Financial Bailouts and Financial Crises*

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Abstract

In response to severe financial crises in 1997, several Asian governments—backed by bilateral and multilateral lenders—provided enormous amounts of support to ailing domestic banks, and issued sweeping guarantees of private financial liabilities (needing funding of up to 30 percent of GDP). In this paper, we examine how the provision of financial sector bailouts affects private capital markets. At the heart of our analysis is a key commitment problem: to avoid financial collapse during a crisis, governments tend not to allow banks to fail, regardless of previous promises. Our analysis shows that expectations of financial sector support in the event of a systemic crisis can lead to over-borrowing, invested in risky inefficient projects, setting the stage for systemic crisis. Ironically, this outcome is more likely, the stronger the financial position of the government. Thus, without prudential regulation, Asian financial systems were especially prone to crisis.

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1. Introduction

One of the most controversial features of the recent crisis in Southeast Asia is the degree of public support provided to ailing private financial institutions. Backed by international funding agencies, several Asian governments went to great lengths to prevent banks from failing. They issued sweeping guarantees of private financial sector liabilities, provided large amounts of liquidity support, and enacted publically funded programs to encourage bank recapitalization. The fear of rapid increases in the money supply to support problem banks was a key factor in the dramatic fall of Asian currencies, and of the Indonesian rupiah in particular.

Concerned with "moral hazard" on the part of private creditors saved from the adverse consequences of their lending decisions, critics of official support packages have targeted their criticism on these financial bailouts (Barro, 1998, Calomiris, 1998a); and the issues raised are central to the debate on a new architecture for the international financial system (Calomiris 1998b, Fischer 1999).

In this paper, we examine how the provision of financial sector bailouts can affect private capital markets. We focus on four specific questions. First, how do expectations of future government support affect financial sector activity? Second, can we explain in such a context the key features of the Asian crisis—large short-term capital inflows to the financial sector, rapid credit expansion, overinvestment, and subsequent collapse?. Most importantly, can we offer any insight into factors that made Southeast Asia particularly prone to crisis? Finally, what alternative policies can be used to lessen the likelihood and severity of crises?

We develop a simple model to address these questions, based on the idea that early liquidation of productive projects is costly (Diamond and Dybvig, 1983). With an optimizing government, it gives rise to a key time-consistency problem. Bank failures are economically costly, and it is difficult for governments to precommit to allow enough banks to fail during a crisis: consequently, expectations of government support in adverse states of nature lead to overborrowing and overinvestment in inefficient projects, worsening the future financial crisis when it occurs.

Fiscally strong governments will be able to offer larger implicit guarantees, worsening these inefficient investment activities. Thus, Asian financial systems, backed by governments with low levels of external debt and sound fiscal positions, were especially prone to overinvestment. Most importantly, our model shows how expectations of a government guarantee induces markets to rely on short-term debt, even when a run on short-term debt bears harsh social costs. Again, the problem lies in the inability of the government to precommit to allow banks to fail in the face of a run on short-term deposits. The use of short-term deposits arises endogenously in our model, and again is more likely for governments with strong fiscal positions.

We consider several alternative means of improving on the time-consistent outcome. First, the social planner's optimum can only be achieved if short-term contracts are discouraged. In principle, this may be achieved by a precommitment not to guarantee the financial sector, which would result in the use of long-term contracts. Alternatively, it could be achieved by a sufficient tax on short-term deposits. The paper shows that controls on investment alone are not sufficient to reach the social optimum: regulators also need to concern themselves with the sources of bank funding.

There is a burgeoning empirical literature on the East Asian crisis (Alba et al.,1998, Corsetti et al.,1998a,b), and we do not attempt to duplicate that literature here. (Roubini's web page provides a comprehensive selection of the materials available.) Nevertheless, we present some suggestive data in support of our model. Specifically, we present evidence that short-term, interbank lending tends to be associated with strong explicit fiscal positions and low levels of external debt. While not conclusive, this evidence indicates that expected guarantees may have had an effect in practice.

Many papers have been written analysing the causes of the Asian financial crisis, although relatively few focus on the role of government guarantees. In an early contribution, however, Michael Dooley (1997) highlighted the risks facing governments who insure poorly-regulated domestic financial markets: he stressed that if substantial foreign money is attracted short-term, an insurance crisis is likely to be followed by a balance of payment crisis as foreign funds are repatiated. Formal development of this idea was taken further by Corsetti et al. (1998a), who argue that due to implicit guarantees of financial sector liabilities, government fiscal positions were actually quite weak, and thus standard (first generation) models of currency crises may be more applicable than previously believed. Our model provides some support for this view, as it shows how strong fiscal positions can attract of-balance sheet liabilities. Krugman (1998) showed how implicit government guarantees can lead to overinvestment and Panglossian overvaluation of real assets; but he does not discuss why those guarantees were offered in the first place. This paper delves more deeply into the latter issue, showing why how strong fiscal balance sheets generate weak financial sectors and larger accumulations of short-term debt, and how financial collapse can engender currency crises. These were important characteristics of the Asian crises.

The paper is organized as follows. The next section reviews the evidence on financial sector support provided by several Asian countries. Section 3 outlines the structure of the model, and derives as a benchmark the outcome that would occur without guarantees. Section 4 deals with solvency crisis and examines several items of interest to policy: the time-consistent equilibrium, the precommitment equilibrium, the social planner's optimum, and the need for prudential regulation involving prompt corrective action. Section 5 discusses the liquidity crisis. Section 6 concludes.

2. Financial sector support in Southeast Asia

At a time when many European nations were struggling to cut public sector deficits below 3% per annum (so as to satisfy the Maastricht criterion that Debt/GDP ratios were on track to fall to a long run target of no more than 60%), their counterparts in East Asia boasted low debt/income ratios and fiscal surpluses. Public sector debt was typically of negligble proportions (in Thailand, for example, the debt/income ratio in 1997 was a mere 5 percent): and Table 1 shows cumulative fiscal <u>surpluses</u> from 1990-96 of over 20 percent of GDP in Thailand and around 5 percent for Indonesia, with Korea showing a deficit of only 2 percent when cumulated over 7 years! Low domestic debt ratios meant that Korea and Thailand have been able to rescue domestic depositors by issuing debt --even though this will involve raising debt income ratios by 18% and by 32% respectively, see table. (Indonesia , with its profound political problems, is really in a different category.)

Table 1. Fiscal probity, Foreign exposure and Restructuring costs.

	Indonesia		Korea		Thailand	
	US$ bn	% of GDP	US$ bn	% of GDP	US$ bn	% of GDP
Cumulative fiscal surplus (1990-96)	9.7	5.3	-4.0	-1.7	25.5	21.2
External bank borrowing[1]	12.4	5.9	67.3	15.4	26.1	17.5
External short-term debt[1]	34.7	16.6	70.2	16.1	45.6	30.6
(Ratio of short-term debt to reserves)[1]	(1.7)	-	(2.1)	-	(1.5)	-
Estimated costs of bank restructuring2						
Total cost	5.4	29.0	6.4	17.5	4.0	32.0
Interest costs	40.0	3.5	60.0	2.0	43.0	3.0
Memo items						
GDP (at current prices, 1997)	208.7	-	437.3	-	149.3	-
Foreign reserves[1]	20.3	-	34.1	-	31.4	-

Notes:
[1] As of June 1997
[2] IMF staff estimates as of November 30, 1998.
Source: BIS, IMF, World Bank.

Note , however, that foreign depositors could not be sure of a bailout. A key feature of the three economies shown in the table was the level of external short-term indebtedness in foreign currency: all three borrowed more than their short-term reserves, and much of the short-term borrowing was by banks. So despite the credibility of domestic guarantees, they were exposed to a bank run by foreign lenders. (The external vulnerability of the East Asian economies is calibrated more fully in Williamson, 1999, and the chapter by David Vines and Jennifer Corbett in Agenor et. al.,1999, forthcoming, provides a detailed discussion of the links between financial and currency crisis.)

3. The model

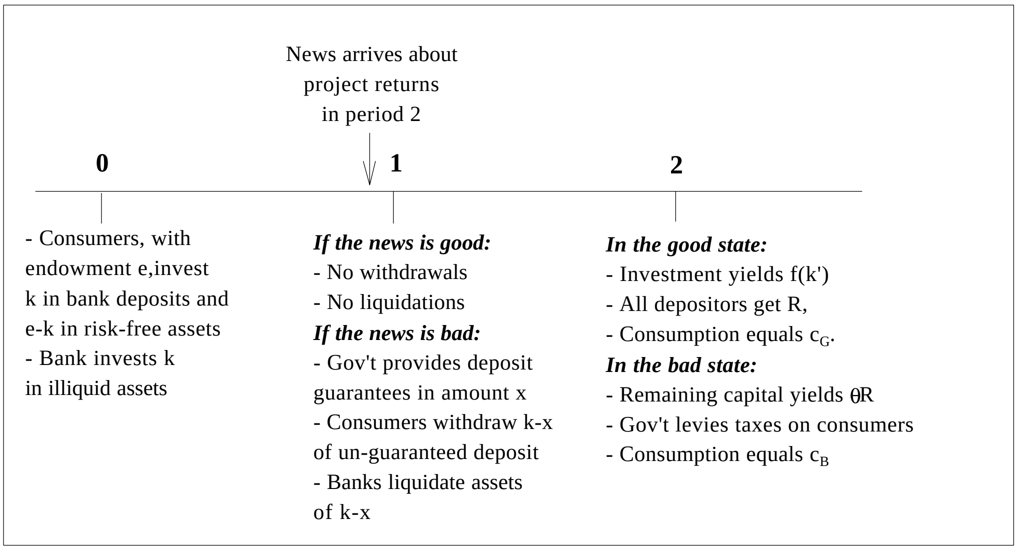
The key asssumption is that financial institutions are expected to receive government support if economic conditions deteriorate: this government guarantee induces moral hazard behaviour by banks, which overborrow and invest in risky, inefficient projects. To motivate the issuance of these guarantees, we adapt a well-known model of bank runs (Diamond and Dybvig, 1983), which focuses on the costs of interrupting production. There are several alternative rationales for providing a guarantee to the banking sector: these include preventing external economic costs of bank failures arising from the collapse of the payments system (Enoch et al., 1997), averting a larger contagious banking panic, protecting depositors, or assisting political interests.

Others have used the Diamond and Dybvig model to explain emerging market crises (Chang and Velasco, 1998; Goldfajn and Valdes, 1997) but none of these authors focus on the issue of moral hazard induced by government guarantees. To make things tractable, we substantially simplify the underlying microeconomic specification, as described below. An overview of the model is provided in Table 2 with the timing of key events shown separately in Figure 1.

Table 2. Basic structure of the model.

	Period 0	**Period 1**	**Period 2**
The (illiquid) investment technology	Invest *k*	Capital may be liquidated Liquidated capital yields β Capital *k¢* remains Amount of liquidations = *k*–*k¢*	Good state: Occurs with probability *p* Remaining capital yields *f(k¢)* Bad state: Remaining capital yields θ*k'* Note: β<*R**θ, so that early liquidation is inefficient even in the bad state.
International risk-free interest rates		Gross risk-free rate=unity between periods 0 and 1	Gross risk-free rate=*R** between periods 1 and 2
Commercial banks (owned by domestic consumer)	Receive deposits *k*; Invest only in the risky illiquid asset.	Possibility of a run on deposits Banks may liquidate capital to meet withdrawals, or obtain a government guarantee of deposits.	In the good state, pay gross interest rate *R.* Due to limited liability, *π≥0.*In bad state, liabilities exceed investment returns, and government liquidity support is at most partially repaid (see below).
Government Objective: maximize national consumption		Guarantees an amount *x* of deposits, *0£x£k*	Repay existing borrowing *b*; honour deposit guarantees as needed; levy taxes.
Consumers	Endowment *e* Invest *k* in banks, *e*–*k* in risk-free asset	Withdraw deposits from the commercial bank	Consume; pay taxes

Fig.1. Timing of key events



Production

At the heart of the analysis is a risky, illiquid production sector, and a financial intermediary that invests in it. There are three points in time, indexed by $t=0,1,2$. Investment takes place at time 0. One unit invested in the illiquid sector yields a salvage or scrap value of $\beta < 1$ units if liquidated at $t=1$. If held until $t=2$, investment projects yield uncertain returns: the good state occurs with probability p, in which the aggregate return to k' (total unliquidated investment in the illiquid sector at the end of period 1) equals $f(k')$, where $f(\cdot)$ is an increasing, concave production function with standard properties[1]. With probability $1-p$, investment will only yield $\theta<1$ per unit. Importantly, *we assume that uncertainty over project returns in period 2 is resolved in period 1*. As discussed below, this gives rise to the possibility of "solvency crises," in which depositors know the bank will fail in the future, and attempt to withdraw uninsured deposits in the present. (The implications of different information structures are discussed in Section 5 below.)

We assume that $\theta > \beta R^*$, where R^* is the gross rate of return on international markets between $t=1$ and $t=2$: this implies that early liquidation of illiquid projects is inefficient. For analytical convenience, the gross risk-free return between $t=0$ and $t=1$ is set equal to unity (as in Diamond and Dybvig, 1983).

Note that the risk of investing in the illiquid sector risk is not idiosyncratic, and cannot be diversified away. This captures the idea that it is large, macroeconomic shocks which tend to give rise to bank failures. Examples include real estate investment, vulnerable to declines in property prices, and unhedged investment in the nontraded sector, exposed to exchange rate movements.

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[1] To ensure that outturns in the good state are always at leas as good as in the bad state, we assume that $f(k') \geq \theta$,

Consumers and the commercial bank

The economy is populated by a large number of identical, risk-neutral agents, who begin with an endowment e of the single good in period 0, and decide whether to invest this good in deposits held at the representative bank or on risk-free international markets. For now, we assume that all bank deposits are held by domestic residents.[2] We also assume, without providing an explicit rationale, that the commercial bank is the only actor that can invest in the illiquid sector, and the bank does not invest in the risk-free project.[3]

Bank deposits are modelled as two-period 'callable' loan contracts. Thus bank borrowing is short-term in the sense that it is callable at the end of the first period; but funds left in the bank attract a high interest rate in the second period (which is not available to new depositors in that period who get R^*). 'Depositors' lending money on this basis are entitled to withdraw deposits at face value at the end of the first period, and banks will repay creditors dollar-for-dollar on a first-come, first-serve basis: but, with limited liability, they will default if insufficient funds are available. In period 2 banks pay the interest rate R on all deposits in the good state; and, in the bad state, R^* (£ R) is paid on guaranteed deposits. (It is prospect of $R > R^*$ in period 2 that explains why, in period 1, depositors are willing to place their funds at risk in the domestic bank at no premium over the riskless foreign rate.)

We do not specify why this callable two-period debt contract (plus a sequential service constraint) is used. Earlier work provides several reasons: a demand for liquidity by economic agents (Diamond and Dybvig, 1983), or the use of demandable debt contracts as a discipline device when other forms of creditor control are not available, and direct financial supervision is inadequate (Rey and Stiglitz, 1993). The advantage of simply assuming this contract is that it allows us to capture the maturity mismatch common to all banks without introducing undue complexity into the model. When we consider the use of alternative contracts below, we show that the bank will prefer to offer callable contracts if it expects a government guarantee.

The balance sheet of the commercial bank evolves as follows. At time 0 the bank accepts deposits k from both domestic and international depositors, which are then invested in the illiquid sector. If a run on deposits occurs in the first period, all deposits in excess of guarantees provided by the government will be withdrawn. Denoting by $k¢$ the amount of deposits remaining, liquidations will equal by $k-k¢$, and the unguaranteed depositors will receive the scrap value of β (<1) per unit of original deposit.

In period 2, with remaining assets of $k¢$ ($\leq k$), the bank faces liabilities of $Rk¢$. With assets yielding $f(k¢)$ in the good state, profits in this state are given by

$$\pi_G = f(k¢)-Rk¢, \qquad (1)$$

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[2] $f¢(e)<R^*$ is a sufficient condition for this. θ

[3] Allowing a choice of projects would introduce further issues of moral hazard, which would obscure our main point.

where R, the risky deposit rate, will be determined below. In the bad state, however, assets yield only $\theta k'$ which is insufficient to honour remaining deposits since $R \geq R^* > 1 > \theta$; so the bank will default on its existing obligations. Given limited liability, bank profits will be zero: $\pi_B = 0$. The first order condition for maximizing the bank's expected profits, $p\pi_G + (1-p)\pi_B$, is simply:

$$f'(k') = R, \tag{2}$$

i.e., to set the cost of capital equal to the marginal return in the good state. This equation reflects the fact that, with limited liability, banks maximize expected profits over states in which they do not default[4], see Stiglitz and Weiss (1981).

As discussed further below, in the bad state, the bank will not survive until period 2 unless its obligations are partially guaranteed by the government. In that case, deposits without guarantee will be liquidated but guaranteed deposits will be paid in full, and the government will become the claimant on the remaining bank assets.

The government

The government, the final actor in this model, is benevolent, and attempts to maximize national consumption in period 2. To avert a bank run at time 1, the government may (between time 0 and time 1) issue a guarantee of an amount x of bank deposits, where $0 \leq x \leq k$. With no risk of default when called, these guaranteed deposits need only pay a rate of return of R^* in period 2 to induce depositors to stay in. (We assume that the deposit guarantee is credible, so that for legal or political reasons the government will not renege on this guarantee in the second period.)

The government funds its deposit guarantee through taxes t in the second period, or potentially, through a guarantee fee. Taxation is distortionary, reducing national income by the amount $\lambda(t)$, where $\lambda(\cdot)$ is an increasing, convex function with $\lambda(0)=0$. For simplicity, we assume that this function is quadratic, so that $\lambda(t_B)=\lambda t_B^2/2$. The government's budget constraint is derived below.

Bank runs

Bank runs can occur in two possible circumstances. The first, a *solvency crisis*, occurs in period 1 when depositors learn that the bad state will occur. Because $\theta > \beta R^*$, it would be efficient to let the projects proceed: but the collective action problem rules this out. Each individual depositor perceives that immediate withdrawal will yield the full face value if s/he is early in the queue, while waiting until period 2 yields only a fraction θ;[5] but the resulting mass withdrawals force early liquidation of projects, and uninsured depositors will on average

[4] In Krugman (1998) where asset prices are endogeneous, the bank values assets as if the best state will occur: in all other states, there will be default as returns fail to justify this 'Panglossian' valuation.

[5] Also, each depositor knows that all other uninsured depositors face the same incentive, and that her money will be lost if the mass withdrawals induce the failure of the bank.

actually realize only the fraction β. There is always a bank run when solvency comes into question. (Note that all non-guaranteed deposits will be liquidated, so that $k'=x$.)

The second type of bank run, a *liquidity crisis*, occurs in the good state. It arises when, despite favourable fundamentals in period 2, each depositor fears that other depositors will withdraw in period 1, forcing the failure of the bank. Given incentives to be first in line and the illiquidity of the assets, there will be a self-fulfilling crisis.

For now, we assume that liquidity crises do not occur, but return to the issue in section 5.

Two benchmarks

As benchmarks, we analyze the outcome that would occur without guarantees and the social planner's optimum. Consider first the equilibrium without guarantees. With the bank run forcing the liquidation of all capital in the bad state, the second period interest rate R_{NG} payable on a demandable debt contract in the good state must satisfy:

$$R^*k = pR_{NG}\,k+(1-p)\beta R^*k \quad \Rightarrow \quad R_{NG} = R^*(\beta + p^{-1}(1-\beta)) \tag{3}$$

i.e. the two period return is the same whether the funds are placed in foreign assets or put in the domestic bank. The level of investment would solve $f'(k_{NG})=R_{NG}$. For future reference, note that if a long-term debt contract maturing in period 2 (rather than a contract demandable in period one) were used, the interest rate would equal

$$R_S = R^*+p^{-1}(1-p)(R^*-\theta) < R^*+p^{-1}(1-p)(R^*-bR^*)=R_{NG}, \tag{4}$$

since a long-term contract does not permit inefficient early liquidation. *For this reason, financial institutions would prefer to use long-term borrowing when they do not expect government guarantees*. But in the context of possible government support, banks may prefer to use short-term contracts. These contracts may carry lower interest rates, as creditors are assured of an exit in bad times.

This interest rate is also the optimum that would be reached by a social planner who could directly control the amount of investment k. To see this, note that the planner would never liquidate investment early, as $\theta > \beta R^*$. So, in period 0, expected consumption is given by:

$$Ec = R^*(e-k)-b-\lambda(b)+pf(k)+(1-p)\theta k. \tag{5}$$

Differentiating, one finds the optimal level of investment is given by $f'(k)=R_S$. We conclude that if government is able to credibly precommit to avoid financial sector guarantees, markets will choose long-term debt contracts and investment will reach socially optimal levels. Alternatively, of course, this outcome could be reached through prohibiting short-term debt contracts! (It should be noted that the socially efficient outcome may actually be obtained in the Diamond and Dybvig model without the use of demand deposits, as the socially optimal allocation is incentive compatible so institutions don't matter!)[6] This suggests the need for a fuller model where short-term debt contracts are essential, for liquidity or monitoring purposes (as in Rey and Stiglitz 1993, for example).

4. The time-consistent equilibrium

We now analyze the outcome that would occur when the government cannot precommit in period 0 not to guarantee the banking sector. This gives rise to a time consistency problem, in which the government provides a bailout in period one, and expectations of the bailout lead to inefficient levels of investment. To show this, consider the government's optimization problem in period one, when the signal for the bad state has been received. As discussed above, a bank run will occur, all uninsured deposits will be withdrawn, and the remaining capital will be liquidated. Taxation in the bad state satisfies

$$t_B = b+(R^*-\theta)x, \tag{6}$$

where b denotes existing debt obligations, and the term $(R^*-\theta)x$ denotes the cost of support to the banking sector to in accordance with deposit guarantees (after realising the returns to the underlying real assets). (The existence of a guarantee fee introduced in period 1 would not affect this analysis, as the bank is insolvent and the fee will not be paid. The impact of a guarantee fee in period 0 could be analysed a special case of the tax on deposits, discussed in Appendix I though we do not pursue this here.)

Consumption in the bad state[7] satisfies

$$c_B = R^*(e-k)+ \beta R^*(k-x)+R^*x-t_B-\lambda(t_B), \tag{7}$$

i.e. it is equal to returns on risk-free investments, plus returns on liquidated deposits, plus returns on guarantee deposits, minus the direct and indirect costs of taxation. The government chooses $x\in [0,k]$ to maximize this, *taking the existing capital stock as given*. The first order condition for an interior optimum is:

$$dc_B/dx = \theta-\beta R^*-\lambda(t_B)t_B(R^*-\theta) = 0 \quad \Rightarrow \quad \lambda(t_B)t_B(R^*-\theta) = \theta-\beta R^*, \tag{8}$$

with t_B defined as in (6) above. The optimal level of taxation is positive, given the assumption that $\theta>\beta R^*$. Note that if the deadweight costs of taxation are zero, the government will choose a full guarantee. Solving this expression yields the interior optimum for guarantees:

$$x_{INT} = (R^*-\theta)^{-1}(((\theta-R^*\beta)/\lambda(R^*-\theta))-b) \tag{9}$$

The optimal deposit guarantee x_{OPT} will equal x_{INT} as long as $x_{INT}\in [0,k]$. If $x_{INT}<0$, which will be true for high levels of existing government debt (so that $(\theta-R^*\beta)/\lambda(R^*-\theta)<b$) then $x_{OPT}=0$

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[6] We are indebted to Sayantan Ghosal for this observation.

[7] Consumption in the good state is $c_G = f(k) -b -\lambda(b)$.

and no guarantee will be offered. If $x_{INT}>k$, then $x_{OPT}=k$; the government will offer a full guarantee.

The expected provision of a guarantee in period one will be priced into market lending rates. As consumers are risk neutral, the interest rate R offered on bank deposits in the second period must satisfy:

$$R^*k = pRk+(1-p)(R^*\beta(k-x_{OPT})+R^*x_{OPT}) \quad (10)$$

i.e., the expected return on deposits, given the possibility of losses in the bad state, must equal the riskfree rate. Solving this equation defines the risk premium required on the second period yield on callable bank deposits, namely:

$$R = R^*[\beta + p^{-1}(1 - \beta) - p^{-1}(1-p) (1 - \beta) x_{OPT}/k]. \quad (11)$$

The premium is decreasing in the amount of the guarantee. If there is a full guarantee, so that $x_{OPT}=k$, deposits will bear the risk-free rate. On the other hand, if $x_{OPT}=0$, then deposits will bear a rate of return reflecting the probability of a bank run in period 1. The risky rate is increasing in the amount of deposits: given the optimal guarantee, a higher level of deposits lowers the expected guarantee per unit of deposit.

We turn now to the behaviour of banks. Note that as long as $R<R_S$, banks will prefer short-term deposit contracts. This will be true for low levels of the guarantee, as long as

$$\theta<R^*(\beta+(1-\beta)x_{OPT}/k). \quad (12)$$

Above this level, banks will prefer long-term contracts, as the prospect of a guarantee embedded in short-term contracts is outweighed by the prospect of inefficient early liquidation short-term contracts entail.

Fig. 2. Deposit guarantees and investment.

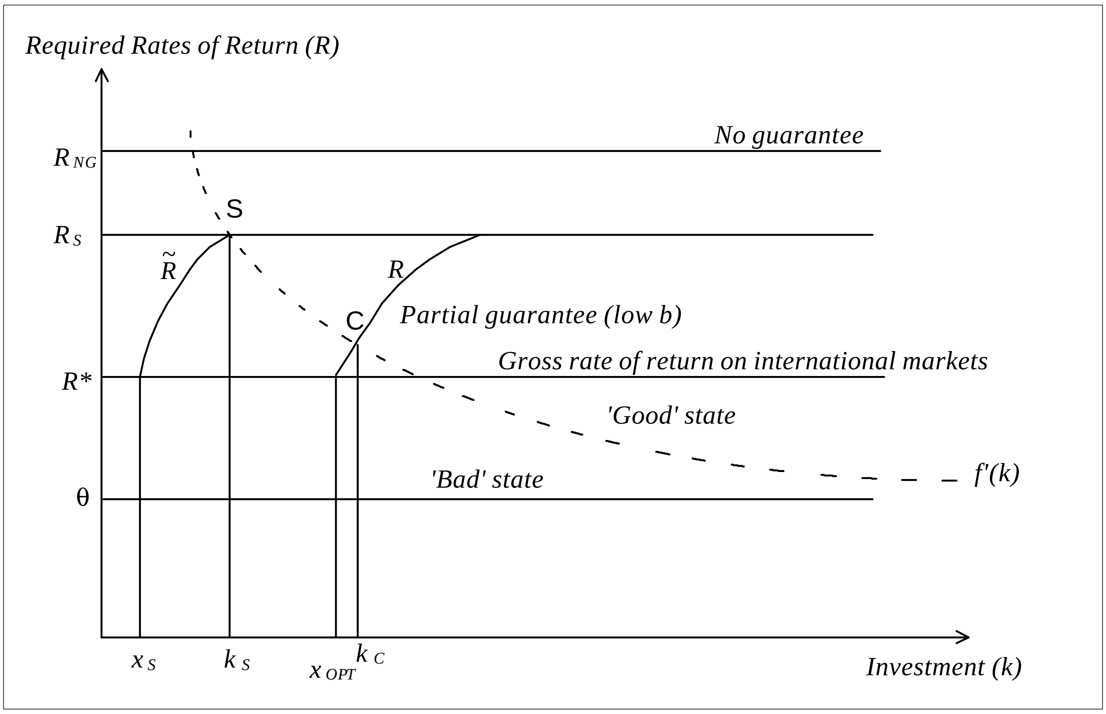
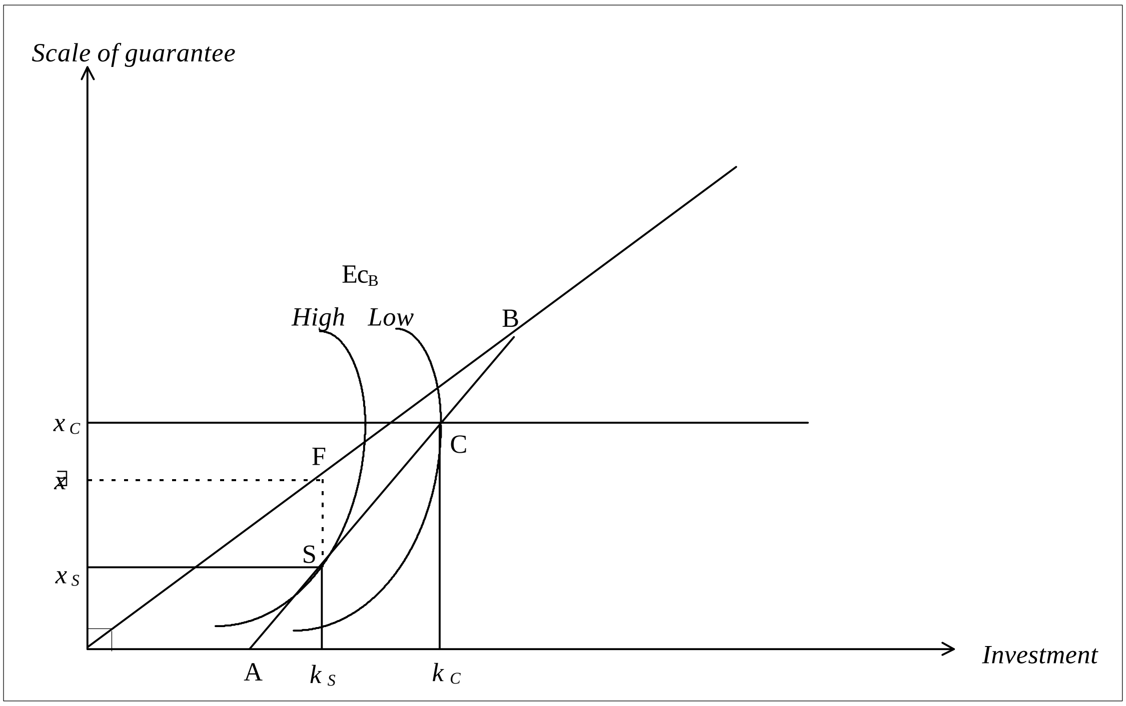


Figure 2 graphs the equilibrium of this model. The curve labeled R displays the market lending rates as a function of the total supply of deposits k. This coincides with R* for low levels of k, then rises to the right with k according to (4). For k£x_{OPT}, $R=R^*$, and a full guarantee is expected in the bad state. For $x_{OPT}<k<R_S$, banks use short-term deposit contracts. After R reaches R_S the R curve coincides with the line marked, reflecting the fact that markets use long-term debt contracts. The marginal product of capital is plotted as the downward-sloping curve. The intersection of this curve with the R_S line at S represents the socially optimal level of investment, k_S; and the intersection with the R curve at C represents the time-consistent equilibrium, k_C.

Three types of time-consistent equilibria are possible, corresponding to the three segments of the curve. First, for large k when $R=R_S$, markets do not use demandable debt contracts, and the outcome is socially efficient. For small k, when $R=R^*$, short-term deposits are fully guaranteed, no inefficient liquidations occur but investment exceeds the optimal level. In the intermediate range (where R slopes upward), investment exceeds the optimal level, but deposits are only partially guaranteed. In short, if $R^*<R<R_S$ in equilibrium, the banks are resorting excessively to inefficient short-term debt contracts, leading to costly taxation (if k£x_{OPT}), and early liquidation (if $k>x_{OPT}$). It seems that social efficiency could be achieved by restricting guarantee to the amount shown x_S but this equilibrium is not credible (not sub-game perfect).

Consider a decline in government debt b. This would increase x_{OPT}, shifting the R curve to the right, and increasing the equilibrium investment. This comparative static exercise provides one clue into the reasons for the massive build-up of banking sector liabilities in Asia, namely the sound fiscal positions of Asian governments!

Fig.3. Deposit guarantees and economic welfare.



The time consistent equlibrium is also illustrated in Figure 3 where the line AB shows how investment responds to the expected provision of guarantees. The levels of expected consumption in the bad state are shown by quadratic social indifferene curves in the figure. Note that expected consumption declines when k is above k_S, and x_C is the size of guarantee that (conditional on k) maximises expected consumption in the bad state. The time consistent equilibrium is at C where investment correctly reflects expectation of guarantees x_C. It is obvious that if the government could limit guarantee of x_S, this would prevent investment exceeding k_S, but this is not 'time consistent'.
(With the bank regulators preventing gambling, investment will be limited to k_S, in which case the government may safely guarantee all deposit as shown by $\bar{x}$ equals k_S in the figure.)

Prudential regulation

In their subtle and timely analysis of the prudential regulation of banks, Dewatripont and Tirole (1994) emphasize that bad news of project out-turns is very likely to trigger 'gambling' by bank managers with little or no equity remaining at risk. They recommend that, as bad news filters in, decision making be shifted to bond holders. Alternatively the agency providing deposit guarantees can be empowered to prevent gambling, by firing the managers, for example, and/or requiring rapid recapitalisation. This is the thinking behind the Prompt Corrective Action (PCA) provisions of the US FDIC Improvement Act[8] of 1991, which

[8] "The FDICIA passed in December 1991, instituted several regulatory reforms that are intended to reduce the burden on the Bank Insurance Fund and promote 'safe and sound' banking... Among the several measures implemented [is]... the introduction of 'prompt regulatory action' to ensure that undercapitalised banks recapitalise rapidly or are shut down early. It is commonly believed that such measure, which include close regulatory supervision and early closure of banks in distress, would ameliorate bank moral hazard behaviour and

emphasized the need for close regulatory monitoring and early bank closure (both limit the FDIC's losses and curb bank moral hazard behaviour).

Could the government issue full deposit guarantees without distorting investment? As shown in Figure 3, the answer in our simple model is affirmative so long as investment can be limited to k_S. But k_S is the point at which (in expectation) bank's profits are zero, i.e., for $k > k_S$, bank managers are gambling: so zealous application of Prompt Corrective Action will do the trick! In other words, the agency whose guarantees encourage excessive investment has the economic incentive to monitor and regulate investment at socially efficient level. If monitoring costs are zero, we conclude that prudential regulation along the lines of FDICIA would resolve the time consistency problem in the model[9]. The latter is of course grossly oversimplified: but it captures a key feature of official support in East Asia: namely that profound structural reform of the financial sector along these lines has been made an explicit condition for the supply of official funds.[10]

Foreign creditors

We now show that the basic results hold even in the presence of foreign depositors, when the endowment e is not large enough to satisfy the equilibrium demand for capital. For legal or political reasons, we assume that foreign and domestic depositors are treated similarly during times of banking distress, and similarly that a government guarantee cannot offer differential treatment to foreign and domestic depositors. Specifically, we assume that the share of foreign deposits covered by a guarantee is proportional to the share of foreign in total deposits. Denoting the share of domestic deposits by d, and noting that $e=(1-d)k$, consumption in the bad state becomes:

$$c_B = \beta R^* d(k-x) + R^* dx - t_B - \lambda(t_B), \qquad (13)$$

and the first-order condition becomes:

$$\lambda t_B(R^* - \theta) = \theta - \beta R^* - (1-d)R^*(1-\beta). \qquad (14)$$

The optimal bailout is still positive for small amounts of foreign deposits (so that d is close to one). The optimal bailout will decline more rapidly as k rises, implying a higher level of foreign depositors, and thus the x_{OPT} will be smaller, and R curve will increase in slope. Intuitively, the resources used in bailing out foreign depositors are lost to the economy, decreasing the attractiveness of the bailout to the benevolent government.

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protect the depositor from ruin", (Mazumdar, 1997, p23). Mazumdar's analysis, however, shows how these optimistic beliefs need to be qualified if there are costs of closure.

[9] Subject to the qualifications emphasised by Mazumdar (1997).

[10] In Thailand, for example, fundamental restructuring of the banking sector (involving substantial recapitalisation and prudential controls) was introduced in August 1998 with the advice of economists from JPMorgan

5. Liquidity crises

We now augment the model by adding the possibility of liquidity crises. Specifically, given the demandable deposit contract, a self-fulfilling run on the banking system could occur in the good state but was previously ruled out by assumption. We now assume that even when the good signal has been received in period 1, a bank run will occur with probability q.

We begin by focusing on time-consistent policy given a run in the good state. In the good state, even in the presence of a run, returns on nonliquidated assets will exceed the risk-free rate offered on guaranteed deposits so the government will not need to expend resources to honor its guarantee. Then $t_G=b$, and consumption (taking k as given) equals:

$$c_G = R^*(e-k)+f(x)+\beta R^*(k-x)-b-\lambda(b) \tag{15}$$

Differentiating this expression yields $f'(x)=\beta R^*<R$, which implies that $x=k$, so that the government offers a full guarantee of deposits, but the good state is otherwise unchanged. Since policies in bad state are likewise unaffected, the occurrence of liquidity crises has no effect on the analysis here.

Alternatively, we could assume that the government does not observe the signal for a bad state in period one, and thus cannot observe whether a run is based on liquidity considerations or on solvency considerations. In this case, given a run, the government will assign the conditional probability $m=pq/[pq+1-p]$ that the good state will occur. The first order condition for maximizing expected consumption is:

$$\lambda t_B(R^*-\theta) = [\theta-R^*\beta]+m(1-m)^{-1}[f'(x)-\beta R^*]. \tag{16}$$

Again, the last term is always positive, since at equilibrium $f'(k)=R>\beta R^*$. The optimal guarantee now reflects both the condition derived in the previous section for solvency crises, and the condition derived above for liquidity crises. The larger m, the more closely this expression will approach the full-bailout response to the liquidity crisis derived above. In all cases, the optimal level of support will exceed that given in a solvency crisis. With greater government support, the incentives for using short-term contracts have of course increased.

6. Conclusions

We have shown how an optimizing government faces a key time-consistency problem which gives rise to inefficient short-term debt contracts and overinvestment in inefficient projects. Our model has the additional feature that the problem is worse the better the fiscal position of the government -- and the East Asian countries recently hit by crisis did have remarkably sound fiscal positions.

One technical solution to the problem is (as for Diamond and Dybig, 1983) to abolish banks (in favour of non-callable lending)! But this merely illustrates the inability of such models to capture all the functions of banks. Taking the existence of demandable deposits as given, Diamond and Dybig (1983) emphasise how deposit insurance (and bank holidays) can restore social efficiency -- but this is assuming no moral hazard. In the context of our model where deposit guarantees generate over-investment, it is clear that social efficiency requires deposit guarantees to be backed by monitoring and prompt corrective action, key features of the rescue packages for the region.

Our analysis, although applied to guarantees of domestic banks, may also be applied to the problem of sovereign governments with access to international capital markets, who perceive that multilateral lenders will serve as a backstop. If the official sector cannot commit to forswear international rescue packages, sovereign borrowers could minimize their costs by borrowing using short-term debt contracts; and markets would expect a bailout at the expense of the official sector if the situation went bad.

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APPENDIX I

A tax on deposits

We continue our analysis of the time-consistent equilibrium by considering the impact of a tax on deposits introduced in period 0. Although the tax will not affect government actions after the bad signal has been received period 1 (since banks are insolvent), it may affect the initial level of investment in period 0. Let t_G equals

$$t_G = b - zk, \tag{A1}$$

where z is the proportional deposit tax. The risky interest rate on short-term contracts will now satisfy

$$R = R^*[\beta + p^{-1}(1 - \beta + Z) - p^{-1}(1-p)(1 - \beta) x_{OPT}/k], \tag{A2}$$

where x_{OPT} is as given above. The risky interest rate on long-term contracts will also be increased by an amount z. Thus, although higher interest rates could decrease investment towards optimal levels, the tax does not discourage the use of inefficient short-term contracts. The social optimum, however, could be reached by a differential tax on short-term deposits, which raises their cost of these.[11] Further analysis along these lines would require a better specification of the need for money in the model; otherwise infinite taxation might be optimal -- so as to rule out use of short-term contracts altogether!

[11] There is an additional benefit: a tax on deposits lessens the need to incur convex costs of taxation. This is an optimal taxation issue, which we do not emphasize here.