1. Introduction

The subprime crisis has reminded us that governments often felt obliged to rescue large or complex banks, or other financial institutions like AIG. In regulatory parlance these are called Systemically Important Financial Institutions (SIFIs).

The Too Big To Fail syndrome is now generalized in the financial sector: higher concentration, development of centralized trading,... CCPs are a new type of SIFI!

Working Assumptions: . there will be other systemic crises in the future, implying large losses (hopefully with a small probability) and government support to private institutions; . traditional regulatory tools (mainly capital requirements) are not well adapted to cover such losses: huge amount, very small probability.
It is true that some large banks may be just too big (M. King), especially when they are too big to be rescued. Similarly, some financial institutions may be too complex/opaque and could be split into simpler parts (Volcker), and retail activities could be ring-fenced (Vickers). Also, some new financing instruments could be used: Coco Bonds (Raviv 2004), Contingent Capital (Flannery 2005) or capital insurance (Kashyap, Rajan and Stein 2008).

But we claim that the SIFI situation will not be completely eliminated by such reforms: there will remain financial institutions that cannot be closed down (or even downsized) by public authorities, even if they can incur so large losses that shareholders will not accept to cover.

PUNCHLINE OF THIS PAPER: In order to avoid moral hazard and ensure financial stability without imposing an excessive burden on taxpayers, a Systemic Risk Authority (SRA) should be endowed with special resolution powers, including the control of managers' remunerations following extreme events.
2. Literature


Repeated Moral Hazard in discrete time: DeMarzo and Fishman (2008), Biais, Mariotti, Plantin and Rochet (BMPR 2004)
There is a single ”bank” of fixed size, generating at each period \( t = 0, 1, \ldots \) a positive cash flow \( \mu \).

With some(very)small probability \( \lambda \) this bank may incur (very) large losses: the amount \( C \) has to be injected, otherwise the bank is forced to shut down forever.

We assume that \( \mu > \lambda C \). Investors are risk neutral, and have discount factor \( \delta \).
Several interpretations of this model are possible:

- **derivative products like CDSs**: the bank sells protection and receives at each period a premium $\mu$ but may be obliged to cover big credit losses if a credit event occurs;

- **Classical transformation of retail deposits into a risky investment**. The cash flow $\mu$ is then interpreted as the net return to investment, after interest paid to depositors. There is a small probability of a catastrophic loss on investment.

- **Clearing House or Exchange** that decides on RM procedures: with a very small probability, several large participants may default simultaneously.
Absent moral hazard or other financial frictions, the expected net PV of the bank’s activity (assuming that it continues forever) is $\frac{\mu - \lambda C}{1 - \delta}$. 

The source of the Too Big To Fail problem is that $\delta \frac{\mu - \lambda C}{1 - \delta} < C$ banks’ shareholders prefer to default in case of large losses.

Thus systemic events are characterized in our model by a very large impact $C$ but a very small probability $\lambda$. To prevent strategic default of the bank, which would inflict negative externalities on society, some form of ex ante regulation is needed.
The bank has to be run by a manager. He can be selected among a pool of potential managers who are all identical: they are risk neutral and discount the future at rate $\delta_M < \delta$.

Managers don’t have any initial wealth that could be pledged. They accept to manage the bank provided the bank’s shareholders offer them expected discounted payments of at least $U$.

There is moral hazard: the manager can shirk (which provides private benefit $B$ per period) without being detected. In that case, the probability of a crisis is increased to $\lambda + \Delta\lambda$ per period, which is socially inefficient:

$$B < C\Delta\lambda.$$
Following BMPR (2004), we adopt the standard recursive method used for solving repeated moral hazard problems.

The decisions specified in a contract are parameterized by the continuation pay-off of the bank manager (the agent), denoted $w$. The only difference with BMPR (2004) is that the bank is never closed nor downsized, but the manager can be replaced at a certain cost.
At the beginning of each period, the contract specifies (as a function of the agent’s continuation pay-off $w$) the probability $1 - \pi(w)$ that the manager is replaced and the bank restructured.

With the complement probability $\pi(w)$, the manager continues and the contract specifies:

- the effort decision $e(w) \in \{0, 1\}$ of the manager (where $e = 0$ means shirking),
- current payments to the agent $u_+(w)$ and $u_-(w)$ conditionally on its performance (where $-$ denotes the occurrence of a crisis),
- the continuations pay-offs $w_+(w)$ and $w_-(w)$ promised to the agent after the current period, also conditionally on its current performance.
The optimal contract is thus associated with the Bellman function $V$ that solves for all $w$

$$V(w) = \max \pi \left[ \mu - \lambda C + (\lambda \hat{V}(w_-) + (1 - \lambda) \hat{V}(w_+)) \right] + (1 - \pi) V_c$$

under the constraints

$$0 \leq \pi \leq 1$$

$$(u_+ + \delta_M w_+) - (u_- + \delta_M w_-) \geq \frac{B}{\Delta \lambda} \quad (IC)$$

$$\pi [\lambda (u_- + \delta_M w_-) + (1 - \lambda) (u_+ + \delta_M w_+)] = w \quad (PK)$$

$$u_+ \geq 0 \quad u_- \geq 0 \quad w_+ \geq 0 \quad w_- \geq 0 \quad (LL)$$

where $V_c$ is the social continuation value of a restructured bank, net of restructuring costs and:

$$\hat{V}(w) = \delta S(w) + \delta_M w = \delta V(w) - (\delta - \delta_M) w.$$
Since (IC) is always binding at the optimum, we can use (PK) to find that

\[ u_+ + \delta_M w_+ = \frac{w}{\pi} + \lambda \frac{B}{\Delta \lambda} \]

and that

\[ u_- + \delta_M w_- = \frac{w}{\pi} - (1 - \lambda) \frac{B}{\Delta \lambda}. \]

Since \( u_+ \) and \( u_- \) do not appear in the objective function, they can be eliminated and the constraints become:

\[
\begin{align*}
0 & \leq \pi \leq 1 \\
\pi (\delta_M w_- + b) & \leq w \\
\pi \left( \delta_M w_+ - \frac{\lambda b}{1-\lambda} \right) & \leq w. \quad (3)
\end{align*}
\]

where \( b \equiv \frac{B}{\Delta \lambda} \)
**Determination of $V_c$:** When the bank is restructured, a new manager must be found. There are two instruments for shareholders: the continuation pay-off $w_0$ promised to the new manager (initialising the optimal contract) and, possibly, a signing bonus (or golden hand-shake) which is needed whenever $U > w_0$. In this case (scarcity of bank managers) $w_0$ is chosen so as to maximize $S(w_0) - [U - w_0]$ $V_c$ equals this maximum minus restructuring cost $\Gamma$.

If on the contrary $U < w_0$, the participation constraint of the manager does not bind and shareholders choose $w_0$ to maximize $F(w_0)$ (remember that the manager has no initial wealth). Then

$$V_c = \left[ \max_{w_0} S(w_0) \right] - \Gamma.$$
A direct adaptation of BMPR (2004) gives:

**Proposition (1)**

When the probability $\lambda$ of systemic crises is small enough, the optimal contract has the following characteristics:

1. When $w$ is small ($w < b \equiv (1 - \lambda) \frac{B}{\Delta \lambda}$), the manager is replaced (and the bank restructured) with probability $(1 - \frac{w}{b})$. With the complement probability $\frac{w}{b}$ the manager is maintained: he receives bonus $u_+ = b \left( \frac{1}{1 - \lambda} - \delta_M \right)$ if no crisis occurs, but is fired with no compensation if a crisis occurs. Continuation utilities are $w_+ = b$ in case of success, and $w_- = 0$ in case of crisis.
Proposition

(continued)

2 When $w$ is intermediate ($b \leq w < w^* = b(1 + \delta_M)$), the manager is kept with probability one. He receives a bonus $u_+ = w - b \left( \frac{1}{1-\lambda} - \delta_M \right)$ in case of success, and $u_- = 0$ in case of crisis. Continuation utility is $w_+ = b$ in case of success and $w_- = \frac{w - b}{\delta M} < b$ in case of crisis.

3 When $w$ is large ($w \geq w^* = b(1 + \delta_M)$), the manager is kept with probability one, and is guaranteed a continuation utility $w_+ = w_- = b$ irrespective of his current performance. He receives the same current payments as in the intermediate case, to which is added an exceptional payment of $w - w^*$. 
5. The Case Where Bank Managers Are Scarce

In the case where bank managers are scarce, (i.e. when $U$ is relatively large) they must be promised a “golden hand-shake” $U - w_0 > 0$ in order to be attracted into the job.

$w_0$ is chosen so as to maximize $F(w_0) - (U - w_0) = V(w_0) - U$.

Thus, when the bank is created, as well as after any restructuring, the new manager is offered the continuation utility $w_0 = w^*$ that maximizes social surplus $V(w)$.

The continuation utility of the manager $w_t$, along the optimal path, always belongs to a finite subset $\{0, b, w^*\}$. In fact the optimal contract is deterministic and can be described in much simpler terms than in Proposition 1.
Proposition (2)

When $U > w^*$, the optimal contract can be described as follows:

- for the first period (grace period) the manager is kept with probability one, and guaranteed a continuation utility $w_+ = w_- = b$ irrespective of its current performance. He receives a high bonus $u^H_+ = \frac{b}{1-\lambda}$ in case of success and nothing in case of a crisis;

- for all other periods, the manager is fired with probability one (with no indemnity) in case of crisis. In case of success, he receives a moderate bonus $u^M_+ = b \left( \frac{1}{1-\lambda} - \delta_M \right)$ and is kept with probability 1.
Proposition (3)

The optimal contract can be implemented as follows:

- During the restructuring period, the insurer charges a low systemic tax $T_0 = \lambda C$ and sets the compensation of the manager.
- For all subsequent periods, the insurer charges a systemic tax $T$ and let shareholders set managerial compensation.
Proposition (4)

If the insurer does not control the compensation of the manager during the restructuring period, the new shareholders find it optimal to give a bonus to the manager, irrespective of its performance. As a result the manager shirks during the first period and the probability of a crisis is excessively high.

Proof of Proposition 4: The optimal contract stipulates that \( w_+ = w_- = b \) in the first period. The continuation value for shareholders is thus \( S(b) \), irrespective of the performance of the manager. Then it is optimal for shareholders to offer to the manager a non performance based payment \( U - B \) in the first period, which induces him to shirk.
Policy Implications

Like in classical insurance contracts, a deductible would be needed to prevent moral hazard in capital insurance for banks. However, banks’ shareholders are not really in a position to monitor managers. They can only control them indirectly through their compensation packages.

Two alternatives may be considered: direct control of managers’ remuneration by insurers (at least during restructuring episodes) or capital requirements forcing shareholders to incur substantial losses in case of extreme events.

Private vs public insurance provision: private insurers might default while public insurers might yield to political pressure and recapitalize banks without punishing managers and shareholders.
Conclusion

We have explored the capital insurance proposal as a new regulatory instrument for dealing with systemic banks.

Our main result shows that such capital insurance is indeed necessary but it is not sufficient. It can only work if complemented by other regulatory tools such as capital requirements or restrictions on managerial compensation during restructuring episodes.