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Fiscal Contingency Planning for Banking Crises

Patrick Honohan

Estimating the likely fiscal costs of future banking crises requires information about the size and composition of the banks' balance sheets and expert assessments about the accuracy of the accounting data and about certain short-term risks.

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Summary findings

There is constant demand for an estimate of the likely fiscal costs of future banking crises, but little precision can be expected in such an estimate. Honohan shows how information that is typically available to authorities could be used to get a general sense of the order of magnitude of the direct fiscal liability.

What is required for such an estimate?

- Information about the size and composition of the banks' balance sheets.
- Expert assessments of the accuracy of the accounting data and of specific short-term risks to which the components are known to be subject.

Honohan's method distinguishes between losses that have already crystallized and the changing risks for the immediate future.

By including contingency planning for banking collapse in their fiscal calculations, authorities may risk destabilizing expectations or worsening the moral hazard in the system. But the risks of contingency planning generally outweigh the risks of sending confused signals. Insisting on ignorance is a poor way to protect against announcement errors that trigger panic.

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FISCAL CONTINGENCY PLANNING FOR BANKING CRISES

Patrick Honohan

Development Research Group,
The World Bank

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FISCAL CONTINGENCY PLANNING FOR BANKING CRISES

1. Introduction

The sudden failure of many banks and the assumption, by the authorities, of some or all of their obligations can place a huge burden on the budget. The first-best response to this risk is for the monetary authorities to have a robust regulatory regime for the banking and financial sectors so that the scale of failures is limited by an incentive structure that reduces the incidence of bad banking and through early intervention of the authorities in failing banks. But what if the first-best policy fails? How can the fiscal authorities best position themselves to minimize undue pressure on the budget from the financial sector? What estimates can be made of the possible magnitude of such pressures and of when they will crystallize? What contingency planning is necessary, whether in terms of pre-funding or in terms of a decision-tree for which potential expenditure obligations should be explicitly assumed? What is the best way of phasing the cash impact on the budget of the assumed liabilities?

This paper reviews the issues and suggests a methodology for fiscal planning in the face of these substantial risks. Three main objectives are suggested for this exercise. First, protection of small depositors, limitation of adverse effects on confidence and on the functioning of the payments system. Second, minimization of fiscal costs, both by reducing moral hazard and by limiting the fiscal impact of any given banking losses. Third, insulating the remainder of the fiscal process, as far as possible, from disruption caused by a surge in banking losses: thus smoothing the impact on tax rates and on other expenditures. Evidently we are here at the junction of banking and fiscal policy. The goal of this paper is to explore the role of the fiscal authority at this junction: accordingly we omit reference to many important banking policy aspects which are of less direct relevance to fiscal concerns.

When the banking failures are part of a wider financial and economic crash, the budget will also suffer indirectly from the operation of automatic stabilizers, as the economic downturn weakens tax revenue and increases social protection expenditures. Though important, this indirect aspect is not considered here.

The paper is organized as follows. In section 2 we review the different ways in which the fiscal authorities have responded to banking crises in the past. Section 3 outlines some requirements for institutional preparedness, and the decision tree that should be traversed in the onset of a crisis. Section 4 describes some of the main approaches that have been adopted in the literature to the question of early warning of banking crises. Section 5 clarifies the concepts of scale, probability and timing which we propose to use (there is more detail on this in Appendix 1). As a prelude to the practical methodology being proposed, Section 6 describes some of the main factors that influence the scale of bank losses. Section 7 sets out our practical, but formal, method for quantifying the expected value of the potential fiscal liability. Section 8 presents a numerical example of this framework in practice. Section 9 briefly discusses the phasing of the cash impact on the budget including through the use of financial instruments. Section 10 concludes.

2. Past experience

Governments do not always assume the liabilities of failed banks. Even in the case of large failures, such as that of the BCCI bank, industrial country governments can and do choose to allow depositors to absorb the losses. In many cases lengthy delays in compensating depositors, or rescheduling their claims by conversion into long-term government obligations, have effectively imposed costs on depositors even if the nominal deposit is eventually repaid. This has been the experience in cases as different as Guinea and Thailand, for example, in the mid-1980s.[1] Nevertheless, whether because they fear widespread economic convulsion due to the collapse of the payments system, or a generalized loss of confidence, governments more often do assume the liabilities of failed banks, even extending cover to large depositors and foreign lenders.

Estimates of the costs of past banking failures range up to about 40 per cent of one-year's GNP (for Chile). It is anticipated that a substantial part of the costs of the recent East Asian crisis – now projected in the region of 20-55 per cent of GDP for the three worst-affected countries – will ultimately fall on the budget. Estimates as of 1996 of cumulative resolution costs for Developing and Transition economies in the order of $250 billion in these countries have been overtaken by events. The projected costs from five East Asian crisis countries (including Korea) alone add more than $200 billion, and upward revisions in relation to the earlier problems in Brazil and Mexico would bring the total to well over $500 billion.[2]

Such figures point to a problem that is difficult to absorb in normal budgetary arithmetic. The sudden arrival of a huge lump-sum charge on the budget, often with only limited possibility for deferral of the spending over time, can have wider psychological and political impacts, such as potentially derailing a medium-term fiscal strategy, creating a confidence-based collapse in foreign exchange markets. Indeed, the prospect of having to cope with additional expenditure of several percentage points of GDP often has the effect inducing policy-makers to delay dealing with the crisis in a comprehensive manner, adopting instead temporary palliatives.

Countries have generally dealt with this problem in one of four different ways.

First, by *brushing it under the carpet*, i.e. doing nothing in the hope that the problem will go away. Although this is generally the worst approach, it is also the most common. While it is undoubtedly true that the fiscal liability should not exceed what is socially optimal for the authorities to assume, that does not mean postponing decisions on how to deal with the problem until one has the resources to pay off depositors. Allowing banks to function in an insolvent or undercapitalized condition has been shown to deepen the hole.

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[1] See Baer and Klingebiel (1995) for some historical accounts of experience with uncompensated depositors.

[2] Adding recent – somewhat speculative – projections for the latent costs in the Chinese banking system would bring the total to $1 trillion. The most comprehensive set of historical estimates is in Caprio and Klingebiel (1997), See also Honohan (1997). The estimates for East Asia are from Deutsche Bank Research (1998).

Second, *the inflation tax*. By meeting the balance sheet deficit of banks through an expansion of central bank credit, the authorities are accepting the inevitability of a sharp increase in inflation which will have the effect of reducing the real value of depositos' funds (including that of the depositors of the banks that have not failed). This approach also imposes losses on holders of cash (bank notes) and on pensioners and others in receipt of incomes which are fixed in cash terms. A windfall gain is imposed on debtors. The inflationary solution thus resolves the problem without directly impacting the budget, but at the cost of arbitrary redistributions. The surge in inflation, and inevitably accompanying currency depreciation, is also likely to have adverse effects on business and investor confidence. This solution, which was, in effect, adopted in most of the transition economies in the early 1990s, is a disorderly one which addresses few if any of the above-mentioned objectives in a satisfactory way.

Third, by *making advance provision*, typically through the establishment of a deposit insurance fund. The resources on which such funds can draw may be notional (invested in unmarketable government obligations) or "funded" (e.g. invested in external obligations). The insurance fund's income is usually a levy on covered intermediaries varying with the amount insured and sometimes with the assessed riskiness of the intermediary's activities. Many of the insurance funds that are in place have been established in the aftermath of a major crisis and their pre-funding has typically been inadequate to meet the demands of large or systemic crises. In the case of the US Savings and Loan crisis, the inadequate scale of the resources available to the insurance fund, and of its borrowing authority, has been held responsible for inducing the fund's managers to adopt resolution strategies that ultimately increased the overall fiscal cost while postponing its explicit recognition.[3]

Apart from its fiscal role, the *pros* and *cons* of establishment of a deposit insurance fund is debated by banking specialists. On the one hand it weakens the incentive for depositors to monitor the banks, and can greatly exacerbate the moral hazard of risk-taking bankers for whom it provides access to low-cost deposit funding regardless of the risks they assume. This risk can be partly mitigated by other measures designed to provide banks with an incentive to stay in business and by effective prudential supervision. On the other hand it can underpin depositor confidence and help support the development of the banking system. Both positive and negative aspects here are only relevant to the extent that the government's promises are credible.

The fourth way in which fiscal authority may respond is by *meeting the crisis when it occurs*. This typically involves three elements: (i) assuming some or all of the obligations of the affected banks; (ii) restraining interventions into the management of the banks, sometimes including temporary nationalization; (iii) adopting measures to recover as much as possible of the delinquent loans and other impaired assets, often including the establishment of dedicated asset management or recovery companies partly independent of the failing banks. The precise design of the financial arrangements established between the government and the failed bank in order to restore the solvency of the latter can greatly influence the success of loan recovery, the incentive for more prudent behavior by the bank in future and the stability of the government's own finances. It has been suggested that the large fiscal cost reported for the Chilean crisis was exacerbated by the design of the compensation mechanisms put in place for the banks, which enabled these to draw-down funds from the government over many years. Early hopes that these funds would be repaid from subsequent profits were not realized. On the other hand, the famous success of the Swedish asset management companies (helped, to be sure, by an exogenous economic upturn) reduced the net budgetary impact of their banking crisis to a fraction of what appeared at first (Dziobek and Pazarbaşioğlu, 1997).

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[3] Thus the insurance fund packaged the sale and assumption arrangements whereby insolvent institutions were disposed of in such a way as to give the purchasing institutions tax write-offs valuable to them but costly to the budget (White, 1991). Similar problems may now be emerging in Argentina.

Credibility of government's plans

Beyond a certain point, the government's willingness or ability to deliver on large promises will be undermined. Large crises can overwhelm pre-arranged plans, and greatly narrow the options of government. Lack of credibility will, in particular, undermine the effectiveness of deposit insurance schemes (as well as their adverse side-effects). It will also mean that promises to make good a deficiency over a period of time may not be believed, so that any interventions have to be made promptly in cash.

Official market intervention.

Not to be neglected in the general context of fiscal or quasi-fiscal measures to alleviate financial crisis are the costs of intervention in the stock market to support share prices and in the foreign exchange market to support the external value of the currency. A third related type of cost - less evident - can be incurred when the government or central bank is a net borrower from the system at high levels of interest rates induced by policy. There can be various motivations for such market intervention, but defending the banking system from losses is often an important consideration. Calculating the fiscal costs of such intervention is not easy, even *ex post*. Brief bursts of foreign exchange market intervention before a devaluation are the easiest to cost: the September 1992 ERM exchange rate crisis led to very substantial quasi-fiscal losses to the authorities in Ireland, Sweden and the United Kingdom, as the domestic currency which they bought from the market in large volumes soon depreciated sharply in international value.[4]

When they are being made, these market interventions can seem to be (and are often represented as) costless in expected value terms in that they are undertaken at market rates, and as such may result in gains as easily as losses. However, large interventions usually see the authorities alone on one side of the market: as such they are dealing in prices far from what would be determined by a private equilibrium. Furthermore, they may be buying from speculators whose existing open positions make it too risky for them to sell more, even though their expectation is of additional gains. Thus substantial market intervention (whether in foreign exchange, domestic financial markets or the stock exchange) involves both an expected loss, and a heightened risk to the authorities.

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[4] Note the important distinction between the total loss of foreign exchange reserves and the much smaller quasi-fiscal loss which is - roughly speaking - the former multiplied by the percentage depreciation of the currency. For one such estimate see Honohan (1994).

Liquidity crises vs. *solvency crises.*

A liquidity crisis that does not impair the solvency of the financial system should be met by financial policy that does not draw on the budget. For example, a crisis of depositor confidence may not be justified by the underlying balance sheet position of the bank. If so, the panic can be met by temporary liquidity loans, which would be reversed when confidence was restored and the true health of the banks revealed. This indeed was the pattern observed in 19th Century Britain. Of course, judging a crisis to be one of liquidity rather than solvency is often little more than wishful thinking. In recent years, banking problems have more often proved to be worse than at first believed. Furthermore, central banks have not proved able to prevent a speculative attacks on fixed exchange rates from driving these rates to new low equilibria that made predictions of banking collapse self-fulfilling. Nevertheless, it may be that the increased frequency of banking crises in recent years has oversensitized investors to the risk of banking losses and that temporary liquidity assistance by a well-informed central bank will be enough to see off some future runs. In that case fiscal liabilities will not arise.

3. Preparing for the crisis: the decision tree

The first and most important task for preparing a fiscal strategy is to develop a clear decision tree covering the eventualities that might lead to undertaking fiscal obligations. In practice, most of the fiscal liabilities that arise are not strictly contingent obligations in any legally binding way. Instead, they are obligations assumed under pressure of circumstances, and often without time for much consideration. It may well be that decisions taken under such conditions will not be optimal. In particular, the assumption by government of open-ended guarantees in the middle of a currency or banking crisis is often done without sufficient consideration of the potential magnitudes involved and of the alternatives available. Particularly unsatisfactory is a situation where the government's credibility and creditworthiness decline sharply because it assumes obligations which market participants do not believe can be met. Such a credibility penalty can greatly increase the servicing cost of debt, as well as introducing a large risk premium into all local currency denominated borrowing, including that of the private sector.

In order to avoid this kind of rushed and sub-optimal policy, it is well to establish procedural arrangements and decision-making capacity that can allow a smooth and orderly assessment of evolving risks, despite the speed with which they evolve. In this section we consider first the institutional arrangements that the fiscal authority should have in place for this purpose. We then outline the decision tree that needs to be traversed as the fiscal authority considers what liabilities to assume.

3.1 Institutional arrangements for the fiscal authority

Although the central bank, the superintendancy of banks and other specialized agencies should embody the chief sources of financial market expertise and advice to government, it is desirable that the Treasury should retain an *independent capacity* in this field. Such a capacity will be invaluable at times of crisis when the narrow focus of the specialized financial regulators may induce them to advocate fiscal bail-outs of financial institutions and their creditors even when the advantages of doing so fall well short of the social costs. Here is an instance where independence of these specialized regulatory entities, and the assignment to each of specific responsibilities, very desirable in general, displays some drawbacks: since each of these entities may have a very specific remit, their advice on fiscal matters cannot necessarily be accepted by the fiscal authorities without scrutiny.

Ensuring an independent capacity will involve assigning this responsibility to a department head within the Treasury. The tasks of this department will include training of relevant officials and the establishment of informal links with private sector market participants with the specific purpose of obtaining an independent source of information about financial market sentiment.

In addition, the Treasury should establish a standing mechanism allowing it to be aware of and to pool the information and perceptions of the specialized official regulatory agencies in the financial field in regard to financial market developments which would have an impact on the budget. The agencies involved would include the central bank, the superintendancy of banks, the securities and exchange commission, the insurance regulator and cognate bodies. The precise modalities of this standing mechanism will depend on country circumstances, but could take the form of a standing inter-agency committee meeting, say, monthly to review recent developments. At times of crisis, the frequency of meetings would naturally increase and the *de facto* representation would become more senior, but the pre-existence of such a committee would greatly facilitate the flow of information in the crisis and, by establishing working relationships between the agencies, would avoid many of the communications failures to which government is especially prone at such times.

It is to be expected that the specialized agencies, especially the central bank, may view the establishment of such an inter-agency committee with some suspicion, fearing that it might represent an attempt by the Treasury to control the activities of the agencies and to compromise the independent mandate which they may have been given. To ensure the effective functioning of the committee, the conduct of its business by the Treasury should be in accordance with an explicit terms of reference that meets these concerns.

3.2 The decision tree

When the crisis hits, the Treasury will have to decide what commitments to assume. If there is an explicit deposit insurance fund, drawings on this fund to make good the losses of insured depositors likely do not require any new approval by the fiscal authorities. But they could have an impact on the government finances insofar as the insurance fund needs to liquidate government bonds or promissory notes to obtain cash to pay depositors. If these securities are marketable, then the fund may sell them on the open market, and there may not be an adverse effect on interest rates, especially to the extent that the recipients of cash redeposit the cash in another bank. If the securities are not marketable, there is an immediate cash call on the budget. How this is best met is briefly discussed in Section 9 below.

Any sizable crisis will frequently cause claims on the deposit insurance fund to exceed the resources available to it. Here again, depending on the legislation underlying the deposit insurance fund, the government may have undertaken to make good any deficiency of the fund. No new approval of the fiscal authority is formally required in this case either, and it will rarely be good practice for the authorities to try to stall on the payment of legal liabilities in this regard. (Only where the government is already in such a severe fiscal crisis that it is unable to pay other liabilities as they fall due would delays in meeting insured depositor losses be worth considering). Nevertheless, in practice this now presents the fiscal authorities with an urgent and likely sizable need for cash.

Going beyond what may have been undertaken as part of an explicit deposit insurance scheme, the fiscal authorities do begin to have some legal discretion. The failure of one or more large banks will certainly raise the question of whether the adverse effect on confidence and on the functioning of the payments system is sufficient to warrant the emergency extension of government protection to hitherto unprotected depositors. Decisive action is necessary here. If cover is to be provided, it should be provided promptly: a delay is likely to result in heavier losses and in some of the adverse confidence and disruption effects which the cover is designed to avoid. But there should be no presumption of cover being provided: moderate banking collapses affecting an identifiably high-risk segment of the market may not create much contagion. If so, the pressures to cover uninsured depositors should be resisted both on grounds of equity and efficiency. Equity, inasmuch as foolhardy depositors will be remunerated by hapless taxpayers; efficiency not only because of the moral hazard effect on future risk-taking of the signal provided by this policy, but also because of the marginal cost of public funds.[5]

Making this decision requires some way of making a social evaluation of the risk of contagion and of disruption. This in turn must be set against the other demands on public funds. That is not to say that action should be deferred when the government cannot afford to pay-off depositors: the reality must be faced up to promptly, even if the resolution is ultimately phased over a long interval.

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[5] Often neglected in public policy discussion, the distorting marginal effect of taxation implies that the value of the marginal public spending proposal must be greater than $ for $, if the proposal is to justify the imposition of (present or future) taxation to fund it.

In short, it may be possible and desirable to limit the extent of emergency cover granted. With this in mind, it is worth classifying the claims on banks in a number of tiers, corresponding to the likely priority to be attached to protecting the claim-holders.

Small deposits of residents in local currency;
Other deposits of residents in local currency;
Deposits of residents in foreign currency;
Deposits of non-residents;
Commercial paper and other bonds issued by the bank;
Loan commitments;
Equity.

There will be strong and probably irresistible political pressure to meet the deposits of low income households. In practice any distinction here will probably have to be on the basis of size of deposit rather than wealth of depositor.[6] It is worth bearing in mind in this context that the really poor households in developing countries do not hold bank accounts at all, and that the prosperous middle classes likely to be lobbying for cover in a crisis will have an inflated idea of what a "small" deposit is. As a reference point the cover offered by the US federal insurance schemes - often considered excessively generous - is less than four times annual *per capita* GNP; the schemes recently put in place in the European Union typically cover about twice annual *per capita* GNP. Mechanically applying these figures in Thailand would give a range of about US$5-10,000; in Nigeria the range would be US$500-$1,000.[7]

Limiting emergency cover to small deposits could reduce the potential liability by a very substantial amount while still fully covering a large proportion of depositors, because the skewed distribution of deposits (many small, few large) means the bulk of the total deposits of any bank comes from a small number of large deposits. However, a risk in practice is that many exemptions from the ceiling on grounds of hardship may be granted, nullifying much of the savings and discrediting the process.

Foreign currency-denominated deposits present a distinct category. For one thing, political pressure to cover these may be much lower in that - apart from the working balances of trading companies - their holding is widely seen as representing a bet, or at least a hedge, against the government's exchange rate and general economic policy. A government refusal to extend emergency cover to these deposits will often command political approval. Furthermore, loss of foreign currency deposits by large companies or banks is arguably less likely to disrupt the domestic payments system. Finally, assumption of foreign currency liabilities greatly increases the vulnerability of the budget to exchange rate change. Considering that banking and currency crises often go hand-in-hand, this is an important and practical consideration (cf. Mishkin, 1997).

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[6] Though an attempt could be made to limit the number of payouts to a given household to deal with the problem of systematic splitting of accounts to increase protection ("smurfing"). This problem is more severe in an explicit deposit insurance scheme than in the case of extending emergency cover discussed here.

[7] As it happens, both of these countries have, or are now introducing explicit deposit insurance schemes, so that this discussion of emergency cover does not apply strictly to them.

Foreign (non-resident) holders of bank deposits exert their own form of pressure on the government to assume the liabilities of failing banks. General considerations of fairness and some legal principles might argue in favor of equal treatment of nonresidents and residents alike, but the risk of disruption of the domestic payments system is much less, and the authorities may well wish to consider limiting payouts to foreign depositors.

But the foreign depositors can present some threats, and in practice these have been sufficient to gain them cover not only for deposits, but also for non-deposit claims, an experience that goes back for a couple of decades at least (Diaz Alejandro, 1983). In principle, though, non-deposit liabilities of banks can and should be treated differently to deposits.

Finally we have equity, which in principle should never be bailed-out.[8]

4. Cross-country approaches to early warning in the literature

A growing literature considers how to identify countries at risk of a crisis, and ideally to predict its timing. This can be of some assistance to national authorities in that, finding themselves in an "at risk" category from an international study might alert them to some hidden problems.

4.1 The skeptics

But this literature cannot be used to provide a reliable predictor of the timing and scale of fiscal burdens. Though Portes probably exaggerates when he says that: "The 'early warning' literature...dates back 25 years at least;...it is as unsuccessful as ever"[9], not too much can be expected from these systems, especially insofar as they relate to currency crises. Wyplosz elaborates on the inherent difficulties of forecasting the timing and even the probability of a currency crisis when the crisis is driven by self-fulfilling market expectations in circumstances where multiple market equilibria exist:

> We could hope to use theory and past experience to identify those weaknesses that are necessary for attacks to occur and to construct early warning indicators accordingly. But since weaknesses are not sufficient conditions for a crisis, they can only indicate countries that are not immune to speculative attacks. Neither those countries with a reasonably high probability of attack actually facing an attach, nor the timing of a

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[8] It should go without saying that where, as in Argentina today, banks are required for prudential purposes to issue subordinated debt to institutions unrelated to the shareholders or management that these, like the shareholders themselves, should not be bailed-out.

[9] Comments made at the CEPR/GEI Roundtable on "World Capital Markets and Financial Crises", Warwick, 24-25 July 1998.

> crisis can be predicted. For self-fulfilling crises, the forecasting properties of estimated models are likely to be very disappointing. (Wyplosz, 1998)

Some types of banking crisis (especially those associated with currency crises) are certainly triggered by this kind of self-fulfilling expectations mechanism which is thus inherently unforecastible. But we can still assess some aspects of vulnerability and scale. Three complementary approaches already in the literature are now briefly reviewed.

4.2 Watching for different varieties of crisis

Honohan (1997) shows that banking crises come in different varieties. In addition to those caused by macro-boom and bust (such as those driven by self-fulfilling expectations), there have also been *epidemics* of bank insolvency attributable to poor management and other microeconomic deficiencies, not associated with macroeconomic collapses. Furthermore, there have also been many situations where countries faced *endemic* crises, displaying a recurrent pattern of distress with insolvency and illiquidity (usually traceable to pervasive government involvement) persisting for years. These types of problem seem more amenable to early warning, as the conditions of insolvency are slow-evolving, even if the timing of its revelation is exogenous. If the authorities are alert to the characteristics of these syndromes, they may be able to intervene early. There will be a heightened risk of problems following regulatory and technological changes, including privatization and financial liberalization (Honohan, 1997), Of course, this is primarily the role of the banking authorities, but in the case of the *endemic* problems driven by excessive government intervention, the fiscal authorities may have a direct role in stopping the rot.

When directed credit, arbitrary and onerous taxation and other quasi-tax impositions press hard on the banking system, the banks cease to be autonomous profit-seeking institutions and become quasi-fiscal entities, dependent for their strategy and survival on the instructions and decisions of government. The underlying solvency of such banks can quickly be eroded. Here is the emergence of a banking crisis in the fiscal authorities' own back yard, as it were.

Honohan (1997) enumerates early warning indicators that can be used to identify countries at risk of problems. The indicators are different for each type of crisis. (Although that paper was completed before the East Asian crisis, the indicators listed for macro-based crises were already flashing strongly for the subsequently affected countries.) But this approach does not quantify the likely fiscal costs. Its purpose is to signal the need for further detailed examination at the country level.

4.3 Expert ratings and outer limits

A rather different approach has been adopted by Standard and Poors rating agency (Karacadag and Manzer, 1997). Though not neglecting the role of micro deficiencies and government interference, their strategy is to quantify the gross banking assets at risk from a major economic downturn. They do this by assigning the country a quality rating based on its vulnerability to asset quality pressure during a recession, and applying a factor (between zero and one) corresponding to the rating to the total assets of the financial system to obtain a quantification they call "gross problematic assets".[10] They also assess separately the risk of a downturn. Although their methodology is not presented explicitly, they state that:

> Trends in credit growth (to the private sector and public enterprises), corporate and household indebtedness, asset-price inflation, and external funding of financial institutions are key indicators of leverage. Rapid increases in two or more of these indicators denote a growing, and possibly excessive, degree of economy-wide leverage….The rankings are expressed in terms of the potential level of problematic assets that the financial system may accumulate in a reasonable worst-case economic downturn. They reflect Standard & Poor's appraisal of factors such as financial sector management and regulation, the pace of change in the regulatory and operating environment, the degree of macroeconomic volatility, and the extent of moral hazard and information deficiencies within the country.

The quantification provided by S&P is presented as a range - quite a wide one in practice. It does not aim to be a measure of the direct exposure of the fiscal authority, but of the gross exposure of the economy (as measured by the size of problematic assets), which is seen as having both direct and indirect effects on the budget. Referring, as it does, to a "reasonable worst-case economic downturn" and to the total of problematic assets, it is clearly pointing to outer limits, and as such is closer to the VAR approach than to an expected value approach. Assuming that not all problematic assets would convert into total loss, the percentages of GDP shown by S&P would exceed the fiscal liability by a large margin even in the "worst case economic downturn".

4.4 Predicting when the crash will come

A third approach is exemplified by Detragiache and Demirgüç-Kunt (1998a and b, 1999), who employ an econometric model (pooled time-series cross section logit) to explain the incidence of banking crises. This draws on observable macroeconomic measures (including GDP growth, change in terms of trade, real interest rate, inflation, growth of credit, fiscal surplus, reserves cover for the money stock and whether there has been a recent financial liberalization). If the model is used to warn of a crisis whenever the fitted probability of crisis exceeds the population average incidence, the equation is successful in classifying (within sample) about two in every three country/year points as either a crisis or not a crisis, and as such provides valuable information about the contributory factors to and triggers of crises. Of course, despite being probably the best available, such an equation cannot be used in a mechanical way as a forecasting tool, being subject to a familiar testing drawback: it generates too many false alarms (about six for every correct alarm during the sample period). Raising the threshold probability to exclude some of these false positives results in too many actual crisis events slipping through. Fully one half of the crises occurred when the fitted probability was .07 or less. Only in a small number of extreme macroeconomic conditions does the equation generate high crisis probabilities: all but ten of 36 actual crises have a fitted probability below 0.25.

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[10] This is similar to the concept of "Potential Future Exposure (PFE)" used by the Basle Committee in its 1999 advisory paper on highly leveraged funds, and defined as "How far could a contract move into the money over some defined horizon and some confidence interval".

Furthermore, as shown by Detragiache and Demirgüç-Kunt (1999) this kind of model, used out-of-sample, would not have given any clear signal of the East Asian crisis, even as late as May 1997 the model would not have rung alarm bells for the East Asian countries, for which "the overall image...would have been a rather reassuring one", assigning, for example, a probability of only 0.033 to a Thai banking crisis. A major practical obstacle to the effective use of such models is that they rely heavily on macro-financial indicators such as interest rates and exchange rates, whose sudden spikes are hard to forecast; little advance warning can be obtained from just this information. To be sure, longer-term institutional and policy factors that pre-dispose a country to crisis are also included as explanatory variables in these and similar studies (e.g. Hardy and Pazarbasioglu, 1998, Keefer, 1998), but in practice, quantification of such factors is highly imperfect.

With such low estimated probabilities, the main potential value of this sort of exercise is not so much a matter of spotting the next crisis, as a way of economizing on precautionary costs. In other words, although it seems that we cannot hope for a reliable forecasting system for banking crises, based on econometric analysis of macro variables, or more generally on information that is quantified and readily available to the econometrician, these forecasting models can be used in the context of the decision whether or not to take costly precautionary action. Even if one is not be able to predict the timing of the crisis with much confidence, there are still gains to be made by avoiding unnecessary and costly precautionary action being taken when the probability of imminent crisis is low. Depending on the relative costs of entering a crisis without having taken such precautions (as against taking the precautions unnecessarily) a net saving can be made over a period of time using the model's predictions together with a trigger point for action.

4.5 Country characteristic correlates of the size of crisis

A less studied statistical issue is what country characteristics are associated with costly crises, regardless of when they happen. Warning that, given the wide margin of error in available resolution cost estimates, it would be unwise to place too much reliance on an examination of cross-country patterns, Honohan (1996) reported that few of the main macroeconomic characteristics of countries appear to be correlated with the relative size of resolution costs. The only noteworthy correlation revealed by regression analysis suggests that disproportionately higher resolution costs seem to be experienced by economically smaller countries as measured by GDP.[11,12]

Statistical models based on readily available macroeconomic and institutional indicators can thus be of assistance to the financial regulator as part of the information flow triggering preventive measures. Small increases in the estimated probability of crisis can matter there. Even if one strongly suspects that unmeasured factors (including the current capitalization and risk profile of the banking system) strongly predispose a particular country to a crisis, and thus that the fitted equation greatly underestimates the probability of crisis, an increase in the fitted probability can helpfully signal the imminence of the crisis. However, it will obviously not do in such circumstances to derive an expected value of the fiscal liability by simply multiplying the fitted probability of crisis by the projected size of loss conditional on crisis: neglecting the suspected downward bias of the equation will result in a large error.[13]

5. Scale and probability

The two most commonly asked question in regard to the fiscal impact of banking crises is: "How big is the problem?", and "When will it hit us?" In practice these are questions on which precision can rarely be expected, even in mature and sophisticated financial systems. Furthermore, those asking the question are often unclear about what precisely they mean. The purpose of this section is to clarify the concepts of scale, risk and timing that it is proposed to employ in the contingency calculations. The discussion is supplemented by a more formal treatment in Appendix 1.

Some situations are more tractable than others. The situation is clear if a bank fails because of massive fraud, leaving few assets and an easily quantified block of insured depositors. The net liability in this case is substantially crystallized, and the uncertainties of future recovery are small. In contrast, the situation of a bank which has hit liquidity problems following a capital outflow in the face of an equity market collapse and a speculative attack on the exchange rate may be extremely difficult to assess. The potential for repayment of its loans is highly contingent on the subsequent macroeconomic evolution and the fact that the condition of the borrowers is not widely known inhibits the establishment of a unambiguous market price. Here there is both a deficiency of current information and a high degree of volatility of future developments.[14] Because of the different time-scales over which the uncertainty is

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[11] On average, halving a country's size (GDP) increases the resolution cost as a share of GDP by one tenth. This correlation is robust to the inclusion of other explanatory variables. Another variable which seems to significantly reduce the costs is the rate of import growth, possibly summarizing one dimension of economic openness.

[12] It is probable that cross-country regulatory and institutional data now being collected by DECRG will help throw more light on this question.

[13] And even if no bias is suspected, expected value is, as mentioned, not the concept we would like to use in a low probability environment

[14] While some of the bank's assets can be marked to market, others have an option value which is likely to be more valuable to the bank than to any prospective purchaser because of the private information which

resolved, we need a concept of "scale of the problem" that can accommodate both types of situation. Perhaps the most useful and unambiguous concept of "scale of the problem" is obtained if we think of the fiscal authority as having sold a put option to the banking system. If the banks get into trouble, they will exercise this option by failing - and thereby triggering a fiscal outlay.

This option value concept of the scale of the problem accommodates both the remote contingencies that need to be borne in mind even in a healthy system, and the certain payments that will have to provided for where a bank has closed and the depositors have been promised payment. In the first case, where the eventual outlays are heavily contingent on the evolving situation, the option value takes account of the range of probabilities involved. The option is "out of the money" and its value essentially arises from future risks. In the other case, the situation has crystallized, even though the amounts involved may not yet be known. The option is then "in the money" and its value is dominated by a loss that has already crystallized.

To adopt the option value concept is not necessarily to use valuation formulas based on known stochastic processes. That could be appropriate if the risks involved were chiefly driven by movements in observable market prices, but this is not so. Instead, we will simplify the question by assuming that the fiscal authority is conducting an assessment of the situation at a particular moment when some matters have crystallized, but when the impact of specific future or recent shocks has yet to be felt. Thus there is a "present" – represented (albeit imperfectly) by the accounts of the banks – and an "immediate future" – in which specific shocks may worsen the situation. For such circumstances, traditional expected value calculations will provide an adequate approximation unless the risk of crisis is low.

To take account of the longer-term risks that face even a healthy banking system, we could add an additional component, not based on the current condition of the banking system, but at most on the broad institutional and environmental conditions of the country. As mentioned in 4.5 above, there is little firm basis for making such distinctions. Instead, a common allowance for the long-run expected fiscal liability from a currently healthy banking system can simply be added to the estimate derived from the assessment of the short-run exposure.

6. An accounting approach to bank losses

If we are to quantify potential fiscal costs arising from the losses incurred by banks, we need to consider how these losses arise.[15] From an accounting point of view, it is useful to distinguish between three sources of losses to banks. First, and quantitatively the most

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the bank holds. Although it would be convenient if these two sources of uncertainty could be kept distinct, they will both enter into a market valuation of the bank's net worth, and will also influence the net present value of the government's liability.

[15] This is not intended as a comprehensive list of possible risk factors.

important factor in most recent cases in developing countries is losses in the loan portfolio due to inability or unwillingness of the borrowers to repay. A second factor is losses in the portfolio of market-related investments, including foreign exchange and derivatives. Third is fraud by insiders which may manifest itself in various parts of the balance sheet. We consider these in reverse order.

Fraud. Poorly run and lightly capitalized banks are the most vulnerable to fraud, and such banks will often be the subject of suspicion and rumors in the market. But such warning signs are not always clear and present and fraud will otherwise arise as a stochastic and unpredictable occurrence. Fortunately, fraud is usually not on a scale that will generate a systemic crisis; the cases of Guinea on 1984 (Tenconi, 1992) being one of the exceptions. BCCI was a large multinational case, though it did not present systemic problems. Correct accounting will eventually uncover fraud, and when it is uncovered, the magnitude of losses will soon become evident. Even if the perpetrator is apprehended, it is likely that little can be recovered. This third source is thus one which is hard to scale in advance, but relatively easy when it has been discovered.

Market risk. Market-related investments can in principle be priced to market (though this is not always done in conventional bank accounts). In principle, then, a static estimate of this source of loss should be available to the regulatory authorities in the normal course. Once again, management errors may confuse matters temporarily (as in the Barings Bank case) but in the case of market-risk, it is the dynamic picture rather than the static that needs particular attention. A market portfolio can have positive present value, but at the same time involve a very large risk of substantial future losses if market prices move against the portfolio. If one or two banks have taken a big bet of this type, that need not translate into serious fiscal pressures: provided supervision remains current, such banks can be intervened before their capital is totally lost, and their good business will allow them to be recapitalized by new owners. More likely to cause problems are system-wide bets, especially on foreign exchange and on interest rates. Foreign exchange bets are usually proscribed by regulation limiting net open positions, but banks may circumvent such regulations if the interest differentials are sufficiently tempting (as happened before the Mexican crisis of 1994). The quality of an apparent hedge may be suspect, as when wholesale funding in foreign exchange from non-resident banks is matched by foreign currency lending to domestic non-banks without foreign currency receivables. In that case an exchange risk has merely been transformed into a credit risk, as such borrowers may be wholly unable to meet their obligations at a much higher exchange rate.

System-wide interest rate risk resulting from maturity mismatch is less common nowadays, though it was the original source of the collapse of the US Savings and Loan industry, and also led to *de facto* insolvencies in housing credit institutions in Transition economies.

There is a huge literature on measuring market risk of a portfolio, based on statistical and decision theory, including proprietary packages such as J.P. Morgan's *Riskmetrics*. The most popular of the summary measures of risk now employed is "value at risk" which is essentially a given ordinate (usually the 99th) of the probability density. Some of these techniques and measures have been extended into loan portfolio analysis (cf. J.P. Morgan's *Creditmetrics*), but it seems unlikely that the underlying statistical regularities are sufficiently well-known or stable for this to be widely applicable in practice yet in developing countries.

Loan losses. Projecting loan losses in a volatile economic environment is a most uncertain business. The private information accumulated by each bank on the creditworthiness of its clients is a major source of the bank's profit. Outsiders should not easily be able to second-guess the bank's management on the recoverability of a loan. (But, because of the tendency for bank management to understate their loan-losses, outsiders may be able to improve on the management's stated estimates as represented in the loan-loss reserves actually provided for in the accounts.) The usual procedure that is recommended is to classify loans into about five qualitative categories, varying from a loan deemed lost and to be fully written-off up to a fully satisfactory loan. In some countries, there has been an accumulation of experience over many years allowing bankers, auditors and supervisors to reach a fairly ready agreement on how each loan should be categorized. Regulation based on historical experience dictates what loan-loss provisions should be made for each category of loan. (In addition a general provision against loan losses of between 1 and 2 per cent of outstanding loan balances is also made in the balance sheet). In normal times in the United States, these provisioning rules provide a reliable indicator of recoverable loans, as can be verified from liquidation records of the many banks that are dissolved or otherwise intervened in that country. In a recession, and *a fortiori* in other countries with a shorter track record, with greater economic volatility and with a less diversified economic base, the reliability of loan classification and loss provisioning procedures is much lower.

Loan loss provisioning is more likely to be accurate for diversified portfolios and where loan risks are idiosyncratic rather than systematic. A property market bust, an exchange rate collapse or the collapse of an important export crop price, or a natural disaster of nation-wide proportions are examples of systemic risks that are poorly captured in standard loan classification and loan provisioning procedures. Note that these are the circumstances under which collaterals are more likely to have also lost their value when the loan cannot be repaid. In summary, even the best implementation of loan classification is unlikely to be informative about the scale of losses impacting the budget in the event of a bad macro shock.

Other risks that may be serious for individual banks, or for the conduct of monetary and exchange rate policy include liquidity risk, where banks are funding illiquid domestic loans with demand or short-notice wholesale funds on the international capital market. Sudden withdrawals of funds may leave the bank unable to meet its obligations as they fall due, but in principle this is a matter which should be resolvable by liquidity loans from the central bank.[16]

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[16] Needless to say, such liquidity lending does expose the central bank to substantial risks in that the decision usually has to be taken at very short notice and without the benefit of an up-to-date and reliable assessment of whether the bank truly is solvent but illiquid. Also, if the withdrawals are due to loss of confidence in the currency, then a liquidity loan will come straight out of the foreign exchange reserves.

Overdues as an early warning signal. The most commonly used early warning indicator of loan losses, namely overdues, is also of limited value. Although servicing payments on a loan may become overdue for many and varied reasons, overdue payments on a loan certainly heightens the probability of less than full recovery. That is why accounting procedures typically require special provisions to be made against loans that are overdue beyond a certain delay (often 90 days or 180 days), and the provisions should be made against the full value of the loan and not just against the installment or interest payments that are actually in arrears.

Not all overdue loans will be wholly lost; even if the borrower does not perform, there may be some collateral value (though less in times of crisis). But loans that are not in arrears can also be problematic. For one thing, poorly managed banks will often, in what is sometimes called evergreening, grant a loan extension or a rollover of interest due in such a way as to conceal overdue payments. But even without evergreening, troubled borrowers may still keep their bank interest payments current until close to the end. At all events, statistics on loan overdues peak long after the crisis is well advanced. Note that it is not correct to state that loan overdues are a lagging indicator of the crisis, as an upturn in loan losses in often observed before the crisis hits; but the pre-crisis increase is typically dwarfed by the post-crisis increase.

Loan losses and capital deficiency. It is worth clarifying a few further simple points about the relationship between bank accounts and the potential fiscal liability. Banks are required to maintain a minimum level of capital in relation to their total risk assets. This capital appears in the balance sheet as a liability - owed in effect to shareholders or other subordinated claim holders. The shareholders' funds or net worth are the residual item: a decline in the true recoverable value of the bank's assets is, in the first instance, effectively absorbed by this element of capital. If this capital falls below the regulated amount, it has to be topped-up for the bank to remain in operation. But (assuming the accounts to be otherwise accurate) it should be possible to find shareholders willing to put up the additional capital as long as the net worth of the bank remains positive (or even beyond that point, considering that the bank's business embodies a franchise value that will generate future profits whose value is not recognized in the balance sheet. Arranging for such an injection of funds may not be easy; especially at times of crisis. And there may be a role for government to assist in this matter, but the essential point remains that sizable losses to the banking system can occur without the government having to step in to bail-out the depositors. The figures for overall loan-losses of the banking system will overstate the potential fiscal liability by at least the size of the banks' true initial capital.

7. The proposed framework

Even auditors and practitioners with access to detailed bank-level information often refuse to make a quantitative forecast of the potential fiscal cost even when the crisis has struck. But this is what we must try to do. It might appear that a reliable balance sheet would inform us of the capital deficiency of the banking system, but this is rarely the case in a crisis, not only because the underlying data may be unreliable, but especially because the adequacy and accuracy of the provisions made in the banks' accounts for loan losses cannot be assured. Even confining oneself to a static picture, an accurate estimate of the gross deficiency of the banking system may require second-guessing the bank's accountants. But in addition, account has to be taken of the vulnerability to future or recent shocks not taken account of in the accounts.

To formalize the question, let us suppose that there are only two relevant time points: now and the future. The bank has certain earning assets - market related investments and non-marketable advances; these have been financed by deposits, and by shareholders' capital. The future value of the earning assets is uncertain. But in the future period, uncertainty will be resolved and the residual net value of shareholders' capital will become known. From the fiscal authorities' viewpoint, the important question is what is the probability of the net capital value being negative, and what is the possible size of such a deficiency.

Different classifications of the bank's balance sheet[17] will be relevant for different shocks. One general-purpose classification is as follows: represent the bank's balance sheet in simplified form as: A+B=C+D where A is advances, B is market-related investments (bills), C is capital and D deposits. At present, A and B are uncertain; D may be taken as known, and C is a residual and hence unknown. We postulate a measurement error u and a vector of future disturbances v affecting asset value.[18] With these definitions, let us write the future value of capital as the following function:

$$C = A + B - D$$

We can use the same identity defining capital C, focussing on alternative elements A and B of the balance sheet as the most significant for whatever scenario is at hand, leaving the remaining net items, little affected by the shocks under consideration, to be included as the residual D.

We now recognize the contribution of future shocks to the value of A, B and D.

$$A = A_0 + \alpha_2' v$$
$$B = B_0 + \beta_2' v,$$
$$D = D_0 + \delta_2' v$$

and the distinct contribution of current measurement error with regard to the basic value which would emerge in the absence of any disturbances.

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[17] Not forgetting that off-balance sheet items can also carry risk.

[18] In the algebraic treatment that follows, we take the disturbances to be additive rather than proportionate This is essentially for convenience of notation: because the balance sheet is built up from additive components, proportionate disturbances cannot be explicitly incorporated without considerable notational complexity. In practice it may often be more realistic to build in proportionality by making the parameters α, β, δ proportionate to the balance sheet elements.

$$A_0 = \alpha_0 + \alpha_1 u$$
$$B_0 = \beta_0 + \beta_1 u$$
$$D_0 = \delta_0 + \delta_1 u$$

Assuming that the residual D (deposits) is measured without significant error and that their future value is not much affected by economic shocks, we can write: $\delta_1 = \delta_2 = 0$. The non-stochastic part of capital $\gamma_0 = \alpha_0 + \beta_0 - \delta_0$ can be taken as representing a similar concept to that of the accounting value of the bank's capital.

If the stochastic terms u and v are independently distributed with probability density ϕ and ψ, respectively, then the expected value of bank capital is:

$$E(C) = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} C(u,v)\phi(u)\psi(v)dudv = \gamma_0 + \gamma_1 \int_{-\infty}^{\infty} u\phi(u)du + \gamma_2 \int_{-\infty}^{\infty} v\psi(v)dv$$

Note that this is not the same as the market value of the bank's shares. That equivalence would only hold if (i) the full information set were available to the market, (ii) market investors were risk neutral and (iii) there were no limited liability, and that shareholders would cover any occurrence of negative capital. The third point here is of course the source of the potential fiscal liability. Thus we may write as an estimate of the value of the potential fiscal liability *E(F)*, *minus* the expected value of the bank's capital conditional on it being negative:

$$E(F) = -\int_{C<0} C(u,v)\phi(u)\psi(v)dudv$$

(This cannot be expressed as the sum of independent integrals in u and v respectively.)[19] Finally, the potential liability from each bank needs to be summed to obtain the total potential liability from the system as a whole.

This formulation can be adapted to many different environments. In particular the type of shock being assessed will typically dictate a particular classification of the portfolio in order to isolate that part which is particularly sensitive to the type of shock at hand. Sometimes we will be sure of the size of shock, so that it is not necessary to take expectations. In any event, the formulation highlights four elements that need to be quantified:

Deficiencies in accounting estimates of the current (i.e. pre-shock) condition of the banking system;
The size of different elements in the banks' portfolios;
The size and probability of likely shocks;
The proportionate impact of any given shock on the value of key elements of the banking system's portfolio.

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[19] If conditions (i) and (ii) prevailed, then the market value V of the shares would equal the sum of the expected value of bank capital and of the potential fiscal liability as defined: $V = E(C) + E(F)$. This relationship could potentially be of use in approximating the fiscal liability.

Accounting deficiencies

The task of spotting instances of fraud, and of ensuring that the portfolio of market-related investments are marked-to-market, where appropriate,[20] are essentially matters for the bank regulator, as is ensuring that the banks have made adequate provision against loan losses. Second-guessing the assessment of the bank regulators of the adequacy of the banking system's accounts is not really something that can usually be recommended for the fiscal authority. What the fiscal authority needs to do is to ensure that it is adequately informed about the degree to which regulatory assessments of bank capital deviates from published data.

But there is an important additional point to be made here. It has often happened that fiscal rules - and specifically the degree to which loan-loss provisions are allowable as tax deductions - have been a strong influence in the direction of poor accounting and inadequate provisioning against loan-losses. In many countries there is a restrictive ceiling on the amount of provisions that can be set against tax.[21] Bank accountants (and often their auditors too) tend to regard this tax rule as an accounting rule, and fail to make provisions against future loan-losses that are already predictable. By exaggerating in this way the apparent profits of banks with a view to enhancing tax revenue, the fiscal authorities may be misleading themselves as to the potential future burden on the public finances coming from the banking system. If this leads to confusion and a delay in needed intervention, the ultimate fiscal cost could be much higher than needed; the apparent gain in tax revenues may be far exceeded by the later bail-out costs.

Size and composition of the portfolio

Subject to the question of accounting deficiencies, it is a relatively simple matter to assemble data on the elements of the balance sheet. Much of the information is publicly available on an annual or quarterly basis. Less readily available may be such sub-aggregates as that part of the portfolio that is denominated in foreign exchange, or that part of the loan portfolio that is advanced for property development. Perhaps the most important caveat is that system-wide averages are totally inadequate. The incidence of bank failure is never uniform across the system, and the authorities may have to pay for costly failures even in a system which, as a whole, is solvent.

Size of likely shocks

Although there is a large variety of potential shocks that we can imagine impacting the banking system, three particular types crop up with such regularity that they are worth special attention. These are: exchange rate changes, property (real estate) price collapses and macroeconomic recessions. Evidently these need not be independent occurrences, but they have rather distinct patterns of impact on the portfolio of the banking system. At the time of a fiscal contingency calculation, it is typical that one or more of these shocks is considered particularly likely, or is in progress. That will provide some guidance as to what type and range of shocks should be taken into account.

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[20] There is some debate as to whether longer-term investments which the bank intends to hold to maturity need to be marked-to-market, and what reserves should be made for valuation changes.

[21] Escolano (1997) discusses the different types of fiscal rule that are commonly applied.

The multiplier

For marketed securities, historical price and return correlations can allow some estimates of the likely portfolio impact of certain shocks, though this is less true for the emerging markets where historical experience is short and volatile. Furthermore, it may be unwise to rely too heavily on historical correlations where we can have little confidence in the time-invariance of the processes involved. For loan portfolios there has, unfortunately, been very little work done that would allow us to quantify the impact of a shock of a given type and size on the value of elements of banks' loan portfolios.

Box: Quantifying the multipliers

What would we need, if we were to make an econometric estimate of the multiplier effect of a given exogenous shock on the value of a loan portfolio? First, we would need to identify and measure the shocks, and ensure that they are exogenous (a problematic point where banking crises tend to feedback onto exchange rate and property prices, as well as onto subsequent economic growth). Second, we would need to have reliable estimates of required loan loss provisions before and after the shock (also problematic, since the need to assess the quality of loan-loss provisioning has often been triggered historically by the crisis itself; therefore "before" estimates are usually not available). Third, we would have to consider whether the multipliers will be invariant across countries (doubtful, because of international differences in economic structures and breakdown of the banking portfolio).

Depending, then, on the type of shock that is anticipated, or in progress, or on the suspected source of accounting deficiencies, we have a broad framework that can be adapted to the particular circumstances by appropriate re-classification of the banks' balance sheet and application of the multiplier and probabilistic approach outlined above. Possible classifications into *A* and *B* for a selection of scenarios is shown below. The purpose of the classification is to allow separate treatment of the two main elements affected by the type of shock shown (*C* is always capital, and *D* the net residual).

Action plan

To summarize, what we are proposing involves four key steps.

Specify the shocks

We assume that the analyst's concerns arise from certain imminent or recent economic shocks. These shocks need to be explicitly specified and quantified so far as is possible (exchange rate, property market, terms of trade, general economic downturn, etc,)

Split the balance sheet
Obtain balance sheet information for the main banks, and reclassify into categories differentially affected by the shocks as exemplified in the table of the previous section. Take care to carry out this analysis on a bank-by-bank basis; aggregates will not do.

Apply multipliers
Based on the assumed shock, apply plausible multipliers to the chosen balance sheet categories. Calculate capital deficiencies for each bank and sum.

Adjust accounting
If considered necessary (and it usually will be) make adjustments for problematic accounting (as discussed – logically this comes before splitting the balance sheet, as it may require a different split)

This procedure gives a maximum fiscal liability, as it implicitly assumes that the bank will be made whole by the fiscal authority. Recalculating to allow for loss absorption by other claimants is a straightforward exercise.

	A	*B*
Exchange rate shocks	FX-denominated loans (affected both directly by currency translation and indirectly by changed loan-loss experience)	Other FX-denominated assets (net) (affected mainly by currency translation)
Property market shocks	Loans to real estate developers (net worth of borrowers directly affected)	Other loans secured on real estate (value of collateral declines)
General economic shocks	Loan portfolio (net worth of borrowers directly affected)	Marketable investments (market values affected)
Problematic accounting	Government-related loans (unrecognized collection problems due political influence)	Other loans (evergreening; over-optimistic collateral valuation etc.)

8. A numerical illustration

To illustrate how the framework of the previous section can be applied in practice, we sketch and application to an exchange rate shock, using data which have been constructed to fit some typical features of recent country experience (the numbers used are based on publicly available data for an actual recent case though with some modifications).

As with many other countries, the country on whose experience we draw saw a sudden end to a period of several years virtual exchange rate stability. The prospect of a sharp fall in the currency naturally raised the question of the impact on the banking system, not least because the banking system was heavily dollarized, with some two-thirds of the loans denominated in US dollars, and an even higher proportion of deposit liabilities. Some observers felt that a contingency provision should be incorporated in the 1999 budget in case of a need to meet banking insolvency. While the collapse of effective demand from important export markets was an additional negative factor affecting the local economy and banking system, the possible impact of the exchange rate can be separately analyzed.

The system has 44 banks; although we have modelled only the largest 20, we will see that it is crucial not to aggregate the data too much.

Ignoring, for this example, the issue of possible accounting deficiencies, we proceed directly to identifying the elements of the banks' portfolios most likely to be affected by exchange rate change. The foreign currency business must be identified, and within this the FX-denominated loans, as these will be subject to heightened loan-loss experience in the event of a large devaluation.[22] Thus, in the balance sheet identity discussed above defining capital,

$$C = A + B - D$$

we re-interpret A as FX-denominated loans; B as net other FX-denominated assets, and D as the net remainder of the balance sheet. The disturbance v is the percentage exchange rate movement, which affects the three elements of the right-hand-side in quite different ways. As a reasonable first approximation, we may take the multiplier α_3 as zero - no effect on the local-currency denominated part of the portfolio; the multiplier α_2 then represents the valuation change $\alpha_2 = B$; and the multiplier α_1 (applied to the FX-denominated loans) representing the combined impact of valuation change and heightened loan-loss experience might be modelled as:

$$\alpha_1 = (1 - \rho) A.$$

This particular specification of α_1 implies that the increased loan-loss experience is proportional to the exchange rate shock. That is a restriction which can be relaxed, allowing the loan-loss experience to be either more or less sensitive to the exchange-rate shock:

$$\alpha_1 = (1 - \rho(v)) A$$

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[22] Published data does not separately identify FX-denominated business in the country in question, but we do have system-wide averages, which have been applied to each bank in this numerical example

All that is now required to implement the model is a numerical value for ρ, and a set of probabilities for the possible exchange rate changes.

By inputting the systemwide totals for A, B and D, we obtain (Table 1) the estimated net deficiency of total bank capital C (below a regulatory target of 8% of total assets) for different values of v and $\rho(v)$:

Table 1: *Estimated gap between net system capital and 8% target*

L million	$v =$	0%	14.3%	25%	40%	50%
	0.1	0	0	0	0	0
	0.2	0	0	0	0	0
	0.3	0	0	0	0	0
$\rho(v) =$	0.4	0	0	0	0	0
	0.5	0	0	0	4.1	16.6
	0.6	0	0	6.7	23.6	40.4
	0.7	1.8	12.2	22.6	43.4	64.2

Note: v is percentage depreciation; $\rho(v)$ is percentage loan-losses.

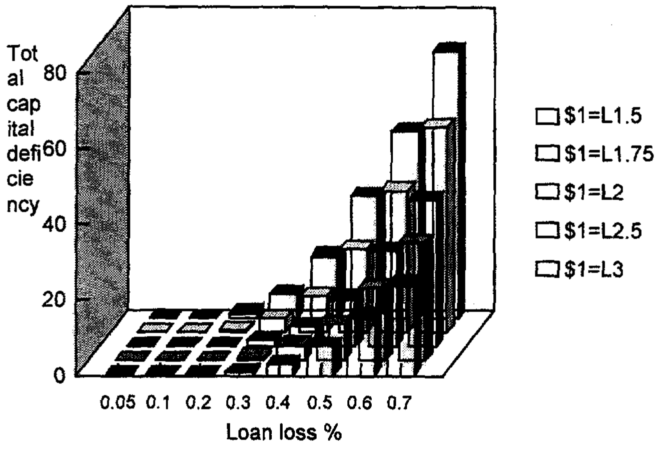
Table 1 suggests that no overall deficiency will emerge if loan-losses remain below 40%, and that even worse loan-losses will not result in an overall deficiency unless the exchange rate movement is greater than 33%. But some banks will do better than others, and the systemwide totals are an inappropriate basis for this calculation. Table 2 shows the result when the same calculation is made bank-by-bank, and the results summed. (See also figure 1). Evidently some capital deficiency will emerge even with loan-losses as low as 30 per cent, or even lower if the exchange rate change is sufficiently large.

Table 2: *Aggregate value of bank capital deficiencies below regulatory target*

L million	$v =$	0%	14.3%	25%	40%	50%
	0.1	0	0	0	0	0
	0.2	0	0	0	0.5	1.4
	0.3	0.7	0.9	1.7	3.8	6.3
$\rho(v) =$	0.4	3.0	4.2	5.7	9.7	16.4
	0.5	7.7	9.8	12.8	22.2	32.2
	0.6	15.5	19.6	25.4	37.4	49.6
	0.7	24.1	31.3	39.0	54.5	70.3

Note: v is percentage depreciation; $\rho(v)$ is percentage loan-losses.

Figure 1: *Aggregate value of bank capital deficiencies below regulatory target*



As discussed above, capital deficiency below regulatory target does not trigger a need for fiscal injection. In order to approximate the maximum potential fiscal liability, we compute the aggregate value of negative capitals, summed from bank-by-bank calculations (Table 3):

Table 3: *Potential fiscal liability*

L million	v =	0%	14.3%	25%	40%	50%
	0.1	0	0	0	0	0
	0.2	0	0	0	0	0
	0.3	0	0	0	0	1.0
$\rho(v)$ =	0.4	0	0	0.6	2.4	5.8
	0.5	0.5	1.2	2.7	6.9	14.7
	0.6	2.6	4.5	7.5	16.1	26.9
	0.7	6.6	10.2	14.7	28.9	43.2

Note: v is percentage depreciation; $\rho(v)$ is percentage loan-losses.

The table shows that the potential fiscal liability remains modest (below L7 million or US$3 million) unless exchange rate change is greater than 40% or loan-losses greater than 50%.

Combining this information into one expected potential fiscal liability $E(F)$ requires assigning probabilities to the exchange rate changes and choosing a specific mapping $\rho(v)$. The spreadsheet on which the above tables are based then reveals the value of $E(F)$. Thus for the probabilities and loan-loss mapping given in Table 4, the expected potential fiscal liability is just L 2.1 million - or about US$ 1 million.

Table 4: *Probabilities and loan-loss mapping*

$v =$	0%	14.3%	25%	40%	50%
Prob (v)	0.1	0.2	0.35	0.25	0.1
$\rho(v)$	0.1	0.2	0.3	0.4	0.5

Note: v is percentage depreciation; $\rho(v)$ is percentage loan-losses.

The crucial quantitative assumptions are those of Table 4. So far, we have not offered any formal methodology for filling this table. The assessment here must, for the present, be based on subjective judgment. Nevertheless, the methodology allows this judgment to be combined in a systematic way with the quantitative information that is available.

9. Spreading the cost over time

It is one thing to have an overall figure that must be covered by the taxpayer sooner or later. But the budgetary implications will typically extend over a period of years both in terms of cash outlays, and in terms of accounting. There is a temptation for budgetary managers to try to arrange for a lengthy deferral of cash outlays, or of the accounting for such outlays, or both. Such action is not innocuous. Excessive backloading of the cash flow in restructuring arrangements may damage the incentives of private banks. Likewise the accounting deferral or concealment of public liabilities can lead to policy errors.

Cash flow. There is generally no need to meet the full capital deficiency of a bank being restructured with cash. The various accepted approaches to restructuring all involve one of two different mechanisms: (i) some of the liabilities of the bank are assumed by a public agency (for example a deposit protection agency); (ii) non-performing assets are replaced in the bank's portfolio by a government obligation.

If it is a government agency assuming the liabilities, then the agency must be in a position to meet cash calls. If it does not itself have cash or liquid reserves, this may be done through its own borrowing, but if it has no statutory authority to borrow, or if it cannot call on a government guarantee, the cost and difficulty of making this borrowing may well induce the agency to seek an alternative approach which could prove more expensive in the long run. There are clear examples from the USA, and from Argentina in recent times. These have involved the agency engineering tax-advantaged arrangements which have either passed the cost to the revenue authorities (USA), or substituting assumption of implicit future commitments for explicit borrowing (Argentina), in each case increasing the net fiscal cost in the process.

One official agency which always has the wherewithal to cover domestic currency obligations arising out of a bank failure is the Central Bank. While the central bank is traditionally described as the "lender of last resort", it is only last in line after private market participants. In practice it is often the first public agency to which a failing bank will have resort. Central banking theory makes a sharp distinction should be made between liquidity loans and solvency support. The former are made to a bank under cash pressure, but which will ultimately be able to liquidate its portfolio. The latter, to an insolvent institution, should not be made by the monetary authority, as this will fuel inflation. As mentioned in section 2 above, the "inflation tax" has often been used to help pay for banking collapses. Any country choosing this route should recognize what it is doing, and not see the use of central bank funds as an easy option.

If there is a fixed exchange rate regime in effect, or when the failing bank has significant foreign exchange obligations, the central bank may no longer be able to assume the claims of depositors and still hold to the exchange rate peg. This is seen in graphic form in a currency board arrangement, where the statutory constraints on the currency board's authority to make loans reflects the absolute priority given to the exchange rate peg.

More generally, the market may call into question the government's ability and willingness to meet out of additional tax revenues, or expenditure cutbacks, the liabilities that it has suddenly assumed (Brock, 1996). The fall-back position of government may be to allow inflation and currency depreciation.[23] Or it may slip into arrears and default. A credible financing plan must be in place to guard against self-fulfilling market expectations driving the economy into a bad equilibrium here.

Credibility is also the key requirement for any financial instruments used to replace bad debts in the balance sheet of insolvent banks. There is always a temptation for governments to opt for an instrument with low cash outlays. For example, a government might simply offer the bank a non-interest-bearing bond with a long maturity. The real value of such a bond falls well short of value of performing loans of equal nominal value. A bank that is offered no more than that in return for ceding non-performing loans is likely to run into difficulties again, as its operations cannot easily be brought back to profitability. Even if sufficient zero-coupon bonds are injected to bring the net present value of the promised payments up to the required level (if calculated at the risk-free discount rate), such an arrangement can not be regarded as satisfactory. A government that acts like that will be suspected of temporizing. It likely has no clear idea of how it is going to fund the bullet payment at maturity; holders will discount the value of the bond, attaching only a moderate probability to its being honored in full and on time. Marked-to-market, a bank holding such an asset may still be insolvent, and may feel itself to be insolvent, with all of the incentive problems that creates. If the bond is tradable in a fairly competitive market, these valuation and credibility problems will come out in the open and force the government to face up to them.

From the banking policy point of view, the financial instruments injected by the government into the failed bank should be tradable in a liquid market (if there is such a market). Ideally, they would bear adjustable interest rates linked to money market rates, thereby avoiding the introduction of unwarranted interest rate risk. These considerations are less important where wholesale financial markets are sufficiently developed to allow the maturity and interest risk characteristics of the banks' investment portfolio to be altered through market transactions, but this will not always be the case.

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[23] This is the basis for the model of Burnside et al. (1998).

Two other aspects of the financial arrangements following a bank failure are worth mentioning in this context. First, the non-performing loans which are carved out of a failing bank are not worthless. With good institutional design and contracting for non-performing asset management and recovery, the government can hope to recover a portion of its initial outlay – perhaps a very high proportion as was achieved in Sweden (Drees and Pazarbasioglu, 1998). But absent these conditions, asset recovery agencies may prove to be no more than an additional drain on the budget. Second, in a major crisis, the fiscal authorities may be called upon to inject funds not only to bring the capital of the banking system back up to zero, but also to provide some of the required capital for future operation if the system is not to suffer from a credit crunch resulting from capital starvation. After all, likely investors in banking will be extremely cautious in the recessionary post-crisis environment. Here again the authorities can hope to make a good return on their investment, the design of which should be arranged (through redemption clauses) to put pressure on the private owners to find enough capital to buy out the government within a relatively short number of years.

10. Concluding remarks

Little precision can be hoped for in this area, yet there is a constant demand for an estimate of the likely fiscal costs of future banking crises. This paper shows how information that is typically available to the authorities could be used to obtain an indication of the order of magnitude of the direct fiscal liability. The information required is on the size and composition of the balance sheet of the banks, and on expert assessments of (i) the accuracy of this accounting data and (ii) specific known short-term risks to which the components are subject. The method distinguishes between short-term and long-term risks, and between the measurement problems of already crystallized losses, and the changing risks for the immediate future.

It is acknowledged that inclusion by the authorities of an explicit or implicit contingency for banking collapse in their fiscal calculations might in itself risk worsening the moral hazard in the system, or destabilizing expectations. But the risks of not making contingency planning generally outweigh the risks of sending confused signals. And insisting on ignorance would be a very poor way of protecting against making announcement errors that trigger panic.

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Appendix 1: The components of risk and the evolution of a crisis

This appendix examines in greater detail the issues raised in Section 5 of the text. In attempting to formalize the fiscal liability arising from a banking crisis, we need to be clear about the time-scale over which uncertainty is resolved.

As is often remarked, in principle, bank failure is a regulatory decision. By this is meant that, in a perfect world, continuous monitoring of the condition of each bank by the regulator and prompt intervention when the value of capital falls below the regulatory minimum will eliminate instances of bank insolvency and hence will also ensure that there are no depositor panics or other sources of extreme illiquidity. In such a perfect world, the question of fiscal liability would not arise.

In practice, things work out less smoothly for two main reasons: first, *measurement deficiencies*: the true capital of the bank is imperfectly measured; second, *regulatory lag*: adverse shocks can cause a deterioration in the capital of the bank more quickly than the regulator can or will respond.

Crystallization and signals of changing risk

Some of this is captured in the two-period model of Dewatripont and Tirole (D-T, 1994). In their notation, the bank has deposit liabilities D and a portfolio of loans with starting value $\eta_0 + \mu_0$. In the first period some of the bank's loans mature with total value μ. There is also a signal v received at time 1 about the likely range of value of the remainder of the loans, which are not due to mature until the next time period. This could be a signal about macro-economic conditions, or about the conduct and performance of the bank management and the risk-profile of its portfolio. At time 2, the remainder of the loans mature, with realized value η. The interesting date here is time 1: at this date we can hope to have some information about the portfolio, both in terms of realization to date (μ) and prospects for next period (v). They assume that μ is known; and that knowledge of v gives a probability density for η : $h(\eta \mid v)$. For example, the expected value of η, given v, is $\eta(v)$, which in general will differ from the base period value (before v is observed) η_0 .

D-T use this framework to recommend rules for when to intervene a bank, based on the known values of μ and v. They point out that conventional capital adequacy rules could be interpreted as placing a floor (8 per cent) to the ratio of capital to risk assets:

$$\gamma_0 = \frac{\eta_0 + \mu - D}{\eta_0};$$

whereas using the information v would give a more accurate picture of capitalization:

$$\gamma(v) = \frac{\eta(v) + \mu - D}{\eta(v)}.$$

For our purpose, the D-T model highlights the sequence of events; the fact that some risks are crystallized before others, and that accurate accounting information about these concrete elements (μ) can give us firm information about the solvency of the bank without looking to future uncertainties. In addition, however, we may obtain a signal (v)

which causes us to alter our beliefs about the future recoveries on the loan portfolio, both in terms of expected value, and overall risk distribution.

Thus, in this two-period framework, we may picture ourselves at date 1, trying to find out the values of actual outturns μ and assess the signals v concerning the likely future value of items that have not yet crystallized. Due to deliberate or inadvertent measurement error, the bank may report, in lieu of the true μ, a biased value $\mu^* = \mu + u$. Furthermore, while v may be observed accurately, we may not know the probabilistic mapping $\eta(v)$.

The practical task of inferring the scale of fiscal liabilities is thus twofold: gauging the scope for error u in the measurement of what is crystallized, and estimating the parameters of $\eta(v)$. Then the fiscal liability may be approximated by *minus* the sum of net capital of all banks for which this is negative:

$$\sum_i \max\{0, D_i - \mu_i + \eta_i\}.$$

In section 7 and 8 of the text, we show how these two tasks can be operationalized.

Timing

In practice, the world does not end after two periods. Week-by-week and month-by-month, some of the bank's ventures are crystallizing, while the prospects for others are changing. At any moment there is still a part of the portfolio whose value can be regarded as crystallized, while another part is still at risk, with signals constantly being received about its prospects. Finally, the bank is constantly entering into new ventures. The net capital of the bank is thus a stochastic process evolving over a multi-period horizon.

In the circumstances we have described, the timing of a bank's failure, and *a fortiori* of a widespread financial crisis, may or may not be a regulatory decision, but may arise either because the size of μ is underestimated by the regulators, who thus leave a bank in operation when it needs intervention, or because a large negative shock occurs, driving the actual realized value of γ well below its expected value $\gamma(v)$, before the regulators can or do intervene. For the purpose of calculating the fiscal liability, this issue of the timing of regulatory intervention is, however, secondary. The important question is when and by how much does the true capital position of the bank go negative.

Instead of the fiscal liability of the government being determined at a single realization, the government remains at risk throughout. Whenever the net capital becomes negative, the implicit "put" option which the government has sold on the bank will be, in effect, exercised, and a fiscal liability crystallized. (Indeed, even after one such crystallization, the government will still be at risk for further failures.) The natural theoretical pricing model to use for such circumstances is that of the option value. We can characterize this option value as the lump sum the government would have to pay in the world market to lay-off this risk.

Textbook option pricing methods are not obviously available to us in this environment. The capital value of the bank is not traded on capital markets (the shareholder's value may be, but this is bounded below by zero), and therefore the usual parameters of pricing formulae are not available. Furthermore, even if we were to construct approximations to these parameters, the arbitrage assumptions underlying the pricing formulae are not valid.

However, we argue that this is not a fatal obstacle: a short-run expected value calculation is, in the relevant circumstances, likely to provide a reasonably adequate approximation to that part of the option value which is based on information about the current situation of the banking system. Two arguments support this: first, if that short-run expected value liability is large, then the option is substantially "in the money", and therefore the option value is approximately equal to the underlying asset value (zero exercise price). Second, the fact that the average maturity of the typical bank's portfolio is short, or at least subject to recontracting means that more distant risks have not yet been assumed; therefore, the appropriate provision now for the contribution of such risks to future fiscal outlays should be limited by the adoption of improved regulatory procedures.[24]

An additional provision could be made to take account of the longer-term risks. But if so, it should therefore be a standard one based not on the current position of the banking system, but on characteristics such as the exogenous volatility facing the country, the quality of regulation, etc. As discussed in the text, there is as yet little empirical evidence to indicate the size of such a provision or how it should vary by country characteristics.

Finally there is the question of supplementing expected value or option value of fiscal liability with some measure of the range of uncertainty. The natural measure here is VAR, i.e. a lower percentile of the probability distribution of the projected liability.

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[24] As against this, it might be pointed out that a large majority of the countries in the world have had significant banking sector problems over the past quarter century: how should we expect the next quarter-century to be any better?

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