. 90	Oct. 90	Aug. 91	2	23	–42.63	–12.27
	Apr. 98	Aug. 98	Sep. 98	Apr. 99	1.5	12	–26.62	–7.68

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