

Costs of banking system instability: some empirical evidence

Glenn Hoggarth and Victoria Saporta, Financial Industry and Regulation Division, Bank of England

There is now a substantial empirical literature on the causes of banking crises¹ but there have been fewer studies measuring the potential costs of financial system instability. Yet it is a desire to avoid such costs that lies behind policies designed to prevent, or manage, crises. This article presents some cross-country estimates of the fiscal costs of crisis resolution and of output losses during crises. Although varying markedly from crisis to crisis, over the past 25 years cumulative output losses during banking crises have, on average, been large – around 15 per cent to 20 per cent of GDP. Moreover, whether banking crises cause or are the result of recession they exacerbate subsequent declines in output, as well as often being costly to resolve.

OVER THE PAST QUARTER OF A CENTURY, unlike the preceding 25 years, there have been many banking crises around the world. Caprio and Klingebiel (1996, 1999), for example, document 69 crises in developed and emerging market countries since the late 1970s. In a recent historical study of 21 countries, Bordo, Eichengreen, Klingebiel and Martinez-Peria (2001) report only one banking crisis in the quarter of a century after 1945 but 19 since then.

This article considers the ways in which banking crises can impose costs on the broader economy and presents estimates of those costs. In particular, the article focuses on cross-country estimates of the direct fiscal costs of crisis resolution and the broader welfare costs, approximated by output losses, associated with banking crises.

Costs of banking crises – an overview

A crisis in all or part of the banking sector may impose costs on the economy as a whole or parts within it. First, 'stakeholders' in the failed bank will be directly affected. These include shareholders, the value of whose equity holdings will decline or disappear; depositors who face the risk of losing all, or part, of their savings and the cost of portfolio reallocation; other creditors of the banks who may not get repaid; and borrowers, who may be dependent on banks for funding and could face difficulties in finding alternative sources. In addition, taxpayers may

incur direct costs as a result of public sector crisis resolution – cross-country estimates of these are shown below.

Costs falling on particular sectors of the economy might in some cases simply represent a redistribution of wealth, but under certain conditions banking crises may also reduce income and wealth in the economy as a whole.

A wave of bank failures – a banking crisis – can produce (as well as be caused by) a sharp and unanticipated contraction in the stock of money and result, therefore, in a recession (Friedman and Schwartz (1963)). Secondly, if some banks fail and others are capital constrained the supply of credit may contract, forcing firms and households to adjust their balance sheets and, in particular, to reduce spending. Output could fall in the short-run. This mechanism – working through the 'credit channel' – was highlighted by Bernanke (1983) who attributed the severity and length of the Great Depression in the United States to widespread bank failure. Moreover, if investment is impaired by a reduction in access to bank finance, capital accumulation will be reduced and thus the productive capacity, and so output, of the economy in the longer run will be adversely affected.

A weakened banking system can lead to a reduction in bank loans either because some banks fail or

¹ For example, see the literature review on leading indicators of banking crises by Bell and Pain (2000) and the references within.

because banks under capital pressure are limited in their ability to extend new loans. Under the Basel Accord (which is applied in over 100 countries) banks can lend only if they can meet the specified capital requirements on the new loans. Banks can, of course, reduce other assets to make room for bank lending but their scope to do so may be limited. Pressure on one or even several banks will only lead to a persistent reduction in the overall supply of credit, however, if other banks do not step in to fill the gaps and borrowers cannot turn to other sources of funding such as the securities markets.

One school of thought suggests that bank credit cannot easily be replaced by other channels because the intermediation function of banks is necessary for some types of borrower (see Leland and Pyle (1977) and Fama (1985)). Collecting information on borrowers over a lengthy period enables banks to distinguish between the creditworthiness of 'good' and 'bad' customers. Bank failures could lead to the loss of this accumulated information and impose costs on the economy in so far as the information has to be re-acquired. In addition the specificity of this information may make it difficult for some borrowers to engage with a substitute bank if theirs is unable to lend (Sharpe (1990) and Rajan (1992)). In practice, the special role played by bank credit is likely to vary from country to country, and its availability or not will be affected by the nature and extent of crisis. In most countries, too, households and small businesses at least are unlikely to be able to obtain finance from the securities markets.

There is some US evidence, although not clear cut, that in the early 1990s pressure on the banks in some states led to a reduction in the supply of loans and affected the real economy (see Kashyap and Stein (1994) for a survey). In practice though, because banking sector problems are most likely to occur in recessions, it is not easy to identify whether a reduction in bank lending reflects a reduction in the supply of or demand for funds (see Hoggarth and Thomas (1999) for the recent situation in Japan). A critical issue, covered below, is therefore whether reductions in output are caused by banking crises or *vice versa*.

There are other channels too through which difficulties in the banking system (if widespread) can affect the banks' customers and the economy more

widely. The banks' overdraft facilities and committed back-up lines for credit are one protection against liquidity pressures for customers, but Diamond and Dybvig (1983) also stress that by providing an instant-access investment (demand deposits) they provide another important mechanism. Most importantly, the payments system will not work if customers do not have confidence to leave funds on deposit at banks or, crucially, banks lose confidence in each other. A complete breakdown in the payments system would bring severe costs since trade would be impaired (see Freixas et al (2000)). In practice, the authorities are likely to take action before a complete loss of confidence occurs.

The overall impact of a banking crisis on the economy depends amongst other things on the manner and speed of crisis resolution by the authorities. For example, a policy of forbearance by regulators could increase moral hazard and harm output over an extended period, whereas a rapid clear out of bad loans might be expected to improve the performance of the economy over the longer term. That said, such longer-run benefits need to be weighed against any potential short-run costs of aggressive policy action; for example, its effect on confidence in the financial sector more broadly.

Since the costs of bank failure can emerge in a variety of different ways, we have adopted in what follows a broad measure of crisis costs.

Measuring the costs of banking crises

There are a number of difficulties in measuring the costs of banking crises. First, defining a crisis is not straightforward. Caprio and Klingebiel (1996) cover 69 crises which they term either 'systemic' (defined as occasions when much or all of bank capital in the system is exhausted) or 'borderline' (when there is evidence of significant bank problems such as bank runs, forced bank closures, mergers or government takeovers). These qualitative definitions have been used in most subsequent cross-country studies, including those cited in this article².

Even when defined, measuring the costs imposed by banking crises on the economy as a whole is also not straightforward. Most cross-country comparisons of costs focus on immediate crisis resolution. Such fiscal costs are reported in the next section. But they may

²: Therefore, on this definition a crisis occurs if and when banking problems are publicly revealed rather than necessarily when the underlying problems first emerge.

simply measure a transfer of income from current and future taxpayers to bank 'stakeholders' rather than the overall impact on economic welfare. The latter is usually proxied by the divergence of output – and in fact the focus is often output *growth* – from trend during the banking crisis period. Estimates of these costs are also reported below. However, these calculations estimate the output loss during the banking crisis rather than the loss *caused* by the crisis. Banking crises often occur in, and indeed may be caused by, business cycle downturns (see Gorton (1988), Kaminsky and Reinhart (1999), Demirgüç-Kunt and Detragiache (1998)). Some of the estimated decline in output (output growth) relative to trend during the period of the crisis would therefore have occurred in any case and cannot legitimately be ascribed to the crisis. In the final section below we discuss the results of some recent studies (by ourselves and others) which attempt, using time series and cross-section data, to separate declines in output during periods of banking crisis attributable to the crisis itself from declines due to other factors.

Fiscal costs

Table 1 shows a summary of recent estimates of the fiscal costs incurred in the resolution of 24 major banking crises over the past two decades, reported by Caprio and Klingebiel (1999) and Barth et al (2000) (see Table A1 in Annex A for the individual country details). In the table a distinction has been made between banking crises alone and those which occurred in conjunction with a currency crisis (so-called 'twin' crises)³. A currency crisis is defined, as in Frankel and Rose (1996), as a nominal depreciation in the domestic currency (against the US dollar) of 25 per cent combined with a 10 per cent increase in the rate of depreciation in any year of the banking crisis period⁴.

Fiscal costs reflect the various types of expenditure involved in rehabilitating the financial system, including both bank recapitalisation and payments made to depositors, either implicitly or explicitly through government-backed deposit insurance schemes. These estimates may not be strictly comparable across countries and should be treated

Table 1:
Fiscal costs of banking resolution in 24 crises 1977-2000^(a)

	Number of crises	Non-performing loans (percentage of total loans) ^(b)	Fiscal costs of banking resolution (percentage of GDP)
All countries	24	22	16
Emerging market countries	17	28	17.5
Developed countries	7	13.5	12
Banking crisis alone	9	18	4.5
Banking and currency crises <i>of which</i>	15	26	23
Emerging market countries	11	30	25
Developed countries	4	18	16
Banking and currency crises with previous fixed exchange rate <i>of which</i>	11	26	27.5
Emerging market countries	8	30	32
Developed countries	3	18	16

Sources: Caprio and Klingebiel (1999), Barth et al (2000), IMF (1998) and IMF Financial Statistics various issues.

(a) See Annex A for country details.

(b) Data available for 16 countries only.

³: Although the term currency 'crisis' is used here as is common in the literature, how a large exchange rate depreciation should be viewed depends on its cause.

⁴: The latter condition is designed to exclude from currency crises high inflation countries with large *trend* rates of depreciation.

with a degree of caution. Moreover, estimates for the recent crises in east Asia may be revised, as and when new losses are recorded.

That said, the data do point to some interesting stylised facts (see Table 1 and Table A1 in Annex A). Resolution costs appear to be particularly high when banking crises are accompanied by currency crises. The average resolution cost for a twin crisis in Table 1 is 23 per cent of annual GDP compared with 'only' 4.5 per cent for a banking crisis alone. Moreover, all countries that had fiscal costs of more than ten per cent of annual GDP had an accompanying currency crisis. Similarly, Kaminsky and Reinhart (1999) find that bail-out costs in countries which experienced a twin crisis were much larger (13 per cent of GDP), on average, than those which had a banking crisis alone (5 per cent).

Whether the association of higher banking resolution costs with currency crises reflects a causal relationship is unclear. On the one hand, currency crises may be more likely to occur the more widespread and deeper the weakness in the domestic banking system, as savers seek out alternative investments, including overseas. On the other hand, currency crises may cause banking crises, or make them larger. A marked depreciation in the domestic exchange rate could result in losses for banks with large net foreign currency liabilities, or if banks have made loans to firms with large net foreign currency exposures, who default on their loans. Bank losses caused in this way may be particularly likely for countries that had fixed or quasi-fixed exchange rate regimes prior to the crisis; such regimes might have encouraged banks and other firms to run larger unhedged currency positions than would otherwise have been the case. Many banks made losses in this way in the recent east Asian crisis (see, for example, Drage, Mann and Michael (1998)). All the 6 countries in Table 1 that incurred fiscal costs of more than 30 per cent of GDP, previously had a fixed or quasi-fixed exchange rate in place.

The cumulative resolution costs of banking crises appear to be larger in emerging market economies (on average 17.5 per cent of annual GDP) than in

developed ones (12 per cent). For example, since the recent east Asian crisis, Indonesia and Thailand have already faced very large resolution costs – 50 per cent and more than 40 per cent respectively of annual GDP – whereas, in the Nordic countries in the early 1990s, notwithstanding widespread bank failures, cumulative fiscal costs were kept down to 11 per cent or less of annual GDP. The difference may be because developed countries face smaller shocks to their banking systems. Some data suggest that non-performing loans have been proportionately much larger in emerging market banking sectors (see Table 1)⁵. Alternatively, both the banking system and the real economy may have been better able to withstand a given shock because of more robust banking and regulatory systems, including better provisioning policies and capital adequacy practices. The difference in these fiscal costs of crisis may also reflect the greater importance of state banks within emerging markets (their share of total banking sector assets is around three times as large, on average, as in the sample of developed countries in Table 1)⁶, since they are more likely than private banks to be bailed out by governments when they fail.

As one might expect, everything else being equal, fiscal costs of banking resolution seem to be larger in countries where bank intermediation – proxied by bank credit/GDP – is higher. For example, during the Savings and Loans crisis in the United States in the 1980s, where intermediation by financial institutions is relatively low by the standards of developed countries, fiscal costs were estimated at 'only' 3 per cent of annual output. However, the problems were largely confined to a segment of the banking industry. In contrast, in Japan, where bank intermediation is relatively important, the resolution costs were estimated at 8 per cent of GDP by March 2001 and with the current stabilisation package might rise as high as 17 per cent of GDP⁷.

Fiscal costs incurred almost certainly depend on how crises are resolved (see Dziobek and Pazarbasioglu (1997)). Poor resolution might be expected to be reflected in crises lasting longer and/or becoming increasingly severe. In the meantime some fragile banks could 'gamble for resurrection' and thus

5: Some caution is needed in comparing non-performing loans across countries because of differences in accountancy standards and provisioning policies.

6: Data on state ownership are for 1997 from Barth et al (2000).

7: Resolution costs in Japan were already estimated at 3 per cent of GDP by 1996. The current financial stabilisation package introduced in 1998 allows for a further 70 trillion Yen (14 per cent of GDP) to be spent on loan losses, recapitalisation of banks and depositor protection. But by end-March 2001 only an estimated 27 trillion Yen (5 per cent of GDP) of this had been spent. The current 70 trillion Yen facility is scheduled to be reduced to 15 trillion Yen in April 2002.

eventually require more restructuring than would otherwise have been the case. That said, there is no clear statistical relationship between fiscal costs and crisis length for the sample of crises shown in Table 1. Frydl (1999) finds a similar result. Recent work by Honohan and Klingebiel (2000), however, suggests that the approach taken to restructuring is important. This analysis of a sample of 40 developed country and emerging market crises indicates that fiscal costs increase with liquidity support, regulatory forbearance and unlimited deposit guarantees.

As noted earlier, resolution costs may not always be a good measure of the costs of crises to the economy more generally. Large fiscal costs may be incurred to forestall a banking crisis or, at least, limit its effect. In this case, the overall costs to the economy at large may be small, and if the crisis were avoided would not be observed, but significant fiscal costs might have been incurred. Conversely, the government may incur only small fiscal costs, and yet the broader economic adverse effects of a banking crisis could be severe. For example, a banking crisis was an important feature of the Great Depression of 1929-33 and yet fiscal costs were negligible since there was little capital support for the failing banks and no deposit insurance. Hoggarth et al (2001) found only weak correlations and rank correlations between the fiscal costs in Table 1 and their estimates of output losses, reported below.

Output losses

Cross-country comparisons of the broader welfare losses to the economy associated with a banking crisis are usually proxied by losses in GDP – comparing GDP during the crisis period with some estimate of potential output⁸. Using GDP as a proxy for welfare though has its problems. First, welfare costs should ideally reflect losses to individuals' current and (discounted) future consumption over their lifetime. But, in practice, this is extremely difficult to measure. Second, changes in the level (and growth) of income may have more impact on individuals' utility at lower income levels than higher ones. This also complicates cross-country comparisons of welfare losses.

There are also a number of issues in the construction of measures of output losses.

⁸: An exception is a study by Boyd et al (2000) which in a sample of mainly developed country crises includes a measure of losses based on the decline in real equity prices at the time of the crisis. The cross-country comparisons described below are dominated by emerging market countries where stock market prices are often unavailable.

⁹: Caprio and Klingebiel's (1996) extensive listing of crisis episodes seems to be the source of most subsequent studies.

Measurement issues

Defining the beginning and end of the crisis

Everything else being equal, the longer a crisis lasts, the larger the (cumulative) output losses. The size of the measured cumulative loss will therefore be sensitive to the definition of the crisis period. Unfortunately, it is not straightforward to define either the beginning or end of a banking crisis.

Defining the beginning of crisis

Since one of the features of banks, given historic cost accounting, is that their net worth is often opaque, it is difficult to assess when and whether net worth has become negative. One possibility is to use a marked decline in bank deposits – bank 'runs' – as a measure of the starting point of a crisis. However, most post-war crises in developed countries have not resulted in bank runs, whilst many crises in emerging market countries have followed the announcement of problems on the asset side. Bank runs, when they occur, have usually been the result rather the cause of banking crises as defined in this article.

Demirgüç-Kunt, Detragiache and Gupta (2000) find, for a sample of 36 developed and developing countries over the 1980-95 period, that deposits in the banking system did not decline during banking crises. Since banking crises have sometimes followed reasonably transparent problems with the quality of banking assets, data on a marked deterioration in the quality of banking assets and/or increases in non-performing loans could, in principle, be used to pinpoint the timing of the onset of a crisis. In practice, such data are usually incomplete, unreliable or even unavailable. Another possible approach is to measure the beginning of a crisis as the point when bank share prices fall by a significant amount relative to the market. However, aside from the problem of deciding what is 'significant', bank share price indices are often unavailable for emerging market economies – the countries where most banking crises have occurred in recent years. Instead most studies – including those reported below – date the beginning of crisis on a softer criterion, based on the assessment of finance experts familiar with the individual episodes⁹.

Defining the end of crisis

As to the end of a crisis, one possibility is to define it subjectively – say, for example, based on the expert judgement or ‘consensus’ view from a range of case studies. An alternative would be to define it endogenously, for example, at the point when output growth returns to its pre-crisis trend (see, for example, IMF (1998) and Aziz et al (2000)). It could be argued that this would, if anything, measure the end of the *consequences* of the crisis rather than the end of the crisis itself. Both approaches are nevertheless included in the estimates below.

Both could underestimate output losses since at the point when output growth recovers the *level* of output would still be lower than it would have been otherwise. If instead the end of crisis is defined as the point when the level of output returns to (the previous) trend, the length of the crisis would be longer and thus the losses during crisis higher. Finally, such estimates of output losses make no attempt to measure any possible longer-run losses or gains in output *after* the crisis has been resolved – for example if the trend growth rate were permanently lowered – but this would be difficult.

Estimation of trend output during the crisis period

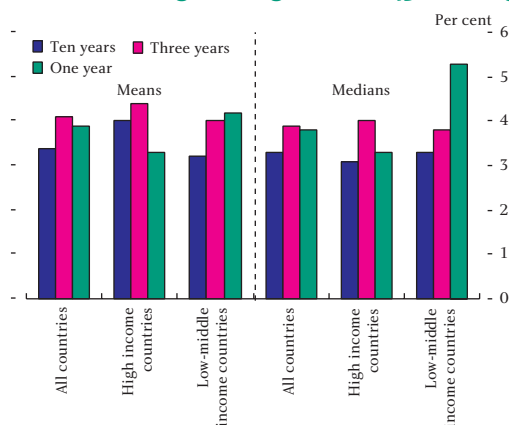
To measure the output loss during a crisis it is therefore necessary to measure actual output compared with its trend, or potential. The most straightforward way of estimating output potential is to assume that output would have grown at some constant rate based on its past performance (ie to estimate the shortfall relative to past trend growth). This is the approach used in the studies reported below. But this approach may overstate losses associated with crises if output growth fell to a lower trend during the banking crisis period. For example, estimates of losses associated with the Japanese banking crisis may be overstated if the growth in output potential in Japan has fallen since the early 1990s for reasons, such as an ageing population, unconnected to the crisis.

In producing comparable estimates of the shortfall in growth against trend in a large sample of countries a standardised approach to calculate trend growth,

based on past information, is necessary. The appropriate number of years to use in estimating the past trend is not clear cut. A number of studies have found that banking sector problems often follow an economic boom (see, for example, Kindleberger (1978), Borio, Kennedy and Prowse (1996), Logan (2000)). If output growth in the run up to the crisis was unsustainable, basing the trend growth on this period would over-estimate output losses during the crisis period¹⁰. On the other hand, a banking crisis may be preceded *immediately* by a marked slowdown in GDP growth (see Kaminsky and Reinhart (1999) for recent crises and Gorton (1998) for a more historical perspective).

As shown in Chart 1, the data from our sample of 43 banking crises discussed below suggest that crises have often come after a boom in developed countries but broke at the peak of one in emerging market economies¹¹. Average GDP growth in the three years before crises was above its 10-year trend in two-thirds of the emerging market countries and three-quarters of the developed countries. For most emerging market crises, output growth was higher still in the year immediately prior to crisis. In contrast, in nearly all developed countries, output growth fell in the year before crisis.

Chart 1:
Pre-crisis average GDP growth in 43 banking crises



Sources: International Financial Statistics and Bank calculations.

Measuring output losses: levels versus growth rates

Perhaps the most obvious way of measuring the output loss – but one that does not appear to have

¹⁰: In addition, it would exaggerate the length of crisis and thus estimated losses on measures that define the end of crisis when output growth returned to its past trend. For example, the rate of output growth in Mexico has yet to return to its three-year average (8.5 per cent per annum) before the 1981-82 banking crisis.

¹¹: Banking crises in transitional economies have been excluded from this sample because of their special problems of transforming from a government-owned to a market-based financial system.

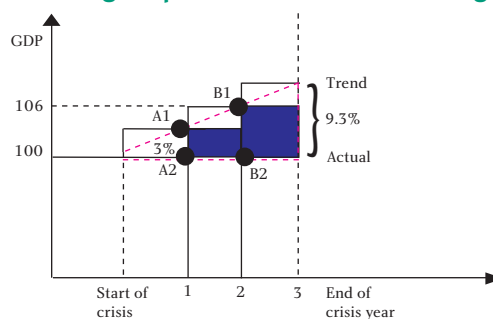
been used in recent research – is to sum up the differences in the level of annual GDP from trend during the crisis period. However, the IMF (1998), Aziz et al (2000) and Bordo et al (2001) measure output loss by summing up the differences in output *growth* rates between the pre-crisis trend and the actual rates during the crisis period. The output loss using the latter method approximates to the percentage deviation in the level of actual output at the end of the crisis period from where it would have been had output grown at its trend rate. All other factors being equal, however, this method will overstate losses associated with crises lasting for one year but understate losses associated with crises lasting for more than two years because it does not recognise the reduction in the output level in previous years (a formal explanation is given in Annex B). To see this, consider the example in Chart 2 where it is assumed that during a 3-year banking crisis period output is flat but that output would have grown by 3 per cent per annum in the absence of crisis. If output losses are calculated as the difference in the *level* of output from trend, output losses in the example in Chart 2 are 14 per cent of annual GDP – the whole area of the red triangle. But simply summing the difference between actual and trend output growth rates – the sum of the small white rectangles in Chart 2 – yields a cumulative output loss of only 9 per cent of annual GDP – the shaded blue rectangles in the chart are excluded from the calculation.

Thus, other things being equal, given that crises usually last for more than two years, estimates which sum up the differences in the *level* of actual output from its trend during the crisis period give a higher measure of output losses¹². Below we show our own estimates of output losses based on accumulating losses in the level of output and these are compared with estimates from recent studies which are based on summing losses in output growth.

Cross country estimates of output losses

Table 2 shows cross-country estimates from recent studies of the average output losses associated with past banking crises. The calculation method used in the IMF (1998), Aziz et al (2000) and Bordo et al (2001) studies are similar. All measure output losses as the cumulative difference between trend and actual *growth* during the crisis and so, as discussed

Chart 2:
Measuring output losses – levels versus growth rates



Year	0	1	2	3	
Trend GDP	100	105 (3%)	106.1 (3%)	109.3 (3%)	
Actual GDP	100	100 (0%)	100.0 (0%)	100.0 (0%)	
Summing levels		1.5%	+ 4.5%	+ 8.0%	= 14.0%
Summing growth rates		3.0%	+ 3.0%	+ 3.0%	= 9.0%

Source: Bank calculations.

above, will (everything else equal) understate output losses. The trend growth is measured over a relatively short pre-crisis period – three years in the case of the IMF (1998) and Aziz et al (2000) and five years in Bordo et al (2001). The end of crisis is defined as the point when output growth returns to trend. The estimates of Hoggarth et al (2001), by contrast, measure output losses as the cumulative difference between the levels of actual output and its trend. Trend output growth is measured over a ten year period prior to the crisis, while the end-of-crisis year is determined, on the qualitative definition, by the judgment of experts.

There are some differences in the results from the various studies. Hoggarth et al's estimates of losses are somewhat higher than those from the other studies, suggesting that the effect of summing the differences in the level rather than the growth in output more than offsets the effect of using a longer, and usually lower, pre-crisis trend growth. To explore this further, we calculated estimates of the mean and median output loss estimates for the 43 crises included in Hoggarth et al on a number of different bases. The results are set out in Table 3. The estimates of Hoggarth et al (2001) based on summing differences in output levels (from Table 2) are shown in bold in the first column. The second column shows estimates where differences in output *growth* rates are summed during the crisis period and where the end of crisis is defined when output growth returns to its pre-crisis trend – the method used by the other

¹²: It will also yield a more accurate measure of output losses so long as the trend is not overstated.

studies reported in Table 2. This analysis confirms that measures that sum output levels are usually higher than those that sum growth rates. Also, using a three year pre-crisis period to calculate the trend

(rather than ten years) would, everything else being equal, increase the median estimates of cumulative output losses calculated using both summing methods¹³.

Table 2:
Recent studies of output losses associated with banking crises (percentage of GDP)^(a)

	Sample period	Number of crises	Average crisis length (years)	Average cumulative output losses (percentage of GDP)
IMF (1998)				
	1975-1997			
All		54	3.1	11.6
Single banking crises		22	3.0	7.5
Twin banking and currency crises		32	3.2	14.4
Developed countries		12	4.1	10.2
Emerging market countries		42	2.8	12.1
Aziz et al (2000)				
Twin banking and currency crises		45	2.4	9.0
Bordo et al (2001)				
Single banking crises	1973-1997 (56 countries)	26	2.6	6.2
	1973-1997	8	3.1	7.0
	1945-1971	0	n/a	n/a
	1919-1939	18	2.4	10.5
	1880-1913 (21 countries)	15	2.3	8.3
Twin banking and currency crises	1973-1997 (56 countries)	27	3.8	18.6
	1973-1997	11	3.7	15.7
	1945-1971	1	1.0	1.7
	1919-1939	15	2.7	15.8
	1880-1913 (21 countries)	9	2.2	14.5
Hoggarth et al (2001)				
	1977-1998			
All		43	3.7	16.9
Single banking crises		23	3.3	5.6
Twin banking and currency crises		20	4.2	29.9
Developed countries		13	4.6	23.8
Emerging market countries		30	3.3	13.9

Source: Bank calculations.

(a) Crisis start: all based on when a significant event is made public. Crisis end: IMF (1998), Aziz et al (2000), and Bordo et al (2001), when GDP growth returns to trend; Hoggarth et al (2001), based on judgment of experts. Trend output: IMF and Aziz et al, average three years before crisis; Bordo et al, average five years before crisis; Hoggarth et al, average ten years before crisis. Summing method: IMF, Aziz et al and Bordo et al, difference between summed trend and actual output growth rates; Hoggarth et al, difference between summed trend and actual output levels.

Twin crisis: IMF and Bordo et al, currency crisis within one year of banking crisis; Aziz et al, currency crisis within two years of banking crisis; Hoggarth et al, currency crisis within the banking crisis period.

¹³: This is particularly true for measures when the end of crisis date, and therefore the length of crisis, are dependent on the pre-crisis trend growth rate.

Table 3:

Average mean cumulative output losses (per cent of GDP) in 43 banking crises on different assumptions (medians in brackets)^(a)

Summing method	Output levels		Output growth rates	
	Consensus opinion		Growth returns to trend	
Definition of end crisis				
Period used in measuring pre-crisis growth rates				
All countries				
Ten years	16.9	(9.2)	8.7	(6.6)
Three years	16.3	(9.9)	14.5	(10.4)
Low-medium income				
Ten years	13.9	(6.5)	8.3	(5.9)
Three years	13.9	(8.9)	14.9	(9.8)
High income				
Ten years	23.8	(12.8)	9.5	(9.2)
Three years	21.9	(18.0)	13.4	(15.1)
Twin crises				
Ten years	29.9	(22.2)	13.0	(10.9)
Three years	29.0	(26.3)	23.1	(16.1)
Single banking crises				
Ten years	5.6	(0.4)	4.9	(1.4)
Three years	5.3	(0.6)	7.1	(0.6)

Source: Bank calculations.

(a) Average of figures reported for individual countries in Table 2 shown in bold.

Analysis of results

Overall, although there are marked variations in output losses across crises, as shown in Table A2 in Annex A, average estimated output losses suggested from all these studies are large. According to Bordo et al (2001) this is also true of crises before the Second World War¹⁴. The average estimates of cumulative output losses in years of banking crisis alone are similar across studies – in a narrow range of 6 per cent to 8 per cent of annual GDP. But as with fiscal costs discussed earlier, the average output losses during twin banking and currency crises tend to be much larger – in the range of 15 per cent to 30 per cent of GDP – and usually last longer. Again, however, the direction of causation is unclear. One interpretation is that exchange rate crises either lead directly to higher output losses – for example

through requiring a tightening in monetary policy – or do so indirectly through increasing losses for banks with foreign currency exposures or loans to sectors which themselves have large currency exposures¹⁵. The latter might be expected to be a problem particularly for emerging market banking systems for which external borrowing tends to be predominantly in foreign currency because of the cost of external borrowing in domestic currency. But causation may be the other way round, with *larger* banking crises causing a general flight from domestic assets and so putting pressure on the currency, which would be exacerbated if capital inflows are concentrated in the banking sector. Another possibility is that twin crises may be more likely to occur in the face of large adverse shocks that are themselves the main cause of the reduction in output

¹⁴: The exceptional period appears to have been the quarter of century after the Second World War when there was only one (twin) crisis in Bordo et al's sample of 21 countries and it yielded small output losses.

¹⁵: However, the cause properly defined of the output loss here is, in fact, whatever caused the exchange rate to depreciate in the first place.

Table 4:
Length of crises in years on different end-crisis assumptions in a sample of 43 crises

	GDP growth returns to its pre-crisis trend		Consensus opinion
	Ten year trend	Three year trend	
All crises	2.1	3.2	3.7
High income	3.3	4.2	4.6
Low-medium income	1.6	2.7	3.3
Single banking crises	1.6	2.0	3.3
Twin crises	2.8	4.6	4.2

Source: Bank calculations.

(relative to trend). The leading indicator literature suggests that twin crises tend to occur against a background of weak economic fundamentals, with banking crises more often than not preceding currency crises which, in turn, exacerbate banking crises (see Kaminsky and Reinhart (1999)).

The results in Table 2 (confirmed in Table 4) indicate that, on average, and irrespective of the precise method for defining the end of crisis, banking crises have typically lasted *longer* in developed countries – by about 1½ years – than in emerging markets. Indeed, this is the main reason why Hoggarth et al (2001) find that on their preferred measure (reported in Table 2) – where output losses are calculated as the cumulative deviation of the *level* of output from trend – output losses (as a percentage of GDP) during banking crises are significantly larger, on average, in developed countries than in emerging market countries.

Why should banking crises last longer in developed countries? In general, financial systems in developed countries would be expected to be more robust to shocks than those in emerging market countries. On the one hand, this might mean that it usually takes a larger shock to cause a banking crisis in a developed economy, and that the crisis is harder to control and so longer lasting. This may be particularly likely if real wages are less flexible in developed than emerging market countries. On the other hand, given the greater strength of the financial system and real economy in developed countries, the effect of a banking crisis on the economy may be initially less dramatic, giving the authorities freedom to take less radical action. The share of bad loans in the banking system of emerging market economies at the time of

the crisis is usually much larger than it is the case in developed countries (as shown earlier in Table 1), making the crises initially more pronounced – banks are more likely to fail. Furthermore, the banking system is usually a much larger part of the financial system in emerging market economies than it is in developed economies, exacerbating the effect on the real economy. However, although crises in developed economies are likely to be less severe, initially, delay in resolving them is likely to increase sharply the long run loss in output. A recent example of this may be the drawn out Japanese banking problems, which have lasted since the early 1990s. In contrast, in lower income countries, speedier resolution mitigates the effects.

Output losses plainly vary a lot from crisis to crisis. Understanding why may help to indicate what measures are most successful in minimising the welfare costs of crises. Bordo et al (2001) investigated this issue. In a sample of 21 countries over the 1973-97 period, they found that banking crises were associated with much bigger output losses when liquidity support was provided and when the exchange rate was previously pegged. However, the opposite was true of banking crises in the late 19th century where liquidity support was associated with lower output losses. They argue that the difference may reflect a greater reluctance of some countries during the 1973-97 period to allow bank failures. This meant that support was in some cases given to insolvent banks as well as to those that were fundamentally sound but illiquid. This, they suggest, may have increased moral hazard and enabled some banks to gamble for resurrection.

Separating out the banking crisis impact on output losses

All the estimates of output losses during crises reported above use the difference between the level (or growth) in output and its past trend. But to the extent that banking crises coincide with, or are indeed caused by, recessions these trend growth paths may overstate what output would have been during these periods in the absence of banking crises.

In an attempt to examine this, Bordo et al (2001) compared, for their sample of countries, the amount of output lost during recessions that are accompanied by banking crises with those which are not. They find that, after allowing for other factors causing recessions, cumulative output losses during recessions accompanied by twin and single banking crises over the 1973-97 period are around 15 per cent and 5 per cent of GDP respectively deeper than those without crises. There remains the possibility, though, that these results show partly that deeper recessions cause banking crises rather than *vice versa*¹⁶.

An alternative method – reported in greater detail in Hoggarth et al (2001) – is to make use of

cross-sectional data comparing the deviation in output from trend (output losses) for countries that have experienced banking crises with similar, neighbouring countries that at the time did not have a crisis¹⁷. Benchmark countries are needed that, in principle at least, are similar in all respects to the crisis countries other than that they do not face simultaneously a banking crisis.

Table 5 compares cumulative output losses in 29 systemic banking crises with output losses in pair countries (see Table A3 in Annex A for the individual country details)¹⁸. The definition of systemic employed is as in Caprio and Klingebiel (1996, 1999): all, or most, of the banking system's capital is exhausted.

Since comparator countries are not identical in every respect the results of the comparisons should be treated with caution. But the estimates suggest that declines in output (relative to trend) for crisis countries are, on average, much higher than for the chosen pairs, especially for high-income countries. For example, output gaps in the UK and Denmark (neither of which had a systemic banking crisis) in the early 1990s were far smaller than in Finland and

Table 5:
Output deviation below trend (losses) in systemic banking crisis and comparison countries (per cent of GDP) during the same period^(a)

	Sample size	Output losses (per cent of GDP)		
		All Countries	Systemic banking crisis countries	Non-banking crises pair countries
All	58	13	19	6
Developed countries	10	19	32 ^(b)	6 ^(b)
Emerging countries	48	11	16	6
Banking crisis alone	12	n/a	9	n/a
Banking and currency crisis	17	n/a	26	n/a
Currency crisis alone	14	n/a	n/a	18
Neither crisis	15	n/a	n/a	-5

Source: Bank calculations.

(a) Output losses are measured on the Hoggarth et al (2001) method reported earlier in Table 2.

(b) Statistically different at the 5 per cent significance level.

¹⁶: Bordo et al (2001) attempt to address this problem through using a two-stage estimation procedure.

¹⁷: A comparison is made of the deviation in output from trend rather than just differences in output because trend output may differ between the crisis and pair countries.

¹⁸: Since there is not always a clear line dividing countries that had banking problems from those that did not, pairs have been made only for the episodes from our sample of 43 crises that were outright systemic banking crises.

Norway (which did). Similarly, output remained close to trend in both Taiwan and the Philippines in 1997-98 – the ‘non-crises’ comparators – although it fell dramatically in Korea, Thailand and Indonesia. On average, the cumulative output losses for countries with banking crises were 13 per cent of GDP higher than in the non-banking crisis countries over the same period.

As mentioned above, evidence that output losses are higher in the presence of banking crises is not sufficient to prove that banking crises cause large output losses. An alternative interpretation is that causation runs in the opposite direction with deeper recessions (larger output losses) increasing the likelihood, and depth, of a banking crisis. To try to deal with this, Hoggarth et al (2001) investigated, where data allowed, a number of indicators of the future path of output growth to see whether the occurrence of crises can ‘explain’ shortfalls in actual output (from trend) against what would be accounted for by these conventional macroeconomic variables¹⁹. For each crisis and pair country the macroeconomic variables were measured as the difference between their value just (two years) before the crisis and their normal value based on their previous trend.

The results of two specifications for the whole sample are reported in Table 6. The dependent variable is the deviation in output from trend. This is measured over the same (banking crisis) period for both crisis countries and their pairs. Four macroeconomic variables were used in the estimation – output growth (DYP), the change in output growth (DDYP), inflation (DCP) and the growth in bank credit/GDP (DCRED). Dummy variables were also included in the estimation to capture whether or not there was a banking or a currency crisis. It emerged that banking crises significantly affected output in developed countries but in emerging countries currency crises, rather than banking crises, most affected output.

Equation (1) shows the results of regressing output losses on the two crisis dummies and the four macroeconomic variables. A likelihood ratio test was used which failed to reject the null hypothesis that the statistically insignificant variables in equation (1) should be excluded from the final specification. To check whether the results were sensitive to the choice

Table 6:
Explanation of the cross-country variation in output losses (per cent of GDP) in 29 systemic crisis and pair countries^(a)

Equation	(1)	(2)
CONST	-0.04 <i>-0.59^(b)</i>	-0.04 <i>-0.57</i>
BCH	0.29 <i>2.57^{**}</i>	0.30 <i>2.27^{**}</i>
CCL	0.22 <i>1.74[*]</i>	0.28 <i>2.55^{**}</i>
DDYP	-5.80 <i>-2.12^{**}</i>	-5.14 <i>-2.40^{**}</i>
DYP	-4.76 <i>-1.46</i>	
DCP	-0.10 <i>-0.60</i>	
DCRED	-0.98 <i>-1.04</i>	
Adjusted R ²	0.10	0.14
Log likelihood	-21.20	-23.94
Number of observations	48	58

Source: Bank calculations.

(a) For the purposes of this regression output losses (the dependent variable) is in decimals rather than percentage points.

(b) The t-statistics corresponding to the coefficient estimates above them are reported in italics.

* Indicates significance at the 10 per cent level.

** Indicates significance at the 5 per cent level.

BCH = 1 when there is a banking crisis in a high income country, 0 otherwise.

CCL = 1 when there is a currency crisis in a low income country, 0 otherwise.

DDYP = change in the annual average of growth in real GDP in the

two years before the crisis period.

DYP = annual average real GDP growth in the two years before the crisis period less its trend before this period back to 1970.

DCP = annual average consumer price inflation in the two years before the crisis period less its trend before this period back to 1970.

DCRED = annual average growth in credit relative to GDP in the two years

before the crisis less its trend before this period back to 1970.

of paired countries, the same procedure was carried out substituting alternative pairs for a sample of the comparison countries (the ‘paired’ countries shown in brackets in Table A3 in Annex A). This made little difference to the results.

Equation (2), the parsimonious relationship, suggests that part of the difference in output losses across the sample is due to pre-crisis macroeconomic variables. In particular, every 1 percentage point fall in output growth before a crisis adds 5 per cent to output losses during the crisis period. But the presence or

¹⁹: The pre-crisis period macroeconomic variables considered were real GDP growth, the change in real GDP growth, consumer price inflation, the growth in credit relative to GDP and the growth in the ratio of M2 to Mo.

not of banking crises in high-income countries (BCH) and currency crises in low-middle income countries (CCL) explain most of the difference in output losses in the sample. These estimates and the interpretation of the results should, however, be treated with caution. The sample of high income countries is small, while the interpretation of the results could be that deeper recessions (larger output losses) cause banking crises in developed countries and cause currency crises in emerging-markets rather than the other way around.

Summary and conclusion

Theoretical studies and empirical work focussing on particular crises suggest that under certain conditions banking crises can impose large costs on an economy. Cross-country estimates of fiscal and output costs (both as a share of GDP) appear to bear this out. But the quantification of these costs, and the direction of causation, is far from straightforward.

The costs of banking crises are often measured in terms of their effect on fiscal expenditure. Cross-country estimates of fiscal resolution costs of banking crises tend to be bigger in lower income countries and those with higher degrees of banking intermediation. Countries with large fiscal costs of crisis have in the past often experienced a simultaneous currency crisis, especially those that had in place a fixed exchange rate regime.

However, resolution costs may simply reflect a transfer of income from taxpayers to bank 'stakeholders' rather than necessarily the cost to the economy as a whole. A better, albeit still imperfect, proxy for the latter is the impact of crises on output. However, a crucial issue in measuring output losses is deciding whether they are caused by the banking crises, and are thus costs of banking crises, or whether recession caused the crises.

The output losses associated with crises are usually measured as the cumulative difference in output, or output growth, during the crisis period from its pre-crisis trend²⁰. Although varying markedly from crisis to crisis, cross-country estimates of output losses during banking crises are, on average, large – around 15 per cent to 20 per cent of annual GDP. Output losses are usually much larger in the event of a twin banking/currency crisis than if there is a

banking crisis alone, particularly in emerging market countries. Causation here is likely to run in both directions with larger banking crises causing currency runs which, in turn, may exacerbate banking problems, especially for banking systems with large net foreign currency liabilities. Crises have also typically lasted longer in developed countries than in emerging markets. Because of this, on some measures output losses during crises are larger in developed than in emerging market countries. One possible explanation of this is that emerging market economies must respond more quickly during banking crises because they usually incur much more widespread bad loan problems than developed countries.

Bordo et al (2001) have attempted to separate out the impact on output during the crisis period caused by factors other than banking sector weakness. They found that recessions are usually much deeper when accompanied by banking crises than when they are not, even when allowing for other factors that may have caused the recession. Using a cross-sectional rather than time series approach, Hoggarth et al (2001) compared output losses in a sample of systemic banking crises with neighbouring countries that did not at the time face severe banking problems. They found that banking crises but not currency crises significantly affect output in developed countries, while the opposite was true in emerging market countries. These results also seem to hold up after allowing for other factors that may have caused output to fall. However, in both these studies there remains the possibility of reverse causation, with larger recessions causing banking (or currency) crises rather than crises causing bigger recessions.

Since there are large differences in estimated output losses from crisis to crisis, a potential fruitful avenue for research is to explain these differences. In particular, from a public policy perspective, it would be useful to better understand what type of resolution measures are most successful in minimising the welfare costs of crises.

Summarising, it seems to be the case that regardless of whether banking crises cause or are produced by recession, they exacerbate subsequent output losses (and are often costly to resolve). Policies aimed at financial and monetary stability are therefore likely to be mutually reinforcing.

²⁰: These estimates take no account of the possible output costs (or benefits) in the post-crisis period.

References

- 1: Allen, F and Gale, D (1998), 'Optimal Financial Crises', *Journal of Finance*, 53, pages 1245–1284.
- 2: Aziz, J, Caramazza, F and Salgado, R (2000), 'Currency Crises: In Search of Common Elements', *International Monetary Fund Working Paper 00/67*, March.
- 3: Barth, J R, Caprio, G and Levine, R (2000) 'Banking Systems Around the Globe: Do Regulation and Ownership Affect Performance and Stability?', *Conference on Prudential Supervision: What Works and What Doesn't*, National Bureau of Economic Research Inc, January.
- 4: Bell, J and Pain, D L (2000) 'Leading Indicator Models of Banking Crises: A Critical Review', *Bank of England Financial Stability Review*, December, pages 113–129.
- 5: Bernanke, B (1983), 'Non-Monetary Effects of the Financial Crisis in the Propagation of the Great Depression', *American Economic Review*, 73, pages 257–76.
- 6: Bernanke, B (1986), 'Alternative Explanations of the Money Income Correlation', *Carnegie Rochester Conference Series in Public Policy*, 25, pages 49–99.
- 7: Bernanke, B and James, H (1991), 'The Gold Standard, Deflation and Financial Crisis in the Great Depression: an International Comparison', in *Financial Markets and Financial Crises: A National Bureau of Economic Research Report*, edited by R. Hubbard, Chicago University Press.
- 8: Bernanke, B, Gertler, M and Gilchrist, S (1996), 'The Financial Accelerator and the Flight to Quality', *The Review of Economics and Statistics*, 78, pages 1–15.
- 9: Bordo, M, Eichengreen, B, Klingebiel, D and Martinez-Peria, M S (2001), 'Is the Crisis Problem Growing More Severe?', *Economic Policy*, 32, pages 51–82.
- 10: Borio, C, Kennedy, N and Prowse, S (1996), 'Exploring Aggregate Asset Price Fluctuations Across Countries: Measurements, Determinants and Monetary Policy Implications', *BIS Economic Papers no 40*.
- 11: Boyd, J H, Gomis, P, Kwak, S and Smith, B (2000) 'A User's Guide to Banking Crises', *mimeo*, University of Minnesota.
- 12: Caprio, G and Klingebiel, D (1996), 'Bank Insolvencies: Cross Country Experience', *World Bank Policy and Research WP 1574*.
- 13: Caprio, G and Klingebiel, D (1999), 'Episodes of Systemic and Borderline Financial Crises', *mimeo*, World Bank.
- 14: Demirgüç-Kunt, A and Detragiache, E (1998), 'The Determinants of Banking Crises in Developed and Developing Countries', *IMF Staff Papers*, 45, pages 81–109.
- 15: Demirgüç-Kunt, A, Detragiache, E and Gupta, P (2000), 'Inside the Crisis: An Empirical Analysis of Banking Systems in Distress', *IMF Working Paper 00/156*.
- 16: Diamond, D and Dybvig, P (1983), 'Bank Runs, Deposit Insurance and Liquidity', *Journal of Political Economy*, 91, pages 401–19.
- 17: Diamond, D (1984), 'Financial Intermediation and Delegated Monitoring', *Review of Economic Studies*, 51, pages 393–414.
- 18: Drage, J, Mann, F and Michael, I (1998), 'Issues For Policy-Makers Arising From the International Crisis', *Bank of England Financial Stability Review*, Spring, pages 69–85.
- 19: Dziobek, C and Pazarbasioglu, C (1997), 'Lessons from Systemic Bank Restructuring: a Survey of 24 Countries', *IMF Working Paper 97/161*.
- 20: Fama, E (1985), 'What's Different About Banks?', *Journal of Monetary Economics*, 15, pages 29–39.
- 21: Frankel, J A and Rose, A K (1996), 'Currency Crashes in Emerging Markets: Empirical Indicators', *NBER Working Paper 5437*.
- 22: Freixas, X and Rochet, J-C (1998), 'Microeconomics of Banking', MIT Press.
- 23: Freixas, X, Giannini, C, Hoggarth, G and Soussa, F (2000), 'Lender of Last Resort: What Have We Learnt Since Bagehot?', *The Journal of Financial Services Research*, 18, pages 63–84.
- 24: Friedman, M and Schwartz, A (1963), 'A Monetary History of the United States', Princeton University Press.
- 25: Fryd, E J (1999), 'The Length and Cost of Banking Crises', *IMF Working Paper 99/30*.
- 26: Gertler, M and Gilchrist, S (1992), 'Monetary Policy, Business Cycles and the Behaviour of Small Manufacturing Firms', *New York University Economic Research Report*, pages 92–108, New York.
- 27: Gorton, G (1988), 'Banking Panics and Business Cycles', *Oxford Economic Papers*, 40, pages 751–781.
- 28: Hall, S (2000) 'Financial Accelerator Effects in UK Business Cycles', Bank of England, *mimeo*, September.
- 29: Hoggarth, G and Thomas, J (1999), 'Will Bank Recapitalisation Boost Domestic Demand in Japan?', *Bank of England Financial Stability Review*, June, pages 85–93.
- 30: Hoggarth, G, Reis, R and Saporta, V (2001), 'Costs of Banking System Instability: Some Empirical Evidence', forthcoming Bank of England Working Paper.
- 31: Honohan, P and Klingebiel, D (2000), 'Controlling Fiscal Costs of Banking Crises', *World Bank Policy and Research Working Paper 2441*.
- 32: International Monetary Fund (1998), 'Financial Crises: Characteristics and Indicators of Vulnerability', *World Economic Outlook* (Chapter 4), May.
- 33: International Monetary Fund (1999), 'From Crisis to Recovery in the Emerging Market Economies', *World Economic Outlook* (Chapter 2), October.
- 34: Jaffee, D and Russell, T (1976), 'Imperfect Information, Uncertainty and Rationing', *Quarterly Journal of Economics*, 90, pages 651–66.
- 35: Kaufman, G (1994), 'Bank Contagion, A Review of the Theory and Evidence', *Journal of Financial Services Research*, 8, pages 123–150.
- 36: Kaufman, G (1998), 'Central Banks, Asset Bubbles, and Financial Stability', *Federal Reserve Bank of Chicago Working Paper 98–12*.
- 37: Kaminsky, G L and Reinhart, C M (1999), 'The Twin Crises: The Cause of Banking and Balance of Payment Problems' *American Economic Review*, 89, pages 473–500.
- 38: Kashyap, A, Stein, J and Wilcox, D (1992), 'Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance', *American Economic Review*, 83, pages 78–98.
- 39: Kashyap, A and Stein, J (1994), 'Monetary Policy and Bank Lending', in *Monetary Policy*, edited by Mankiw, N G University of Chicago Press.
- 40: Kashyap, A, Lamont, O and Stein, J (1992), 'Credit Conditions and the Cyclical Behavior of Inventories: a Case Study of the 1981-82 Recession', *Quarterly Journal of Economics*, 109, pages 566–92.
- 41: Kindleberger, C (1978), 'Manias, Panics and Crashes: A History of Financial Crises', New York: Basic Books.
- 42: Leland, H and Pyle, D (1977), 'Information Asymmetries, Financial Structures and Financial Intermediaries', *Journal of Finance*, 32, pages 371–87.
- 43: Logan, A D (2000) 'The Early 1990s Small Banks Crisis: Leading Indicators', *Bank of England Financial Stability Review*, December, pages 130–145.
- 44: Lown, C, Morgan, D and Rohatgi, S (2000), 'Listening to Loan Officers: The Impact of Commercial Credit Standards on Lending and Output', *Economic Policy Review*, Federal Reserve Bank of New York, 6, pages 1-16.
- 45: Michael, I (1998) 'Financial Interlinkages and Systemic Risk', *Bank of England Financial Stability Review*, Spring, pages 26–33.
- 46: Rajan, R (1992), 'Insiders and Outsiders: The Choice Between Relationship and Arm's Length Debt', *Journal of Finance*, 47, pages 1367–1400.
- 47: Rajan, R (1996), 'Why Banks Have a Future: Towards a New Theory of Commercial Banking', *Journal of Applied Corporate Finance*, 9, pages 114–128.
- 48: Samolyk, K A (1994), 'Banking Conditions and Regional Economic Performance: Evidence of a Regional Credit Channel', *Journal of Monetary Economics*, 34, pages 259–278.
- 49: Sharpe, S (1990), 'Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Consumer Relationships', *Journal of Finance*, 48, pages 247–66.
- 50: Stiglitz, J and Weiss, A (1981), 'Credit Rationing with Imperfect Information', *American Economic Review*, 71, pages 393–410.

Annex A

Table A1:

Selected banking crises: non-performing loans and costs of restructuring financial sectors

Crisis countries	Years	Duration (years)	Non-performing loans (percentage of total loans) ^(a)	Bank credit/GDP per cent ^(b)	Fiscal and quasi-fiscal costs/GDP ^(c)	GNP per head (US\$ oos PPP) ^(d)	Currency crisis as well (pre-fix **) ^(e)
High income countries							
Finland	1991-93	3	9.0*	89.9 (89.9)	11.0	15.8	Yes**
Japan	1992-98	7	13.0	119.5 (182.5)	8.0(17) ^(f)	21.5	No
Korea	1997-		30-40	70.3 (82.2)	34.0	14.7	Yes**
Norway	1988-92	5	9.0*	61.2 (79.6)	8.0	17.3	No
Spain	1977-85	9	n/a	68.1 (75.1)	16.8	4.7	Yes
Sweden	1991	1	11.0*	50.8 (128.5)	4.0	17.2	Yes**
United States	1984-91	8	4.0*	42.7 (45.9)	3.2 ^(g)	15.2	No
Average		5.5	13.5	71.8 (97.7)	12.1	15.2	
Medium and low income countries							
Argentina	1980-82	3	9.0*	29.8 (33.0)	55.3	6.4	Yes**
Argentina	1995	1	n/a	19.7 (20.0)	1.6	10.5	No
Brazil	1994-96	3	15.0	31.7 (36.5)	5-10	6.1	No
Chile	1981-83	3	19.0	58.8 (60.2)	41.2	2.7	Yes**
Colombia	1982-87	6	25.0*	14.7 (14.7)	5.0	2.9	Yes**
Ghana	1982-89	8	n/a	25.2 (25.2)	6.0	0.9	Yes**
Indonesia	1994	1	n/a	51.9 (51.9)	1.8	2.5	No
Indonesia	1997-		65-75	60.8 (60.8)	50-55	3.0	Yes**
Malaysia	1985-88	4	33.0*	64.5 (91.8)	4.7	3.3	No
Mexico	1994-95	2	11.0*	31.0 (36.3)	20.0	7.2	Yes**
Philippines	1981-87	7	n/a	23.2 (31.0)	3.0	2.4	Yes
Sri Lanka	1989-93	5	35.0	21.3 (21.3)	5.0	1.9	No
Thailand	1983-87	5	15.0*	44.5 (48.5)	1.5	1.7	No
Thailand	1997-		46.0	118.8 (134.9)	42.3	6.2	Yes**
Turkey	1994	1	n/a	14.2 (15.3)	1.1	5.4	Yes
Uruguay	1981-84	4	n/a	33.4 (47.8)	31.2	4.6	Yes**
Venezuela	1994-95 ^(h)	2	n/a	8.9 (12.3)	20.0	5.6	Yes
Average		3.7	27.8	38.4 (43.6)	17.6	4.3	
Average all countries		4.2	22.4	48.1 (59.4)	16.0	7.5	
<i>of which: twin crises</i>		4.1	26.1	46.5 (56.5)	22.9		
<i>banking crisis alone</i>		4.3	17.7	50.8 (64.2)	4.6		

Sources: Non-performing loans and fiscal costs (unless otherwise stated) Barth, Caprio and Levine (2000) and Caprio and Klingebiel (1999). GDP and bank credit, IMF International Financial Statistics, 1999 Yearbook. Systemic crises (according to Barth et al (2000)) in bold, *IMF, World Economic Outlook, May 1998, Chapter IV. (a) Estimated at peak. Comparisons should be treated with caution since measures are dependent on country specific definitions of non-performing loans and often non-performing loans are under-recorded.

(b) Average during the crisis period. Credit to private sector from deposit money banks (IFS code, 22d) and the figures in brackets include also credit from other banks (IFS code, 42d).

(c) Estimates of the cumulative fiscal costs during the restructuring period expressed as a percentage of GDP.

(d) In the year the banking crisis began.

(e) Exchange rate crisis is defined as a nominal annual depreciation of the domestic currency (against the US dollar) during the crisis period of 25 per cent or more together with a 10 per cent increase in the rate of depreciation from the previous year.

(f) Resolution costs in Japan were estimated at 3 per cent of GDP by 1996. The current financial stabilisation package introduced in 1998 allows for a further ¥70 trillion (14 per cent of GDP) to be spent on loan losses, recapitalisation of banks and depositor protection (the figure in brackets). But by end-March 2001 only an estimated ¥27 trillion (5 per cent of GDP) of this had been spent.

(g) Cost of Savings and Loans resolution.

(h) The apparent low degree of bank intermediation in Venezuela at the time reflects the impact of high inflation on the denominator (nominal GDP).

Table A2:
Accumulated output losses incurred during banking crises^(a)

Crisis countries	Date of crisis ^(b)	Duration ^(b) (years)		GAP1 ^(c) per cent	GAP2 ^(d) per cent	Currency crisis as well
High income countries						
Canada	1983-85	3	(0)	0.0 ^(e)	-10.5	No
Denmark	1987-92	6	(7)	22.3	31.9	No
Finland	1991-93	3	(3)	22.4	44.9	Yes
Hong Kong	1982-83	2	(4)	23.1	9.8	No
Hong Kong	1983-86	4	(1)	1.1	4.3	No
Hong Kong	1998	1	(1)	9.6	9.0	No
Italy	1990-95	6	(9)	18.2	24.6	Yes
Japan	1992-98	7	(7)	24.1	71.7	No
Korea	1997 ^(f)			6.7	12.8	Yes
Norway	1988-92	5	(6)	9.8	27.1	No
Spain	1977-85	9	(9)	15.1	122.2	Yes
Sweden	1991	1	(3)	11.8	3.8	Yes
United States	1984-91	8	(0)	0.0 ^(e)	-41.9	No
Average		4.6	(4.2)	13.4	23.8	
Medium and low income countries						
Argentina	1980-82	3	(3)	20.7	25.9	Yes
Argentina	1985	1	(1)	7.9	7.1	No
Argentina	1989-90	2	(2)	14.0	16.1	Yes
Argentina	1995	1	(2)	11.4	5.8	No
Bolivia	1986-87	2	(1)	0.6	0.4	No
Bolivia	1994 ^(f)		(0)	0.0 ^(e)	-26.8	No
Brazil	1994-96	3	(0)	0.0 ^(e)	-12.7	No
Chile	1981-83	3	(8)	41.4	24.3	Yes
Colombia	1982-87	6	(4)	6.7	31.4	Yes
Egypt	1991-95	5	(6)	10.0	22.8	No
El Salvador	1989	1	(1)	0.6	-1.3	No
Ghana	1982-89	8	(1)	5.5	-47.4	Yes
India	1993 ^(f)		(0)	0.0 ^(e)	-41.1	No
Indonesia	1994	1	(0)	0.0 ^(e)	-2.2	No
Indonesia	1997 ^(f)			24.5	20.1	Yes
Madagascar	1988	1	(0)	0.0 ^(e)	-3.1	No
Malaysia	1985-88	4	(3)	14.5	39.2	No
Mexico	1981-82	2	(18)	110.4	-0.2	Yes
Mexico	1994-95	2	(1)	9.5	5.4	Yes
Nigeria	1997	1	(0)	0.0 ^(e)	0.1	No
Peru	1983-90	8	(1)	12.5	94.0	Yes
Philippines	1981-87	7	(7)	35.2	111.7	Yes
Sri Lanka	1989-93	5	(1)	0.6	-10.0	No
Thailand	1983-87	5	(0)	0.0 ^(e)	-2.8	No
Thailand	1997 ^(f)			25.9	28.1	Yes
Turkey	1994	1	(1)	10.4	9.2	Yes
Uruguay	1981-84	4	(5)	42.0	64.1	Yes
Venezuela	1980-83	4	(6)	27.6	52.2	No
Venezuela	1994-95	2	(3)	14.7	10.6	Yes
Zimbabwe	1995 ^(f)		(1)	0.4	-3.3	Yes
Average		3.3	(2.8)	14.9	13.9	
Average all countries		3.7	(3.2)	14.5	16.9	
of which: twin crises		4.2		22.9	29.9	
banking crisis alone		3.3		7.1	5.6	

Source: Bank calculations.

(a) Crises in bold are judged as systemic by Barth, Caprio and Levine (2000).

(b) Caprio and Klingebiel (1999) definition of crisis. Figures in brackets assume end of crisis is when output growth returns to trend.

(c) IMF (1998) method. The cumulative difference between trend and actual output *growth* during the crisis period. Trend is the average arithmetic growth of output in the three-year prior to the crisis. End of crisis is when output growth returns to trend

(d) The cumulative difference between the trend and actual *levels* of output during the crisis period. Beginning and end of crisis is the Caprio and Klingebiel (1999) definition. The counterfactual path for output is based on a Hodrick-Prescott filter ten years prior to the crisis.

(e) Actual growth rate returns to trend during the first year of the crisis in Canada, the United States, Bolivia (1994-), Brazil, India, Indonesia (1994), Madagascar, Nigeria and Thailand (1983-87).

(f) Where crisis has not yet ended – Korea, Indonesia and Thailand on GAP1 plus Bolivia, India and Zimbabwe on GAP2 – costs are measured up to and including 1998.

Table A3:**Accumulated GAP2 output losses incurred during banking crises for systemic crisis and comparison countries**

Crisis countries	GAP2 percentage	Currency crisis	Pair non-systemic banking crisis countries ^(a)	GAP2 percentage	Currency crisis
High income countries					
Finland 91-93	44.9	Yes	United Kingdom (Denmark)	19.6 3.9	No (No)
Japan 92-98	71.7	No	Korea ^(b) (United States)	6.1 -8.0	No (No)
Korea 97-	12.8	Yes	Taiwan	-1.9	No
Norway 88-92	27.1	No	United Kingdom (Denmark)	2.1 20.7	No (No)
Sweden 91	3.8	Yes	United Kingdom (Denmark)	4.5 0.5	No (No)
Average	32.1		Average	6.1	
<i>of which: twin crises</i>	20.5		<i>of which: currency crisis</i>	n/a	
<i>banking crisis alone</i>	49.4		<i>neither crisis</i>	6.1	
Medium and low income countries					
Argentina 80-82	25.9	Yes	Brazil	15.3	Yes
Argentina 85	7.1	No	Brazil	-5.0	No
Argentina 89-90	16.1	Yes	Chile	-17.1	No
Argentina 95	5.8	No	Chile	-4.2	No
Bolivia 86-87	0.4	No	Paraguay	7.1	Yes
Bolivia 94-	-26.8	No	Peru (Paraguay)	-149.5 4.7	No (Yes)
Brazil 94-96	-12.7	No	Chile (Uruguay)	-8.6 -1.7	No (No)
Chile 81-83	24.3	Yes	Brazil	44.3	Yes
Colombia 82-87	31.4	Yes	Costa Rica	57.1	No
El Salvador 89	-1.3	No	Guatemala	-3.7	Yes
Ghana 82-89	-47.4	Yes	Sierra Leone	89.6	Yes
Indonesia 97-	20.1	Yes	Philippines	-1.4	Yes
Madagascar 88	-3.1	No	Malawi (Mozambique)	-1.3 -4.9	No (No)
Mexico 81-82	-0.2	Yes	Brazil	23.3	Yes
Mexico 94-95	5.4	Yes	Chile	-3.5	No
Peru 83-90	94.0	Yes	Ecuador	95.3	Yes
Philippines 81-87	111.7	Yes	Indonesia	26.6	No
Sri Lanka 89-93	-10.0	No	India (Pakistan)	-1.6 2.9	Yes (No)
Thailand 83-87	-2.8	No	Philippines (Malaysia)	-86.3 25.0	Yes (No)
Thailand 97-	28.1	Yes	Philippines	-1.4	Yes
Uruguay 81-84	64.1	Yes	Brazil	64.8	Yes
Venezuela 80-83	52.2	No	Brazil	34.2	Yes
Venezuela 94-95	10.6	Yes	Chile	-3.5	No
Zimbabwe 95-	-3.3	Yes	South Africa (Botswana)	-23.9 8.3	Yes (Yes)
Average	16.2		Average	6.1	
<i>of which: twin crises</i>	27.2		<i>of which: currency crisis alone</i>	18.3	
<i>banking crisis alone</i>	0.9		<i>neither crisis</i>	-10.9	
Average all	19.0		Average all	6.1	
<i>of which: twin crises</i>	26.0		<i>of which: currency crisis alone</i>	18.3	
<i>banking crisis alone</i>	9.0		<i>neither crisis</i>	-5.2	

Source: Bank calculations.

(a) Alternative pairs used in the regression sensitivity analysis are shown in brackets. The summary statistics reported in the table, however, reflect averages across the pairs not shown in brackets.

(b) Since Korea – a comparison country for Japan 1992-98 – had a crisis itself from 1997, its output loss was estimated over the 1992-96 period and then scaled-up by multiplying by 7/5.

Annex B

The relationship between output loss measures based on growth rates and levels

Recent research has measured output losses during crises by summing up the difference between a constant trend growth rate and actual growth rates observed during crises. This measure, denoted as G1, can be written as:

$$G1 = \int_{t_0}^T (\gamma - g(t)) dt,$$

where, t_0 is the point at which the crisis started, T is the point when it ended, γ is the constant trend growth rate and $g(t) = Y'(t)/Y(t)$ is the rate of change of output $Y(t)$ ¹.

A more appropriate measure of output losses during crisis periods would be to cumulate the difference between the level of actual output and its trend level as a percentage of the trend level. Using the same assumptions as above, we can write this measure, denoted by G2, as:

$$G2 = \int_{t_0}^T \frac{Y(t_0) \exp(\int_{t_0}^t \gamma dv) - Y(t) \exp(\int_{t_0}^t g(v) dv)}{Y(t_0) \exp(\int_{t_0}^t \gamma dv)} dt$$

The above expression can be simplified to:

$$G2 = \int_{t_0}^T (1 - \exp(x)) dt,$$

where

$$x = \int_{t_0}^t (g(v) - \gamma) dv.$$

Evaluating G2 analytically is not straightforward, but so long as x is small and negative, ie actual output growth during the crisis is below its trend (in practice a valid assumption), we can use a Taylor's series expansion to approximate $\exp(x)$ by $1+x$. This yields:

$$G2 \approx \int_{t_0}^T \left(\int_{t_0}^t (\gamma - g(v)) dv \right) dt \approx \frac{1}{2} (T - t_0) \int_{t_0}^T (\gamma - g(t)) dt = \frac{1}{2} (T - t_0) \times G1. \quad (1)$$

All other factors being equal, equation (1) shows, within approximation error, that measuring output losses by cumulating differences in growth rates rather than levels will yield: (i) lower estimates of losses for crises lasting longer than two years; (ii) bigger estimates of losses for crises lasting one year and (iii) roughly the same answer for crises lasting two years (see Chart 2 for a stylised example). The longer the length of the crisis the greater the gap between the two measures. Since crises usually last for longer than two years, everything else equal, cross-country estimates based on G2 are usually larger than those based on G1.

¹: Since it is usually assumed that the end of crisis (T) occurs when actual growth ($g(t)$) returns to trend (γ), $G1 \geq 0$.