The Benefits and Costs of Intervening in Banking Crises

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Abstract

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

This paper provides a framework to assess the benefits and costs of intervening in a banking crisis. Intervention involves liquidity support and resolution actions. Principal benefits of intervention include avoiding panic and eliminating the economic costs of distorted incentives. Principal costs include fiscal costs and the economic costs of delay. The government's main decision concerns the length of the resolution horizon—whether to adopt a deliberate or an aggressive resolution strategy. Dominant factors affecting net benefits are the relative size of the banking system and the loss liquidation rate on assets financed by bank loans.

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I. INTRODUCTION

Official intervention to contain the dimensions of a banking system crisis and to resolve failed banks has become a common feature of the international financial system in recent years. Intervention refers to actions that authorities can take to stabilize and restructure a banking system in crisis. It is distinguished from prevention, which covers more forward-looking activities such as improving regulation and supervision, strengthening monitoring and incentives, and enhancing information transparency.

Typically, a systemic banking crisis has two principal dimensions that require intervention: first, a liquidity crisis that threatens widespread depositor panic; second, a degree of systemic distress represented by large losses in asset values that have generated widespread insolvency of banks and capital deficiencies. Decisions regarding the liquidity crisis must be taken under pressure in an environment of high uncertainty. After deposits are stabilized, decisions regarding the resolution of failed banks can be taken in a less volatile environment.

This paper examines the reasons for intervention in banking crises from a public policy perspective and elaborates the benefits and costs of intervention. Section II presents an overview of the issues. Section III details the types of actions that can be taken to intervene under different circumstances and sets the stage for defining the fiscal accounting of intervention. Section IV examines the methodological issues of measurement related to intervention. Section V presents a conceptual framework for characterizing a banking crisis and examines how it will evolve with or without official intervention. Section VI provides a general cost-benefit framework for the full economic benefits and costs of intervening, including fiscal costs. Section VII describes estimation procedures for quantifying the accounting concepts developed in section VI. Section VIII applies the framework developed earlier to the case of Sweden. Specific measures of benefits and costs are constructed based on the institutional features of the Swedish economy and the availability of data.

II. BENEFITS AND COSTS OF INTERVENING IN BANKING CRISES: AN OVERVIEW

The prevalence of banking crises around the world over the past two decades has prompted governments to innovate approaches for dealing with the problems. This paper is an attempt to conceptualize those intervention decisions in a framework that allows an assessment of their benefits and costs.[2] The technique of cost-benefit analysis provides a relatively simplified quantification of optimal decision rules. Whether such a technique is fruitful depends on whether the fundamental decision process is an economic choice. In that

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[2] Experience with bank restructuring is reviewed and analyzed in Sheng (1996), Alexander, *et al* (1997), Santomero and Hoffman (1998), Enoch *et al* (1999), Hawkins and Turner (1999), Lindgren *et al* (2000), and Woo (2000).

regard, the application of cost-benefit analysis to intervention in banking crises seems useful. Such intervention does not depend on a fundamental political choice, such as war or peace, whose implications cannot be easily reduced to economic quantities. The choice between letting a banking crisis run its course and using public funds to intervene in various fashions is essentially an economic investment decision, well-suited to cost-benefit analysis.

An additional factor affecting the utility of cost-benefit analysis is whether the relevant economic benefits and costs can be readily quantified. This problem is especially acute for estimating potential economic effects beforehand in applying decision rules. Difficulty in quantifying economic factors is a general problem of cost-benefit analysis, but the issue is of much practical importance in the decision on intervening in banking crises. The benefits of stopping the spread of a banking crisis typically involve avoiding a systemic breakdown. Since experience with systemic breakdowns is very limited, estimations of the benefits will entail speculative assessments that can be questioned. Also, costs associated with the future moral hazard provoked by intervention actions reflect subjective probabilities of risk taking and are hard to quantify. Nevertheless, the formalization of the decision-making process into a cost-benefit framework imposes consistency and focuses attention on whether hard-to-quantify factors will actually have a deciding effect on the decision if they are in any realistic range of values.

The nature of a crisis

The logic of cost-benefit analysis is straightforward: the government will maximize the net benefit, appropriately discounted, of its actions. Formally,

Net benefits = Benefits (Intervention actions) – Costs (Intervention actions),

where the amount of both benefits and costs depends on the kinds and degrees of intervention actions taken.

The first necessary step in giving this formal rule content is to define the features of a crisis. Characterizing a crisis will specify the nature of the benefits and costs involved and the kinds of intervention actions that can be taken. A crisis represents a pathological condition of the banking system. In one dimension, the crisis state entails a greater degree of the kind of distress that may affect a banking system without posing a critical problem. Distress consists of accumulated losses that have generated capital deficiencies (relative to regulatory requirements) and insolvencies. The problem of distress is more severe if the accumulated losses are accompanied by chronic unprofitability rather than being the consequence of a one-time loss of asset value. Limited distress, affecting single institutions or narrow classes of banks, may prompt official actions, but on a small scale that does not require the commitment of extraordinary resources.

A distress grows, it becomes at some point systemic in scope and produces a qualitatively distinct feature characteristic of the crisis state—the threat of a banking panic.

Panic concerns the liquidity state of the system. Liquidity problems, like distress caused by asset losses, can develop by varying degrees short of a systemic problem. In the mildest form of a liquidity problem, an individual institution may have to pay a premium but can still maintain deposit levels. In a more severe problem, a bank starts to lose deposits but is able to replace these with funds from the interbank market. If the interbank market dries up, the bank may seek lender-of-last-resort (LOLR) assistance.

An individual bank may find itself with a liquidity problem for reasons that are independent of its distress level. In principle, a systemic liquidity problem could emerge for a relatively distress-free system, for example, if a contagious depositor panic feeds off the failure of the banking system in a neighboring country with a structurally similar economy. While such a scenario exists as a logical possibility, it seems to be an extremely rare historical occurrence. The emergence of a systemic liquidity problem in a banking crisis is typically the consequence of deepening and widening distress. Therefore, the prototype of a banking crisis examined in this paper is characterized by two essential elements: a high degree of systemic distress and the imminent prospect of panic.

Intervening in a crisis

These characteristics of a banking crisis define the broad outlines of intervention actions. Intervention will occur in a two-step process. The threat of panic is the immediate problem and the government must first decide whether it is worthwhile to pay the costs to avert it. This step will entail some form of liquidity support, typically the guarantee of bank deposits by the government. If the guarantee successfully averts the spread of panic, the government is then exposed to costs arising from the distorted incentives produced by deep and widespread distress. These costs will include the potential fiscal costs of the deposit guarantee on banks that continue to fail and the economic costs of distorted bank behavior, including credit crunch effects and financial market uncertainties.

The government makes a choice about how aggressively to intervene according to the criterion of maximizing benefits, chiefly economic in nature, less costs, both fiscal and economic. It is possible that, following this criterion, the government will choose not to intervene. This outcome is more likely the greater is the initial damage to the banking system. A very large initial shock has two consequences. First, it leaves little value in the banking system to be defended from further loss. Second, it exposes the government to a relatively large payment on any guarantee of deposits to avert a panic because many banks will already be put in a position of deep insolvency. Both of these factors work against the government providing liquidity support and toward allowing a panic to run its course. In other words, if there is relatively little to be saved from averting a panic, the government may prefer to let depositors rather than taxpayers bear the cost of the crisis.

Another factor is the size of the banking system relative to the economy. If bank loans are not a large source of credit to the enterprise sector, the collapse of the banking system will have a less disruptive effect on investment and employment. In this case, the government will be less likely to stem a panic since the economic benefits of that intervention are

relatively small. Even in this case, however, banking system collapse will disrupt the payment system. The economic costs of that disruption can be large. The case of Russia, for example, suggests that the collapse of a relatively small banking system can have serious economic costs through payments disruption. The reversion of large transactions to barter arrangements in the wake of the Russian banking system collapse greatly impeded economic efficiency and government tax collections.

If the government does intervene to avert panic, it must then determine how aggressively it will act to resolve distress within the banking system. The existence of distress produces distorted incentives that generate new economic losses and further banking system distress. The government can choose to eliminate distress and the economic costs that it produces. Actions to resolve banking system distress will involve closing or restructuring failed and weakened banks. In some cases, restorations can be carried out by private restructuring, but these efforts may involve some kinds of official assistance. In other cases, the direct use of government funds through payment under deposit guarantees or public recapitalization will be needed.

In general, the government's decision will balance the economic and fiscal costs of using public sector resources against the benefits of forestalling further economic deterioration through prompt action. In a case where the premium attached to the use of public sector resources is large, for example, because of a high current or prospective government debt burden, the government may pursue a very deliberative and slow intervention strategy in order to economize on the outlay of public monies, even at the expense of higher economic costs. An aggressive resolution strategy, on the other hand, will limit deterioration costs by cutting short the intervention period but may require a greater use of public funds by relying more on nationalization or liquidation of banks with payments to depositors and less on private recapitalization and merger, which are time-intensive resolution options.

Nature of benefits

The benefits of official intervention in a banking crisis can be organized into broad classes that reflect benefits of intervention both to stabilize the banking system and avert a panic and to restore the banking system to a healthy state, free from distress-related distortions. These benefits, which can also be interpreted as the avoided costs of failing to act, can be characterized as:

> (1) *Maintain the integrity of the credit mechanism.* A dysfunctional banking system is subject to many kinds of distorted behavior that disrupt normal credit relationships. Different banks may simultaneously take uneconomic risks; restrict credit to viable borrowers; force acceleration of loans and, thereby, disrupt productive activities; force liquidation of assets, depressing prices below fundamental valuations; and so forth.

(2) *Maintain the integrity of the payments system*. The collapse of a banking system will disrupt the payments system in ways that will go beyond interruption to the clearing and settlement mechanism. Bank deposits will be destroyed and economic participants will be forced to hold the medium of exchange in the form of currency. The absence of bank deposits will inefficiently restrict transactions to currency and barter.

(3) *Maintain general financial stability*. The general financial uncertainty produced by a banking crisis increases the country's risk premium, which raises borrowing costs to all classes of borrowers and depresses asset prices, and spreads contagion effects to balance sheets outside the banking system.

(4) *Maintain economic stability*. The negative financial consequences of a banking crisis—a credit crunch, high borrowing costs, weak asset prices, liquidity squeezes—breed losses in wealth and recessionary contractions of output.

(5) *Promote an efficiently structured banking system*. A final benefit of intervention in a banking crisis is the opportunity it provides for a microeconomic reorganization of the banking system through an efficiently managed exit of unprofitable institutions.

Nature of costs

The costs of intervening in a banking crisis fall into two broad classes: fiscal costs and economic costs. Fiscal costs reflect actions that generate an actual outlay of public funds. Economic costs reflect the distortionary consequences of intervention actions on the incentives facing economic participants.

Fiscal costs

Fiscal costs can be organized according to the type of intervention activity they finance.

(1) **Liquidity support**. In the early stages of a banking crisis, official liquidity support may take the form of LOLR assistance from the central bank. This kind of lending is normally short-term and highly secured but, as conditions worsen for individual banks, it may have to be converted into longer-term official exposure. Also, as the crisis deepens and the threat of panic sets in, the authorities will have to move beyond LOLR liquidity support to blanket deposit guarantees. Both the conversion of short-term LOLR assistance to longer term lending and payments made under official deposit guarantees will generate explicit fiscal costs for liquidity support.

(2) **Recapitalization**. The second broad function of intervention is the recapitalization of distressed or failed banks. This activity can generate fiscal costs through the direct government takeover of failed banks or the use of public funds to rehabilitate impaired assets—say, through their purchase and segregation in an asset management company (AMC)—in order to facilitate private recapitalizations.

(3) **Other costs**. Operating expenses, tax subsidies, and the costs of searching for private counterparties to restructure distressed banks will also generate budgetary costs.

Economic costs

The economic costs of intervention arise as increased moral hazard. This moral hazard reflects a higher propensity for participants who benefit directly or indirectly from intervention to engage in risky or uneconomic actions that increase the chance of future economic costs. Moral hazard can be further divided into short-term and long-term.

(1) **Short-term moral hazard**. Once the decision is made to provide liquidity support and stabilize the system against panic, the distortions resulting from existing distress generate further economic costs until that distress is eliminated. The speed with which resolution is effected is the chief determinant of these costs. A slow resolution strategy (which may be less costly in other dimensions), therefore, entails high short-term moral hazard costs.

(2) **Long-term moral hazard**. Long-term moral hazard refers to whatever economic costs, if any, may be generated by an increased incentive for risk taking in the post-crisis future. In post-crisis conditions, the banking system will have been restored to health and does not suffer distorted incentives from continuing distress. The tendency toward increased risk taking in the long run arises from the government's revealed preference to intervene in a crisis situation. For some market participants, this willingness to intervene will reduce the risk perceived in some future states and will, therefore, encourage risk taking.

III. INTERVENTION ACTIONS

Government intervention in cases of widespread insolvency of banks should be designed appropriately to achieve the following three economic objectives:[3] (a) restore the

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[3] See Lindgren *et al* (2000).

viability of the financial system as soon as possible so that it can mobilize and allocate funds. (This requires having in place a core banking system to preserve the integrity of the payments system, capture financial savings and ensure essential credit flows to the economy.); (b) provide an appropriate incentive structure throughout the restructuring process to ensure effectiveness and minimize moral hazard for all parties involved; and (c) minimize the cost to the government by managing the process efficiently and ensuring an appropriate burden-sharing.

This chapter gives an overview of the type of government interventions that have typically been undertaken in systemic banking crises in recent decades. It sets the stage for the next chapter that discusses the fiscal accounting for government intervention. The chapter discusses the interventions more or less chronologically, i.e., liquidity support, deposit guarantee, recapitalization and impaired asset management.

Liquidity support

Typically, liquidity support from the central bank to troubled financial institutions starts long before the systemic nature of a banking crisis has been recognized. When a bank, or several banks, start experiencing withdrawals from depositors and creditors (both domestic and foreign), and they cannot borrow directly, or only at high rates, from the interbank market, the central bank becomes their "last resort." Very often this is the first clear sign of distress in a bank.

To address the problem, central banks may in the initial stages be more prepared to ensure funding for the distressed bank(s) by channeling interbank funds to them. This approach would not commit the central bank's own resources and emphasizes the reliance on markets to solve the problem. This approach, however, might be unsuccessful because other banks could become unwilling to lend to troubled institutions, once the latter are known to be in such a state. In that case, recourse to the central bank is the only alternative for the troubled bank.

In principle, central banks should only support illiquid but still solvent banks. However, during the early stages of an unfolding crisis, it is often very difficult to distinguish illiquidity from insolvency. Very often, it turns out that banks resorting to the central bank for liquidity support have been insolvent for a while, without this being known.

In theory, central bank loans should always be fully collateralized to avoid losses for the central bank. This is even more the case when a bank is suspected to be in a state of distress, even though in such a situation it may become increasingly difficult to identify good collateral. When a state of distress is discovered in a borrowing bank, the bank should be inspected and monitored closely and further borrowing from the central bank (under an emergency facility) should be subject to specific conditions, decided upon in consultation with the supervisors. Such conditions are needed to avoid the central bank lending to a "lost case" and, thus, incurring more and more losses.

Depending on the origin and type of the unfolding crisis, a central bank may be forced to provide support other than under its traditional mechanisms, such as overdraft loans to support the payments system, broad discounting of eligible paper, reduction of required reserves or foreign exchange loans to banks (Dziobek, 1998). To keep the system afloat, the central bank may also be forced to reschedule short-term loans into medium- or long-term obligations.

Deposit insurance and blanket guarantee

Once the true nature of the crisis has been identified and bank insolvency has been revealed as widespread, other instruments are needed to stabilize the system. Quite often, countries have established limited deposit insurance funds, but experience has proven that, when faced with a systemic crisis, limited deposit insurance schemes become inadequate to restore confidence. On the contrary, as was clearly indicated in the Indonesian case, they may aggravate the crisis.

What is needed in such cases is the announcement of full protection for depositors and (most) creditors. Such a blanket guarantee aims to stabilize the banks' funding and prevent, or stop, bank runs. As such, it is mainly a confidence booster. In addition, announcing a blanket guarantee buys the government time while the restructuring work is being organized and carried out. A blanket guarantee entails a firm commitment by the government to depositors and most creditors of financial institutions that their claims will be honored.[4]

By announcing a blanket guarantee the government acquires a very sizeable contingent liability against assets of uncertain value. These assets are very often insufficient to pay for the contingent liability that the government may be called to honor. Finally, a blanket guarantee is only able to stabilize the banking system's domestic funding. Other measures—some of them already listed above under liquidity support—may be needed to stop a flight from the currency, if that is also an issue.

Bank resolution

Once some initial stabilization of the banking system has been achieved through a combination of liquidity support, announcing the blanket guarantee and, perhaps, the closing of some nonviable financial institutions (to stop the drain on government resources), governments need to devise a bank-restructuring plan. While private sector involvement should be sought from the start—in particular if the private banking sector is significant—the nature of the crisis itself may make government intervention a necessity.

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[4] For a discussion of the detailed modalities of blanket guarantees, as well as country experiences, see Garcia (2000), Ingves and Lind (1996), and Lindgren and others (2000).

Government intervention broadly takes three forms: closure and liquidation of nonviable banks and recapitalization through capital injections or through rehabilitating the assets. Both recapitalization approaches can be used separately, depending on the particular condition a bank is in, but more often they are combined when rehabilitating an insolvent bank. Because the cost involved in closure and liquidation boils down to paying out the depositors and other creditors under the blanket guarantee, as discussed under the previous section, this intervention will not be further discussed in this section.

Recapitalization: capital injections

A discussion of intervention techniques with a view to determining their impact on the budget needs to discuss two aspects: the **resolution techniques** used by the government to arrive at a least cost solution (from the government's point of view) and the **financial instruments** used to recapitalize the banks.

A stylized presentation of resolution techniques—assuming there is a blanket guarantee—broadly yields the following options:[5] the failing bank can be nationalized, or the government can resolve the bank through a purchase and assumption operation or the use of a bridge bank. Each of these options involves varying degrees of capital injections by the government and the choice of the option should be based on the least cost principle. Typically in a systemic crisis, all three techniques will be used (in addition to closures), depending on the condition of the failing commercial bank.

Nationalization of a failing bank means that the government becomes the (main) owner of the insolvent bank and recapitalizes it. The use of the term here is different from the more traditional nationalization that refers to a situation wherein the government takes over a solvent bank. In a systemic crisis, the government's aim is usually to own the bank temporarily and to seek to privatize it at an early date.

A *purchase and assumption operation* (P&A) typically involves the purchase by a solvent bank of the good assets of a failing bank, including its customers' base and goodwill, as well as part or all of the liabilities.[6] In a government supported P&A operation, the government typically will pay the purchasing bank the difference between the value of assets and liabilities. Often the bad assets are liquidated or transferred to an AMC.

A variation of a P&A involves the use of a temporary financial institution, *a bridge bank,* to receive the good assets of one or several failed institutions. A bridge bank is a type of P&A where the government (or the restructuring agency) itself temporarily acts as the acquirer until the time that the institution is ready for a sale. The bridge bank may be allowed

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[5] See also, among others, FDIC (1998), Lindgren *et al* (2000) and Enoch *et al* (1999).

[6] See FDIC (1998) for a discussion of several types of P&A operations.

to undertake all or only some banking business such as providing new credit and rolling over existing credit. Bad assets are liquidated or transferred to an AMC. If it is expected that the bridge bank will be sold quickly to a solvent bank, the government may opt not to inject any capital in the bridge bank, which makes the bridge bank arrangement potentially a cheap arrangement for the government.

Among the above options, the initial fiscal impact is highest under a nationalization. The government needs to recapitalize the bank, at least up to the minimum capital/asset requirement, and preferably even higher. A P&A requires typically less capital from the government, while a bridge bank arrangement can be run without capital injection. Of course, if the bad assets in all cases are not written off, but transferred to an AMC, other costs for the government are involved. The other side of the coin is that the government receives dividends from the nationalized banks and, later on if the nationalization is seen as temporary, the proceeds from privatizing the rehabilitated bank.

A variety of **financial instruments** can be used to recapitalize banks (Enoch et al, 1999). Providing Tier 1 and Tier 2 capital can be done through capital instruments (different types of shares, bonds) and at least two means of payments. The choice of instrument has an impact on the type of control the government will be able to exert in the bank taken over and the type of payment has an impact on the budget. *Payments in cash or through bonds* are common practices, depending on the instrument used.

Recapitalization: rehabilitating the assets

Recapitalization can also be done through purchasing and rehabilitating bank assets and facilitating debt-workouts to assist banks. Rehabilitation of bank assets is a key aspect of bank restructuring. There are many variations for managing and disposing of impaired assets that not only have an impact on the recapitalization of the troubled banks, but on the entire restructuring process. Key decisions concern the speed of disposition of the impaired assets and the use of a centralized versus decentralized management framework.

Regarding the latter choice, some countries facing a systemic banking crisis have decided to leave the rehabilitation of assets to the markets, by forcing or encouraging through certain incentives, banks to establish their own AMCs. In this case, the government is not, or only marginally, involved in the process and does not use this policy as a recapitalization method. The cost to the government is limited to the incentives—if any—given to the banks to establish their own AMCs.

Quite often in a deep and widespread systemic crisis, in particular when a large number of public banks is among the troubled banks, the government may opt for the use of public, and most often, centralized AMCs. The use of this approach to rehabilitate assets goes hand in hand with techniques to recapitalize the troubled banks. Typically, the AMC will buy impaired assets from troubled banks in exchange for bonds or cash. The bonds could either be issued by the government directly or by the AMC, in which case they usually are government-guaranteed (Enoch et al, 1999). A critical factor in this operation, which has a

bearing on the cost to the government, is proper valuation of the impaired assets. If assets sold to the AMC are overvalued, such an operation leads to a backdoor recapitalization.

Given the critical nature of the impaired asset rehabilitation process for the entire restructuring process, the approach chosen may have very different outcomes in terms of cost and benefits. The longer the asset rehabilitation process takes, the likelier it is that asset values depreciate further, ultimately resulting in situations were they cannot be sold any more.[7] The most important potential benefit to the government, and the restructuring process, resulting from the use of a public AMC is that the government gets more leverage over the troubled bank since it can impose conditions linked to its purchases of assets (and the concomitant recapitalization). The most significant disadvantage of a public AMC is that the assets tend to be parked in the AMC and continue to lose value, increasing the fiscal cost to the government.

Other intervention tools

Governments may resort to some other intervention tools to expedite the restructuring process and enhance its efficiency. Such tools are used in conjunction with other tools, described above. While some of these tools have no impact on the fiscal cost to be borne by the government, their advantage is often that they limit the need to activate the blanket guarantee if the weaker bank(s) would fail in the absence of the operation.

Mergers can be assisted or unassisted. In the unassisted merger, a weaker partner is merged with a stronger one and the involvement of the authorities is limited to bringing the parties together and overseeing the merger process. An assisted merger involves some type of financial assistance to the acquirer (or tax incentives) by the government. As such, there is a fiscal cost involved, similar to the one involved in recapitalizations, but at a smaller scale. The benefit of mergers (both types) is in avoiding potential failures of the weaker partner(s) involved in the deal and, therefore, potentially limiting the resort to the blanket deposit guarantee. However, if mergers are not implemented properly, and the resulting new institution turns out to be weak, more costs might be involved in the future.

Transfers of deposits. To assist troubled banks, the authorities may decide to transfer government deposits from sound banks to troubled banks. In principle, such operation should be neutral in fiscal terms, unless the troubled bank offers a lower interest rate on those deposits, or, even worse, the weaker bank fails at a later stage.

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[7] For a list of advantages and disadvantages of centralized public AMCs, as opposed to private arrangements, see Lindgren et al (2000) Box 8.

Tax incentives are sometimes given temporarily to weaker banks or to acquiring banks (either under P&As, bridge banks or mergers) to facilitate the operation and the return to profitability. They result in foregone revenue for the government.

Forbearance. To assist troubled but viable banks in the rehabilitation process, authorities may give these banks time to meet new loan loss provisioning rules or new capital adequacy requirements. There is an ongoing debate about benefits and drawbacks of forbearance. The benefits attached to such policies—as long as they are conducted transparently—are that they allow the banks to operate temporarily under less stringent conditions and therefore allow a continuous flow of credit to the economy. In addition, forbearance may avoid bank failures and thus, indirectly reduce the cost that would otherwise fall on the deposit insurance scheme. However, some studies point out that forbearance results in higher long-run resolution costs. FDIC (1998) states, referring to the 1980s experience with the savings and loan industry, that forbearance without proper oversight can create the opportunity for further deterioration of financial institutions and result in increased resolution costs as operating costs accumulate, thus leading to higher intervention costs in the medium and long run.

State guarantees are often attached to specific operations of troubled banks to facilitate their "return to normal" and to avoid interruptions in the flows of credit to the economy. For instance in the Asian crisis countries, governments provided guarantees on credit to the export sector or to the small and medium-sized enterprise sector. While no direct fiscal cost is attached to such operations, these guarantees create a contingent liability to the government.

IV. METHODOLOGICAL ISSUES OF QUANTIFYING BENEFITS AND COSTS

The decision to intervene in a systemic banking crisis, is taken because the government hopes that through its interventions the benefits listed in Section II will outweigh the costs resulting from the unfolding crisis and the ensuing restructuring. However, the measurement of several of these costs and benefits is an almost impossible task, making it in the end very difficult to state clearly by how much the benefits have outweighed the costs. Two relevant questions in this regard include: (a) what can governments *ex ante* reasonably know about costs and benefits when deciding to intervene? And (b) to what extent can *ex post* observations from other experiences be used to evaluate the decision to intervene?

Ex ante versus ex post issues

When taking the decision to intervene in a banking system hit by a crisis, it is very hard for the government to form a reasonable ex ante estimate of the benefits and the costs. The nature of the identification process of costs and benefits is very different. At the onset of the crisis, the **gross costs** are a given factor (deposits are being withdrawn and assets are losing value). However, their amounts are unknown (and still growing). During the crisis, governments can try to minimize the **net cost** by using the most appropriate intervention

techniques (the difference between gross and net can be considered a measurable benefit from the intervention). Some of these cost are quantifiable as they enter the fiscal accounts. Other costs are harder to quantify (disruption of payments system and of credit flows, loss of confidence in the banking system, deteriorating macroeconomic conditions), as discussed in Sections VI and VII. Benefits of intervention are of a different nature. Some are of an immediate nature, while others will only become apparent in the medium and long run. Immediate benefits of the intervention are very often of a counterfactual nature: preventing the system for deteriorating further, i.e., keep credit flows going, keep the payment system going, restore depositor confidence. Medium and long-term benefits are mainly the emergence of a more efficient banking system.

Establishing ex ante estimates of costs and benefits is rendered difficult by the following factors:

- Experience has proven that it takes time for the government to recognize that there is a crisis and that this crisis is of a systemic nature.

- Once the systemic nature is recognized, it takes time to make an inventory of the problems, while at the same time the situation is most likely still deteriorating.

- The initial estimate of the size of the problem will, in the course of the restructuring process change (sometimes dramatically) as a result of factors that are under the government's control, but more importantly by factors that are not under the government's control.

Under the government's control are:

- The speed at which initial measures are taken (blanket guarantee, liquidation of nonviable banks).

- The speed at which a restructuring strategy is worked out.

- The types of resolution procedures use (recapitalization, impaired asset management).

- The measures taken to address the crisis in the corporate sector.

- Factors that are not, or only marginally, under the government's control include:

- The impact of the macroeconomic environment. Will it further deteriorate or stabilize?

- The size of the corporate sector crisis. This factor, taken together with the first one, will determine if restructuring will go through cycles, i.e., that following any initial clean-up period, more nonperforming loans will show up on the books of the banks, further increasing the cost of the crisis.

- The market's reaction to the government's measures (blanket guarantee, bank liquidations).

- The market's willingness to participate in the restructuring process, i.e., the willingness of the private sector to assist in the recapitalization process and willingness of the foreign sector to participate. Availability of capital in the private domestic and foreign economy will determine to what extent the government may have to provide incentives to attract these sources of capital. This will also add to the cost for the government.

Taken together, these factors make it very difficult to get a reliable ex ante idea of costs and benefits from intervening in a systemic crisis. To underline this point, Table 1 provides a comparison for selected countries between the fiscal costs estimated at the beginning of the crisis and the most recent estimate. Such a comparison clearly indicates the shaky nature of any ex ante estimates. It should be noted that this comparison only covers measurable fiscal costs. Other costs and benefits are even harder to forecast and compare.

In the same vein, it is difficult to base the decision to intervene or not on any specific ex post observation. There is a general belief and understanding that government intervention in a systemic crisis in the end yields more benefits than costs, but the specific nature thereof varies greatly from country to country.

The very factors that were listed above appear in different intensities in crisis countries and, therefore, lead to different costs to the government. The table above also compares across countries the estimated fiscal cost of some major banking crises in the 1980s and 1990s and clearly points out how difficult it is to infer any reasonable estimate from previous crises.

Furthermore, benefits and costs will also depend on the type of intervention. For example, interventions can be proactive or not, broad-based versus specific, aggressive or deliberate, and can rely heavily on nationalization or not. In most of these scenarios, the decisive factor is the difference in cost needed to achieve the same nature of benefits.

Proactive interventions (interventions before a real crisis breaks) seem to have been rare so far. However, if intervention is planned when the first signs of distress are discovered, the cost of intervention could be reduced significantly, while the intervention strategy could yield the same benefits as when the intervention takes place in a full-blown crisis. Lower costs would come from lower fiscal costs (less liquidity support, no resort to blanket guarantee, lower recapitalization because erosion of the capital base is interrupted earlier in the process) and lower costs associated with no (or smaller) disruption of the payments system and of credit flows.

Table 1. Comparisons of Initial and Final Fiscal Costs of Bank Restructuring

Country	Initial Estimate	Latest Estimate (chronologically)
Indonesia (1997-99)	29 (11/98) 1/	45 (authort.) 2/ 42 (2/99) 3/ 51 (mid-99) 4/ 45-80 (9/99) 5/
Korea (1997-99)	17.5 (11/98)[1]	15 (authort.) 2/ 10 (2/99) 3/ 13 (mid-99) 4/ 15-40 (9/99) 5/
Mexico (1994-97)	8.4 (1996)[6]	14 12-15 (10/96) 5/ 21.3 (1999) 6/
Malaysia (1997-99)	18 (11/98)[1]	12 (authort.) 2/ 11(2/99) 3/ 5 (3/99)[4]
Sweden (1991-93)	4.7 (1994)[1]	1.2 (1997)[8] 4-5
Thailand (1997-99)	32 (11/98)[1]	25 (end-98)[4] 26 (2/99)[3] 35-45 (9/99)[5]
Chile (1981-85)		19-41
Finland (1991-93)	14.7 (1994)[7]	8-10
Colombia (1982-87)		5-6
USA (1980-92)	0.07 (1984)[9]	2.4 (1992)[9]

Note: Estimates refer to gross fiscal costs as a percentage of GDP.

1/ IMF Staff estimates of November 30, 1998, WEO.
2/ Authorities' estimates for the gross cost of financial sector restructuring. OccP No. 188.
3/ Merrill Lynch, "Asia-Pacific Banks: Progress and Issues in Restructuring," February 23, 1999.
4/ "Financial Sector Crisis and Restructuring: Lessons from Asia," OccP No.188, 1999.
5/ GAO "Actions Taken to reform Financial Sectors in Asian Emerging Markets," September 1999.
6/ Fernando Montes-Negret, World Bank, Second WB/IMF Financial Sector Liaison Committee Seminar, January 11, 2000.
7/ Bulletin of Bank of Finland, August 1994.
8/ In Sweden the majority of bank support has been recovered in proceeds through the sales of Nordbanken/Gota Bank, Securum and Retriva. As estimated by *Ingves and Lind (1997)*, SKr 48 billion or 73.8 percent of original support were recovered. Note: since almost all support has been recovered, this may not be the best example to illustrate that costs are being underestimated at the onset of the crisis. Instead, we have included as a case of underestimation the U.S. thrift crisis.
9/ Congressional Budget Office, "Resolving the Thrift Crisis," April 1993.

Broad-based interventions are often more costly than *specific ones,* but may reap more benefits because they aim at more thoroughly cleaning the banking system, allowing a more efficient system to operate after the crisis. Specific interventions may lead to situations where inefficient or loss-making institutions can continue to operate in the system, leading to new problems at a later stage. *Aggressive or quick* strategies may be more costly in the short term, but again, they may lead to reaping the benefits of the intervention more quickly because a well-operating core banking system may be put in place more quickly than in the case of an intervention that allows banks time to restructure. Finally, depending on the size and nature of the crisis, widespread *nationalizations* early in the crisis could be beneficial in that they help stop runs and, therefore, lead to a faster restoration of confidence in the system. However, the ultimate cost of interventions that rely heavily on nationalization depends on how well these nationalized institutions are managed and sold, once intervened.

Budgetary accounting

This section discusses issues in budgetary accounting for the intervention techniques, building on the previous chapter. Depending on their nature, some costs are fiscal, others are quasi-fiscal. Table 2 presents an overview of their nature and the way they should be accounted.

Liquidity support is typically provided by the central bank. This, and the fact that it comes early in the unfolding crisis, often leads to situations wherein the quasi-fiscal costs attached to the support are not taken into account in the final calculation of the cost of the restructuring. It is only when this liquidity support is actually recognized by the government as part of the restructuring bill that it draws attention as a fiscal item. Sometimes the government issues bonds to compensate the central bank for its support (Indonesia, Thailand), or the support is converted into equity or subordinated debt.

The budgetary implications of central bank instruments used to support banks differ, depending on the type of instrument used (Dziobek and Pazarbaşioğlu, 1997). Normal central bank lending (i.e., at market conditions) has no fiscal impact in principle. However, if lending takes place at below market rates or if the central bank applies broader than normal principles of discounting, there will be an impact on central bank income, and profit remittances to the government budget will be smaller. In the same vein, if other measures are taken, such as a reduction of reserve requirements to assist commercial banks, profit remittances will be lower through the impact on central bank income. In the worst case, such measures might lead to central bank losses. If central banks provide foreign currency loans to commercial banks, central bank international reserves fall and so will the bank's income from capital.

Table 2. Government Intervention Techniques and Their Fiscal Implications

Intervention technique	Fiscal Cost	Fiscal Revenue	Fiscal Treatment
Liquidity Support			
Lender-of-Last Resort (different types)	As long as cost stays with the central bank (CB), it is a quasi-fiscal cost. As explained in text, most types of LOLR that do not meet market criteria result in CB lower income, thus lower profit remittances to the budget		Lower profit remittances are foregone revenue. If central bank lending is converted into government bonds: interest payments annually and repayment of bonds at maturity.
Deposit Insurance			
Limited Deposit Insurance	N/A in systemic crisis		Depends on arrangement. If privately funded, no fiscal contribution. Government contribution can be in cash or bonds.
Blanket guarantee	Is a contingent liability initially. When called upon, will be direct fiscal cost (when financed from budget) or quasi-fiscal cost (when financed through the CB). Ultimately always budget.		Depends on arrangement. Cash, directly from the budget or bonds. If bonds are used, interest payments enter annual budget, repayments of bonds at maturity.
Recapitalization through capital injections			
Capital Injections (nationalization, bridge bank, P&A) bonds versus shares	Cash outlays from budget For bonds: interest and amortization	Dividends Proceeds from (re)privatization at a later stage	Cash payments: directly from budget. Bonds: see above. Dividends: nontax revenue.
Intervention technique	**Fiscal Cost**	**Fiscal Revenue**	**Fiscal Treatment**
Recapitalization through rehabilitation of assets			
Rehabilitation of bank assets through private AMCs	If incentives are given to establish private AMC, this is a cost, depending on the type of incentive.	none	Depends on type of incentive (most often forgone revenue or subsidy).
Rehabilitation of bank assets through public AMCs	If bonds are issued: interest and amortization costs	Sales of impaired assets	Bonds and interests: see above. Sales of impaired assets: capital revenue for government.
Other techniques			
Merger (assisted and unassisted)	Assisted merger may involve tax advantages.	May avoid resort to blanket guarantee if weaker institution had failed.	Forgone revenue in case of tax advantages.
Transfer of government deposits	If new bank offers lower interest rates, there is forgone revenue for the government.	Same	Forgone revenue in some cases

Tax incentives			Forgone tax revenue
Forbearance		May avoid resort to blanket guarantee if weaker institution had failed. Or lower recapitalization costs for government.	
State guarantee	Is contingent liability		
Operational costs (operation of institutions such as BRA, AMC, asset valuation, experts) Others costs (macrocost from credit crunch, greater interest spreads)			Current government expenditures (operations and maintenance).

Very often, faced with a systemic crisis, governments and central banks have no time to organize themselves properly to tackle the crisis. In such cases—as was seen in the Asian crisis—central bank liquidity is the main source of funds to the system in the initial stages. In Indonesia and Thailand, formal arrangements were worked out later, whereby the government compensated the central bank for any losses it had incurred while providing liquidity support to the system. As such, the issuance of government bonds to the central bank replaces the quasi-fiscal cost by an explicit fiscal cost. When central bank lending is converted into equity or subordinated debt, central bank income also falls and so do profit remittances to the budget.

Blanket guarantees. It is possible that blanket guarantees, mainly being confidence boosters, are not called upon. In other words, it is possible that the mere announcement of such guarantees suffices to stop bank runs and restore confidence in the banking system. However, if called upon, the affected banks' assets will most likely not be sufficient to pay for the contingent liability that the government may need to honor. So, the fiscal implications of the blanket guarantee may be significant. The guarantee can either be financed directly from the budget or through the central bank. In the latter case, the central bank would give a long-term loan to the agency in charge of the restructuring, and the government would guarantee this loan and pay the interest and amortization through the budget. While the direct fiscal cost of giving a blanket guarantee might be considerable, this cost might in the end be lower than the potential economic and social cost of a complete collapse of the banking system.[8]

Recapitalization. Capital injections and rehabilitation through purchases of impaired assets. The fiscal impact of straight capital injections depends on the methods and

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[8] Blanket guarantees may also entail a regressive wealth distribution effect because taxpayers' funds are used to protect not only small savers, but also large depositors and creditors, including external creditors (Lindgren *et al* 2000).

means of payment used. If government bonds are used, the fiscal accounts will reflect interest payments and, later on upon maturity, amortization. If payment in cash is used, the ways the recapitalization enters the fiscal accounts depends on the origin of the cash. Japan, for instance, has issued government bonds to fund the cash injections; Malaysia has used the proceeds from the sale of impaired assets as cash injection; Thailand converted LOLR support into equity in intervened banks; in Chile, the central bank issued central bank bills to replace nonperforming assets in the banks' balance sheets; and in still other countries, the government borrowed from the central bank.

The net fiscal cost of recapitalization will most likely be lower because, in the case of equity holding by the government, the payment of dividends to the government provides a flow of income. However, this flow comes later in the process when banks start to become profitable again. In addition, privatization of the nationalized banks will reduce the net cost of the operation significantly, and may even yield a profit to the government.

Government support through the **purchase of impaired assets** mainly takes place through the issuance of government bonds, or government-guaranteed bonds to replace the nonperforming assets in the books of the banks. Impaired assets can either be bought at book value or at market value. When buying impaired assets at book value, the operation amounts to a back-door recapitalization of the problem bank. Buying at market prices gives an incentive to the problem bank to continue the recovery efforts of its assets and to the AMC to sell the acquired assets at a better price, thus realizing a profit. The net cost/benefit of the operation depends in the end on the government's ability to sell the impaired assets (through the AMC).

In some countries (Chile, for example) assistance to banks took place through the issuance of central bank bills (long-term paper) in exchange for nonperforming loans. The impact on the budget of such operations comes through a fall in the asset quality and in the earnings of the central bank, leading to lower profit remittances to the government.

State guarantees on bank credits, like deposit guarantees represent a contingent liability for the budget. **Tax incentives** represent forgone revenue for the government. **Forbearance**, finally, should have no direct fiscal impact, but could have a medium-or long-term impact in the form of higher resolution costs later. Such costs of a prolonged or recurring crisis would be accounted for under one of the categories listed here.

Other costs that need to be taken into account and that have an impact on the budget include the salaries of experts hired to assist the government in addressing the crisis, the hiring of accounting firms to audit the troubled banks and to value bank assets, the hiring of experts (firms) to manage impaired assets and to prepare banks for sale. If central banks are involved in the restructuring process, their administrative costs will increase, since they will need experts to handle parts of the process.

V. THE EVOLUTION OF A BANKING CRISIS

This section develops an analysis of the nature of a banking crisis and how it will evolve with and without intervention actions. This analysis builds a conceptual basis for the formulation and estimation of the benefits and costs of intervening.

Shock and distress

Banking system distress can be characterized by varying degrees of severity. Systemic distress is not a simple concept but has several interrelated features, the most important of which are the extent of asset value loss, the extent of insolvency, and the risk of a liquidity panic. A stylized version of the structure and evolution of banking system distress that integrates these features and sheds some light on intervention strategy is presented in Figure 1.

Figure 1: Structure and Evolution of a Banking Crisis
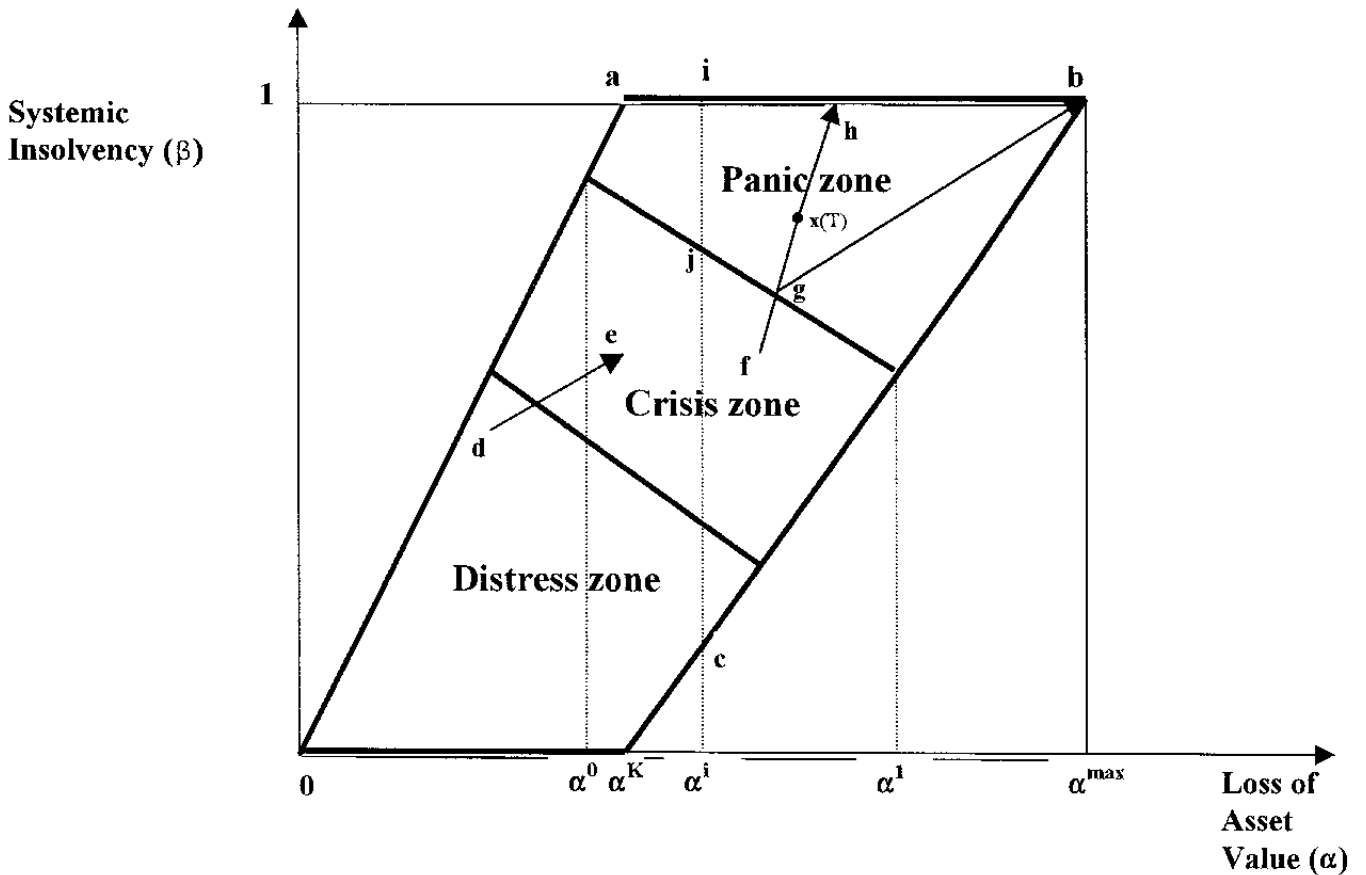
The axes represent two key characteristics of banking system distress, loss of asset value and the degree of systemic insolvency. The fall in assets, α, is measured by the ratio decline in the value of pre-shock assets

$$(1) \qquad \alpha = 1 - A/A(0),$$

where A is the current book value of banking system assets and A(0) is the pre-shock level, valued at point 0. The maximum loss reached when all system assets must be liquidated is

$$(2) \qquad \alpha^{max} = 1 - A(b)/A(0),$$

where A(b) is the liquidation value.

The degree of systemic insolvency, β, is measured by the share of the booked value of banking system assets held by insolvent banks

$$(3) \qquad \beta = A_I/A,$$

where A_I is the volume of assets held by insolvent institutions.

A loss in asset value of a given size can be associated with varying degrees of systemic insolvency, depending on how that loss is distributed across the banking system. The line **Oa** represents the maximum degree of insolvency for each level of loss in aggregate banking system assets. Similarly, the line $\alpha^K b$ represents the minimum degree of systemic insolvency corresponding to any loss of asset value. When the asset loss exceeds α^K, the aggregate pre-crisis capital of the banking system, some institutions must be insolvent. Minimum levels of systemic insolvency increase with asset loss along the line $\alpha^K b$, until the maximum degree of asset loss, α^{max}, is reached. The area **Oabα^K**, then, gives the set of feasible outcomes (α, β) that characterize conditions of banking system distress.[9]

Starting from a given point in the feasible set, systemic distress will increase along any path that moves upward and to the right. As systemic distress increases, it is reasonable to think that liquidity problems among banks will become generally more widespread. At some point, the combination of banking system distress and emergent liquidity problems becomes so pervasive that the system reaches a state characterized by the prospect of qualitatively different behavior that can be categorized as a crisis rather than just general

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[9] The shape of the contours **Oa** and $\alpha^K b$ depends on the distribution of capital and assets across banks. They are represented for convenience in Figure 1 as straight lines, which assumes that capital and assets are uniformly and continuously distributed across banks; in other words, the banking system is assumed here to be purely competitive with a large number of small equally-sized banks.

distress. A crisis, then, represents an advanced state of systemic distress combined with the prospect of systemic illiquidity.

When all banks in the system are insolvent, represented by outcomes on the line **ab**, risk-neutral depositors will have an incentive to panic. In that case, each depositor will realize that every bank lacks sufficient funds to meet all of its potential deposit withdrawals. Since banks meet deposit withdrawals on a first-come-first-serve basis, each depositor has an incentive to withdraw funds immediately, creating panic.

Risk-averse depositors, however, can panic even when $\beta < 1$. Some banks may not be insolvent but asset losses may be so great that depositors view the risk of systemic insolvency as unacceptably high. At any given level of systemic insolvency, higher levels of asset loss will raise the risk of additional insolvencies. Therefore, if depositors are risk-averse, there will be a larger set of points (α, β) that will induce panic than those lying on line **ab**. This set is labeled "Panic zone" in Figure 1. In this zone, every bank in the system can experience a run regardless of its capital condition, unless there is some guarantee on deposit values.

The beginning of an episode of banking system distress can be viewed as drawing an initial point (α, β) from the feasible set, which represents the initial shock. This initial shock may arise in two broad ways. First, there may be relatively abrupt changes in economic or financial conditions that negatively impact bank asset values, such as the onset of recession or a collapse in real estate values. This type of shock emerges from an actual change in the state of the world.[10] Second, there may be a relatively sudden realization of changes in the condition of the banking system that have built up gradually over time. Typically, this kind of shock represents an accounting event, such as the discovery of hidden fraud or of "evergreening", throwing good money after bad by propping up nonperforming loans through new credits. Also, a change in accounting rules that causes previously hidden shortfalls, such as losses on a securities portfolio or accumulated losses on subsidized lending to state-owned enterprises, to be marked to market or otherwise shown more transparently in the accounting information set can be the trigger for a crisis.

The initial shock that generates systemic distress will affect banks differently. How the banking system will evolve depends on the specific conditions created by the initial shock. Of particular importance is how asset losses are distributed across banks. The distribution of initial losses will determine the capital conditions of banks in the system. The capital condition of banks, in turn, will have a large effect on their liquidity condition and their risk behavior. These conditions together will affect the evolution of the system in the

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[10] Although the discussion generally refers to a loss in asset values, what matters, of course, is a loss in asset values relative to liability values that negatively impacts bank net worth. This condition can arise from an increase in liability values, e.g., where a bank holds foreign currency—denominated deposits in a mismatched position.

absence of official intervention. A detailed discussion of how conditions of distress generate distortions in bank behavior is presented is Appendix I.

Factors causing increased distress

A distressed banking system is in a pathological condition. Banks that are knocked out of a healthy condition of capital adequacy and normal liquidity (classified as Class 1 banks in Appendix I) by an initial shock face distorted incentives that lead to further expected deterioration in the state of the banking system unless the authorities intervene to resolve the problem. This further deterioration arises for several reasons:

(1) ***Distortions that produce inefficient lending.*** Banking system distress can produce inefficiencies in bank lending. These inefficiencies can be manifested in two broad ways: through excessive risk-taking, which will threaten to worsen bank asset losses, or through a "credit crunch," which will aggravate the economic costs of the crisis for business borrowers and further weaken bank loan quality.

(a) Risk taking. Low net worth and insolvent banks have an incentive to "gamble for resurrection", that is, to take risky positions with low probabilities of large payoffs but negative expected returns, in order to try to recover from insolvency before being forced into closure. The illiquid condition of these banks will, of course, limit the extent of risk-taking in which they can engage, but will not prevent it. This risk-taking will manifest itself in many different ways, e.g., through taking off-balance sheet positions, mismatching maturities and currencies, or extending risky loans. It is likely that risk-taking banks will direct new loans to borrowers who were excluded in pre-crisis conditions, because they will offer the largest (but riskiest) potential payoffs, rather than to less risky borrowers that have been shut out by risk-averse banks after the initial shock, even if the latter offer a positive expected return.

(b) Credit rationing. Relatively strong banks that have experienced some asset loss but are not near insolvency will become risk-averse. If they have slipped below regulatory minimum capital ratios, they will be reluctant to add to risk assets, even as they obtain inflows of funds, until they have rebuilt their capital ratios. In this regard, even if they are receiving inflows of funds as the counterparts to illiquid banks that are experiencing deposit withdrawals, they will not necessarily provide sufficient demand for assets or extend sufficient new loans to offset the negative effects of asset sales and loan liquidations by illiquid banks. If the initial shock is severe and pervasive enough that there are no Class 1 banks, no liquid institutions will be inclined to extend credit to borrowers who were squeezed by risk-averse banks. A consequence of this restriction of the supply of credit is that some previously creditworthy borrowers will be rationed out of the market—a credit crunch.

So, a banking crisis can exhibit both credit crunch conditions and excessive risk taking simultaneously.

(2) *Illiquidity.* Low net worth and insolvent banks will experience liquidity pressures that drive them to sell assets and liquidate loans, resulting in depressed asset prices and economic activity.

(3) *Rise in risk premium.* A banking crisis can produce a loss of confidence among investors in the ability of the country to conduct a suitable macroeconomic policy. This loss of confidence, together with a general uncertainty about the full dimensions of the crisis that will exist until it is more clearly resolved, will work to raise the country risk premium. This increase in the risk premium is likely to be embedded in the borrowing costs for all classes of borrowers—banks, businesses, and government—not just in bank loans but in international and other domestic financial markets as well. Furthermore, this rise in the risk premium can spread credit crunch behavior even to healthy banks.

A credit crunch provoked by a banking crisis, then, develops along two dimensions. First, it is driven by the interaction of capital deficiency, distorted incentives and illiquidity. Second, even healthy banks may ration credit if the increased risk premium drives interest rate levels up to so high a level that the risk concerns of adverse selection—only impetuous or untrustworthy borrowers are willing to pay the prevailing rates—dominate the higher returns.

(4) *Contagion.* The increases in uncertainty and risk premiums, the assets sales by illiquid banks, and the credit rationing by risk-averse and other banks associated with a banking crisis can disrupt the liquidity of financial markets, weaken the economy, and spread a broader contagion affecting other financial institutions. Public debt markets and the cost of issuing domestic public debt may be adversely affected. Failures may result among other highly leveraged institutions, and derivatives transactions can extend the losses more broadly through the financial sector.

For these reasons, banking system distress will be expected to worsen after the initial shock if no intervention actions are taken to mitigate the problem. For example, in Figure 1, if point **d** represents the condition of the banking system after the initial shock, the system will experience over time an expected deterioration along the path **de** in the absence of intervention actions. Of course, all participants—the authorities, banks, customers,

depositors—will have only uncertain expectations about the magnitude and direction of the path **de** and about how fast conditions will deteriorate.[11]

States of the system

Keeping that point in mind, we can make certain useful distinctions about different states of banking system distress. All of the initial starting points (α, β) that will eventually deteriorate into the panic zone if no intervention steps are taken are labeled "Crisis zone" in Figure 1. Starting from an initial point, **f**, in the crisis zone, the banking system would deteriorate without intervention along the expected path **fh**. The evolution of the system would not reach point **h**, however. At point **g** where it crosses into the panic zone, the system would shift to path **gb**, characterized by very rapid deterioration because of panic withdrawals of deposits and culminating in total liquidation of the banking system.

All other initial points that do not deteriorate into the panic zone are labeled "Distress zone."[12] Starting from point **d** in the distress zone, the system will, without intervention, cross into the crisis zone and reach the end point **e**. It will not deteriorate further, however, because the factors driving the deterioration will have burned out. For example, although risk-taking banks initially tend to go deeper into insolvency, they will eventually become bankrupt and be liquidated, ending their capacity to do further damage. Low levels of asset loss and insolvency, then, may produce conditions of distress that generate further

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[11] These expectations will depend on the specific conditions that banks are in after the initial shock. Before the shock, participants will have an unconditional expectation about how the system will evolve from any starting point, say, point **d**, based on the probable distribution of distress across banks at that point. After the shock, when the starting point and conditions of distress are actually revealed, participants will form revised conditional expectations about the path **de**.

[12] The lower boundary of the panic zone can be defined as a definite threshold that depends only on the aggregate values α and β but not on the conditions of individual banks. At this boundary the behavior of all depositors abruptly switches. The boundary between the crisis zone and the distress zone, however, has to be defined in a probabilistic sense in terms of (α, β) combinations that have an unconditional expectation of being the origin points of paths that will reach the panic zone. After the initial shock is revealed, the origin point and the conditions of distress are known. New conditional expectations about the path that the system will follow from the origin point are formed. It may turn out that these revised conditional expectations yield a path that starts in the distress zone but crosses into the panic zone or one that starts in the crisis zone but does not reach the panic zone. This ambiguity results from the two-dimensional nature of Figure 1. If the dimensions were expanded to include the percentage of bank assets held by banks in each state in Appendix Table 1, all potential events (post-shock states) and the evolution of the system from any starting point could be specified unconditionally.

deterioration, but not to levels sufficient to provoke systemic disintegration. Crisis distress and non-crisis distress evolve in much the same way, but crisis distress reaches a state advanced enough to trigger panic.

Depositor behavior and attendant bank liquidity problems differ in degree among the three zones and will be managed in different ways. In the distress zone, liquidity problems are most likely to be sporadic and limited to name problems for individual institutions. They can usually be managed through the normal functioning of an interbank market or through the extension of LOLR credit to individual banks in need.

In the crisis zone, liquidity problems are likely to be more extensive and may affect entire classes of banking institutions that are viewed as being especially impacted by the nature of the initial crisis shocks. Depositors will exhibit widespread "flight to quality" behavior and severe tiering may occur in the interbank market, with the classes of banks having problems being shut out from access to funds. These conditions will require interventions that go beyond ordinary LOLR actions. The central bank may have to inject general liquidity into the market and may have to organize "lifeboat"–style concerted lending to compensate for the seizing up in the interbank market.

Deposit guarantees to stop panic

Liquidity conditions in the panic zone are qualitatively worse. In the crisis zone, even though conditions are characterized by a pervasive flight to quality, funds still remain in the banking system and there is no damage to the payments system. Not so in the panic zone, where depositors are withdrawing funds from all banks, threatening an implosion of the stock of deposits and a collapse of the payments system.[13] These conditions cannot be easily managed by LOLR interventions. Central banks are generally heavily constrained from making direct loans to insolvent banks and insolvencies are widespread in the panic zone. While general liquidity support through massive open market operations (if the central bank has such capability) can mitigate the monetary contraction arising from depositor panic, it cannot readily restore confidence in the banking system and stanch the outflow of deposits and the resulting losses from forced asset liquidations and payments system disruption. The authorities are most likely in this situation to resort to granting emergency universal deposit guarantees to stabilize deposits.[14] Such guarantees are typically temporary but the conditions under which they will be removed are left unspecified at the time that they are granted.

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[13] State-owned banks may retain their pre-crisis level of deposits because of the implicit guarantee but not attract new deposits. Whether this outcome will avoid major payments system damage will depend on the extent of such deposits.

[14] An alternative action is to freeze deposits. While such a measure, unlike deposit guarantees, would create no actual or potential fiscal exposure for the government, it would create extensive disruption to the payments system, since the design and administration of

In the context of Figure 1, a universal deposit guarantee means that the banking system will not shift onto path **gb** as it passes into the panic zone but will, rather, follow along the path **fh**. In other words, the guarantee neutralizes the system against the effects of passing into the panic zone.

Such neutralization comes at a cost, however. Guarantees enhance the level of moral hazard in the system. Low net worth and insolvent banks that have an incentive to take on more uneconomic risk will be less constrained by liquidity problems and will take on risk faster. The system will move more rapidly along the path **fh** once guarantees have been issued.[15] This development represents a problem of short-term moral hazard. It creates an incentive for the authorities to take quick action to resolve the crisis and prevent deterioration. On balance, deposit guarantees buy time for the authorities to take appropriate and value-conserving interventions to deal with the damage to the banking system by forestalling the threat of complete meltdown in a panic. However, deposit guarantees will tend to accelerate the actual rate of deterioration in the banking system by worsening the problem of short-term moral hazard before interventions are undertaken to relieve distress.

Another aspect of risk related to granting deposit guarantees can arise. The authorities may have information regarding the initial shock that allows them to form an expectation of α, the size of the asset loss, before they have information on β, the degree of systemic insolvency, or other conditions of banks in the system. Take the expected loss of asset value to be α^i in Figure 1. If $\alpha_0 < \alpha^i < \alpha_1$, there is a probability, but not a certainty, that an asset loss of that size will lead to panic.[16] The authorities must decide on incomplete information whether to grant a guarantee. Suppose they do and conditions turn out to place the system in the distress zone at α^i. This action would increase the short-term and long-term moral hazard of dealing with the system's distress. On the other hand, not granting the guarantee could result in panic.

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efficient exemptions to the freeze would be very difficult. Countries whose government does not have sufficient financial strength may be unable to issue a credible guarantee unless accompanied by a program of actions to resolve banking system distress, limit future exposures and finance guarantee liabilities. Such a comprehensive program often requires time to be designed and enacted. Under the time pressure of an incipient panic, such countries may be forced to resort to a deposit freeze.

[15] In general, of course, comprehensive deposit guarantees can affect not just the rate at which the system moves along a path like **fh**, but the magnitude and direction of such a path as well.

[16] Suppose, for example, that the conditional probability of systemic insolvency given α^i is uniformly distributed over feasible states. Then, the conditional probability of panic is **ij/ic**.

Resolving distress

After dealing with the threat of an incipient panic, the authorities must resolve the conditions of distress that generate short-term moral hazard, that is, they must take steps to stop the system's deterioration along path **fh**. This deterioration stems from (1) credit crunch effects arising from risk aversion created by capital deficiencies and general uncertainty, (2) the risk taking of insolvent and low net worth banks, and (3) the economic burden of a higher risk premium, which is itself generated by systemic insolvency and capital inadequacy.

A direct approach to overcoming credit crunch effects is to quickly restore the capital position of risk-averse banks. Encouragement for recapitalization through directions and incentives to retain earnings and issue new equity is one option. Temporary relaxation of capital requirements is another route, but this could have further negative effects on the country's risk premium and thereby produce additional self-defeating credit crunch effects. Finally, the authorities may use monetary or fiscal policy to try to offset the economic consequences of the credit crunch.

Shutting down the risk taking of insolvent and low net worth banks will require action to put the institutions under some form of conservatorship that will be charged with protecting asset values. The capacity for this kind of intervention will typically not exist and will have to be developed, which will be costly. The more quickly this step can be taken, however, the sooner deterioration can be slowed.

Restoration of a normal risk premium will usually depend on resolution of systemic distress. Achieving this outcome will involve a sequence of actions. The following steps make up a prototypical sequence. First, the bank restructuring authorities must pay a monitoring cost to determine which institutions have a positive franchise value. Those without a positive franchise value will be liquidated, which will generate costs for paying out on guaranteed deposits in excess of liquidated assets. Then, the authorities will seek to arrange private restructurings or mergers for banks with positive franchise values. This stage may entail search costs, as well as tax incentives or other implicit or explicit subsidies, such as temporary relaxation of various banking regulations. The impaired assets of such banks will often be transferred to a public AMC, which will also require a payout. Last, banks with positive franchise value that cannot be privately recapitalized or merged will be recapitalized with public funds with the aim of future reprivatization. In the long run, the authorities may realize cost offsets through recoveries on impaired assets or profits on reprivatizations.

Long-term consequences

There are also long-run consequences of intervention actions that will have their effect beyond the time horizon in which the bank crisis is resolved. Two types of these consequences are worth noting: long-term moral hazard and the efficient structure of the banking system.

(1) *Long-term moral hazard.* Interventions that contain some element of subsidy, notably granting deposit guarantees, will change the future direction of bank risk taking even after the episode of crisis is concluded and the emergency guarantees are removed. Under limited liability, bank equity holders, who typically control the decision on bank asset risk profiles in normal times, have an incentive to take on more risk than depositors prefer. Depositors can limit this risk taking by incorporating a risk premium into the return on deposits, if they have information on the risks that banks are assuming. However, if the government is willing to provide guarantees on deposits in certain states of the world, such as during a banking crisis, depositors will require a somewhat lower risk premium, since any risks that banks assume that result in those states being realized will not harm depositors.

Emergency guarantees, in contrast to a permanent system of universal deposit insurance, provide protection only in some states of the world when there is a state of systemic crisis. Therefore, an individual bank will still face the prospect of a rising risk premium on its deposits if it increases its idiosyncratic risk. This condition creates an incentive for different banks to take on risk in ways that are positively correlated, since such action increases the conditional probability that if a bad outcome occurs for an individual bank, it will be perceived by the government as part of a systemic problem. Granting emergency universal guarantees creates an incentive for the banking system to take on higher risk in the form of risks that are positively correlated across banks—for example, all banks increasing their lending to the real estate sector. Positively correlated risk taking, however, increases the risk of another systemic crisis, since it eliminates diversification benefits in the total banking system portfolio in the case of a negative exogenous shock. In this sense, granting emergency universal guarantees creates a perverse moral hazard incentive.

(2) *Efficient structure.* Intervention to stabilize the banking system in a crisis and conduct orderly resolution of problem banks can have the additional benefit of producing an efficiently restructured banking system at lower cost than will a disorderly liquidation. Both liquidation through panic and a more orderly resolution will remove badly mismanaged and truly insolvent banks and replace them, in the long run, with investments in new banks that have an efficient structure. However, a disorderly liquidation will require a more expensive investment to restore an efficient banking system structure, since it will also eliminate all well-managed banks with a positive franchise value. Orderly resolution procedures allow restructuring plans for these institutions and, hence, keep them intact.

VI. ACCOUNTING THE ECONOMIC BENEFITS AND COSTS OF INTERVENTION

An accounting of the general economic costs and benefits of intervening in a banking crisis can be developed in terms of the conceptual framework discussed in Section V. Benefits and costs first must be allocated across time; future benefits and costs will be discounted to a present value. We make a distinction between the short run and the long run, demarcating the separation by T_E, the anticipated end date for the crisis when resolution actions are completed. There are, then, three time periods to consider: the immediate present $(t = T_0)$, the short run $(T_0 < t \le T_E)$, and the long run $(t > T_E)$.

Assume that the anticipation that T_E is the end of the crisis is realized. This assumption imposes a consistency that is often elusive in practice between *ex ante* plans, which are relevant to cost-benefit calculation, and *ex post* outcomes, which are the accounting data. The discussion will not deal with the complications that arise from revising intervention strategies.

Let $x(T)$ be a point on line **fh** in Figure 1 that represents the state of maximum distress reached during the resolution period. This state depends on the choice of $T(= T_E - T_0)$, the horizon of the resolution plan.[17] The authorities will choose T to maximize the net economic benefits of the resolution of the crisis. This choice involves a balancing of factors. The greater is T, the longer is the time available for negative influences, such as short-term moral hazard, to weaken the economy. On the other hand, shortening T will push the intervention strategy toward greater reliance on costlier techniques, such as liquidation, and away from time-intensive but less fiscally costly options, such as private recapitalization or merger. It will be most convenient to think of $x(T)$ as lying between **g** and **h** on **fh**, so that crossing into the panic zone could not be reasonably avoided. (Interpreting the immediate present to be the period before any resolution actions can be taken, the transition of the system from point **f** to point **g** will occur immediately.) The authorities, then, face a choice between an intervention strategy that includes granting a guarantee or not intervening.

Benefits of a deposit guarantee

The economic benefits of intervening can be defined in terms of economic costs that are avoided from letting a crisis run its course. These benefits can be divided into those arising from granting the deposit guarantee and those stemming from resolution actions. The benefits of granting the guarantee are the avoided costs of panic. We take these costs to be given by the condition of moving from point **g** to point **b** in Figure 1. The costs of panic are valued at point **b** and at $t = T_0$, because no intervention actions apart from a deposit guarantee can forestall these costs once point **g** is reached and because they proceed rapidly. These benefits are summarized in Table 3.

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[17] The level of distress $x(T)$ is reached at some time between T_0 and T_E. At T_E, resolution is completed and the system has returned to a normal state of zero distress.

Avoiding liquidation of assets

The costs of panic can be classified into those caused by liquidation of bank assets and those arising from the disruption to the payments system. Liquidated bank assets are of two relevant types: marketable assets and nonmarketable assets, notably loans.

Marketable assets

Marketable assets—securities, commodities, real estate, etc.—are liquidated under duress at "fire-sale" prices. These depressed prices reflect the banking system's lost capacity to generate effective demand for the assets. The loss to the banking system is the difference in the bank value of marketable assets (their market value before liquidation) and the liquidation value of the assets (their market value at fire-sale prices). Other holders of these assets will suffer the induced market price decline on their holdings as well.

The wealth loss arising from fire sales is not permanent. In the long run, with the banking system reconstituted and its capacity to generate effective demand restored, asset prices will return to the pre-liquidation levels determined by long-term fundamentals. The avoided loss from fire-sale liquidation of marketable assets held by the banking system can be expressed as the difference between the undiscounted value of the immediate avoided loss and the discounted future value of the reversal of the loss:

$$(1 - \delta(t > T_E))\phi(M(g) - M(b)), \quad \phi > 1$$

where $M(g)$ is the value of banking system marketable assets at the crossover point g before the fire sale and $M(b)$ is the liquidation value. The total wealth loss is a multiple, ϕ, of the banking system's loss.

Nonmarketable assets

Costs related to the liquidation of nonmarketable loans can be more extensive. The analog to fire-sale liquidation of marketable assets is acceleration of the loan, which may lead to possible foreclosure and borrower bankruptcy. In any case, this step will result in the liquidation of underlying collateral, which will disrupt the economic activity that the loan finances. For example, bank loans may be collateralized by the capital equipment of the projects that they finance. At times this capital equipment is highly customized to the production processes of the borrowing firm and will not have an appreciable resale value.

Even when the liquidation value of the underlying collateral covers the value of the loan to the bank, the borrower will still suffer some loss of equity from the forced liquidation of the investment project. The losses in borrowing company equity value and in bank loan value that occur are permanent losses of a stream of future income. Moreover, other resources, especially labor, used in the liquidated projects may also have specific qualities

that make their prompt re-employment difficult. So the forced liquidation of loans may generate a recessionary rise in unemployment that represents an additional, although temporary, economic cost.

The total benefits of the deposit guarantee arising from the avoided liquidation of bank assets are given by the sum of the permanent wealth loss and the recessionary effect of the forced liquidation of loans. The permanent wealth loss is equal to the liquidation loss on assets of companies in the business sector, given by $A_C(\mathbf{g}) - A_C(\mathbf{b})$, where A_C represents the asset values in the business sector, which are the underlying collateral on bank loans. These liquidation losses are spread among equity holders of the business sector, equity holders of the banking sector, and bank depositors, depending on, among other things, the degrees of leverage in the business and banking sectors.

Table 3. Economic Benefits of Intervening in a Banking Crisis

	Immediate $(t=T_0)$	**Short run** $(T_0 < t \leq T_E)$	**Long run** $(t > T_E)$
Benefits			
Deposit guarantee			
(1) Avoided liquidation of banking system assets			
(a) marketable assets	$\phi(M(g) - M(b))$		$\delta(t > T_E)\phi(M(g) - M(b))$
(b) nonmarketable assets	$A_C(g) - A_C(b)$	$\delta(T_0 < t < R_E)\lambda[(A_C(g) - A_C(b)) - (L(g) - L(b))]$	
(2) Avoided disruption to payments system	$[\mu(D(g) - A(b)) + \nu A(b)]$		$\delta(t > T_E)[\mu(D(g) - A(b)) + \nu A(b)]$
Resolution actions			
(1) Profit on asset disposition			$\delta(t > T_E)\Pi_A(\rho(g))$
(2) Profit on reprivatization			$\delta(t > T_E)\Pi_E(\rho(g))$
(3) Efficient restructuring			$\gamma\delta(t > T_E)(A(0) - A_L(0))$

The recessionary loss is assumed to be proportional to the wealth loss in the business sector. Since this amount equals the total wealth loss minus the liquidation loss on bank loans, the recessionary loss equals

$$\delta(T_0 < t < R_E)\lambda[(A_C(\mathbf{g}) - A_C(\mathbf{b})) - (L(\mathbf{g}) - L(\mathbf{b}))], \qquad \lambda > 0$$

where $L(\mathbf{g})$ and $L(\mathbf{b})$ are the values of banking system loans at the crossover point $\mathbf{g}$, and the liquidation point, $\mathbf{b}$, respectively, with λ representing a proportionality factor that incorporates recessionary effects. The expression $\delta(T_0 < t \leq R_E)$, represents discounting terms applied to the costs at various times during the intervention period (see Table 3).These effects are discounted since they arise temporarily over the short run, although over a horizon, $R(= R_E - T_0)$, that may differ from T, the horizon of the resolution plan. The loss from forced liquidation of assets is valued from $\mathbf{g}$, the point of crossover into the panic zone. The deterioration from $\mathbf{f}$ to $\mathbf{g}$ is assumed to be unavoidable and is treated as occurring in the immediate period.

Avoiding disruption to the payments system

A separate benefit of granting a deposit guarantee is avoiding disruption to the payments system. This benefit is an independent factor from the avoided wealth loss arising from the forced liquidation of assets. The destruction of deposits that occurs in a panic is costly over and above the wealth loss because it destroys the medium of exchange as well. In addition, the flight to currency during the panic will also reduce the transactional efficiency of the medium of exchange, which is assumed to be, per unit of currency, a less damaging disruption than the destruction of deposits. The costs associated with these disruptions can be formalized as being roughly proportional to the deposit loss and the deposit shift:

$$\mu(D(\mathbf{g}) - A(\mathbf{b})) + vA(\mathbf{b}), \qquad \mu > v > 0$$

where $(D(\mathbf{g}) - A(\mathbf{b}))$ is the deposit loss from asset liquidation and $A(\mathbf{b})$ is the amount of deposits converted to currency, equal to the liquidation value of assets. Banks can only pay out the liquidation value of their assets against deposits valued at the beginning of the panic. Systemic costs may be limited by the extent of state-owned bank deposits, which may be more stable because of an implicit official guarantee.

Like the costs from marketable asset liquidation, the costs from disruption of the payments system are not permanent and will be reversed when the banking system is reconstituted in the long run. The net economic cost, then, of payments system disruption is:

$$(1 - \delta(t > T_E))(\mu(D(\mathbf{g}) - A(\mathbf{b})) + vA(\mathbf{b})).$$

Long-term benefits from efficient restructuring

In the absence of intervention, all banks are driven to insolvency and forced into liquidation. In the long run, the banking system will be reconstituted. Assume that it is reconstituted at its pre-crisis capacity. Similarly, after intervention is completed, the banking system will be reconstituted at pre-crisis capacity. However, the costs differ in the two cases.

Assume that the organizational set-up costs for *de novo* banks in the reconstituted system are proportional to the pre-crisis level of assets (the measure of capacity) held by banks liquidated during the crisis.[18] Without intervention, all banks wind up liquidated and set-up costs are proportional to systemic pre-crisis assets, $A(0)$. Under intervention, however, only the class of insolvent banks without a positive franchise value, designated C_L, is liquidated. Set-up costs in this case are proportional to the pre-crisis assets of that smaller set of liquidated banks, $A_L(0)$. The benefits of efficient restructuring, then, are given by:

$$\gamma\delta(t > T_E)(A(0) - A_L(0)).$$

Fiscal-related costs

Deposit guarantee

The short-term economic costs of a deposit guarantee depend on the fiscal costs that are actually generated. These fiscal costs, in turn, depend on resolution actions that determine which banks are actually closed under orderly liquidation procedures that require a payment to depositors on the guarantee. All intervened banks that are liquidated are in C_L, representing the set of insolvent banks without a positive franchise value. The present value of the economic cost of the payment on the guarantee is given by

$$\theta\delta(T_0 < t \le T_E)\sum_{C_L}(D(g) - A[g, x(T)]), \qquad \theta > 0$$

where $D(g)$ is deposit value at the beginning of intervention and $A[g, x(T)]$ is realized values on assets between points g and $x(T)$ for banks in C_L. The parameter θ represents the economic cost to the government of distributing losses from depositors to taxpayers. Its role is discussed in more detail later.

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[18] This assumption is superior to having set-up costs be proportional to the number of liquidated banks, since an efficient reconstitution of the banking system may require changes in bank size. In general, both the capacity of the reconstituted system and the number of *de novo* banks will affect set-up costs.

Table 4. Economic Costs of Intervening in a Banking Crisis

	Immediate$(t=T_0)$	Short run$(T_0 < t \leq T_E)$	Long run$(t > T_E)$
Costs			
Deposit guarantee			
(1) Fiscal-related		$\theta\delta(T_0 < t \leq T_E)\sum_{C_I}(D(g) - A[g, x(T)])$	
(2) Long-term moral hazard			$\delta(t > T_E)\int_T^{\infty}[y(r_1, \omega(p_1), t) - y(r_0, \omega(p_0), t)]dt$
Resolution Actions			
(1) Fiscal-related			
(a) monitoring costs	mC_I		
(b) search costs		$\delta(T_0 < t \leq T_E)s(\sigma, (C_4 + C_{5+}), T)$	
(c) support for private restructuring		$\delta(T_0 < t \leq T_E)(\Psi(g)\sum_{C_P}A[g, x(T)] + \theta\sum_{C_P \cap C_{I+}}(D(g) - A[g, x(T)]))$	
(d) temporary public recapitalization		$\delta(T_0 < t \leq T_E)\sum_{C_N}(A(0) - A[g, x(T)])$	
(2) Short-term moral hazard		$\delta(T_0 < t \leq T_E)\int_0^T\int_{f(z)=0}Y'(Z)dZ\, dt$	

Resolution actions

Resolution actions generate fiscal and fiscal-related costs and moral hazard costs. Some economic costs associated with resolution actions must be accounted at their full fiscal cost, because they would not have occurred if intervention had not been undertaken. Basically, these items represent kinds of operating costs, of which two are particularly important -- monitoring and search costs.

Monitoring costs

The resolution authorities must pay a monitoring cost to determine which insolvent banks have a positive franchise value. These costs, mC_I, are expended immediately and are fixed per institution at m, so that total monitoring costs depend only on the number of banks in C_I. Monitoring information allows the authorities to separate the banks into those that have a positive franchise value (C_{I+}) and those that do not (C_{I-}). Banks in C_{I-} are liquidated in an orderly manner and funds are paid out to depositors under the guarantee.

Search costs

For low net worth banks and insolvent banks with a positive franchise value— $C_4 + C_{5+}$, according to the categories established in Appendix I—the authorities will search for private investors who will recapitalize or merge with the banks. Total costs associated with these searches, $s(\sigma, C_4 + C_{5+}, T)$ arise over the short run. They depend positively on each of the following: (1) σ, a government decision parameter that represents the total search cost per bank per time period, a measure of the intensity of the search effort; $C_4 + C_{5+}$, the total number of banks that are private restructuring candidates; and T, the time horizon of the resolution strategy.

The search will reveal a subset of $C_4 + C_{5+}$ for which private restructuring— recapitalization or merger—will occur. Let C_P represent this subset. The remainder of these intervened banks, C_G, will be recapitalized by the government to be reprivatized after the crisis has been resolved. Assume that the fraction of banks that is recapitalized by the government, n, depends on the value of the country risk premium, ρ, at the start of intervention; on search intensity, σ; and on T:

$$(4) \quad C_G = n(\rho(\mathbf{g}), \sigma, T)(C_4 + C_{5+}).$$

C_G rises with $\rho(\mathbf{g})$; the higher is $\rho(\mathbf{g})$, the more reluctant are private investors to commit to a restructuring for a given set of incentives. C_G, of course, falls when more funds are expended on searching and when a longer time is taken for searching.

Support for private restructuring

To facilitate the private restructuring of banks in C_P, the government may have to segregate some assets. This action will generally generate further fiscal costs. For example, the government can purchase these assets at a "fair" value to be placed in an AMC for future disposition. Let $\Psi(g)$ represent the share of assets in C_P transferred to the government over the intervention period. For simplicity, assume that the government sets the criteria for Ψ on the basis of conditions at the beginning of intervention. The higher the level of the risk premium, the greater the amount of impaired assets with uncertain value that will have to be "cleaned up" before private capital will commit to restructuring. The present value of the cost of these asset transfers is

$$\delta(T_0 < t \leq T_E)\Psi(g)\sum_{C_P}A[g, x(T)].$$

Since the government enters into a bilateral negotiation with the banks about the terms of the transfer, the government can set the price at which it purchases the assets. If asset prices depend on the value of the risk premium, the government, then, has two options.

First, it can value the assets at the expected restored normal risk premium at the conclusion of the crisis, which is equivalent to the pre-crisis risk premium, $\rho(0)$. This valuation will appear beneficial to the private sector, which values assets at $\rho(g)$, the crisis risk premium, which is higher than $\rho(0)$. This difference in valuations arises because the government is certain at the start of its intervention that it will take actions to resolve the banking crisis, while the private sector is not. In this case, the price at which the government purchases assets generates no expected long-term economic profits and will, therefore, induce relatively high short-term private sector involvement in restructuring. The government will expect to realize an accounting profit in the long run that covers the time value of money and a capital charge, so that the appropriately discounted expected value of assets disposed in the long run will equal the discounted expected value of assets transferred in the short run. The government will prefer this option if it has a strong priority to put restructured banks into private hands quickly in order to avoid the complications of operating them.

Alternatively, the government can set a price that incorporates the risk premium $\rho(g)$, which will allow the government to acquire assets at the prevailing market values and to maximize its expected economic profit on their disposition. Of course, the government can price assets somewhere in between these two values.

We assume that the government will purchase assets at prevailing market values to generate an expected economic profit and will accept the reduction in the amount of proposals for private restructurings that this action produces. The government will need a margin of expected to profit to provide incentives for asset managers to get the best value. The expected profit on asset disposition is indicated in Table 3 by $\Pi_A(\rho(g))$.

For privately recapitalized banks that are technically insolvent, the government must provide additional funds to cover the hole between the value of assets and the value of guaranteed deposits. The economic cost of that payment is

$$\theta\delta(T_0 < t \le T_E)\sum_{C_P \cap C_{I+}}(D(g) - A[g, x(T)]),$$

where C_{I+} is the subset of C_{5+} that consists of technically insolvent banks. Note that the fiscal cost of covering the hole in asset value is multiplied by the distributional parameter θ. In the absence of private recapitalization of insolvent banks, the banks would be liquidated and the government would pay this amount of funds out under the deposit guarantee.

Temporary public recapitalization

Banks in C_G will be recapitalized by the government for future reprivatization. Assume that banks are recapitalized to a level , $A(0)$, that would sustain pre-crisis assets in compliance with capital standards. Discounted public outlays for recapitalization during the intervention period are

$$\delta(T_0 < t \le T_E)\sum_{C_N}(A(0) - A[g, x(T)]).$$

As with the case of asset transfers, the government can expect to receive an economic profit, indicated in Table 3 as $\Pi_E(\rho(g))$, that depends on the value of the crisis risk premium, which determines the value of assets. In the long run, with ρ at pre-crisis levels, government-owned banks will realize capital gains on assets and a rise in equity values that can be captured by reprivatization.

Fiscal cost versus economic cost

The economic cost of the deposit guarantee is different from the fiscal cost. The loss represented by the payments on deposit guarantees has already occurred before any payments are made and must be borne by some group, either depositors or taxpayers through the government. If the government were indifferent between these two groups, there would be no economic cost to the payout on the guarantee. But the government is not indifferent. The economic cost to the government, then, is given by the term θ. This term is positive since payouts, which effectively transfer the burden to taxpayers, are assumed to be more costly than losses borne by depositors because the government gives priority to the protection of taxpayer interests.[19] Governments grant depositor guarantees, therefore, not because they value depositor gains more highly than taxpayer gains, but in order to avoid the economic costs of depositor panic.

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[19] Actual disbursements of funds may be viewed as more costly than off-balance sheet guarantees because they need to be financed by on-balance sheet increases in debt that have a greater negative effect on the government's perceived credit standing.

A similar premium does not apply to other disbursements of government money in interventions. Monitoring and search costs are not realized if the government does not take intervention actions. Public funds used to purchase and segregate impaired assets or to recapitalize banks represent new investment choices. The net return (or loss) on the face value of these investments is an accurate measure of the economic benefit (or cost).

Short-term moral hazard

Another kind of cost associated with crisis intervention has already been alluded to and can be characterized as short-term moral hazard. Essentially, it represents the deterioration in income that results from the persistence of banking system distress. Even if banking system distress does not increase, economic costs will increase from the initial level of distress as time passes until resolution is completed. So this cost must be aggregated over both time and conditions in the banking system. This moral hazard cost (MHC) is given by

$$\delta(T_0 < t \leq T_E) \int_{T_0}^{T_E} \int_{f(Z)\,=\,0} Y'(Z)dZdt,$$

where $Z = (\alpha, \beta, \rho(\alpha, \beta))$ is a vector of the factors arising from the conditions of distress in the banking system that generate economic costs: as in Figure 1, α is the aggregate loss in banking system asset value; $\beta = (\beta_1, \ldots \beta_n)$ is a vector of the distress conditions in the banking system, with each β_i equal to the share of banking system assets held by banks in distress class i[20]; and $\rho(\alpha, \beta)$ is the risk premium induced by banking system distress.

The relation $f(Z) = 0$ implicitly defines the path of evolution of banking system conditions through the crisis and its resolution. Starting from point g in Figure 1, conditions will deteriorate to a point of maximum distress, $x(T)$, and then follow some path back to normality, represented by point 0, when the banking system is reconstituted at the end of the resolution period. The authorities can minimize this cost, and search costs as well, by being very aggressive in their intervention strategy and setting T close at a low value. But that choice will maximize liquidations of banks and payouts to depositors, which may not be the efficient choice.

Long-term moral hazard

As discussed earlier, granting a guarantee can change incentives for future actions on the part of banks and depositors. More precisely, the degree of future risk taking that banks undertake depends on their expectation of government intervention in future crises. If the outcome of the government's decision whether to grant the guarantee or not is expected, no new moral hazard effects are generated. If the outcome is unexpected, future risk taking

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[20] The conditions of distress in the banking system are detailed in Appendix I.

changes. In either case, the government will have to take account of what future risk taking will be in light of its decision.

The natural assumption is that market participants expect the authorities to issue a guarantee to forestall a panic; this action has typically been the actual choice of governments that have found their banking systems in extreme jeopardy. The discussion in this paper, however, has used the case of no intervention as the baseline for discussing benefits and costs. By making no intervention the baseline expectation, the paper will refer to the moral hazard costs of intervention rather than the moral hazard benefits of no intervention.

The essential element of long-term moral hazard is this: emergency deposit guarantees shift banks toward increased risk taking because the guarantees protect depositors in certain conditions, namely, a systemic crisis, and thereby lessen any discipline depositors may exert on bank decisions. It is unclear, however, whether this shift toward increased risk taking will have an economic cost.

To see this point, consider a simple comparison. Assume that the baseline case of no deposit guarantees is associated with a particular future path of economic growth. This outcome would occur if the availability of banking finance is actually a binding constraint on the development of some economic assets. Assume also that the shift to increased risk taking produced by the moral hazard of granting a deposit guarantee is manifested as recurrent episodes of temporary shortfalls from baseline growth – recessions caused by recurrent banking crises. The greater the degree of moral hazard, the greater is the frequency of these recurrent crises.

If the growth path that incorporates the moral hazard effects is no higher than the baseline path, then the riskier path clearly has a lower present value in terms of current income and moral hazard is costly. If, however, the higher risk assets that banks finance under moral hazard also generate a higher expected return, then the present value outcome of the change in future growth paths is unclear. In light of this ignorance, the government can reasonably take the expected value of the economic cost of long-term moral hazard to be zero and can neglect it as a factor in its decision regarding the granting of a deposit guarantee.

Formally, the cost (benefit) of long-term moral hazard can be represented as

$$\delta(t > T_E) \int_T^\infty [y(r_1, \omega(p_1), t) - y(r_0, \omega(p_0), t)]dt,$$

which is the discounted value of the difference in the growth paths with (subscript 1) and without (subscript 0) the deposit guarantee. The path of y depends on time; on r, the growth rate of potential output; and on ω, a process that generates recurrent crisis episodes of shortfall from the potential output growth path. The process ω, depends on p, the probability of a banking crisis, with a higher probability producing more frequent and, possibly, larger

crises. The moral hazard of granting a deposit guarantee implies that $p_1 > p_0$. But if $r_1 > r_0$, the value of the moral hazard term may be a positive net benefit.

When will $r_1 > r_0$? If the banking system in its pre-crisis risk-normal[21] condition was truly risk-neutral, it financed assets in priority of their expected returns only, regardless of their riskiness. In order to take on more risk, then, in light of the moral hazard of the deposit guarantee, the banking system in the future would have to adopt a risk-taking bias. To achieve this state, the banking system would have to switch into some lower yield but higher risk assets, which would actually reduce the potential growth path that it finances.

If, however, the banking system in its pre-crisis risk-normal condition was risk-averse, it could shift into riskier assets that also produce a higher yield, since not all high yield assets would have already been incorporated into the baseline growth path. As a consequence, r_1 could exceed r_0 and the net economic effect of moral hazard would be uncertain. It is not unreasonable to think that some degree of risk aversion, rather than strict risk neutrality, characterizes the risk-normal condition of the banking system. If so, the government would be justified in ignoring long-term moral hazard effects, since it could not form a clear expectation of the direction of these effects in terms of economic costs.

The government's decision process

The government's problem in intervening in a banking crisis is to maximize net benefits by choosing values of the policy variables that it controls. A crisis is defined so that intervention requires issuing a deposit guarantee followed by actions to resolve distress among capital-deficient and insolvent banks. Not intervening entails not issuing a deposit guarantee and allowing a panic to run its course.

The infrequency of pro-active resolution

The alternative of taking actions to resolve distressed banks without issuing a deposit guarantee represents a strategy of pro-active intervention under non-crisis conditions. Since such a pro-active strategy would reduce economic losses and forestall distress from growing, possibly to the point of even threatening panic, it is somewhat puzzling why many countries have been reluctant to intervene against banking problems short of a crisis. The framework suggests two possible explanations: limited short-term moral hazard costs and myopic government.

Limited short-term moral hazard costs

The government may perceive short-term moral hazard costs as not rising indefinitely. Failing to intervene pro-actively will allow moral hazard costs to run up to their

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[21] Risk-normal conditions are discussed in Appendix I.

maximum but will save on fiscal costs. If the ex ante probability of panic is very low—making the expected benefits of avoiding panic negligible—and θ is very high, the net benefits of intervening can be negative and less than the costs of not intervening to resolve distress. Only when distress has reached a point at which the expected benefits of panic avoidance become significant is the government willing to grant a guarantee. Granting the guarantee works to increase the moral hazard costs of delaying resolution, so the government then has a greater incentive to eliminate distress. Therefore, if moral hazard costs do not rise indefinitely with time, a government may not be motivated to take resolution actions to eliminate distress until conditions have deteriorated substantially.

A government behaves in this fashion when it is surprised by moral hazard costs of inaction that turn out to be higher than it had first suspected. This outcome can result when it is hard to know the maximum level of moral hazard costs with precision. On the other hand, some governments could be expected to overestimate the maximum level of moral hazard costs, leading them to take prompt actions to relieve distress. The nature of the actions that governments take to relieve high levels of distress, however, may differ qualitatively from those undertaken at low levels of distress. Specifically, at low levels of distress, governments may have more options to induce rehabilitative actions through "quiet" interventions, such as moral suasion, supervisory pressure, tax breaks, etc. These actions may result in weak banks rebuilding capital or becoming acquisition targets of stronger banks. The government's intervention may be hard for outsiders to observe and the resolution of distress will look like unassisted private actions. At high levels of distress, government intervention actions are more constrained and require overt commitments of public funds that are easy to observe. So, the apparent asymmetry in government behavior that produces the noticed infrequency of pro-active intervention is rooted in an asymmetry in observation.

Myopic government

Another potential explanation of why, in the absence of crisis, the perceived net benefit of resolution actions is not positive may rest on myopia in the government's perspective. This outcome could arise if the government—or, at least, that part of the government that must commit resources to the resolution of banking distress—is myopic in the sense that it seeks to avoid only those costs that appear as fiscal costs on its own account, not as economic costs in the general economy. A myopic government would ignore the prospective costs of banking distress, including potential losses in deposit values. However, when distress is great enough to produce a threshold probability of panic, the government will issue a blanket deposit guarantee to stabilize the situation. Under the guarantee, the government internalizes the costs of potential deposit loss and is motivated to act to eliminate the distress that produces those costs. In sum, the government may have little incentive in a pre-crisis situation to combat banking distress until, in a crisis, the deposit guarantee is switched on, generating a direct financial exposure

Why would a myopic government ever issue a deposit guarantee? Although the economic costs of forced asset liquidation in a panic are qualitatively similar to those arising from bank runs in a non-crisis situation, one feature of a panic is qualitatively different: the

disruption to the payments system. So long as a significant portion of the banking system remains viable, the payments system can function. When the level of systemic distress is high enough, however, all banks, regardless of financial condition, are subject to runs and the payments system collapses. This collapse can impose unique costs on the government, for example, by disrupting the efficient collection of taxes, that distress short of panic does not generate. As a consequence, the government will issue a guarantee only in crisis when the threat of panic is sufficiently high. This step internalizes for the government the prospective costs of banking distress and motivates it to takes resolution actions.

Policy choices

While limited moral hazard costs or myopia may explain the infrequency of pro-active resolution actions, this paper presents a normative decision rule under which the government rationally considers the economic costs to the entire society when calculating the net benefits of banking sector intervention. In the decision-making framework of this paper, the government controls three kinds of policy variables:

(1) *The criteria on which it is willing to purchase impaired assets from banks that are candidates for private restructuring.* These criteria include the kinds of assets that the government is willing to purchase—say, impaired assets as indicated by some degree of supervisory classification—and the price at which it will purchase. The broader the range of assets that the government is willing to purchase and the higher the purchase price, the more willing will investors be to undertake private restructurings of banks.[22]

(2) *The intensity of the search effort for private investors who will carry out private restructurings.* This effort consists of making inquiries in different markets about potential investor interest in mergers or restructurings. More funds expended on searching are likely to produce a higher volume of private restructurings, thereby saving on other public funds used for recapitalization.

(3) *The length of the resolution effort.* The principal policy choice for the government is the length of the intervention effort, T. This can be viewed as the decision to pursue either an aggressive or a deliberate resolution strategy. An aggressive strategy—a short length—will economize on short-term moral hazard costs but will reduce the efficiency of the search for private investors, leading to a relatively high level of bank liquidations and payouts on deposit guarantees. A more deliberate strategy has converse effects. The government will choose a value of T that minimizes the total of fiscal-related and economic costs.[23]

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[22] The government may also provide more clear-cut subsidies, in terms of tax advantages, for example, to encourage private restructurings.

[23] The decision not to intervene but to allow a panic to run its course can be represented by setting $T = 0$.

A "quick and dirty" method

A short-cut procedure for assessing the benefits and costs of actions to deal with a banking crisis can be developed along the lines of the framework presented above. This approach focuses on a general relation between an aggregate measure of the severity of the banking crisis and some measure of the overall macroeconomic costs that are avoided through intervention actions.

As noted earlier, resolution costs, as they appear in the fiscal accounts of the government, are not typically an accurate representation of the underlying economic costs of intervening in a banking crisis. A "rational" government, which would seek to minimize total economic costs, would recognize losses that had already occurred. A deposit guarantee transfers these losses from depositors to taxpayers but does not increase their size.[24]

The economic cost of redistribution under a deposit guarantee will be some proportion, θ, of the face value of the fiscal costs of the guarantee. This proportion will depend on a complex of factors, including the tax burden on taxpayers, the debt-servicing burden on the government, the share of guaranteed deposits held by individuals, etc. However, it is reasonable to assume that, other things equal, the government will place a premium on the use of public funds in order to protect taxpayer interests. As a consequence, we assume $\theta > 0$.

A first approximation of additional economic costs is to add to fiscal costs an estimate of the economic growth shortfall that arises from the distressed condition of the banking system—essentially, short-term moral hazard costs. These costs, as a fraction of GDP, grow with delay in taking intervention actions and, therefore, depend on the length of the intervention period, T:[25]

$$(5) \quad MHC = kTY,$$

where Y is the level of GDP at the start of the crisis and k is the annual economic shortfall represented as a fraction of GDP.

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[24] Some payouts under a guarantee may be made on deposit losses that arise because the guarantee removes liquidity constraints on risky banks that are then able to take actions that generate new losses. This effect is an aspect of short-term moral hazard.

[25] They also depend directly on the size of the initial crisis shock, since a greater level of initial distress will produce more distorted incentives that will, in turn, generate a faster rate of deterioration in the economy and the banking system.

Total costs of intervening in a banking crisis (C), then, are the sum of the economic burden generated by fiscal costs and short-term moral hazard costs:

$$(6) \quad C = \theta FC + MHC.$$

A simple specification of the benefits of intervening is given by the expected avoided costs of a banking panic, represented by the probability of panic at the start of the crisis multiplied by an overall measure of panic costs. The avoided costs of panic are a measure of a counterfactual outcome and are, therefore, unobservable except in the case where panic is actually allowed to happen. Such cases are sporadic and it is even arguable that there are no clear examples at all of a full-scale panic allowed to run its course without some kind of intervention, at least in recent history. A simple rough estimate of panic costs can be made by extrapolating to the whole banking system the experience of asset loss for individual banks that suffered runs.[26] An estimate of the panic loss as a percentage of assets, represented by α, an observed loss in asset value for individual banks experiencing forced liquidations, which we set at .33. Expected panic costs, C^P, then, are given by .33A, where A is the value of banking system assets, measured by loans to businesses at the start of the crisis.

The net benefits of intervention are:

$$(7) \quad NB = pC^P - \theta FC - kTY.$$

Drawing on an estimate of the average economic costs of delaying resolution action based on a cross-section of banking crises,[27] we set k = .007. Ex ante fiscal costs are measured by their realized outcome taken at face value ($\theta = 1$).

To make this simple rule-of-thumb formula applicable to our case study, we insert variable values that correspond to the Swedish banking crisis. We date the Swedish crisis at 1991-Q1 to 1993-Q4; so T = 2.25. The value of A is given by the 1991-Q3 amount of banking system loans to business, SEK484 billion. This estimate underestimates the base of banking system assets subject to liquidation in a panic since it ignores the fire-sale liquidation of marketable assets. Fiscal costs are taken as the undiscounted sum of funds expended over the crisis period, SEK64 billion, which exaggerates net fiscal costs by ignoring discounting and not taking account of offsets, such as gains from reprivatization. Base year (1991) GDP, Y, is SEK1447 billion. At these values net benefits are given by

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[26] This procedure will considerably underestimate the economic cost of a banking system panic because it ignores the lost value on business assets liquidated to pay bank loans that is not reflected in losses to banks.

[27] See Frydl (1999).

$$(8) \quad NB = .33*p*484 - 64 - .007*2.25*1447 = 160p - 87.$$

This calculation (which should be viewed as a high-end estimate of the break-even probability of panic) implies that the net benefits of intervention in the Swedish case were positive if p > .54, or if the odds of panic were roughly even.

VII. QUANTIFICATION OF ECONOMIC BENEFITS AND COSTS

The next step in making the cost-benefit framework operational is to specify constructive procedures that produce reasonable estimates of the analytical concepts of benefits and costs using readily available data. These procedures are detailed in Appendix II.

Benefits of intervention

Avoided costs of liquidation of marketable assets

Under panic conditions, the banking system is forced to dump its holdings of marketable assets. Assume that this fire sale immediately depresses asset prices to a new equilibrium.

Figure 2. Fire Sale of Marketable Assets by Banks
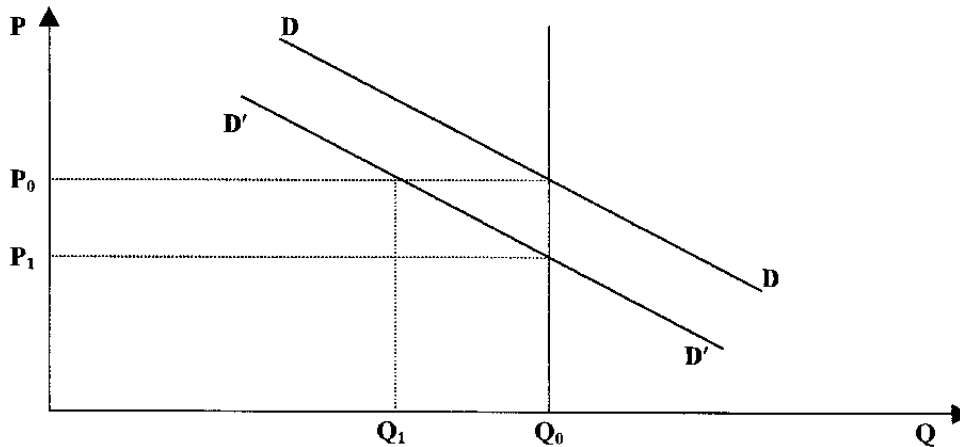
Figure 2 illustrates the case. Forced liquidation by banks during a panic depresses the demand curve for marketable assets from **DD** to **D'D'**. Demand for marketable assets falls by $Q_0 - Q_1 = M(g)$, the level of the banking system's holdings at the start of the crisis. This decline depresses the equilibrium price level immediately to P_1 so that asset holders experience a wealth loss equal to $(P_0 - P_1)Q_0$. Since the percentage change in quantity demanded is fixed at the banking system's share of the market, the percentage change in asset prices and the wealth loss can be calculated if the price elasticity of demand is known.

Avoided costs of liquidation of nonmarketable assets

The economic cost of the liquidation of nonmarketable assets reflects the disruption of productive economic activities caused by banks canceling or accelerating loans and forcing the liquidation of underlying collateral. This disruption can result in a permanent loss of wealth from abandoned projects together with the temporary recessionary cost generated by displacing workers. The wealth loss unfolds from destruction of asset values in the company sector. This loss, $A_C(g) - A_C(b)$, where A_C represents assets in the company sector, will be distributed among company equity holders and company debt holders, whom we take to be banks. The losses borne by banks are, in turn, distributed among bank equity holders and bank debtors, especially depositors.

The disruption of the combination of specific capital, knowledge and skills in the liquidated investments represents a permanent loss of wealth. Businesses must liquidate an amount sufficient to cover their bank loans: $L(g) = (1-\Lambda)X(g)$, where Λ is the liquidation loss rate and $X(g)$ is the book value of the amount of liquidated assets. The loss in asset value, then, is given by

$$(9) \quad A_C(g) - A_C(b) = L(g)/(1-\Lambda) - L(g) = \Lambda L(g)/(1-\Lambda).$$

To get the liquidation losses on bank loans, first assume as a simplification that company sector borrowing from banks is subordinate to all debt owed to nonbanks and that the latter is included in company sector capital. Furthermore, note that for firms that cannot cover their loan values

$$(10) \quad L(b) = A_C(b) = (1-\Lambda)A_C(g).$$

In other words, the liquidation value on bank loans, $L(b)$, is just the liquidation value on the underlying collateral, $A_C(b)$, which is less than the book value of the loan. If it is possible to calculate this loss separately for each firm on the basis of individual balance sheet data, the total losses to banks on their loans will be given by the summation of losses across individual businesses, designated by the subscript i:

$$(11) \quad L(g) - L(b) = \Sigma Max[0, L_i(g) - (1-\Lambda)A_{C,i}(g)] = \Sigma Max[0, (k_i + \Lambda - 1) A_{C,i}(g)],$$

where $k_i = L_i(g)/A_{C,i}(g)$ is the (bank) debt/asset leverage ratio for a business. Firms for which the leverage ratio and the liquidation loss rate exceed unity ($k_i + \Lambda > 1$) will be liquidated into bankruptcy and will generate losses on their bank loans.

In addition to these permanent losses of asset value, there will be a temporary recessionary loss because workers displaced from liquidated investment projects will typically not be immediately re-employed. Assume that the economic loss from this recession is proportional to the loss in business sector capital, a measure of the size of the

negative shock from banking sector panic that hits the business sector. This recessionary loss, then, can be expressed as

$$\delta(T_0 < t \le R_E)\lambda[(A_C(\mathbf{g}) - A_C(\mathbf{b})) - (L(\mathbf{g}) - L(\mathbf{b}))],$$

where λ is the proportionality factor and R $(= R_E - T_0)$ is the length of the recession, which may differ from T, the length of the period for intervention actions.

The parameter λ can be proxied by (the inverse of) an marginal capital-output ratio from a production (input-output) relation. The recession length, R, can be taken as the historical average length and a prototypical dynamic pattern over time can be imposed. For example, recessionary effects can be assumed to build steadily to a maximum at R/2 and then to decline.

Avoided disruption to the payments system

As discussed earlier, these avoided costs can be divided into those that arise from loss of deposits and those that arise from the forced holding of currency as the medium of exchange and can be expressed as

$$\delta(T_0 < t \le T_E)[\mu(D(\mathbf{g}) - A(\mathbf{b})) + \nu A(\mathbf{b})].$$

D($\mathbf{g}$), deposits at the start of the crisis, are observable. The liquidation value of banking system assets, A($\mathbf{b}$), is equal to the observable pre-crisis level, A($\mathbf{g}$), less liquidation losses on marketable and non-marketable assets:

$$(12) \quad A(\mathbf{b}) = A(\mathbf{g}) - [\varepsilon * M(\mathbf{g})] - \Sigma Max[0, L_i(\mathbf{g}) - (1-\Lambda)A_{C,i}(\mathbf{g})].$$

The parameter μ reflects the output loss stemming from the deposit loss with wealth held constant. Wealth effects are accounted for in the avoided losses of asset values. The loss that arises from the destruction of deposits here is a "pure" payments system effect. This effect is related to the role that bank deposits play as the medium of exchange in the modern economy. In that regard, deposits have the character of an "input" into aggregate production. Consequently, μ can be proxied by the estimated coefficient that captures the effect on output of money balances in an aggregate production function.

The parameter ν reflects the loss that arises from economic agents being forced to hold the medium of exchange as currency rather than as bank deposits. It is legitimate to say that economic participants are forced into this state, since they must take this action to preserve the value of their monetary assets under the extreme condition of panic. The economic loss imposed by this condition can then be estimated as the loss of consumer surplus from a quantitative restriction—to hold more currency than desired. The loss from this restriction can be estimated as an area under a demand curve, similar to techniques used in international trade studies to estimate the loss from imposition of a quota.

Profit on asset disposition and reprivatization

Any expected profit to the government from the disposition of acquired assets and the reprivatization of publicly recapitalized banks is a benefit of intervention, or, more precisely, an offset to its costs. Since the government will recapitalize banks and acquire the assets of the banks at the depressed values that prevail during the crisis, it can have a rational expectation of profit on these transactions. This expectation is based on the asymmetry of knowledge between the market and the government about actions to resolve the crisis. The market's expectation of a continued unresolved crisis is priced into the risk premium on bank assets. The government knows that it will take steps to resolve the crisis, which will restore a normal risk premium and allow it to realize increased value on any assets that it acquires.

The expected profit to the authorities on reprivatization of public recapitalization of banks is given by the expected capital gain on equity. If equity is treated as an investment of infinite duration, the expected percentage capital gain, dP/P, can be approximated by the change in interest rates implied by the restoration of the normal risk premium, which is

$$dP/P = -\rho(g)/(r(0) + \rho(g))$$

where $r(0)$ is the pre-crisis interest rate (incorporating the pre-crisis risk premium) and $\rho(g)$ is the observable risk premium at the start of the crisis. The expected capital gain to the government is

$$(14) \quad \delta(t > T_E)\Pi_E{}^*\rho(g) = \delta(t > T_E)[-\rho(g)/(r(0) + \rho(g))]{}^*\sum_{C_N}(A(0) - A[g, x(T)]),$$

where the last term is the amount of public equity put into the banking system.

The expected profit on asset disposition depends on the duration of purchased assets, $Dur(A(g))$ and the expected change in interest rates, which is given by the elimination of the crisis risk premium, $\rho(g)$. The change in interest rates, then, is

$$(15) \quad \Delta r = -\rho(g).$$

The corresponding present value of the expected gain on asset disposition is

$$\delta(t > T_E)\Psi(g)\sum_{C_P}A[g, x(T)]{}^*Dur(A(g)){}^*(-\rho(g)).$$

Efficient restructuring

This benefit, expressed as

$$\gamma\delta(t > T_E)(A(0) - A_I(0)),$$

represents the avoided set-up costs of reconstituting an entirely liquidated banking system. The parameter γ is a fraction of the assets of the banks that avoid unnecessary liquidation. This fraction will be reported to the authorities by their investment bankers and is, therefore, pre-determined. As a first practical cut, we will take it to be roughly equivalent to an investment banking fee.

Costs of intervention

Fiscal-related costs

Deposit guarantees

Fiscal-related costs associated with a deposit guarantee arise when funds have to be paid out to depositors. This payout occurs when insolvent banks are liquidated. The undiscounted dollar amount of the payout is given by

$$\sum_{C_i} (D(g) - A[g, x(T)]).$$

The average asset value over the intervention period, $A[g, x(T)]$, can be set equal to a fraction of the asset value at the beginning of the period:

$$(16) \quad A[g, x(T)] = d*A(g),$$

where d is an estimate of the average rate of deterioration in asset value during the crisis period. With d known, the payout amount is known after monitoring that identifies the set of insolvent banks to be liquidated, C_I.

The value of d will depend on the rate of deterioration of banking system assets that results from delaying resolution actions. Frydl (1999) reports an estimate from a cross-section of banking crises based on Caprio and Klingebiel (1996) that the fiscal costs of crisis resolution rise by 0.8 percent of GDP per year of resolution horizon length. Assuming that assets deteriorate to the same extent resolution costs rise, this estimate will generate a rate of asset loss from which d can be constructed as a geometric mean:

$$(17) \quad d = \left(\prod_{i=1}^{T} (0.92)^i\right)^{1/T}.$$

The economic cost of the deposit guarantee is given by the discounted payout multiplied by θ, which represents the economic cost to the government of distributing losses from depositors to taxpayers. This parameter is difficult to estimate. If the government considers both groups equivalent, θ will be near zero and there will be few economic costs that arise from the fiscal costs of intervention. Since θ is likely to increase directly with both the tax burden, τ, and the government's debt burden, which is related to the future tax

burden, a simple-minded approximation is to set $\theta = (\tau + i) / Y$, where i is government interest payments and Y is GDP.

Other fiscal-related costs

(1) *Monitoring costs*: Total monitoring costs (mC_I) are predetermined. The number of intervened banks to be monitored, C_I, is known and the per bank fee is set by the auditors.

(2) *Search costs*: Search costs, $\delta(T_0 < t \leq T_E)s(\sigma, (C_4 + C_{5+}), T)$, reflect the effort that the government engages in to find private investors to restructure banks. They are determined by the government's own policy decisions. The terms σ and T are choice variables for the authorities. The authorities' investment bank will provide a schedule based on market knowledge linking σ, a measure of the intensity of the search effort for private investors, and T, the length of the resolution period, with n, the fraction of banks that has to be recapitalized by the government. The authorities will choose the values of σ and T that maximize net benefits. This choice, in turn, determines n, the fraction of banks with positive franchise value recapitalized by the government, and C_G and C_P, the number of such banks publicly recapitalized and privately restructured, respectively.

(3) *Support for private restructuring*: The economic cost generated by the fiscal costs of support for private restructuring is given by

$$\delta(T_0 < t \leq T_E)(\Psi(g)\sum_{C_P} A[g, x(T)] + \theta\sum_{C_P \cap C_{I+}} (D(g) - A[g, x(T)])).$$

As a first approximation, Ψ—the fraction of assets of privately restructured banks that is purchased by the government in order to facilitate the restructuring—can be take to be the fraction of bank assets at the start of the crisis that are subject to some degree of supervisory classification. The second term in the expression represents the economic cost of payments to fill the hole in the net worth of insolvent but privately restructured banks. This amount is multiplied by θ since it is equivalent to a payout under a deposit guarantee.

(4) *Temporary public recapitalization*: The amount of funds expected to be committed to public recapitalization of banks, given by

$$\delta(T_0 < t \leq T_E)\sum_{C_N}(A(0) - A[g, x(T)]),$$

is determined when d, n, and T are known.

VIII. A CASE STUDY: SWEDEN

This section applies the framework developed above to the Swedish banking crisis of 1991–92 as an illustrative case study.[28] The Swedish episode exhibits many key features of crisis and resolution as presented in the paper: issuance of an emergency universal deposit guarantee, transference of assets to an AMC, official recapitalization and reprivatization. Of course, not all features of the framework apply in a specific historical example. In the Swedish case, the deposit guarantee was granted after the generally accepted start of the crisis and no bank liquidations or guarantee payouts occurred.

In dating the Swedish intervention, we relied on the expert opinion of those involved in planning and executing the intervention actions. We date the crisis from 1991-Q3 to 1993-Q4; this is consistent with the dating in earlier studies.[29] To calculate the net benefit of intervening in the Swedish crisis, we utilize ex post fiscal costs and benefits, assuming that they are the realized outcomes of ex ante expectations. These fiscal costs and benefits are presented in Table 5, along with the discount factors applied to all future values relative to the start of the crisis, 1991-Q3.[30] No banks were liquidated and no payouts were made in the Swedish case on the deposit guarantee.[31]

The remaining benefits and costs are calculated according to the formulas presented in Tables 2 and 3 and Appendix II. The values of parameters and variables used for those

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[28] The Swedish crisis is discussed in Ingves and Lind (1996, 1997), Backstrom (1997), Drees and Pazarbasioglu (1998), and Jennergren and Naslund (1998).

[29] Although the deposit guarantee was extended in September 1992, we date the start of the crisis as 1991-Q3, when recapitalization funds were first extended. Earlier studies date the Swedish crisis in the 1990-93 range and estimate gross fiscal costs at 4-5 percent of GDP. See Caprio and Klingebiel (1996); Kaminsky and Reinhart (1996); Lindgren, Garcia, and Saal (1996); Dziobek and Pazarbasioglu (1997); and Demirguc-Kunt and Detragiache (1998).

[30] Discount factors in Table 5 were derived from the market rates on government coupon-bearing securities for the listed maturities that held at the start of the crisis. This procedure introduces an error since precise calculation requires that zero-coupon rates be applied to future cash flows. However, when the yield curve is relatively flat, as in the Swedish example, the error is small (Hull, 1993).

[31] The Riksbank also deposited a part of its foreign exchange reserves in the banking system in September 1992. Although this action represents a type of extraordinary liquidity support, we do not account for it as an intervention cost. We account for that part of public recapitalization funds that covers the net worth "hole" in intervened banks at face value, implying $\theta = 1$.

calculations are in Table 6. Values for outstanding balance sheet data are taken at end-1990, the closest pre-crisis point for which consistent data are available. A two-year horizon is assumed for the recessionary shock arising from the forced liquidation of bank loans. In the absence of direct estimates, "reasonable" values are assumed for needed parameters.

The resultant estimates are presented in Table 7. They show a net benefit for the Swedish intervention of SEK 365 billion (25 percent of base year GDP). The avoided loss on marketable securities is calculated assuming a unitary price elasticity of demand in the absence of a direct estimate. The loss is assumed to reverse at a five-year horizon.

The avoided loss on nonmarketable securities, equal to SEK 346.7 billion dominates the calculation. This amount is composed of a permanent loss in business capital value of SEK 260.6 billion and a recessionary shock of SEK 86.1 billion. The significance of the permanent loss depends on the size of bank business loans relative to GDP and Λ, the loss liquidation rate. We assumed a loss liquidation rate of .33, since the liquid assets of

Table 5. Fiscal Costs and Benefits of Government Intervention in the Swedish Banking Crisis

(SEK billions)

	91 Q3	91 Q4	92 Q1	92 Q2	92 Q3	92 Q4	93 Q1	93 Q2	93 Q3	93 Q4	1994	1995	1996	1997	Totals	PDV*
Costs																
Recapitalization - bonds	-4.2			-2.1	-10.0					-24.0					-40.3	-34.1
Recapitalization through purchases of impaired assets						-24.0									-24.0	-21
Other costs/revenue											-1.0		3.8		2.8	1.6
Total															**-61.5**	**-53.5**
Benefits																
Revenue from reprivatization											8.4	2.5			10.9	8.7
Increase in value of bank shares held (net value of bank shares outstanding)	(5.5)													36.8 (42.3)	36.8	17.6
Total															**47.7**	**26.3**
Net fiscal costs	**-4.2**			**-2.1**	**-10.0**	**-24.0**				**-24.0**	**-1.0**	**8.4**	**6.3**	**36.8**	**-13.8**	**-27.2**
Discount rates		10.27	10.40	10.48	10.56	10.53	10.50	10.47	10.43	10.40	10.36	10.36	10.38	10.39		
Discount factors		0.975	0.950	0.925	0.900	0.877	0.855	0.833	0.812	0.792	0.744	0.671	0.604	0.545		

*Present discounted value

Note: Discount rates for 3 and 6 months, and 1, 3, 5, and 7 years are from the *Quarterly Review* of the Sveriges Riksbank. Other maturities are estimated by linear interpolation.
      Fiscal costs and benefits are from Jennergren and Naslund (1998).

Table 6. Parameters and Variables Used to Calculate Benefits and Costs of Intervention in the Swedish Banking Crisis, 1991-Q3 to 1993-Q4

Parameters and variables	Symbol	Value	Date	Source	Comment
Deposits	D(g)	SEK 656.0 Bil.	end-1990	SA	Deposits by nonbank public
Bank holdings of marketable assets	M(g)	SEK 172.3 Bil.	end-1990	SA	Bonds and shares*
Bank loans to business	L(g)	SEK 521.2 Bil.	end-1990	SA	Including unincorporated business
Bank assets	A(g)	SEK 1604.9 Bil.	end-1990	SA	
Assets in business sector	A_C(g)	SEK 3053.4 Bil.	end-1990	OECD, SC	Capital stock plus financial assets**
GDP	Y	SEK 1447.3	1991	IFS	
Recession length	R	2 years			By assumption
Time horizon	T	9 quarters			1991-Q3 to 1993-Q4
Inverse of marginal capital-output ratio	λ	.33			By assumption
$\partial Y/\partial(M/P)$ from production function	μ	.10			By assumption***
Area under currency demand curve	ν	0			By assumption
Price elasticity of demand for marketable assets	ε	1.0			By assumption
Liquidation loss rate on business sector assets	Λ	.33			By assumption
Growth shortfall per year of resolution delay	K	.007		Frydl (1999)	Fraction of base year GDP

*Securities of domestic issuer; non-listed shares excluded.
** This assumed value is consistent with a range of estimates from various studies; see Laumas and Mohabbat (1980), Nguyen (1986), and Sephton(1988).
*** Net capital stock (from OECD) excludes government capital and dwellings; financial assets of nonfinancial enterprises (from SC) are net of domestic intergroup company claims and domestic trade credit.

IFS: *International Financial Statistics*, IMF.
SC: *Finansrakenskaper, 1986-90*, Statistiska Centralbyran.
SR: *Statistisk Arsbok, 1991*, Sveriges Riksbank.
OECD: *Flows and Stocks of Fixed Capital, 1971-1996*, OECD

Table 7. Estimates of Benefits and Costs of Intervening in the Swedish Banking Crisis

Benefit/Cost	Formula	Value
Benefits		
(1) Avoided loss on:		
(a) *marketable assets*	$(1-\delta(t=5))M(g)/\epsilon$	68.2
(b) *nonmarketable assets*	$(1+\delta(t<2)\lambda)[A_C(g) - A_C(b)] -$ $\delta(t<2)\lambda\ (L(g) - L(b))]$	346.7
(3) *payments system disruption*	$(1-\delta(t=5))\mu(D(g) - A(b)) + vA(b)$	0
(2) Profit on reprivatization and held bank shares	Ex post value, Table 5	26.3
Total benefits		**441.2**
Costs		
(1) Fiscal costs	Ex post value, Table 5	-53.5
(2) Short-term moral hazard	$kTY = (.007)(2.25)(1447.3)$	-22.8
Total costs		**-76.3**
Net benefits		**364.9**

Swedish nonfinancial enterprises (deposits and short-term securities), at SEK 183 billion, covered only 35 percent of the sector's loans from Swedish banks. For a country like Sweden, with a relatively developed bank credit market, potential liquidation of business loans poses a large threat, especially since the value of these asset losses is not discounted.[32]

The size of the recessionary shock is assumed to be proportional to the loss in business sector net worth induced by asset liquidation. To calculate the size of the recessionary shock, the loss in business asset value must be allocated between a loss in net worth for the enterprise sector and a loss in loan value for the banking system. Data on the distribution of bank loans across businesses are not available; but since the ratio of bank debt

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[32] We do not take account of potentially significant liquidation losses on other kinds of loans, such as mortgages; banks loans to the household sector at end-1990 totaled SEK 244 billion.

to assets in the business sector was low—17 percent—we assumed a slight loss on bank loan values equal to 10 percent of the loss in business sector asset value.

The avoided losses on payments system disruption are calculated in the Swedish episode at zero, because: (1) the estimated liquidation value of bank assets, $A_C(b)$, far exceeded the value of deposits, $D(g)$, since Swedish banks relied to a significant degree on funding with nondeposit liabilities; and (2) we assume that currency demand is inelastic, so that the deadweight loss parameter, v, is set equal to zero.

Realized values are used for proceeds on reprivatization and accrued capital gains as of the reprivatization date for remaining bank shares held. Realized fiscal costs are used and short-term moral hazard costs are calculated as in Section VI (but discounted).

An alternative way of looking at this calculation is the approach taken in Section VI: to assume that there is some probability of panic occurring and to use the expected benefits of avoiding it, that is, to multiply the gross benefits by the probability of panic. The benefit and cost values in Table 7, then, yield a break-even probability of panic of 17 percent, which can be set against the authorities' prior view of an acceptable risk of panic.

IX. CONCLUDING REMARKS

A banking crisis is identified by the combination of a high risk of panic and widespread systemic distress produced by asset loss and capital deficiencies, including insolvencies. Intervention to address a crisis involves liquidity support actions, notably a universal deposit guarantee and resolution actions, liquidations of failed banks, assistance for private restructurings, and public recapitalizations. The principal benefits of intervention include the avoided costs of panic-induced asset liquidation and payments system disruption and the elimination of distorted incentives in the banking system and elevated risk premiums in financial markets that generate economic costs. The principal costs of intervention include the fiscal costs of paying for intervention actions and the economic costs of delay in resolving banking system distress.

The government should adopt the policy that maximizes net benefits. When intervening, the government's principal decision concerns the length of the resolution horizon—whether to adopt a deliberate or an aggressive resolution strategy. An aggressive strategy will reduce the economic costs of delay, but a deliberate one may reduce fiscal costs by relying more on private restructurings and less on liquidations and public recapitalizations.

A careful accounting of these benefits and costs allows a quantification of the net benefits of intervening in a crisis, in both an ex ante sense of evaluating a current policy decision on intervention and in an ex post sense of evaluating a previous decision. While many factors affect the net benefits of intervention, dominant considerations are likely to be the size of banking system relative to the economy, especially, in terms of advances to the

enterprise sector, and the loss liquidation rate on business assets financed by bank loans. These factors are important because the loss from a panic liquidation is borne immediately and not discounted, while the fiscal costs of intervention actions (and other costs) are spread out over the future.

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The Condition of Banks Before Intervention

Table 1 presents a taxonomy of conditions in the banking system after an initial shock but before intervention actions. The classification distinguishes between private and state-owned banks and lists banks by their capital and liquidity conditions and their risk behavior.

Table 1. Conditions of Banks After an Initial Shock

Type of Bank	Capital Condition	Liquidity Condition	Risk Behavior
Private	Capital-adequate	Liquid	Risk-normal/risk-averse
State-owned	Capital-adequate	Liquid	Risk-normal/risk-averse
Private	Capital-deficient	Liquid	Risk-averse
Private	Capital-deficient	Liquid	Risk-taking
Private	Capital-deficient	Illiquid	Risk-averse
State-owned	Capital-deficient	Liquid	Risk-averse
State-owned	Capital-deficient	Liquid	Risk-taking
Private	Insolvent	Illiquid	Risk-taking
State-owned	Insolvent	Liquid	Risk-taking

Assumptions: No state-owned banks are illiquid because of a credible implicit guarantee on deposits. All capital-adequate banks are liquid but may be either risk-normal or risk-averse. Private insolvent banks are illiquid.

Making the distinction between private and state-owned banks is important because state-owned banks often operate on noncommercial criteria, such as providing subsidized lending to favored sectors. Indeed, the accumulated losses from such noncommercial lending can themselves become the trigger for a systemic crisis when they reach a high enough level.

The capital and liquidity conditions of banks and their risk behavior fall into different categories. Banks are classified as capital-adequate, capital-deficient, or insolvent in terms of their capital condition after the initial crisis shock. Capital-adequate banks exceed or meet regulatory minimum capital ratios, while capital-deficient banks fall below the minimum requirement. Insolvent banks show a negative book value of net worth.[33] The capital condition of a bank is based on accountable claims and obligations. It typically does not incorporate the franchise value of a bank, which reflects the present value of the institution as an ongoing concern. Positive franchise value will arise from the economic benefits to the bank of established customer relationships, the existence of a geographically extensive branch network that allows the bank to have access to a relatively inexpensive deposit base,

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[33] Marketable assets, such as securities or real estate, are considered to be booked at market values; nonmarketable assets, such as loans, are marked down in an appropriate manner to reflect their impairment.

and so forth. The capital condition of a bank can be readily observed by banking system participants, but the franchise value can be known only by paying a monitoring cost.

Banks are categorized as either liquid or illiquid; illiquid banks experience a net outflow of deposits but do not have ready access to interbank funds as a replacement. Banks that can replace deposit outflows with interbank funds are considered liquid.

Banks are rated either risk-normal, risk-averse, or risk-taking. A risk-normal bank makes investment decisions on the basis of the risk-return trade-off that is characteristic of a bank operating under normal conditions, i.e., without problems of liquidity, profitability or capital deficiency. Such a bank may be strictly risk-neutral, making investment decisions solely on the basis of expected net returns and ignoring the risk characteristics of assets. It is more likely, however, that a risk-normal bank will exhibit some degree of risk aversion, i.e., that it will forego some investments with positive expected returns.

If risk aversion in investment is a consequence of the asymmetric information problem that arises between borrowers and lenders, the assumption that risk-normal banks are risk-neutral is equivalent to saying that they provide a full solution to that problem. This is a restrictive assumption, since even strong banks may exhibit some degree of risk aversion.[34]

Risk-averse banks are so characterized relative to the risk-normal state. If risk-normal banks operate with a minimal degree of risk aversion, risk-averse banks exhibit abnormally large risk aversion. Finally, risk-taking banks will undertake some investments with negative expected returns.

The number of possible states that banks may be in after an initial shock can be limited by a few reasonable assumptions:

(1) *Deposits at state-owned banks are assumed to carry a credible implicit guarantee, which protects any state-owned bank, even an insolvent one, from experiencing liquidity problems.* Of course, if the financial condition of the government is so weak, because of, say, heavy foreign indebtedness or a degraded ability to collect taxes, that a guarantee is not credible, the strategy of intervention becomes much more complicated. Steps to restore the government's own financial status will have to be taken prior to or simultaneously with actions to resolve the banking crisis. State-owned banks can also wind up in an intermediate liquidity position. The implicit guarantee on their deposits may be viewed as applying to deposit levels before

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[34] Whether risk-normal banks are risk-neutral or risk-averse has important consequences for assessing the costs of long-term moral hazard arising from intervention in a banking crisis, as discussed in Section VI.

the crisis hit. New depositors may have less confidence that they will be protected. As a consequence, state-owned banks will not serve as an effective source of supply in the interbank market able to channel back funds lost by illiquid banks during a crisis.

(2) *All capital-adequate banks are liquid but may behave in either a risk-normal or risk-averse manner*. Even a well-capitalized bank, of course, can experience an idiosyncratic liquidity problem, e.g., one arising from a computer disruption, but will likely be free of a distress-related liquidity squeeze, at least until the system crosses into the panic zone, where the interbank market fails and deposit outflows become systemic.

If the increase in the risk premium generated by the crisis is sufficiently large, even capital adequate, liquid banks may turn risk-averse because of a pervasive adverse selection problem. This problem can arise at high interest rate levels if uncertainties about the quality of borrowers remaining in the market override the increased returns.

(3) *Private insolvent banks are illiquid.* In the absence of a full deposit guarantee, depositors will have a clear incentive to withdraw funds from a private insolvent bank. Central banks are generally precluded from extending lender-of-last-resort (LOLR) assistance to insolvent banks.[35]

The further evolution of the banking system without official intervention depends on the condition in which banks have been placed by the initial shock. Capital-adequate banks will continue to operate without distorted incentives, i.e., in a risk-normal condition. Insolvent banks face inevitable closure or liquidation, unless they can rapidly restore their condition in the limited time that they have to operate. As a consequence, insolvent banks are biased toward assuming risk. Capital-deficient banks can be broadly divided into moderate net worth and low net worth institutions. We categorize moderate net worth banks as adopting a risk-averse posture. Such banks have a reasonable expectation of restoring compliance with regulatory capital requirements quickly through a strategy of retaining earnings on relatively safe assets, thereby avoiding any regulatory interventions that could affect their operations.

Low net worth institutions, on the other hand, do not have reasonable expectations of being able to restore their capital position to regulatory compliance through following a conservative strategy. For such banks, the cost of further losses is low, since most shareholder wealth has been depleted and they already face the prospect of relatively severe regulatory intervention. They have a strong incentive to undertake risky, uneconomical projects that have some chance of a high payoff in the hope of a fortunate outcome. Low net

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[35] Central banks, of course, often lend to distressed banks that later fail.

worth banks, although technically solvent, face incentives that are very similar to those faced by insolvent banks. In other words, for moderate net worth banks the lure of returning to full regulatory compliance and maximum freedom of action dominates their decision-making; for low net worth banks, the threat of insolvency dominates.

At the same time, low net worth banks are more likely than moderate net worth banks to face liquidity problems since risk-averse depositors and other liability holders will be sensitive primarily to a bank's own capital condition and only secondarily to conditions throughout the system. There is the logical possibility of low net worth but liquid private banks. This condition could arise for banks that have a passive base of liability holders, for example, small, relatively uninformed retail depositors. Low net worth state-owned banks are, by assumption, liquid and will be less constrained from taking risks.

A Hierarchy of Bank Conditions

In circumstances in which the set of capital-deficient, liquid, risk-taking banks is narrow—say, where state-owned banks are a relatively small part of the banking system and banks have broadly similar liability structures—banks can be partitioned into a hierarchy of conditions on the basis of their capital-asset ratios alone. This system of classification is represented in Figure 2. A bank can take on one of three liquidity states: liquid (L_{Liquid}), illiquid ($L_{Illiquid}$), or subject to a run (L_{Run})—and one of three risk preferences: risk-neutral (R_{Normal}), risk-taking (R_{High}), or risk-averse (R_{Low}). Assume that: (1) the switch points between states depend only on the bank's own capital-asset ratio when the system is outside the panic zone; (2) the bank switches from risk-normal to risk-averse to risk-taking (along the lines discussed above) and from liquid to illiquid to bank run as its capital ratio falls, and (3) no further switches occur. Since capital-deficient, liquid, risk-taking banks are precluded by assumption, the first liquidity switching point, k_{L1}, must lie between the two risk preference switching points, k^* and k_R.

Figure 1. Conditions of Banks Before Intervention
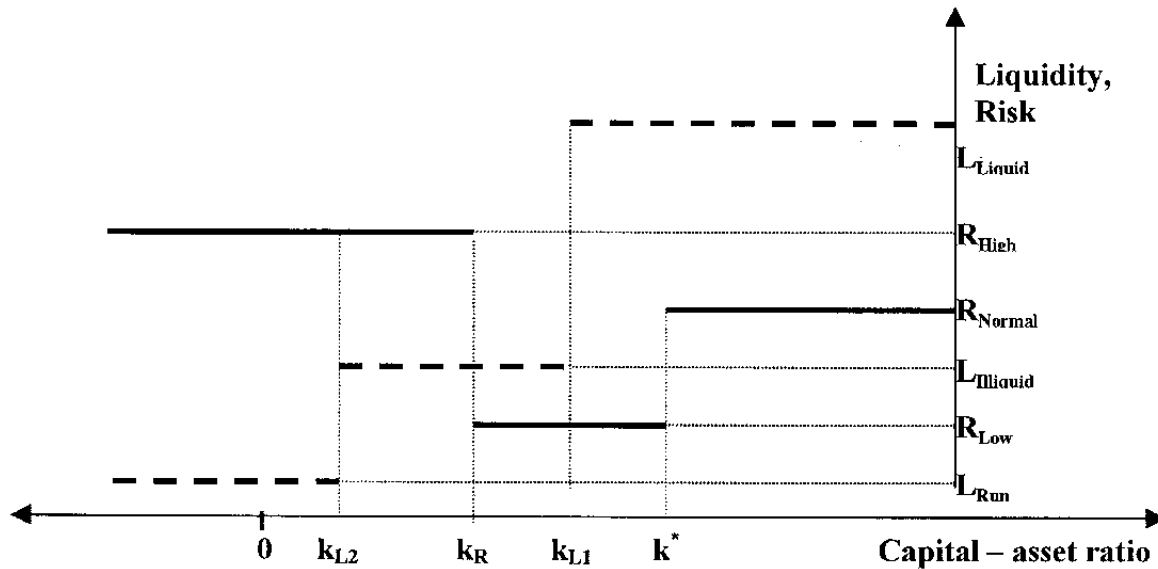
Source:

Low net worth banks face incentives to take risk similar to those faced by insolvent banks but are subject to less extreme liquidity pressures. As an example, assume that there are two classes of depositors, risk-averse and risk-neutral. Risk-averse depositors will begin to withdraw funds from a bank if its capital-asset ratio drops below k_{L1}. Risk-neutral depositors have no incentive to withdraw funds if they have an expectation of positive net worth for the bank. However, a rational risk-neutral depositor must consider that a low net worth illiquid bank is in a condition of disequilibrium. A risk-neutral depositor may not know which other depositors of the bank are risk-averse but will assign some probability to the bank being in an illiquid state and, therefore, under pressure to liquidate assets. Additionally, the depositor will assign some probability to the bank undertaking risky projects of negative expected profitability. As a consequence, a rational risk-neutral depositor will expect that the accounting value of a low net worth bank overstates its true net worth and will begin to withdraw deposits before insolvency occurs, as indicated by the second liquidity switching point, k_{L2}.[36] At capital-asset ratios below k_{L2} a bank is subject to a run as both classes of depositors pull out funds.

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[36] If a bank's net worth could be continuously accounted, a risk-neutral depositor could react only to accounting values. Since there is an accounting lag, however, a rational, risk-neutral depositor must use all present information that affects the expected net worth of the bank.

This schema, presented in Table 2, allows banks to be grouped into five classes. Illiquid banks that are capital-deficient but still solvent will generally qualify for LOLR assistance. But incentives to seek such assistance vary among the classes of banks that qualify, because the LOLR will typically closely monitor borrowing banks, inducing them to behave in a risk-averse manner. Class 3 banks may be expected to seek LOLR assistance, since they are already inclined to be risk-averse as a strategy to restore their regulatory compliance. Class 4 banks, however, will pass up LOLR funds in order to maintain their preferred strategy of risk-taking. Class 5 low net worth (but still solvent) banks with capital ratios between 0 and k_{L2} may shift back to seeking LOLR assistance as the last hope to avoid insolvency and closure brought about by a bank run. Such a pattern of shifting incentives may help explain why LOLR assistance is provided so often to banks that eventually fail. Risk-taking banks have no incentive to seek LOLR funds until they are in a deteriorating condition so near insolvency that their true net worth is difficult to assess.

Table 2. Bank Conditions Ordered by Capital-Asset Ratios

	Capital-asset ratio	**Conditions**
Class 1 (C_1)	$k \geq k^*$	Capital-adequate, liquid, risk-neutral
Class 2 (C_2)	$k^* > k \geq k_{L1}$	Moderate net worth, liquid, risk-averse
Class 3 (C_3)	$k_{L1} > k \geq k_R$	Moderate net worth, illiquid, risk-averse
Class 4 (C_4)	$k_R > k \geq k_{L2}$	Low net worth, illiquid, risk-taking
Class 5 (C_5)	$k_{L2} > k$	Low net worth/insolvent, illiquid, risk-taking

Procedures for Estimating Economic Benefits and Costs

Formula	**Ex ante procedure**	**Ex post procedure**

Benefit

	Formula	**Ex ante procedure**	**Ex post procedure**
Avoided loss on marketable assets	$\delta(T_0 < t < T_E)\phi(M(g) - M(b))$	For each marketable asset class, the percentage change in price equals the price elasticity of demand times the percentage change in quantity:	Ex post valuations also require estimation of counter-factual outcomes. Ex post procedures are the same as the ex ante ones.

$$dP/P = (1/\varepsilon) * dQ/Q.$$

The price elasticity, ε, can be derived from estimated demand functions for each asset class. Since the banking system must liquidate its asset holdings, the percentage decline in demand is given by

$$dQ/Q = M(g) / M = M(g)/\Phi M(g) = 1/\Phi,$$

where M is the total of marketable assets. Therefore, the loss in asset value from fire-sale liquidation is given by

$$\phi(M(g) - M(b)) = dP/P * \phi M(g) = (1/\varepsilon) * dQ/Q * \phi M(g)$$

$$= (1/\varepsilon) * (1/\phi) * \phi M(g) = (1/\varepsilon) * M(g),$$

the price elasticity of asset demand times the banking system's holdings of marketable assets. If the government is uncertain whether demand is elastic or inelastic, it can simply assume $\varepsilon = 1$, so that the estimated benefit of preventing liquidation of marketable assets is simply equal to the banking system's holdings of such assets, $M(g)$.

	Formula	**Ex ante procedure**	**Ex post procedure**

Benefit

Avoided loss on nonmarketable assets	$(1 + \delta(T_0 < t < R_E)\lambda)(A_C(\mathbf{g}) - A_C(\mathbf{b}))$ $- \delta(T_0 < t < R_E)\lambda(L(\mathbf{g}) - L(\mathbf{b}))$	The potential loss from the liquidation of business sector assets, $A_C(\mathbf{g}) - A_C(\mathbf{b})$, represents a speculative counterfactual estimate of the loss arising from the disruption of productive investment projects. It can be estimated by applying a liquidation loss rate, Λ, to an amount of business sector assets, X, whose liquidation value is sufficient to cover the book value of outstanding bank loans, $L(\mathbf{g})$. This loss in asset value is given by:	Same.

$$A_C(\mathbf{g}) - A_C(\mathbf{b}) = L(\mathbf{g})/(1-\Lambda) - L(\mathbf{g}) = \Lambda L(\mathbf{g})/(1-\Lambda).$$

For the liquidation loss on banking system loans, $L(\mathbf{g}) - L(\mathbf{b})$, note that for firms that cannot cover their loan calls,

$$L(\mathbf{b}) = A_C(\mathbf{b}) = (1-\Lambda)A_C(\mathbf{g}).$$

If the balance sheet leveraging of individual firms can be observed, the loss on banking system loans can is

$$L(\mathbf{g}) - L(\mathbf{b}) = \Sigma \text{Max}[0, L_i(\mathbf{g}) - (1-\Lambda)A_{C,i}(\mathbf{g})],$$

which is the sum of losses over all firms.

Finally, the parameter λ, which represents the recessionary effects arising from the capital destruction caused by the banking system collapse, can be proxied by the inverse of the marginal capital-output ratio in a production (input-output) relation. If this quantity cannot be estimated directly, an estimated value for an economy of similar structure can be substituted. The recession length, R, can be taken as the historical average length for recessions. The dynamic pattern can be taken as a prototypical profile. For example, the recessionary effects can be assumed to build steadily to a maximum at $t = R/2$ given by the marginal capital-output calculation and then to decline steadily.

	Formula	**Ex ante procedure**	**Ex post procedure**

Benefit

Avoided disruption to the payments system $\delta(T_0 < t < T_E)[\mu(D(g) - A(\mathbf{b})) + \nu A(\mathbf{b})]$

The liquidation value of banking system assets, $A(\mathbf{b})$, is equal to the pre-crisis asset value, $A(g)$, less the liquidation losses on marketable and non-marketable assets

$$A(\mathbf{b}) = A(g) - [M(g)/\mathcal{E}\Phi] - \Sigma Max[0, L_i(g) - (1-\Lambda)A_{C,i}(g)].$$

The parameter μ, which reflects the output loss stemming from the deposit loss with wealth held constant, can be proxied by the estimated partial derivative of output with respect to money balances in an aggregate production function. If this term cannot be directly estimated for the country, an estimated value from a structurally similar economy can be substituted.

The parameter, ν, reflects the loss that arises from economic agents being forced to hold the medium of exchange as currency rather than bank deposits. A estimate of this loss can be derived from a currency demand function, say,

$$C/M = a - br,$$

where C/M is the currency share of the money stock. Forcing C/M = 1 (which destruction of the payments system does) is equivalent to imposing a quantitative restriction. The loss in consumer surplus from this restriction can be estimated as an area under the demand curve ("Harberger triangle").

Same.

	Formula	**Ex ante procedure**	**Ex post procedure**

Benefit

Profit on asset disposition $\delta(t > T_E)\Pi_A(\rho[g, x(T)])$

The expected profit on the disposition of purchased assets depends on the rise in asset prices consequent on the resolution of the crisis, which is given by duration of purchased assets times the change in interest rates:

$$\text{Dur}(A(g)) * \Delta r,$$

with $\Delta r = -\rho(g)$. The present value of the expected capital gain on asset disposition is, then,

$$\delta(t > T_E)\Psi(g)\sum_{C_P}A[g, x(T)] * \text{Dur}(A(g)) * (-\rho(g))$$

Recorded in fiscal accounts. Economic profits represent gains in excess of opportunity cost, so they must be discounted at the alternative return, the cost of government debt.

Profit on reprivatization $\delta(t > T_E)\Pi_E(\rho[g, x(T)])$

The expected profit to the authorities on reprivatization of public recapitalization of banks is given by the expected capital gain on equity. If equity is treated as an investment of infinite duration, the expected percentage capital gain, dP/P, can be approximated by the change in interest rates implied by the restoration of the normal risk premium, which is

$$dP/P = -\rho(g)/(r(0) + \rho(g))$$

where $r(0)$ is the pre-crisis interest rate incorporating the pre-crisis risk premium. The expected capital gain to the government is

$$\delta(t > T_E) * -\rho(g)/(r(0) + \rho(g)) * \sum_{C_N}(A(0) - A[g, x(T)]),$$

where the last term is the amount of public equity put into the banking system.

Recorded in fiscal accounts.

Efficient restructuring $\gamma\delta(t > T_E)(A(0) - A_L(0))$

This benefit represents the avoided set-up costs of reconstituting an entirely liquidated banking system, expressed as γ, a fraction of the assets of the banks that avoid unnecessary liquidation. These costs are pre-determined. As a first practical cut, we will take it to be roughly equivalent to an investment banking fee, say, 50 basis points on assets, or $\gamma = .005$.

Should be observable from the accounts of de novo banks.

| | **Formula** | **Ex ante procedure** | **Ex post procedure** |

Cost

Deposit guarantee

Fiscal-related $\theta\delta(T_0 < t < T_E)\sum_{C_I}(D(g) - \Lambda[g, x(T)])$

The summation term is the payout made on deposit guarantees for liquidated banks during the intervention period. The average asset value over the intervention period, $A[g, x(T)]$, can be set equal to a fraction of the asset value at the beginning of the period

$$A[g, x(T)] = d * A(g),$$

where d is the average deterioration over the intervention period. With d known, the quantity $\sum_{C_L}(D(g) - A(g))$ is known after monitoring.

The value of d will depend on the rate of deterioration of banking system assets that results from delaying resolution actions. Frydl (1999) reports an estimate from a cross-section of banking crises based on Caprio and Klingebiel (CK) (1996) that the fiscal costs of crisis resolution rise by 0.8 percent of GDP per year of resolution horizon length. Assuming that assets deteriorate to the same extent resolution costs rise, this estimate will generate a rate of asset loss from which d can be constructed.

The parameter, θ, which represents the economic cost to the government of distributing losses from depositors to taxpayers, is difficult to estimate. If the government considers both groups equivalent, θ will be near zero and there will be few economic costs that arise from the fiscal costs of intervention. Since θ is likely to increase directly with both the tax burden, τ, and the government's debt burden, which is related to the future tax burden, a simple-minded approximation is to set $0 = (\tau + i) / Y$, where I is government interest payments and Y is GDP.

Reported in fiscal accounts.

	Formula	**Ex ante procedure**	**Ex post procedure**
## Cost			
Long-term moral hazard	$\delta(t > T_E) \int_0^\infty [y(r_1, \omega(p_1), t) - y(r_0, \omega(p_0), t)]dt$	As per argument in the text, this quantity can be taken as equal to zero.	Same.
Resolution actions			
Monitoring costs	mC_I	Predetermined by the authorities' investment bank.	Reported in fiscal accounts.
Search costs	$\delta(T_0 < t < T_E)s(\sigma, (C_4 + C_{5t}), T)$	The terms σ and T are choice variables for the authorities. The authorities' investment bank will provide a schedule linking σ and T with n, the fraction of banks that has to be recapitalized by the government, and the authorities will choose the value that maximizes net benefits.	Reported in fiscal accounts.
Support for private restructuring	$\delta(T_0 < t < T_E)(\Psi(g)\sum A[g, x(T)]$ $+ \theta\sum_{C_P \cap C_{I*}}(D(g) - A[g, x(T)]))$	As a first approximation, Ψ is assumed to be the fraction of assets classified at the start of the resolution period.	Reported in fiscal accounts.
Temporary public recapitalization	$\theta\delta(T_0 < t < T_E)\sum_{C_N}(A(\mathbf{0}) - A[g, x(T)])$	This quantity is determined when θ, d, n, and T are known.	Reported in fiscal accounts.

Cost

	Formula	Ex ante procedure	Ex post procedure
Short-term moral hazard	$\delta(0 < t \le T) \int_{0}^{T} \int_{f(Z)=0} Y'(Z)dZdt$	Any growth shortfall in the economic forecast at the start of the crisis will reflect the economic cost of the initial crisis shock. Assume that this forecast incorporates a resolution horizon of one year, which is the mode of crisis lengths in the CK sample of crises with definite length. Frydl (1999) presents an estimate of 0.7 percent of GDP per year of resolution horizon length as the rate of deterioration in the growth shortfall. This estimate allows a calculation of the economic costs of delay in resolution beyond that assumed in the consensus forecast.	Attribute any increase in the growth shortfall beyond that forecasted at the start of the crisis to delay in resolution.