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The Economics of Bank Restructuring: Understanding the Options

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EXECUTIVE SUMMARY

Based on a simple framework, this note clarifies the economics behind bank restructuring and evaluates various restructuring options for systemically important banks. The note assumes that the government aims to reduce the probability of a bank's default and keep the burden on taxpayers at a minimum. The note also acknowledges that the design of any restructuring needs to take into consideration the payoffs and incentives for the various key stakeholders (i.e., shareholders, debt holders, and government).

If debt contracts can be renegotiated easily, the probability of default can be reduced without any government involvement by a *debt-for-equity swap*. Such a swap, if appropriately designed, would not make equity holders or debt holders worse off. However, such restructurings are hard to pull off in practice because of the difficulty of coordinating among many stakeholders, the need for speed, and the concerns of the potential systemic impact of rewriting debt contracts.

When debt contracts cannot be changed, transfers from the taxpayer are necessary. Debt holders benefit from a lower default probability. Absent government transfers, their gains imply a decrease in equity value. Shareholders will therefore oppose the restructuring unless they receive transfers from taxpayers.

The required transfer amounts vary across restructuring plans. Asset sales are more costly for taxpayers than asset guarantees or recapitalizations. This is because sales are not specifically targeted to reduce the probability of default. Guarantees or recapitalizations affect default risk more directly. Transfers can also be reduced if the proceeds of new issues are used to buy back debt.

Depending on the options chosen, restructuring may generate economic gains. These gains should be maximized. Separating out bad assets can help managers focus on typical bank management issues and thereby increases productivity. Because government often lacks the necessary expertise to run a bank or manage assets, it should utilize private sector expertise. Low up-front transfers can help prevent misuse of taxpayer money. Moreover, the design of bank managers' compensation should provide incentives to maximize future profits.

If participation is voluntary, a restructuring plan needs to appeal to banks. Bank managers often know the quality of their assets better than the market does. This means banks looking for new financing will be perceived by the market to have more toxic assets and, as a result, face higher financing costs. Banks will therefore be reluctant to participate in a restructuring plan and demand more taxpayer transfers. A restructuring that uses hybrid instruments—such as convertible bonds or preferred shares—mitigates this problem because it does not signal that the bank is in a dire situation. In addition, asset guarantees that are well designed can be more advantageous to taxpayers than equity recapitalizations. A compulsory program, if feasible, would obviously eliminate any signaling concerns. Information problems can also be mitigated if the government gathers and publicizes accurate information on banks' assets.

In summary, systemic bank restructuring should combine several elements to address multiple concerns and trade-offs on a case-by-case basis. In any plan, the costs to taxpayers and the final beneficiaries of the subsidies should be transparent. To forestall future financial crises, managers and shareholders should be held accountable and face punitive consequences. In the long run, various frictions should be reduced to make systemic bank restructuring quicker, less complex, and less costly.

I. INTRODUCTION

What is the best policy option for rescuing a troubled systemically important bank? Various plans have been proposed, some of which have already been implemented around the world. Examples include capital injections in the form of equity or hybrid securities (such as convertible debt or preferred shares), asset purchases, and temporary nationalizations. However, the various restructuring options are rarely evaluated and compared with each other based on a coherent theoretical framework. This note develops such a framework. [2]

Claims often heard in the public debate can be clarified and evaluated using this framework. Should bad assets be sold off before a bank is recapitalized? Should hybrid securities, such as preferred stock or convertible debt, be used rather than common stock in recapitalizations? Is it possible to restructure a bank balance sheet without resorting to a bankruptcy procedure and without involving public money? Is it better when taxpayers participate in a rescue plan in order to benefit from upside risk?

We make three main points:

- In principle, restructuring can be done without taxpayer contributions;
- If debt contracts cannot be renegotiated, taxpayer transfers are needed, but some schemes are more expensive than others; and
- Once the relevant market imperfections are taken into account, restructuring is likely to require actions both on the liability and the asset sides.

The goal of restructuring is assumed to be a lower probability of the bank's default with a minimal taxpayer burden. We start our analysis with a simple frictionless benchmark, following Modigliani and Miller (1958). We then exclude the possibility of debt renegotiation. This approach illuminates a key conflict between shareholders and debt holders. Later, we introduce more realistic assumptions, for example, the costs of financial distress and asymmetric information.

In the frictionless framework, debt contracts can be renegotiated easily and the default probability of a bank can be lowered by transforming some debt into equity (*debt-for-equity swap*). This restructuring preserves the financial value of both debt and equity. Therefore, there is no need for public involvement to decrease the probability of default. In practice, however, such restructuring is often difficult because of the speed of events, the dispersion of debt holders, and the potential systemic impact.

When debt contracts cannot be renegotiated, taxpayer transfers are necessary in order to carry out a restructuring plan. The debt holders see the value of their claim go up, thanks to a lower

[2] If a bank is not systemically important, a government should apply standard procedures, such as those defined in the "Prompt Corrective Action" law in the United States.

default probability. Absent government transfers, their gain equals the loss in equity value; shareholders would therefore oppose the restructuring.

Transfers vary depending on the plan. The level of transfers reflects how much debt holders benefit from the restructuring. Most options are equivalent to a simple recapitalization, in which the bank receives a subsidy conditional on the issuance of common equity. The transfer can be reduced if the proceeds of new issues are used to buy back debt. Restructuring involving asset sales turns out to require more transfers than recapitalization.

We next examine how to design restructuring outside the Modigliani and Miller framework. Specifically, we examine cases in which restructuring can bring economic gains—for example, the bank can gain new customers who were previously apprehensive. The potential for private surplus can facilitate restructurings and reduce taxpayer cost. In maximizing the total surplus (i.e., private surplus and social benefits), we find both pros and cons of key strategies. The restructuring plan should include contingent transfers so that a bank manager has an incentive to try to make the bank profitable. Up-front transfers should be minimized to prevent misuse of taxpayer money. Separating bad assets from a bank helps managers focus on standard bank management and can therefore increase productivity. Some assets may be underpriced compared with their fundamental value as a result of lack of liquidity and deep-pocket investors. In such cases, it may be optimal for the government to buy them. However, because the government often lacks the necessary expertise, it is advisable to use private expertise to run an asset management fund or a nationalized bank. Finally, from a long-run perspective, managers and shareholders should be sufficiently penalized to prevent future financial crises.

We also investigate the role of asymmetric information—when banks know more about their assets than the public does. When that is the case, banks are more reluctant to participate in a restructuring plan and demand additional taxpayer transfers. This is because participating banks may be perceived by the market to have more toxic assets and to need more of a capital buffer. Such negative market perception induces a lower market valuation and higher financing costs. The use of hybrid instruments, such as convertible bonds or preferred shares, mitigates the problem because it does not signal that the issuer is in a dire situation. Asset guarantees turn out to be even more advantageous. To eliminate participation-related transfers, a compulsory program, if feasible, is the best. In addition, the government should gather accurate information on underlying assets through rigorous bank examination and utilize it in designing restructuring options.

In summary, we find that the best course for a government is to combine several restructuring options to solve the multifaceted problems. On the one hand, rescue plans determine how the surplus from restructuring is shared among debt holders, equity holders, and taxpayers. On the other hand, the surplus from restructuring itself varies depending on the plans, since they change the behavior of the various parties. The best overall strategy involves both asset- and liability-side interventions.

The note proceeds as follows. Section II introduces the benchmark Modigliani-Miller framework. Section III assumes no scope for debt renegotiation and compares several restructuring options under fixed restructuring surplus to achieve the target default probability of a bank. In Section IV, under various frictions, we examine how the restructuring design affects the surplus. Section V discusses the willingness of banks to participate in a plan when asset quality is known only by bank managers. Section VI analyzes other considerations, namely, political constraints and a worst-case scenario in which bankruptcy is inevitable. Section VII reports case studies for Switzerland, the United Kingdom, and the United States. Section VIII concludes.

II. A BENCHMARK FRICTIONLESS FRAMEWORK

We begin by analyzing the restructuring of a bank in a simple framework in the spirit of Modigliani and Miller (1958). We show that the bank can decrease its probability of default to any target level by converting some debt into equity. A restructuring can be carried out in such a way that both equity holders and debt holders are not financially worse off.

A. Setup

A bank manages an asset A currently (time 0), which will have a final value A_1 next period (time 1). The final value A_1 is stochastic. It is drawn from a cumulative distribution function (CDF), F. The capital structure at time 0 is debt with face value D, which needs to be repaid at time 1. Equity has book value E (see Figure 1a). Absent restructuring, the probability of default of the bank at time 1, p, is the probability that the next-period value A_1 will be less than the debt obligation D, that is, $p = F(D)$ (see Figure 1b).

The assumptions of Modigliani-Miller are complete and efficient markets, without any information frictions. Under these assumptions, the sum of the market values of debt and equity is independent of the bank's capital structure and equals the market value of the asset: $V(A) = V(E) + V(D)$ (see Figure 1c). We also assume $D < V(A)$, implying that the bank is not currently insolvent, but we do assume a positive default probability.[3] The market value of debt $V(D)$ is thus smaller than the book value D.

Assuming large social costs associated with default of a systemically important bank, the government's objective can be stated as lowering the default probability or, in practice,

[3] A more practical definition of insolvency is regulatory insolvency. In this case, certain positive equity is required in order to be solvent, that is, a bank is solvent if the book value of assets is large enough $(A > D +$ *required capital*$)$. However, the thrust of the analysis would not change, and thus a simple condition of solvency, $V(A) > D$, is used throughout this note.

achieving a target default probability $p^* = F(A^*)$.[4] A bank restructuring problem amounts then to finding a way to achieve $p = p^*$ starting from a higher default probability, $p > p^*$.

Figure 1a. Assets and Liabilities of the Bank

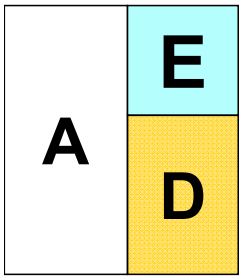


Figure 1b. Cumulative Distribution Function of Ex Post Asset Value

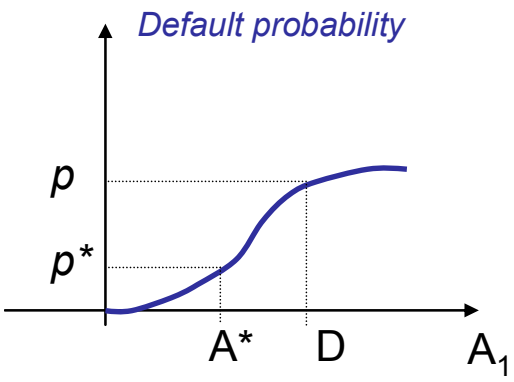
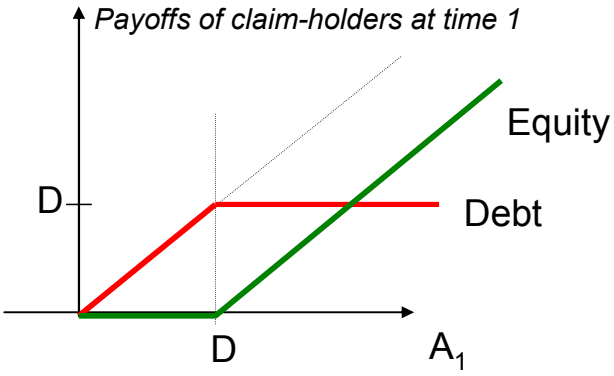


Figure 1c. Sharing Rule



B. First Best—Voluntary Debt Restructuring

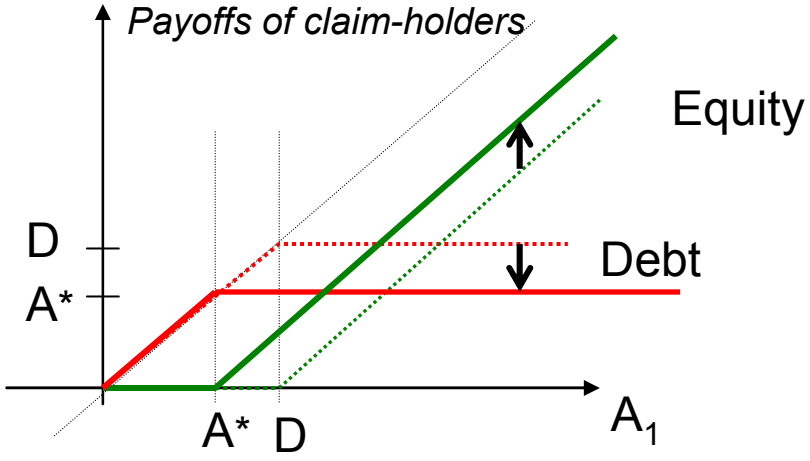
The government's objective is to decrease the probability of default p while making no one financially worse off. This is feasible by a change in the structure of claims, namely, the partial transformation of debt into equity. More specifically, a restructuring that leaves both debt and equity holders indifferent is the conversion of debt D into a combination of lower-face-value debt ($D' = A^*$) and an additional piece of equity with value $V(D) - V(D')$. This is a (partial) *debt-*

[4] $A^* = F^{-1}(p^*)$ is the marginal threshold of the realization of A_1 to achieve the target default probability. Put differently, if the debt is restructured to have face value A^*, then the default probability will be p^*. Note that the social costs associated with default are assumed not to be sensitive to the recovery rate of debt in the event of bankruptcy.

for-equity swap. The new financial stake of the initial debt holders is worth $V(D') + (V(D) - V(D'))$, which is by design unchanged from the original market value of debt $V(D)$. The firm's future cash flows are unchanged, and only the sharing rule for these cash flows has changed, so that the total value of the firm is unchanged (following the Modigliani-Miller theorem). Because the value of the claims that belong to the initial debt holders is unchanged, the value of the equity of the initial shareholders remains the same as well.

Figure 2 illustrates the change in the liability structure induced by this partial debt-for-equity swap that makes the probability of default equal to p^*. The total payment promised to debt holders decreases from D to A^*. This is illustrated by the downward shift of the horizontal line for debt payoff in Figure 2. After the restructuring, a fraction of the equity is held by the initial debt holders to compensate them for the decrease in the value of debt. Thus, when the bank does not default, equity accounts for a larger fraction of the asset's payoffs. Graphically, the equity line shifts up. The full conversion of debt into equity against a fraction of equity would also be a solution to the restructuring problem. Either scheme can be implemented by means of a *debt-for-equity swap*.[5]

Figure 2. Debt-for-Equity Swap



III. Restructuring with No Debt Renegotiation

Although the proposed debt-for-equity swap is the first-best solution, it is often a difficult solution to implement in practice. A major reason is the speed of events, which leaves no time

[5] This scheme is possible only when debt holders and equity holders negotiate freely and reach agreement easily. In practice, this is difficult outside a bankruptcy regime. Zingales (2009) advocates this solution by changing the bankruptcy law for banks. Note that in this truly frictionless framework, it is sufficient to prevent default with an ex post *debt-for-equity* swap that triggers when the realized asset value is less than the debt obligation, $A_1 < D$. In other words, no *ex-ante* restructuring is needed.

for negotiation. The possibility of a deposit run calls for speedy resolution, while dispersion of bank debt holders requires a lengthy negotiation process. An orderly bankruptcy might be the most efficient way to structure the renegotiation process, but might negatively impact other systemically important institutions. In what follows, we assume that the government wants to avoid such a bankruptcy procedure because of the potential systemic costs.

With no renegotiation of debt contracts and no help from the government, a restructuring that reduces the probability of default increases the value of the debt and thus decreases the value of the equity. Therefore, it will be opposed by shareholders. A restructuring thus will not happen unless the government provides subsidies in some form or makes participation compulsory. We examine in this section various possible restructuring options that *do not involve renegotiation of the debt contracts*. We also assume that transactions with external parties other than the government are carried out at a fair price (i.e., reflecting expected discounted cash flows) and that markets are efficient. This means that, for these external parties, financial transactions must be zero net present value (NPV) projects.

Many schemes are equivalent, though not all. The reason is that some imply a higher recovery rate for debt in case of default than others. Asset sales, for example, are more expensive than subsidizing the issuance of common equity. The optimal scheme is a form of partial insurance on the assets' payoff. Changing the liability side by subsidized debt buyback is an option close to the optimal scheme.

A. Difficulty of Voluntary Restructuring

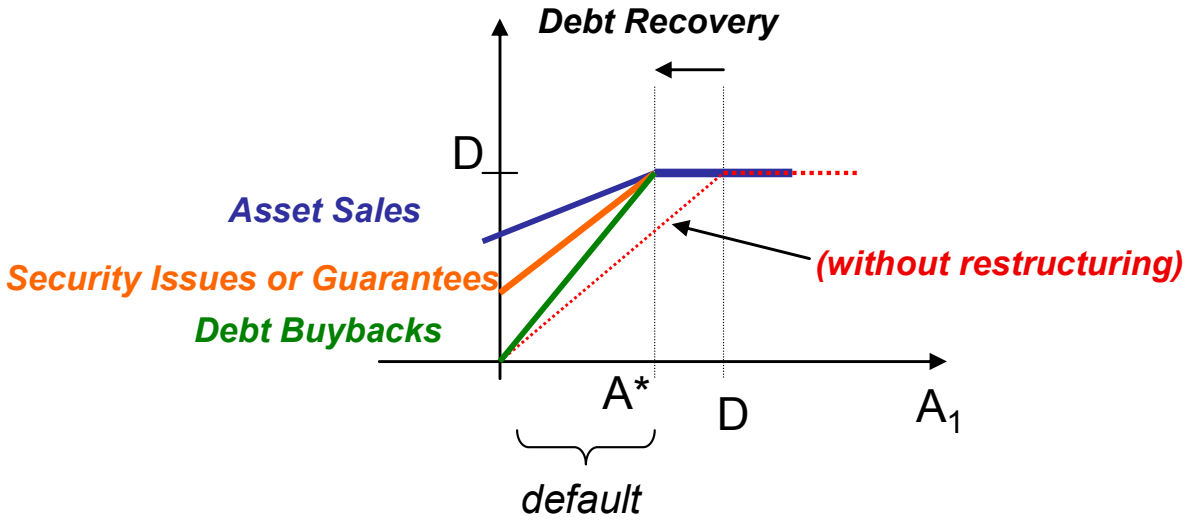
Without debt renegotiation and in the absence of transfers from the government, all restructuring that lowers the default probability p would be opposed by equity holders. This is because such restructuring increases the value of debt at the expense of equity (the debt overhang problem; see Myers, 1977). Indeed, debt holders are better off in every possible scenario—the default probability of a bank becomes lower and the recovery rate in the event of default becomes higher. The value of debt thus increases from $V(D)$ to $V'(D)$ and, without third-party involvement, the increase in debt value is precisely compensated by a decrease in equity value, $V'(E) - V(E) = -(V'(D) - V(D)) < 0$. The worse off the bank is initially, the larger $V(D) - V'(D)$ and the larger the loss imposed on shareholders. Shareholders of more distressed banks thus tend to be more reluctant to restructure.

Shareholders need to be either forced or induced through subsidies in some way by the government to approve such restructuring. Their approval is needed, because they have control rights as long as the bank does not default. The transfer needed from the government is equal to the increase in the value of debt, $T = V'(D) - V(D)$. This transfer equals the expected discounted value of immediate and future payoffs from the government. Under this transfer, the value of equity remains unchanged. We now examine in detail how this transfer varies across different restructuring schemes.

B. Government Subsidy and Debt Recovery

All restructuring schemes that achieve a target default probability p^* must therefore involve a subsidy from the government. The size of this subsidy determines the degree of the debt's safety. From this perspective, among the schemes we will examine, asset sales appear to be the most costly for taxpayers. This is because whatever the final realization of A, asset sales imply the largest increase in debt recovery and therefore the largest transfer to debt holders. Figure 3 gives a preview of our results, illustrating the recovery schedule of debt for various realizations of A and various types of restructuring. Restructuring shifts the default threshold to the left (from D to A^*) and changes the payoff to the debt holders in case of default $D<A^*$. This new recovery schedule can vary depending on the restructuring plan (three different slopes in Figure 3). Restructuring that creates higher recovery schedules is more costly to taxpayers, since it (indirectly) transfers more value to debt holders.

Figure 3. Restructuring and Debt Recovery



C. State-Contingent Insurance: Optimal Subsidy

We first describe the restructuring scheme that minimizes the transfer from taxpayers. The size of the transfer can be expressed graphically as a function of the asset's realization A_1 (Figure 4a). Figure 4b shows the corresponding debt recovery. Because the objective is to decrease the probability of default, there is no need to improve the recovery of debt in case of default. Graphically, default occurs in the left part of the figure, $A_1<A^*$. The government should make no transfer in this region (Figure 4a). This leaves debt recovery unchanged from the prerestructuring situation (Figure 4b). When the realized asset value A_1 is between A^* and D, the bank needs a transfer $D - A_1$ from the government so that it is able to repay D to debt holders and avoid

default. When the realized A_1 is above D, no subsidy is needed to avoid default. In other words, the optimal restructuring is a guarantee under which the government transfers money ex post only when the bank is in default but not far from solvency. This scheme would not provide any transfer to debt holders when default is inevitable ($A_1 < A^*$) or when the bank can repay debt on its own ($A_1 > D$).[6]

The relative cost to taxpayers of various types of restructuring depends on how close they are to implementing this optimal debt-recovery schedule. This scheme might be difficult to implement and calibrate in practice, but it provides three useful insights. First, to decrease the probability of default, the government does not have to subsidize the recovery rate for all the realized value of the assets. It should instead focus on avoiding default only when the bank is close to solvency. Second, it is *not necessarily a bad deal* that the taxpayers do not receive any upside or even any positive cash flow in exchange for their intervention. Some of the rescue schemes we will examine below occasionally provide payments to taxpayers. This optimal scheme never provides any payments to taxpayers, but its overall cost to taxpayers is the lowest. Third, more transfers could boost the share price, but a higher share price does not mean a good rescue plan from the point of view of taxpayers.

Figure 4a. Transfer of the Optimal Subsidy

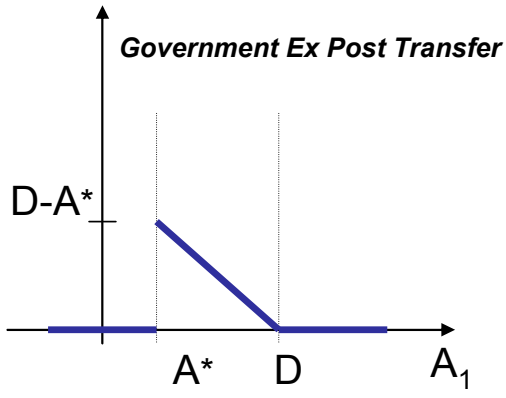
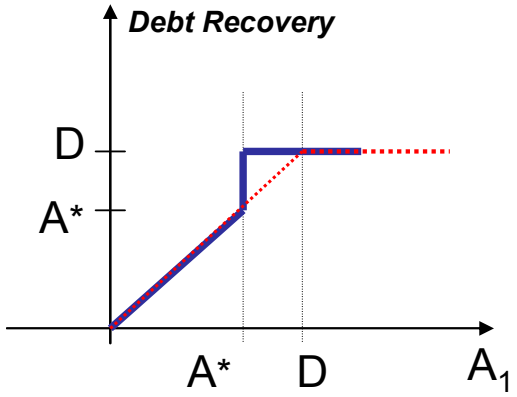


Figure 4b. Recovery Rate



D. Recapitalization with Common Equity

One straightforward way of decreasing the default probability is to issue new equity and keep the proceeds as cash. This makes the debt less risky. Bankruptcy occurs then with *prob(A + Cash < D)*, equivalently, *prob(A < D – Cash)* or *F(D – Cash)*. The minimum amount of cash that has to

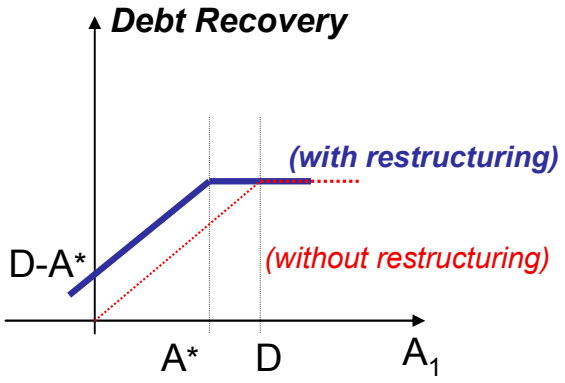
[6] Here, we assume that the social benefits from saving a systemically important bank are limited, and thus the government will not transfer funds beyond the upper limit $D - A^*$. However, if there is a need to transfer money to counterparties in case of default, a subsidy that gives higher debt recovery given default $A < A^*$ may be optimal.

be raised is such that $p^* = F(D - Cash)$, that is, $Cash = D - A^*$. This is shown as the intercept of the debt recovery schedule in Figure 5. For a given realization of asset value A_1 that forces the bank into default ($A_1 < A^*$), and the debt holders can then recover cash *in addition to the remaining assets,* $D - A^* + A_1$.

Because default occurs less often and the recovery rate is higher, the value of debt increases from $V(D)$ to $V'(D)$. The new equity holders do not make or lose money by investing (*efficient markets*). Assuming no government subsidy, the gain of debt holders $V'(D) - V(D)$ is obtained at the expense of the old equity holders, who will lose *exactly that amount*. This implies that they would oppose the restructuring. Issuance of equity is *dilutive* for preexisting shareholders not because an equally large pie is now divided among more shareholders—in fact, the pie is bigger because of the proceeds of the new equity issue—but because the debt holders receive more of the pie.

To make the restructuring acceptable to shareholders, the value of the equity should not decrease. To this end, a possible policy option is for the government to give the bank cash in the amount of $V'(D) - V(D)$ conditional on the bank's issuance of equity of an amount $D - A^* - (V'(D) - V(D))$ at a fair price reflecting the expected discounted value of future payouts to shareholders. With the total new cash $D - A^*$, the probability of default becomes p^*. The market value of the debt jumps by $V'(D) - V(D)$ and the government loses exactly that amount, so that, as planned, shareholder value is unchanged (see Figure 5).

Figure 5. Recapitalization



E. Recapitalization by Issuance of Preferred Stock or Convertible Debts

Instead of issuing equity, banks could issue hybrid securities such as convertible debt or preferred stock.[7] This would not change the analysis done in the previous section. In these cases, the debt-recovery schedule of initial debt holders is the same as in Figure 5, implying that the

[7] Issuance of new (nonconvertible) debt would increase the default probability and is thus not a possible restructuring scheme.

restructuring's impact on preexisting debt value, $V'(D) - V(D)$, and thus the transfer of the taxpayer, is the same as in a recapitalization through the issuance of equity.

To show that the recovery of preexisting debt is the same as in Figure 5, there are two cases to consider separately. In the first case, the new claims do not trigger default. This applies to preferred stock or convertible debt with a conversion option at the issuer's discretion, since the dividends do not have to be paid out (preferred stock) or debt converted into equity (convertible debt) when the bank is unable to pay dividends or coupons. In this case, the amount of capital that needs to be raised to achieve the target default probability $p = p^*$, and thus the recovery schedule of initial debt, remains the same as in the case of recapitalization with common equity. The second case involves the issuance of convertible debt, with the conversion not determined by the issuer (i.e., the conversion is automatic or at the holder's discretion) and seniority equal to that of preexisting debt.[8] The recovery rate is in proportion to total debt (*pari passu*)—so the slope of the recovery is the same as in the equity issue case (see Figure 6a). At the same time, the trigger point for defaults after restructuring is set to be A^* as in the equity issuance case. Thus, the recovery of preexisting debt is exactly the same as in the equity issuance case.[9]

Figure 6a. Same Seniority Convertible

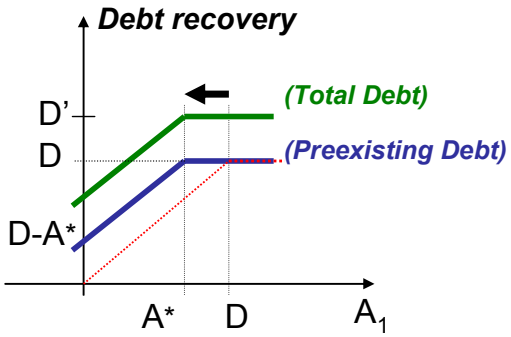
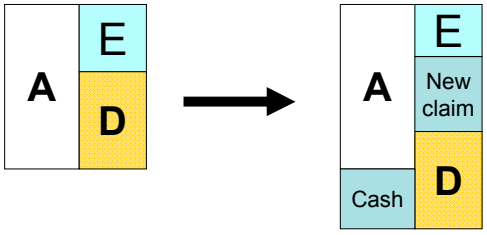


Figure 6b. Recapitalization with Hybrid Securities



Modigliani-Miller: ***Cash = V(New Claim)***

[8] Conversion options in hybrid securities are discussed further in section V A below.

[9] It is more costly for taxpayers to issue convertible *subordinated* debt (i.e., junior to preexisting debt) with conversion not determined by the issuer. In this case, although the trigger point is still the same as in Figure 6a, the preexisting debt holders will be given priority in case of default. This extra gain imposes an extra cost on taxpayers.

To make equity holders willing to accept the restructuring, the government has to compensate them with a conditional transfer identical to the one needed in the case of an equity issuance. Indeed, total wealth before and after the restructuring remains the same (*conservation of value*). That is, the sum of the changes in wealth of initial equity holders, initial debt holders, new claim holders, and taxpayers is zero. Because new claims are issued at a fair price, the new claimholder's wealth is unchanged. Provided the restructuring needs to leave initial equity holders' wealth unchanged, the taxpayer transfer should be equal to the change in debt value. This is the same as in the case of an equity issue.

F. Subsidized Debt Buybacks

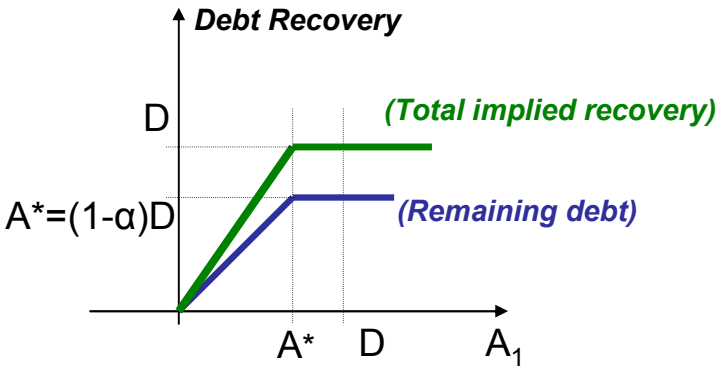
When equity or other securities are issued, banks do not have to keep the proceeds on their balance sheet and might as well use them to buy back some debt. This decreases the transfers from taxpayers required to implement $p = p^*$. The bondholders that sell to the bank are not assumed to be naïve—they know that the value of the debt will rise as a result of the restructuring and therefore agree to sell only at the fair price that reflects the postrestructuring value of their claim.[10] The fraction α of outstanding debt that needs to be bought is such that $(1 - \alpha) D = A^*$, and the remaining debt contracts are untouched, so the new aggregate face value of the debt is $(1 - \alpha) D = A^*$. After the announcement, the value of the initial debt should increase from $V(D)$ to $V'(D)$, reflecting the lower default probability after the restructuring. Out of this initial debt, a fraction α is bought by the firm at a value $\alpha V'(D)$, while a fraction $(1 - \alpha)$ remains outstanding, with market value $(1 - \alpha) V'(D)$.

To leave the equity holders indifferent, the government needs to subsidize the buyback. In exchange for the transfer, the bank should be willing to issue equity to buy back a fraction α of the debt. Equivalently, the government can directly buy debt at the postrestructuring market price and convert it into equity at a conversion rate that leaves equity holders indifferent.[11] As in the other schemes, the optimal size of the government transfer is equal to the increase in debt holders' wealth created by the restructuring, $V'(D) - V(D)$. Whether they keep their bonds or sell them, all initial debt holders receive this gain on a pro rata basis. The remaining debt is a fraction $(1 - \alpha)$ of the initial debt. The gains of the remaining debt holders are $(1 - \alpha)$ of the gains of all the initial debt holders. Thus, the transfer by the government can be calculated by rescaling the realized recovery of the remaining debt by a factor $1 / (1 - \alpha)$ (the upper line in Figure 7). This *total implied recovery* reflects the restructuring effects on the *full* initial debt.

[10] Note that this is a conservative assumption in evaluating taxpayer transfers, since it implies that the firm is not able to buy back debt secretly and restructure afterward by surprise.

[11] Note that this scheme is equivalent to finding some debt holders that agree to convert into equity at the postrestructuring price, which is higher than the current market price but below the face value.

Figure 7. Debt Buyback

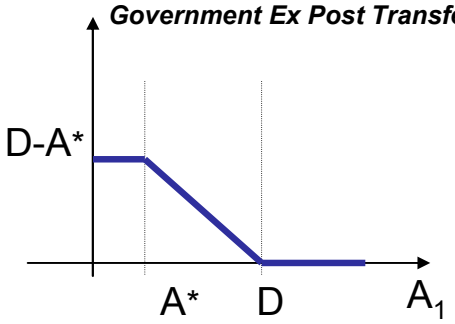


This scheme is less costly for taxpayers than a recapitalization in which cash from new issues is kept on the balance sheet. Indeed, the recovery schedule (upper line of Figure 7) of this scheme is lower than the recovery schedule of the recapitalization in Figure 5. Economic intuition suggests that buying back debt and converting it into equity is closer to the first-best solution (i.e., debt-for-equity swap agreed to by debt holders). Altering the liability structure decreases the size of the transfer required from the government (see Bulow and Klemperer, 2009).

G. Simple Asset Guarantees

An alternative way to decrease the default probability down to p^* is for the government to offer full or partial insurance on the bank's assets using simple asset guarantees. To limit the cost to the taxpayers, such insurance can have a cap (partial insurance). For instance, to reach a default probability p^*, the government can insure against the value of assets falling below D, with a maximum transfer of $D - A^*$. This guarantees that the bank is able to repay its debt fully as long as $A_1 \geq A^*$. In contrast to the optimal scheme, however, this transfer will be paid even in the worst cases, $A_1 < A^*$ (see Figure 8).

Figure 8. Transfer under Capped Asset Guarantee



This scheme leaves the equity value unchanged from the prerestructuring situation (all transfers benefit debt holders) and has exactly the same cost for the government as a recapitalization that involves subsidizing new securities issues (equity or hybrids). This is because the implied debt recovery is identical to that in Figure 5. Compared with the optimal partial insurance scheme in Section C, this plan is more costly, since it makes debt recovery higher in case of default. A full insurance scheme (without the transfer cap) would cost taxpayers more, since it involves higher payments in the worst cases, $A_1 < A^*$.

It is always optimal for taxpayers to insure total assets as opposed to a specific subset of them. Future payoffs of a subset of assets do not perfectly predict the default of the bank as a whole. Thus, higher transfers (as a precautionary cushion) are necessary to achieve the same default probability.

H. Caballero's Scheme

Ricardo Caballero (2009) has a proposal that can be described as follows: If the bank issues new equity in the amount of $D - A^*$ to private investors, the government provides a loss guarantee for the new equity owners by promising to buy back the new equity at a fixed price in the future. In other words, the government distributes free put options to the new equity holders. The floor price can be set by backward induction. Specifically, the government transfer should be set to equal the gains of debt holders, $V'(D) - V(D)$. This makes the current equity holders willing to adopt this scheme as it leaves their wealth unchanged.

In terms of transfer by the government, Caballero's scheme is equivalent to the subsidized recapitalization with common equity (Figure 5), since it implements the same debt recovery schedule, $D - A^* + A_1$. It differs from the subsidized equity issues in that it requires no up-front transfer by the government.

I. Above-Market-Price Asset Sales

Another alternative is to sell a fraction a of the assets to the government at an overvalued price with markup m, that is, $(1 + m)\, a\, V(A)$, to achieve the target default probability $p = p^*$ without dilution for shareholders.[12] The proceeds of the sale are again kept as cash on the balance sheet. It turns out that the government transfer needed for these asset sales is larger than for all the mechanisms considered so far.

To see this, note that the new assets owned by the bank are cash and remaining old assets, $(1 + m)\, a\, V(A) + (1 - a)\, A$, which have higher expected value and lower risk than the original assets A

[12] The parameters a and m can be picked as the solutions of two equations. The first equation states that the probability of default is p^*, $(1 + m)\, a\, V(A) + (1 - a)\, A^* = D$. The second equation states that the negative NPV of the government's injection covers the increase in the value of debt, $a\, m\, V(A) = V'(D;a) - V(D)$—new value of debt, $V'(D;a)$, depends on the sales fraction a.

(see Figure 9a). Because default occurs less often than in the do-nothing case, the value of the debt increases by *V'(D) – V(D)*. This jump is larger than in the case of recapitalization with common-equity issuance with the same default probability *p**, since the recovery rate for every realization A_1 is larger.[13] This is illustrated by a simple graphical intuition showing that the slope of the recovery schedule in the default zone is now *(1 – a)* instead of 1 (see Figure 9b). Note that it is irrelevant whether the government or private investors hold the assets, as long as the government subsidizes the price by a markup *m* so that it provides the subsidy required to compensate equity holders.

Figure 9a. Assets and Liabilities after Asset Sales of a Fraction *a*

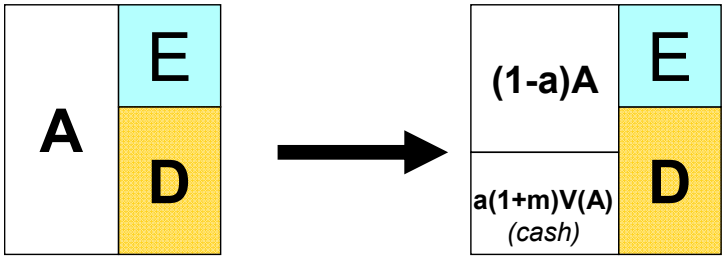
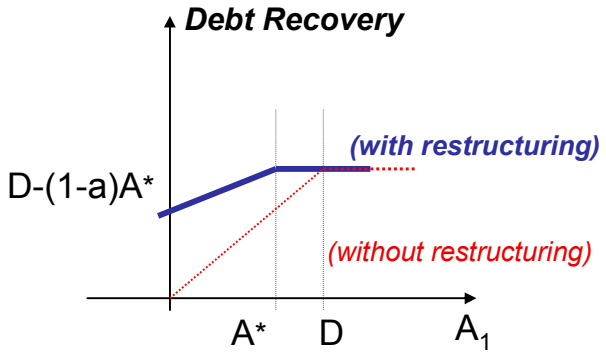


Figure 9b. Debt Recovery after Asset Sales of a Fraction *a*



[13] The probability of default is equal to *prob((1 – a) A < D – cash)*, equivalently, *prob(A < (D – a V(A)) / (1 – a))*. Hence, the required fraction of assets *a* should solve *(1 – a) A* = D – a V(A)*. For a given realization of asset value A_1 that makes the bank default ($A_1 < A^*$), the debt holders recover cash *a V(A)* and liquidation value *(1–a)* A_1, that is, *D – (1 – a) (A* – A_1)*, which is more than in the equity issue case, *D – (A* – A_1)*.

J. The Sachs Proposal

Sachs's (2009) proposal is a variant of asset sales. Instead of using a market price, Sachs proposes to sell a fraction of assets at book value to the government to avoid immediate write-downs, but with a condition that requires the bank to pay ex post the government's losses when the assets are sold off later (*recourse condition*). Sachs proposes to use newly issued equity to compensate the government for the losses ex post. More specifically, the government would hold warrants entitling it to receive common stock equal in value to the eventual loss from the sale of the assets. The current equity holders would bear the costs through the dilution.

This plan includes a hidden subsidy from the government to debt holders. Indeed, the probability of default is now lower and the recovery rate higher. The government does not recover anything unless all debt has been repaid, because the value of the equity is zero in case of default. However, equity holders become worse off under this plan. On the one hand, if the asset value turns out to be lower than the book value, equity holders face the same payoff as in the do-nothing case—the government receives the difference between the book value and the realized value. On the other hand, if the asset value turns out to be higher than the book value, the initial equity holders receive only the initial book value. Therefore, the impact of the plan on the value of the equity is negative: Equity holders would oppose it.

K. Combining Several Schemes

A bank restructuring plan can be designed by combining multiple schemes, such as asset sales and recapitalization. As long as banks have to participate in all schemes or none, the overall transfer matters, but not the origin of the transfer. For example, a higher asset sales price can be compensated by a lower subsidy to new equity issues. However, if banks can choose to participate in some schemes but not others, subsidies must be chosen optimally on a scheme-by-scheme basis rather than as a whole.

IV. Private and Social Surplus from Restructuring

We can think of the future cash flows of a bank as a *pie* shared between shareholders and debt holders. Restructuring can increase the size of this pie. To this end, the government needs to pay attention to the various stakeholders' payoffs and incentives . For example, decreasing the probability of default might attract customers who were previously worried about the bank's high probability of failure. This potential private surplus can facilitate restructuring and reduce or even eliminate the need for transfers from taxpayers. Contrary to the clear-cut picture that emerges from the previous section, an optimal restructuring plan is no longer easy to identify. Actual plans may need to combine features of various schemes considered so far. For example, relying exclusively on asset guarantees might diminish managerial incentives to optimize ex post asset payoffs, but relying exclusively on ex ante cash injections might create opportunities for managers to increase their own private benefits.

A. Key Concepts

Costs of Financial Distress

It is widely recognized that a high probability of default reduces a firm's total value (the value of equity plus liabilities). We can say that a bank is in *financial distress* when this decrease in value becomes economically significant. In our exposition, we will associate financial distress with a probability of default $p > p^*$. A small fraction of the *costs of financial distress* is composed of the direct, ex post costs of bankruptcy (e.g., legal fees), but a large fraction is composed of indirect, ex ante costs. For example, depositors, interbank market counterparties, and employees tend to avoid a bank close to bankruptcy. Managerial attention might be diverted to keeping the company afloat rather than managing projects. In addition, some positive-value projects, such as new lending opportunities, may not be undertaken by a financially distressed bank,[14] which reduces the total value of the firm (*debt overhang*).[15] All in all, lowering the default probability of a bank (from p to p^*) can create some extra value, which we call the *private restructuring surplus*.

A parsimonious way to introduce the potential gains from restructuring is to assume that when the probability of default is higher than p^*, the ex post payoff of assets becomes less than its potential by an amount C.[16] The restructuring is then a positive-sum game over the surplus C to be shared between debt and equity holders. The corporate finance literature estimates that, for a typical nonfinancial company, these costs of financial distress are about 10 percent to 23 percent of ex post firm value (Andrade and Kaplan, 1998). The surplus can be generated if the default probability becomes less than p^*. Because there is a (private) surplus (C) to share, the incentives to find an agreement through renegotiation are higher than in the frictionless case.

Social Benefits and Government Participation

Restructuring a systemically important bank is likely to bring aggregate economic gains, in particular when it is near collapse.[17] The magnitude of the social benefit B determines the upper

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[14] This is because a significant fraction of the value generated by these projects would go to the debt holders, whereas the costs would be fully paid by the equity holders. Because the latter have the control rights, the bank will not finance these projects (Myers, 1977). There is a vast amount of literature on the *costs of financial distress* and *debt overhang*, for example, summarized in Tirole (2006).

[15] Liquidity policies aim at reducing the cost of financial distress and may indirectly reduce the probability of default. Examples include accommodating monetary policy (both conventional and unconventional measures), loss guarantees for debt holders, and (implicit) subsidies for new lending. Such policies are outside of the scope of this note.

[16] In other words, the cumulative density function of default probability F shifts to the right when a restructuring occurs, and becomes $F'(\bullet) = F(\bullet + C)$.

[17] A key risk is the collapse of the decentralized payment system (see Rochet and Tirole, 1996).

limit of government's willingness to pay for a restructuring plan. The social benefit depends on how much other banks are affected by the bank's failure (putting the functioning of the payment system at risk) and on how unexpected the default event is.[18]

Allowing for government intervention, restructuring a bank becomes a positive-sum game where the total surplus $S = C + B$ is shared among three parties: equity holders, debt holders, and the government. There can be three cases.

- If the private restructuring surplus for a bank is more than the improvements in debt value by the restructuring, $C > V'(D) - V(D)$, government intervention is not needed. The government should resist attempts by the other stakeholders to extract a subsidy.

- If government intervention is needed, the government is willing to pay a transfer T as long as the aggregate benefit is bigger than this transfer, $B > T$. The minimum cost for the government to achieve $p = p^*$ is $V'(D) - V(D) - C$, that is, the change in debt value net of the private surplus created by the restructuring.

- If the social benefits are small, $B < V'(D) - V(D) - C$, aggregate surplus is still positive but too small to leave the debt contract unchanged and make both equity and the government better off. In this case, the government needs to organize renegotiation of the debt contract to reach a mutually beneficial restructuring.

B. Endogenous Surplus and Restructuring Design

Both the private and social surplus created by decreasing the bank's default probability are not purely exogenously given, but are affected by the design of a restructuring plan. Among the various schemes that achieve the target default probability $p = p^*$, those that maximize the restructuring surplus $B + C$ are the most efficient—they will minimize the transfer required from taxpayers—and thus should be pursued.[19] We analyze several relevant frictions, such as the allocation of talent and managerial incentives, which should be taken into account when designing a restructuring plan.

Allocation of Talent

Span of Control and Attention: To increase bank managers' productivity, it may be useful to remove toxic assets from a bank. This can be done either through asset sales or by splitting a bank into a *"good" bank* and a *"bad" bank*. Removing distressed assets from the managers' span of control allows them to focus their attention on typical bank operations, without spending

[18] Government also has a direct stake in the bank, since it typically provides deposit insurance.

[19] In fact, the optimal p^* can be determined by maximizing total surplus S as a function of restructuring design, taking into account the optimal bank capital structure, payment-system implications, and macroeconomic consequences.

much time on bad-asset management, which other specialists, such as vulture-fund managers and bankruptcy lawyers, can handle with more expertise.

Expertise: Managerial decisions should be in the hands of agents equipped with the appropriate level of expertise and experience. This concern is particularly relevant when public control is involved in a restructuring. The mechanisms through which managers are appointed and monitored should be carefully designed when the government inherits some control rights. This principle should apply to both banks and asset management companies. In other words, bank restructuring, particularly asset sales, should involve some form of public-private partnership. One way to select managers in a transparent and efficient way (i.e., without leaving them excessive rents) is to auction off the management contracts to a predetermined group of professional investors who meet certain standards of quality.

Moral Hazard (Hidden Actions)

Free Cash Flow (Looting of Subsidies): Injecting public money up-front before the asset's payoffs are realized may offer bank managers an unnecessary opportunity to use public money for their private benefit, such as larger bonuses and perks. In addition, shareholders may demand more dividend payments. To reduce this problem, a government should try to use ex post rather than ex ante transfers. For example, asset guarantees are immune to this ex ante looting possibility, since they do not provide managers and shareholders with an opportunity to misuse public money.

Incentives to Run a Restructured Bank: Bank managers should be given incentives to maximize the final payoff A_1. For example, asset guarantees may reduce managerial incentives to maximize the asset's payoffs A_1 as well as shareholders' incentives to monitor managers. The implications of this concern are thus the opposite of the previous one. The optimal solution depends on the relative importance of both frictions. A reverse problem occurs in Sachs's proposal, in which assets are bought at face value by the government and banks commit to pay the losses ex post—a full guarantee by banks about ex post payoffs might provide poor incentives to the government or the manager of the asset management company to maximize asset liquidation values.

Concerns about the Future

Positive Medium-Term Effects of Convertibles: A restructuring plan should be evaluated not only on its effect on the following period but on subsequent periods as well. It can minimize the costs of financial distress in the future by including a plan of action in case the bank's outlook deteriorates further. In particular, adding a convertible feature to new debt-like claims enhances surplus, since it can be seen as an automatic restructuring plan for future periods. Suppose, for example, that a bank raises capital in the initial period through convertible debt, but that the default probability in the future turns out to be higher than expected. In this case, the bank (the issuer) would convert the convertible debt to common equity, thereby reducing the default probability in the future (Stein, 1992).

Long-Run Impact: To prevent future crises, it is important to recognize the long-run effect of a restructuring plan. The moral hazard problem inherent in too-big-to-fail institutions is increased if the current punishment of managers and equity holders (and then bondholders) was small and transfers from taxpayers were large.

Undervaluation Resulting from Limits of Arbitrage

We have so far assumed efficient markets, such that market valuation $V(A)$ always coincides with the fundamental value of assets, $J(A)$ (i.e., the discounted value of future cash flows). However, the market does not always price assets at their fundamental value. Undervaluation of assets does not necessarily stem from irrational behavior of market participants. It can result from a lack of deep-pocket arbitrageurs. The price of an asset depends on liquidity constraints of market participants and can drop following negative shocks to the liquidity available for funding. Because the government is less constrained, such *limits of arbitrage* in the market may create a situation in which the market price of the asset $V(A)$ is lower than the pricing by the government $V^{GOV}(A)$. The difference in pricing creates a *motive to trade* between market participants and the government. The surplus from restructuring a bank should include this arbitrage gain to the government, $V^{GOV}(A) - V(A)$.

If indeed they are undervalued in the market, toxic assets might be bought by the government above the market price but below their fundamental value, with a net gain from the point of view of the taxpayers. The arbitrage gains are largest if the government purchases the most underpriced assets from banks. The arbitrage gains of the government are smaller if its claims in the banks or in the vehicles holding toxic assets are more debt-like than equity-like. A debt claim's payoff is capped, and therefore does not vary with the underlying asset's final payoff when it is large. By contrast, an equity claim's final payoff keeps increasing with the underlying asset's payoff, allowing the arbitrage to be large. This is also the case for a highly distressed debt instrument that behaves like an equity. If the government relies on private investors to purchase toxic assets from banks at their fundamental value, the government may use a part of the potential arbitrage gains $V^{GOV}(A) - V(A)$ as an incentive for private managers and ensure their participation.

Note that, when computing the fundamental value of an asset, the same cost of capital should be applied, whether by a private market participant or by the government. It is *not* the cost at which debt can be issued by the entity but the cost that reflects the risks of the specific asset. In the current context, both the government and market participants should value a bank at the same fundamental value $J(A)$—the sum of future profits discounted with the risk premium associated with assets, but without including a liquidity premium associated with the financing constraints of a specific entity. The arbitrage gains, if any, exist because the market participants cannot purchase at this fundamental value as a result of funding liquidity constraints, not because the fundamental value for the government is different from the fundamental value for the market participants (*the cost of capital fallacy*).

V. Participation Issues under Asymmetric Information

When the asset quality of banks is unknown to market participants but known to managers, participation in a restructuring plan tends to signal negative information about asset quality. This makes banks reluctant to participate in a plan without a high subsidy. This reluctance comes in addition to the reluctance induced by the debt-overhang problem analyzed earlier (Section III). The additional subsidy required to overcome the signaling problem can be reduced if the plan uses asset guarantees or hybrid securities rather than equity issues. A compulsory program, if feasible, reduces the taxpayer burden. Rigorous bank examination can also mitigate the problem if the results can be communicated credibly to market participants.

A. Recapitalization with Asymmetric Information on Across-Bank Asset Quality

In the presence of asymmetric information, managers have private information on the fundamental quality of their assets $J(A)$.[20] The market values the bank asset at the average quality $V(A)$. If private information could credibly be made public, high-quality banks would be valued above market value. Otherwise, the information gap remains.

Voluntary Participation

We now analyze how to induce banks to participate in a recapitalization plan. Assume there are two types of banks: one with high-quality assets and the other with low-quality assets. We focus on the case in which even banks with high-quality assets need restructuring. The default rates of low-quality banks (p_L) and high-quality banks (p_H) are both higher than the threshold level, $p_L > p_H > p^*$.[21] The goal of the government is to make sure that both types of systemically important banks achieve the target level of default probability p^* while minimizing taxpayer transfers to those banks.

When banks participate voluntarily in a restructuring plan that involves claims issued to private investors, managers of above-average banks demand high subsidies from the government. The reason is that the high-quality bank cannot signal its true value. Thus, when issuing new financial claims on assets based on the market perception, existing shareholders would bear an unfair burden: because new claim holders would price the new claims below their fundamental value, the issue would take place at a discount, at the expense of existing shareholders. This discount must be compensated for in the transfers the government provides.

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[20] How a bank evaluates securities and business loans is difficult to know. Under the current accounting rules, even securities with market prices do not need to be evaluated at the market price (they can be "marked to model"). Moreover, the composition of assets is also difficult to know, at least in real time.

[21] The assumption is not restrictive. The case in which high-quality banks are healthy (i.e., $p_H < p^*$) can be analyzed in a similar fashion.

Without a high subsidy, high-quality banks would opt out of the plan. Given this behavior, even low-quality banks would not participate in the plan. If they participated, their identity would be revealed and their assets would be valued at their true, low level $J(A_L)$. This would further increase the cost of their financial distress.[22]

Therefore, the government needs to pay a high subsidy to induce *all* banks to participate in the plan. As a result, low-quality banks would be *oversubsidized*, benefiting from an informational rent. At the same time, high-quality banks would end up *overrecapitalized* by the plan because they received the same treatment as the low-quality banks. [23]

Role of Hybrid Securities

To induce voluntary participation in a plan involving the issuance of new *equity*, the subsidy from taxpayers would have to be high. This is because the information gap between the fundamental value and the market value of the equity is large for a high-quality bank. Debt would be an ideal claim to issue, because the gap is small as a result of its flat-payoff shape.[24] Unfortunately, issuing debt is not useful, since the goal of restructuring is to decrease the default probability. However, hybrid debt-like claims can be used to decrease taxpayer costs, since their value is less sensitive to private information than equity. In addition, hybrid securities such as convertible notes, subordinated debt, and preferred shares can be (partially) counted as regulatory capital.

- *Convertible notes* can be seen as essentially "backdoor equity" if the exercise of the conversion option is mandatory or at the discretion of the holder. It is a way to issue equity while reducing the information-based cost of equity issues. For a specified period (typically, a few to several years), it has the payoffs of a debt contract and can be converted after that at the discretion of the holder into a prespecified number of equity shares. Figure 10 illustrates the final payoffs of a convertible note, with conversion at time 1 at the holder's discretion. Notations are identical to those of Section III, and D_0 denotes the initial debt's face value. The slope of the equity portion of the payoff line of

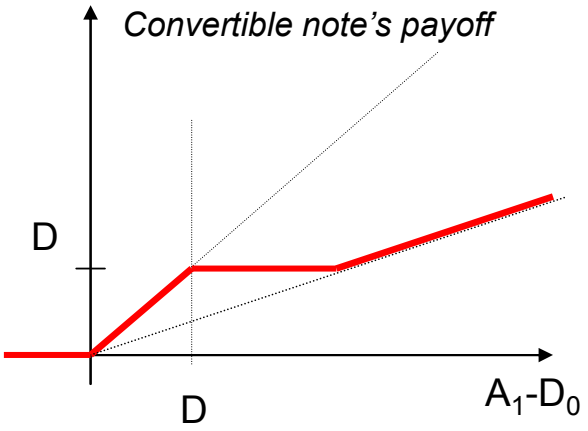
[22] Negative market perception translates into a high financing cost in the interbank market and even a possible bank run. A similar situation was analyzed first by Majluf and Myers (1984).

[23] Although it is not always possible, the government could save some informational costs by differentiating between two types of banks in a separating equilibrium in which low-quality banks self-select into equity-based recapitalization that does not attract high-quality banks. However, the costs of asymmetric information would not be removed completely, since the issuance of equity by low-quality banks occurs at a high financing cost, which would need to be compensated for. A separating equilibrium would require a menu of contracts that are quite sensitive to distributional assumptions on asset quality among banks and are difficult to implement in practice. We therefore refrain from the analysis.

[24] Debt is said to be *less information sensitive,* whereas equity is *information sensitive*.

the security on the right of the graph is proportional to the conversion ratio (i.e., the number of shares each convertible note converts into).

Figure 10. Convertible Note



Unlike the issuance of additional debt, issuing convertibles allows a decrease in the probability of default. This is because the cash raised by issuing the convertible is the value of the debt portion *plus* the equity portion of the convertible's future payoffs. If the equity portion is large enough, the amount of cash raised is larger than the promised debt payment *D*, so that the issue decreases the probability of default. The choice of the conversion ratio needs to solve a trade-off: on the one hand, the higher the conversion ratio, the lower the probability of default becomes, since more cash is raised initially; on the other hand, when the conversion ratio is lower, the payoff is flatter overall and therefore less sensitive to information on the final payoff. In line with theory, stock market reactions to convertible issues are typically much less negative than for equity issues. If the conversion is automatic after a certain time, rather than left to the discretion of the holder, the equity feature of the convertible is stronger (everything else equal). Thus the signaling cost is higher.[25]

- *Preferred shares* essentially work as a credit line: payments are fixed but can be skipped, in which case they accumulate at a certain rate. This type of claim is clearly less information sensitive than equity (because payments are fixed) but more sensitive than debt (the firm can skip payments when in distress). Therefore, the costs for initial shareholders of issuing preferred shares should be lower than for issuing common equity.

[25] If the option or timing of conversion is at the discretion of the issuer, the issuer will convert in bad times, not in good times, so that the convertible issue will lose its signaling virtues. This contrasts with the benefit under the other objective, as it is clearly a good instrument for a bank in distress, especially from a medium-term perspective (see Section II E).

Note that features of preferred shares and convertibles (or any hybrids) can be combined in practice.

Optimality of Asset Guarantees or State-Contingent Transfers

The cost of asymmetric information can be mitigated if the government proposes transfers that do not involve the issuance of new securities and that are contingent on the realization of asset values. From the point of view of asymmetric information frictions, among the restructurings considered so far, asset guarantees, either the optimal partial insurance scheme or the second-best capped transfer contingent on default, appear to dominate all restructuring plans involving the issuance of a claim on the assets. If a plan does not ask anything from banks in return, every bank will participate in the plan (*no signaling*). The government should compute A^* using the payoff distribution of the low-quality bank. By doing so, it overinsures the high-quality banks as in recapitalization cases (they will have a default probability lower than p^*), but there is no need to overtransfer to low-quality banks, unlike under recapitalization cases, in which they benefit from an informational rent (subsidy to compensate the *stigma* of issuing equity).

Compulsory Programs

The costs associated with asymmetric information stem from the need to ensure that banks voluntarily participate when participation is regarded as a bad signal about the quality of a bank's assets. However, the government does not need to use a voluntary program. Rather, it can use a compulsory program targeting a specific set of banks (e.g., mandatory equity issuance proposed by Rajan, 2008; and Diamond and others, 2008). By doing so, the government can largely mitigate the asymmetric information problem. A compulsory program, however, may need specific changes in the legislation and might not be feasible when systemic risk is imminent.

B. Asset Sales with within-Bank Adverse Selection ("Lemons" Problem)

Some bank assets are of higher quality than others, and managers have private information on their quality. If given the opportunity, banks will sell lower-quality assets. The government should factor in this behavior and pay only the price that reflects the anticipated quality of assets, which could be determined by an auction mechanism (see Ausubel and Cramton, 2008).

Balance Sheet Externalities: The price of sold assets determines the book value of bank assets (under mark-to-market accounting) and therefore the compliance of banks with regulatory solvency ratios. If a government purchases an asset at the price of low-quality assets, it may force a bank into regulatory insolvency. This is because this bank (as well as all other banks) needs to book all assets at this price. A consequence would be that all banks will write down equity or set limits on asset growth (i.e., credit crunch). This in turn justifies subsidized sales

prices. This argument has, however, no economic motive other than regulatory constraint, since rational market participants are aware that banks sell their worst assets.[26]

Correlation between the Amount of Toxic Assets and Overall Asset Quality: If a bank sells more toxic assets to the government than the average bank, market participants will infer that the bank's asset quality is below average.[27] This might create reluctance to participate in the plan as a result of the negative signal.

C. Use of Government Information

Bank Examination: If the government obtains more accurate information about bank assets from their rigorous examination (e.g., a stress test), the government can reduce the cost of any restructuring plan by disclosing the results to inform investors.

Asset Guarantee: Asset guarantees without a cap on transfers put taxpayers at risk and thus can work as a credible signal that the government is confident about the downside risk of assets. In contrast, a public statement without such a commitment would not be a credible signal. In turn, asset guarantees can convince investors to invest in the bank at a price that may not be dilutive for existing shareholders.

Caballero's Scheme and Commitment on Future Policy: Insurance on the stock price of a bank, as in Caballero's (2009) proposal, is also a way to send a credible signal about a government's confidence in the asset quality of a bank as well as future policies of the government. For example, by guaranteeing the stock price, nationalization with high dilution of shareholder value becomes a more costly option for the government. This, in turn, can make equity more valuable, especially if private investors do not believe the government's denial of future nationalization because of a time-inconsistency problem.

VI. Other Considerations

A. Political Constraints

Opportunity Cost for the Government: If the government has limited overall resources, it should take into account the restrictions that the restructuring scheme puts on other investments. In

[26] Regulatory reform is beyond the scope of this note. However, we would like to note that weakening mark-to-market accounting would intensify the degree of the asymmetric information problem. To mitigate the regulatory distortion, it would be better to design countercyclical capital-ratio regulation while keeping mark-to-market accounting.

[27] Philippon and Schnabl (2009) analyze a case in which the asset quality and future profits are uncorrelated. In this case, the problem regarding the asymmetric information on asset quality and the problem of revealing future profit opportunities are distinct from each other. If the government uses only one tool (e.g., asset purchase or recapitalization), there can be a preferable policy—recapitalization with common equity in their analysis.

addition, given political pressures and fiscal rules, the cost of mobilizing liquid resources immediately may be high (see discussions in Johnson and Kwak, 2009). In this case, preference might be given to mechanisms such as asset insurance or Caballero's scheme (insurance on new stock issues), which involve only ex post transfers. However, a credible plan on how to honor these transfers should be in place.

Political Influence on Management: If a government continues to be a major shareholder for a long period, a general problem for state-owned enterprises would emerge. Voting-rights holders are supposed to monitor management, but the government is not equipped for this function. Mismanagement would be likely to occur often, since the government lacks expertise and might be subject to political pressures concerning the bank's lending policy. This would discourage participation in a restructuring plan, if voluntary. Recapitalization by hybrids, without voting rights, would be less likely to induce this type of mismanagement. If there is little chance of selling public stakes quickly, one way to avoid the inefficiency resulting from public control is to have the government hold common equity without voting rights. However, with a large disparity between control rights and cash flow rights, another type of mismanagement may arise. For example, other shareholders might use their de facto control power to misuse the bank's profits at the expense of the taxpayers (*tunneling*). In addition, note that even without voting rights, the government (or parliament) could influence—at least partially—managerial decisions, if a bank participates in any government-led restructuring plan.

B. If Bankruptcy Is Inevitable

If the realized asset value is less than the threshold level ($A_1 < A^*$), the optimal response of the government is to let the bank go bankrupt (A^* is chosen that way). In particular, if the bank is under heavy liquidity pressure in the market or from depositors, other options may not be readily available. Still, the government should make the bankruptcy less destructive. For a typical distressed firm, private equity funds or rival firms would take over immediately. However, there is not much time for those investors to conduct due diligence for a bank. This is partly because banks are highly leveraged and may collapse quickly before the due diligence is completed. Moreover, bank assets are much more opaque, compared with the assets of firms in other industries, so that due diligence requires more time, likely a half year or more.

To carry out an orderly resolution, temporary nationalization is inevitable.[28] This strategy essentially mimics a private solution for a severely distressed firm in other industries (i.e., vulture funds). By holding a large share of common equity, the government can control the bank's management. In particular, the government can acquire all the necessary information to assess asset values and liquidity conditions more accurately and quickly. As the majority owner, the government is in a strong position to ask debt holders and other stakeholders to share the

[28] This solution is the norm for smaller banks. See also cases for systemically important banks in Japan, in particular, Long-term Credit Bank and Nippon Credit Bank (Hoshi and Kashyap, 2008).

burden. As a consequence, the government can limit the taxpayers' burden, expedite the resolution process, and sell out the bank to private investors.

If temporary nationalization is unavoidable, further discussion is needed about the scope of debt to be honored, in addition to deposits covered under deposit insurance or any other instruments covered under various insurance schemes. Even without any prearrangement, to save the payment system—at least in the short term—transaction-purpose instruments should be honored, for example, interbank market borrowings. There is less justification for honoring long-term debt. However, further discussion is needed on other transaction-purpose instruments, such as bank guarantees on securities backed by credit card debt and accounts payable.

VII. CASE STUDIES

A. Switzerland: Good Bank/Bad Bank Split in the Case of UBS

Information on Bank Asset Quality and Participation

The Swiss case in fall 2008 was relatively straightforward. There are only two systemically important banks in Switzerland. Only one of them, UBS, had substantial exposure to U.S. subprime mortgage securities by fall 2008. Therefore, the Swiss authorities focused their restructuring efforts on UBS. UBS voluntarily participated in the plan. Credit Suisse was initially offered the opportunity to participate in the same plan but declined.[29]

Overview

The plan is a combination of asset sales to an asset management fund ("bad bank") and recapitalization by convertible notes. Almost all transfers are up-front. UBS is not liable for future losses on transferred assets but keeps a partial share of its upside. There are two potential sources of subsidies: (1) the price of transferred assets could be higher than the fundamental value of the assets net of the buyback option's value, and (2) the issuance price of convertible notes could be above fundamental value.

Asset-Side Restructuring: Asset Sales

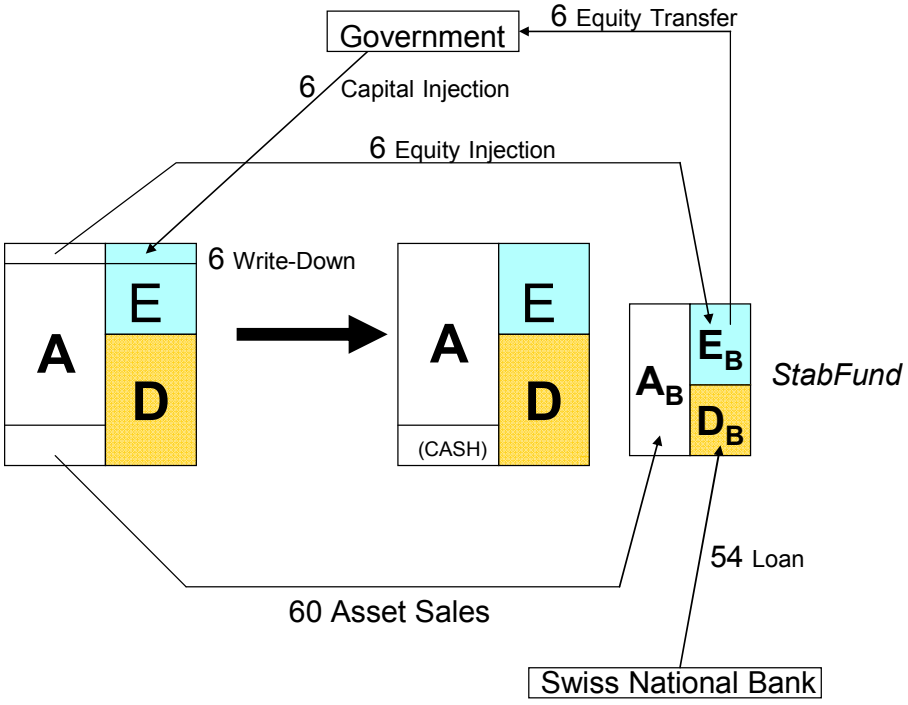
In October 2008, the Swiss authorities and UBS removed toxic assets by creating a special purpose vehicle to hold them (*StabFund*) under the Swiss National Bank.[30] The *StabFund* was to be the "bad bank," and the remainder of UBS was supposed to become the "good bank." Up to $60 billion in toxic assets was allowed to be removed from UBS, whose assets totaled almost $2 trillion at that time. UBS provided 10 percent of asset value (i.e., up to $6 billion) for the equity

[29] Credit Suisse raised $10 billion in new capital by selling equities and hybrids to private sources (including a sovereign wealth fund).

[30] The assets purchased were primarily U.S. and European residential and commercial mortgage-backed securities.

of the bad bank but immediately transferred the equity ownership to the Swiss government for $1. This would cover the first 10 percent of losses of the *StabFund*. The Swiss National Bank lent the *StabFund* additional funding, up to $54 billion at the London interbank offered rate (LIBOR) plus 250 basis points. The future loss of the *StabFund* would not be charged to UBS (*nonrecourse condition*), but UBS retained some upside option.[31] In the end, UBS transferred only $39 billion worth of its assets to the *StabFund*. The price was set by an independent valuation process.

Figure 11. UBS Restructuring (Announced Plan)
(Billions of U.S. dollars)



Liability-Side Restructuring: Recapitalization

UBS received $6 billion from the Swiss government by issuing mandatory convertible notes at 12.5 percent interest. The proceeds were intended to finance UBS's equity injection in the *StabFund*, which was immediately valued at $1. If UBS had transferred the assets limit of $6 billion, there would have been no increase in the book value of capital for UBS. However, because UBS ended up transferring only about $4 billion to the *StabFund,* UBS was able to retain $2 billion worth of capital in net.

[31] Once this loan is fully repaid by the *StabFund*, UBS can exercise its option to repurchase the fund equity by paying the Swiss National Bank $1 billion plus 50 percent of the equity value at the time of exercise in excess of $1 billion.

Corporate Governance

The UBS shareholders had already suffered through voluntary recapitalization in April 2008 by new equity issuance (rights issue) without any public help. The old management also had to exit in April 2008, at the annual general meeting of the shareholders, when UBS asked for the rights issue.[32]

B. United Kingdom: Recapitalization and Asset Guarantee for RBS and Lloyds-HBOS

Overview

The U.K. case combines recapitalization and asset guarantees. The initial state-financed recapitalization in fall 2008 of the Royal Bank of Scotland (RBS) and Lloyds-HBOS appeared to be an emergency rescue, rather than a preventive measure, since it was done after the realization of large valuation losses. On the other hand, asset protection introduced in January 2009 is a preventive measure to avoid future defaults. The government also asked the banks to continue lending to homeowners and small businesses.

Liability-Side Restructuring: Recapitalization

In the United Kingdom, by fall 2008, it became clear that RBS and HBOS were in trouble. In October 2008, the U.K. authorities decided to offer a recapitalization scheme to systemically important banks, targeting RBS and Lloyds-HBOS.[33] The government injected capital with preferred shares and ended up owning 58 percent (£20 billion) of RBS total ownership and about 44 percent (£17 billion) of Lloyds-HBOS.

Asset Guarantees Combined with Government Ownership

In January 2009, additional measures were taken. A large portion of RBS and Lloyds-HBOS assets were guaranteed (*Asset Protection Scheme*): £325 billon (14.5 percent) of end-2008 assets

[32] The first-round recapitalization by RBS was in October 2007 by convertible note issues to a sovereign wealth fund of Singapore and a private investor from the Middle East.

[33] RBS raised capital using a rights issue in April 2008, without government help. Lloyds was relatively healthy before acquiring troubled HBOS. In October 2008, as a liquidity measure, the *Credit Guarantee Scheme* was also introduced and applied to a wider set of banks. This provided insurance for debt holders and in turn lowered financing costs of banks. In January 2009, the *Asset-Backed Securities Guarantee Scheme* was introduced to complement the *Credit Guarantee Scheme,* since the latter excludes nonstructured instruments. This new scheme essentially aims to facilitate new mortgage lending, since it guarantees the value of originally AAA-rated mortgage-backed securities issued only after January 2008.

for RBS and £260 billon (23.4 percent) of end-2008 assets for Lloyds-HBOS.[34] If the valuation of assets were to fall below a particular threshold,[35] the government would compensate the loss up to 90 percent.

This guarantee was not offered for free. The insurance fees were to be paid in preferred shares. For Lloyds-HBOS, the government would own close to 50 percent of the total economic stake. For RBS, in addition to insurance fees, the government also announced an extra injection of capital through preferred shares. The government economic stake would rise to more than 80 percent. With the conversion of preferred shares to common equity, the voting rights share of the government for RBS became about 70 percent.

Corporate Governance

As the majority shareholder, the government needs to monitor bank management. Already in the October 2008 plan, the government obtained the right to appoint new independent nonexecutive directors. In addition, the government limited executive compensation and dividend payouts.

C. United States: The Geithner Plan as of May 2009

Background on the Geithner Plan

Information on Bank Asset Quality in Fall 2008

In the United States, the relative asset quality of systemically important banks was not fully known in fall 2008. The authorities needed to take into account this lack of information when they designed the first-round rescue plan at that time.

Across-the-Board Recapitalization

Given the information problem, the Treasury encouraged many banks to participate in a recapitalization program. Banks could receive cash by offering preferred shares to the Treasury. The recapitalization was across the board with few conditions.[36] This was done under the *Capital Purchase Program* as a part of the *Troubled Assets Relief Program* (Paulson Plan) in October and November 2008.[37]

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[34] As an expansion of monetary policy (i.e., liquidity injection), the *Asset Purchase Facility* was introduced in January. It was funded by the Treasury and established within the Bank of England. The Bank of England has been using it to improve corporate credit liquidity and to meet the inflation target.

[35] This is tailored to each bank. The first loss amounts (i.e., threshold) are £19.5 billon (6 percent) of protected assets for RBS and £25 billion (9.6 percent) of protected assets for Lloyds-HBOS.

[36] Some conditions (e.g., limit to executive compensation) were applied ex post.

[37] As a liquidity measure, new debt holders of Federal Deposit Insurance Corporation (FDIC) member banks were temporarily insured by FDIC under the *Temporary Liquidity Guarantee Program*. Moreover, the Federal Reserve

Targeted Restructuring for Citibank and Bank of America

An exception was made in the case of Citibank in November 2008 because of an urgent situation. Citibank received additional recapitalization as well as asset guarantees from the Treasury, FDIC, and Federal Reserve. In January 2009, both measures were formalized as the *Targeted Investment Program* and *Asset Guarantee Program,* respectively, and extended to Bank of America. Terms and conditions were determined on a case-by-case basis.

The Geithner Plan: Restructuring Based on Better Information

Overview

In February 2009, the U.S. Treasury announced a comprehensive bank restructuring plan, the Financial *Stability Plan* (Geithner Plan). The plan tries first to evaluate the asset quality of systemically important banks through a specific examination of their assets' risks (stress test or *Supervisory Capital Assessment Program*).[38] This is compulsory for the 19 largest banks. Then the plan combines recapitalization (*Capital Assistance Program*) and asset purchase using private money (*Public-Private Investment Program*). These are voluntary in principle but semivoluntary in practice, since banks must meet the required capital criteria. In addition, the plan includes several conditions to prevent misuse of public money and to facilitate lending. In addition, the plan encourages banks to promote lending, especially to small businesses and communities, and to support homeowners, especially those facing foreclosure.

Information Gathering and Communication

In early May 2009, the Treasury reported the detailed results of the comprehensive stress test (*Supervisory Capital Assessment Program*). This is a forward-looking examination of bank solvency, since it identifies how much capital is needed to cope with future adverse shocks to the asset quality of each bank. It evaluates the future downside risk further than typical bank examination. The results confirmed that the largest banks were not insolvent and determined how much extra capital was needed, if any, for each bank to weather a future adverse shock.

Liability-Side Restructuring: Recapitalization

Banks are required to raise the extra capital identified by the stress test. This compulsory feature eliminates the signaling problem described in Section III. Banks can raise capital through private markets or by participating in a government scheme, the *Capital Assistance Program.* In this

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started to lend up to $200 billion on a nonrecourse basis to holders of certain AAA-rated asset-backed securities (ABS) backed by newly and recently originated consumer and small business loans (*Term Asset-Backed Securities Loan Facility,* TALF). Banks were given incentives to increase new lending, since they would not face downside risk of valuation loss in the ABS.

[38] The authorities also plan to increase balance sheet transparency and disclosure.

program, banks will receive capital from the government by issuing preferred shares that automatically convert into common equity after seven years. An earlier conversion can be made at the issuer's discretion with the approval of the regulator. The use of such hybrid securities minimizes the future cost of financial distress should asset values deteriorate further (as discussed in Section III E). The investment of the Treasury will be managed under a separate entity (*Financial Stability Trust*).

Asset-Side Restructuring: Asset Sales

Under the asset sales scheme (*Public-Private Investment Program*), the government solicits private investors for the purchase of troubled (*legacy*) loans and securities from banks. Slightly different schemes are provided for loans and securities. However, the key idea is to utilize private expertise and solicit it by guaranteeing the future losses and providing subsidized loans.

Several funds will be set up to purchase legacy loans. Each fund will buy pools of legacy loans that are sold by banks. The price will be determined by competitive bidding by funds. In addition, inexpensive financing is available—each fund will receive 50 percent equity participation from the Treasury without voting rights and can also issue debt guaranteed by the FDIC (leverage ratio up to 6). The FDIC will supervise the funds.

In addition, several funds will be set up to purchase legacy securities from banks. Eligible securities are nonagency residential mortgage-backed securities that were originally AAA rated and outstanding commercial mortgage-backed securities and ABS that are rated AAA. The Treasury will again provide a 50 percent equity stake without voting rights and lend money to each fund at up to a 2-to-1 leverage ratio. These are nonrecourse loans: if the asset values turn out to be very low, funds can default on the Treasury, and fund managers will not have any responsibility other than their losses on their own investment in the funds.

The fact that the plan involves a government transfer is in line with our analysis of noncompulsory plans—a transfer is needed to convince banks to participate. The private sector involvement will lower the fiscal costs by utilizing private sector money as well as private sector expertise. Further evaluation of the plan requires assessment as to whether it minimizes the level of the government transfer, given the recapitalization objective. For this, it is necessary to evaluate how close the plan is to an optimal compensation scheme. There are two dimensions to consider. The first is the moral hazard problem in running the asset management funds. The government-sponsored inexpensive leverage is necessary to encourage private investors to take risks, but the risk taking might become more than optimal. The second consideration is the need to calibrate the subsidy provided to secure the participation of high-quality managers. A difficulty with the plan is estimating how the public subsidy will be shared between the banks and the fund managers (as Spence, 2009, stressed). It has been argued that the optimal subsidies could be calibrated using an auction to sell the management and cash flow rights (Bebchuk,

2009). This would require thorough preselection of qualified managers but might also set the equilibrium transfer to the banks to be less than intended.

Corporate Governance

To address potential moral hazard problems, the plan requires banks to restrict executive compensation, dividends, stock repurchases, and acquisitions. At the same time, the plan prohibits political interference in investment decisions, and the Treasury will make all contracts public.

VIII. CONCLUSION

When designing a restructuring plan for a systemically important bank, a key issue is to limit transfers from taxpayers. Essentially, this involves avoiding unnecessary subsidies to debt holders and maximizing the economic value created by the restructuring. We find that there is no magic bullet. Table 1 summarizes the pros and cons of various policy options. Some of our key findings are the following.

- In a Modigliani-Miller framework in which cash flows are independent of capital structure, restructuring is theoretically possible by converting some debt into equity. This is, however, difficult in practice.

- Without changing debt contracts, all restructuring involves transfers from the government. A plan subsidizing common equity issues and buying back debt is close to optimal. Subsidized asset sales are more costly to taxpayers, since debt holders benefit more.

- The precise design of a restructuring should take into account the value created or destroyed because of changes in the participants' behavior. Expertise and incentive of managers are concerns that should be addressed in restructuring.

- If assets are undervalued as a result of liquidity or "lemons" problems, the government can make profits by buying assets above market value but below fundamental value. A caveat is that such undervaluation is difficult to assess.

- Asymmetric information on the value of future payoffs makes equity holders reluctant to support restructurings involving new-claim issues. A restructuring impasse can be avoided through (1) conducting stress tests with credibly publicized results, (2) using compulsory rather than voluntary schemes, (3) providing contingent guarantees for banks to avoid new-claim issues, or (4) making banks issue low-information-sensitive claims such as convertible debt or preferred stocks.

- From a long-run perspective, it is important that managers and shareholders of bailed-out banks be punished in a way that discourages excessive future risk taking.

Overall, the restructuring of a systemically important bank should combine several solutions to resolve multiple concerns and trade-offs on a case-by-case basis. In fact, the case studies are in line with our analysis. Although different schemes have been used in Switzerland, the United Kingdom, and the United States, all of them employ measures both on the asset side (e.g., sales of toxic assets) and on the liability side (e.g., recapitalization with preferred shares). In addition, the speed of events appeared to be a major friction when designing restructuring plans. However, there may be room for improvement. In particular, the costs to taxpayers and the final beneficiaries of the subsidies should be more transparent in all plans. Treatment of managers and shareholders could be less favorable.

A restructuring plan cannot be judged by the stock market reaction. The reaction depends on the gap between ex ante anticipations and the announced plan—anticipated transfers may be larger or smaller than those in the announced plan. Moreover, even if the announcement comes as a surprise, a stock price increase may not be good news. On the one hand, it may suggest an increase in surplus, both private (e.g., reduction in the cost of financial distress) and social (e.g., stabilization of the financial system). On the other hand, it may also suggest too high a transfer to shareholders from taxpayers. In the case of compulsory plans, a good plan may clearly be associated with a decrease in stock prices as shareholders are forced to take some responsibility.

In the long run, various frictions can and should be reduced to make systemic bank restructuring less complex and less costly. Specifically, a better legal framework should be designed, so that the renegotiation of debt can be handled more quickly and with a smaller threat of systemic meltdown. For example, opacity can be reduced by more timely and in-depth disclosure requirements for bank asset information and counterparty exposures. Regulation can give banks more incentives to include conversion clauses in their long-term debt contracts, so that such debt will automatically convert into equity in a distress situation.

Table 1. Pros and Cons of Various Policy Options 1/

	Constant Surplus		Endogenous Surplus 2/			Future Concerns 2/		Other Concerns	
	First Best	(Honoring Debt Contracts)	Talent Allocation	Moral Hazard	Adverse Selection 3/	Near Future Distress	Long-Run View Punishment	Regulatory Requirement	Upfront Taxpayer Cost
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Non-state-contingent measures									
Debt-for-equity swap	+	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	+	−
Recapitalization (with debt reduction)									
With common equity	n.a.	+			−			+	−
With convertible notes									
(Holder converts or mandatory)	n.a.	+						+	−
(Issuer converts)	n.a.	+			−	+		+	−
With preferred share	n.a.	+				+		+	−
With subordinated debt	n.a.	+						+	−
Asset purchase (Either via asset management company or good bank/bad bank)	n.a.	−	+					−	−
State-contingent measures									
Limited loss guarantee on asset for banks	n.a.	+		−	+		+		+
Loss guarantee on liability for liability holders	n.a.	+		−	+		+		+
Recapitalization with loss guarantee on equity Only for new equity holders (Caballero)	n.a.	+			−		+	+	+
Good/bad bank split with recourse condition With loss paid by equity of good bank (Sachs)	n.a.	−	+	−			+	−	+

1/ + indicates the restructuring plans that are worth considering while − indicates those that should be avoided.

2/ Assessment is made for the cases without renegotiating the debt contracts.

3/ Assessment is based on voluntary plans. Compulsory plans can eliminate this problem. Also, the government can mitigate this problem with rigorous bank examination.

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