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**Comments on
Proposal to ensure the loss absorbency of regulatory capital at the point of
non-viability**

Consultative Document of the Basel Committee on Banking Supervision, August 2010:

1. Introduction

1. The Basel Committee is certainly right in its finding that, in the financial crisis of the past few years, government support has pre-empted the loss absorption function of many securities that had counted as Tier 2 or even Tier 1 capital. The Basel Committee is also right in its assessment that this experience has worrisome implications for the interplay of bank finance and bank governance in the issuance of these securities and for their treatment as part of the regulatory capital of banks.
2. I fully support the basic principle underlying the Basel Committee's proposal, namely that only securities that are there to absorb losses should be counted as part of regulatory capital. Any strengthening of the loss absorption function of securities that are counted as part of regulatory capital must be welcomed. To the extent that, in the financial crisis, this function was impaired by a lack of frictionless procedures for invoking the loss absorption function, the Committee's proposal goes in the right direction.
3. This being said, I am not convinced that the proposal will achieve its objective. I see several weaknesses:
 - Insufficient account is taken of the political economy of government interventions in support of banks.
 - I am not convinced that the proposed mechanism for triggering conversion of hybrid securities into common stock will work.
 - There are a number of open questions concerning the details of the actual arrangements in the event of conversion.
4. In the following, I will discuss these points in turn. I will also provide a critical discussion of the Basel Committee's discussion of the impact of the proposal on the incentives of the different participants.

2. Political Economy of Government Interventions

5. In the analysis of the Consultative Document, the fact that Tier 1 and Tier 2 capital were not made fully liable for losses appears as a kind of accident: In order to forestall another Lehman event, governments had to provide support quickly, without taking the time to negotiate proper burden sharing with the holders of Tier 1 and Tier 2 securities, let alone go through the legal proceedings that would have been required to convert hybrid securities into equity. As they did, the funds and the guarantees that taxpayers were made to put up reduced or even eliminated the losses that holders of Tier 1 and Tier 2 hybrid securities, or even shareholders, would have had to bear without government support. The Consultative Document seems to suggest that this outcome, which was expensive for taxpayers and which undermines the loss absorption function of capital, would have been avoided if smoother procedures had been available to call on the loss absorption function of hybrid capital.
6. I agree with the assessment that it would be highly desirable to have smoother procedures. In particular, I agree with the assessment that a reform of bank resolution procedures is highly desirable. Such a reform must aim towards uncoupling the resolution of the claims of different securities from the “resolution”, winding down or continued operation under another name, of the bank’s financial activities. Unfortunately, I also have to agree with the assessment that such a reform is unlikely to come any time soon. Even when it does come at the national level, there is still the matter of international recognition, co-ordination, and, to some extent, harmonization of bank resolution procedures to be dealt with. On this matter, progress seems a long way off.
7. However, I disagree with the view that the lack of proper resolution procedures was the only factor – or even the main factor – behind the bailouts of hybrid-security holders that we have seen. In some cases, protection of the hybrid-security holders themselves seems to have been a major objective of government interventions. Hypo Real Estate in Germany is a case in point. According to an interview with Mr. Rehm, the Chairman of Soffin, that Frankfurter Allgemeine Zeitung published on March 15, 2009, government protection of Hypo Real Estate was needed in order to protect (i) holders of “Pfandbriefe”, and thereby the instrument of the “Pfandbrief” itself and (ii) holders of unsecured loans amounting to some 100 bn. EUR; these holders included social retirement systems and churches. In the years prior to the crisis, low rates of return on long-term securities had induced many private and institutional investors to accept risk from unsecured and subordinated debt in order to obtain a return that would be somewhat closer to the rates of return that they had been used to in the past. The Rehm interview suggests that protection of these investors was a major concern of the government. A government’s providing such protection runs precisely counter to the philosophy of the Consultative Document.
8. Given this observation, I am not convinced that the Basel Committee’s proposal will achieve its objective. To be sure, there is an automatic trigger for conversion of hybrid capital into equity. However, the existence of such a trigger does not alter the political economy of government intervention in favour of certain classes of investors. Unless the legal and contractual rules are designed in such a way that conversion clauses *have to be* triggered before the first euro of taxpayer money is used, when push comes to shove, governments will find ways to circumvent the rules.

9. Under the given proposal, such circumvention might occur by having the government provide funding *in advance of* the triggering event. Whereas the Consultative Document makes automatic conversion of hybrid securities into common equity contingent upon a declaration by the regulator, it does not say anything about funds that the government might put in before such a declaration.
10. Within the European Union, the problem is to some extent reduced by the need to get the European Commission's approval of the state aid that is involved. However, in the wake of the financial crisis, the European Commission has been less concerned with preventing bailouts of undeserving (?) holders of securities than with preventing the continued operation of problem banks from distorting competition in the Common Market. State-aid control by the European Commission is thus not well suited to handling the concerns about bailouts of hybrid-security holders that are expressed in the Consultative Document. In any case, at a more general level internationally, there is not even an EU-type control of state aid.
11. To sum this point up: The Consultative Document is not exhibiting any mechanism that would effectively commit governments to not bailing hybrid-security holders out.

3. Specification of the Trigger

12. The proposal puts a lot of responsibility on the regulatory authority pulling the trigger. I am not convinced that regulatory authorities are in a position to perform this task effectively.
13. In a crisis situation, the regulatory authorities will be under tremendous pressure *not* to pull the trigger. This pressure will come not only from the banks themselves but also from the political authorities. The spectre of a new Lehman event will be raised by all interested parties. The holders of the affected securities will also raise questions about legal liability for any damages that they may suffer when the trigger is being pulled.
14. In the proposal, the trigger is conditioned on the regulatory authority finding that, without a suitable injection of capital or a suitable write-off, the institution would become nonviable. Assessments of nonviability involve an exercise of judgment based on a mixture of hard and soft facts. The soft facts leave room for interpretation – and hence for lobbying to make the authority see things in a more optimistic light. In this context, it is worth recalling that, in the financial crisis, supervisory authorities were quite slow to pull any triggers at all. Many problem banks stayed in business until their refinancing broke down.
15. To avoid a repetition of this experience, it seems desirable to introduce an extraneous indicator into the trigger mechanism. One such indicator might be the price of a credit default swap on the bank's junior long-term debt, as proposed by Hart and Zingales, A New Capital Regulation For Large Financial Institutions (<http://www.economics.harvard.edu/faculty/hart/files/ANewCapitalRegulation-8-2010.pdf>). In their analysis, an intervention mechanism is triggered once the price of the credit default swap on junior long-term debt exceeds a certain threshold and the regulatory authority confirms that the intervention mechanism should be put into operation. The intervention mechanism they envisage differs from the conversion of

hybrid securities considered here, but the notion of an extraneous trigger is applicable here as well as in their analysis.

16. As explained by Hart and Zingales, reliance on the price of the credit default swap only would raise the possibility of a bear raid designed to weaken the position of the bank, possibly with a view to gaining control against the wishes of management and incumbent shareholders. This is why they suggest that the trigger be conditioned on both, the extraneous indicator and the declaration of the regulatory authority.
17. There is a question, however, as to how these two components of the trigger mechanism would interact in practice. On the one hand, the regulatory authority's intervention is needed to avoid susceptibility to a bear raid. This intervention must involve an element of discretion. On the other hand, the extraneous indicator is needed to relieve some of the pressures under which the authority would be operating. Clearly, there is a tradeoff: The more discretion the authority has in affirming that the trigger needs to be pulled, the more susceptible it will be to political pressures. The less discretion it has, the greater is the danger of a bear raid.
18. In this context, it may be useful to think in procedural terms, allocating the burden of proof in legal proceedings on whether the authority's decision accords with the extraneous indicator or not: If the extraneous indicator exceeds the alarm threshold and the authority intervenes, then, in any legal proceedings, it is incumbent on the plaintiffs to give evidence why the intervention was inappropriate; if, in this situation, the authority fails to intervene, it is up to the authority to provide a sufficient reason why it remained inactive even though the alarm had rung. If the extraneous indicator does not hit the alarm threshold, allocation of the burden of proof would be just the opposite: The authority would have to show why they did intervene if they did, a plaintiff would have to show why the authority should have intervened if it didn't.

4. How Does Conversion Work?

19. The Consultative Document leaves the conversion rate open and merely mentions different possibilities such as zero conversion despite a full write-off or conversion into a high number of shares.
20. This raises several questions. First, how and when are conversion rates determined? Presumably, the rules for determining conversion rates must be chosen at the time of contracting, ex ante, but then the question is how to take account of the information that is available at the time of the trigger event, when the conversion occurs. Is the determination of such rules to be left to private contracts? Is this going to be subject to statutory regulations setting conditions for the inclusion of such securities in Tier 1 or Tier 2 capital?
21. Second, when multiple securities are involved, how will differences between the different securities that count against Tier 1 and Tier 2 capital be handled? Will there be a different triggering event for each security or will there be a single triggering event requiring conversion of all of them at once? How will differences in priority rankings between these securities be handled?

22. There may be a temptation to leave these matters to private contracting in order to gain some experience with how the proposed system will work. Against this temptation, I warn that there is a significant need for standardization. Standardization is useful for the markets in which these securities are traded. It is also important in order to reduce legal uncertainty and frictions arising if ever the trigger is pulled and a conversion is imposed on security holders. Legal uncertainty at this time would run counter to the very purpose of the proposal made in the Consultative Document.
23. Mentioning legal uncertainty, I wish to point out that the relation of the proposed regime to insolvency law must be clarified. Under insolvency law, there is a clear ranking so that, to take the simplest constellation, senior debt is served first, then junior debt is served, and finally shareholders get whatever is left. If available assets do not suffice to satisfy all creditors, shareholders get nothing, and the lowest priority class of creditors get whatever is left after all creditors ahead of them have been served. In this setting, conversion of low-ranking debt into equity is accompanied by the elimination of incumbent shareholders; they are completely wiped out, and low-ranking debt holders take their place. The Consultative Document's discussion of conversion rates suggests to me that, under the proposed procedure, these priority rankings will not be preserved; otherwise the case of zero compensation would not be mentioned as one possibility.
24. Given the potential discrepancy between the proposed regime and the rules stipulated by most insolvency laws, the relation between the two legal regimes ought to be made clearer. Otherwise, the difference may give rise to legal conflict. To see the issue, suppose that a bank is insolvent. The regulatory authority stipulates a conversion, presumably with the idea that this will keep the bank viable. In fact, this is not enough to keep the bank afloat, and it ends up in insolvency anyway. The holder of a hybrid security find that he would have been better off if the bank had gone into insolvency right away, giving him priority over incumbent shareholders. He will then want to sue the authority for damages because its intervention has deprived him of the rights he would have had in insolvency proceedings. .
25. The Consultative Document is silent on possible implications of the proposal for corporate governance. There are solid reasons why changes in corporate control play a key role in insolvency law. Neglect of this aspect of how to deal with banks in difficulties – and of its interaction with the proposed changes – seems like an gap in the proposal. The gap is important because some of the more wasteful episodes of recent banking history have involved bank executives denying that their bank was in trouble so as to prevent a change of control. The forbearance with which the US Savings and Loans Institutions were treated in the early eighties provides a case in point.

5. Potential Impact of the Proposal on Incentives

26. Speaking as someone whose original specialization lies in economic theory, I find Section 4 of the Consultative Document to be very theoretical, with some imprecision in the analysis and hardly any concern for empirical relevance. The basic argument boils down to the assertion that, under the proposed automatic-conversion regime for securities that count as Tier 1 or Tier 2 capital, bank shareholders will prevent bank management from taking excessive risks because either the buyers of these securities

will condition the rates they want on the prospect of failure, or the shareholders must fear the dilution of their positions in the event of conversion. I do not find this argument convincing.

27. First, the argument presumes that shareholders are actually in control. This is incorrect. Control is in the hands of bank management. Bank management may be guided by concerns about shareholder value, but this does not mean that shareholders are actually in control. At most, shareholders exert an indirect influence as they decide to buy or sell shares, and the stock market price as a measure of shareholder value is a concern for management.
28. Second, for the version of the proposal that involves high conversion rates, I fail to see why the automatic-conversion regime that is being proposed should be any more successful in making shareholders concerned about risk than an ordinary insolvency regime would. Indeed, as long as “dilution” of incumbent-shareholder positions is less than the total wipe-out under insolvency law, I would expect such concerns to be less than under insolvency law, i.e., there is bound to be excessive risk taking. With high conversion rates, shareholder incentives to avoid risk taking under the proposed regime will be weaker than they are under any other regime that does not provide them with protection. A strengthening of these incentives can only be presumed if the standard of comparison involves government support coming to the aid of incumbent shareholders as well as the holders of hybrid securities that count as Tier 1 or Tier 2 capital. This standard of comparison, however, does not seem to be what the Consultative Document presumes.
29. Third, for the version of the proposal that involve zero shares, i.e. a write-off of hybrid securities without compensation, the argument presumes that shareholders, presumed to be in control, worry about funding costs which they see as adapting rapidly to the riskiness of the bank’s strategy. The Consultative Document here seems to be accepting the “Debt-Provides-Discipline” theory of Calomiris and others without taking account of the fact that the theoretical basis for this theory is extremely weak, involving only models in which there is no stock market and no form of market discipline by “shareholder value”, and without taking account of the fact that the experience of the years prior to the crisis provides convincing evidence against the theory. In joint work with Anat Admati, Peter DeMarzo, and Paul Pfleiderer of Stanford University (<http://papers.ssrn.com/abstract=1669704>) we have thoroughly discussed the matter. Therefore, I merely sketch the main points of the argument here. For references to other authors, I refer to the paper.
30. In the first place, the argument given for the case of zero shares raises the question of what is the maturity of the securities in question and what is the average turnover rate per period. For the incentives considered in the Consultative Document to be fully effective, the average turnover rate should be high, i.e., the average maturity should be low. If hybrid securities have to be rolled over frequently, investors have a chance to adapt their financing decisions to the risk taking that they observe. This would in fact correspond to the original Calomiris-Kahn analysis of deposit finance as a mechanism of market discipline. With short maturities, however, the system is very fragile, as we have learnt in the crisis. To be sure, fragility can be reduced by having long maturities; this has been suggested among others by W. Poole. However, this suggestion neglects that whatever incentive effects are expected from investor decisions in the process of renewing their investments will be weakened if maturities are long and conditions on

the bulk of the hybrid capital are fixed for significant period of time. I have yet to see a satisfactory analysis of this trade-off in the literature.

31. Leaving aside the concern that discipline by debt comes at a cost in terms of fragility, there also is a question about who has what information. The “debt-as-discipline” theory assumes that debt holders are particularly well informed. Debt holder incentives to spend resources on information have been studied in models without stock markets, but not in models in which the bank also has outstanding shares and these shares are traded in the market. There are good reasons to believe that in a setting with both shares and debt, shareholders have greater incentives to invest in information than debt holders and debt holders have an incentive to free-ride on the information contained in the stock price. The reason is that equity returns are much more sensitive to news. Returns to debt depend on news only if there is a question about solvency. Otherwise, the bank just services the debt, and the debt holder can sleep quietly without worrying too much. He may also feel that the stock price, which aggregates the information collected by shareholders, provides enough of a clue as to what is going on so that he need not invest in information himself. If the stock price goes down, that will be soon enough to worry.
32. With a side-by-side of shareholders and debt holders as described, debt holders will not impose much discipline in the upturn. As they see share prices rising, they assume that things are going sufficiently well so that they do not need to worry. They will intervene and exert discipline by asking for haircuts on collateral, higher rates, or even refusing to lend altogether when share prices are declining and they appreciate that there is a problem. This is too late, however, to prevent management from engaging in a risky strategy that benefits shareholders (and themselves) at the expense of greater default risk. By the time the risks are recognized, the positions have been built up and cannot be eliminated from one day to the next. The experience of 2004 – 2007 and then again 2007 – 2009 illustrates the problem very well. I consider it scandalous that, in 2010, we have discussions of discipline by debt holders that completely ignore the experience of these years.
33. Going back from theory to political economy, if the holders of hybrid securities expect to be bailed out by the government, they will not even think about exerting discipline. I appreciate that the Basel Committee is well aware of this problem and that the proposal of the Consultative Document stems from this. However, as mentioned above, I am sceptical about the reliability of the proposed mechanism as a means of precluding new bailouts.
34. Underlying the experience that we have had is a constellation with a flush of savings putting pressure on long-term interest rates globally. This poses a problem for investors who want to fund expenditures from interest income. Rather than cutting expenditures, they will be tempted to go for securities offering higher yields, without fully appreciating the risks involved. Yield panic among investors is not a good basis for imposing discipline on borrowers. If these are investors with sufficient political clout, we are back to the political economy problem.

6. Summary

- 35. I agree with the Basel Committee's objective, but, for the reasons indicated in these comments, I am sceptical about the scope for achieving it. The proposal is a valiant attempt, but I do not believe that it will work.
- 36. This being said, I am fully in favour of imposing restrictions on the specifications of the securities that will be counted as Tier 1 or Tier 2 capital.
- 37. In the long run, the Basel Committee should consider going further and considering only equity as capital. This would avoid all questions about how to make effective the loss absorption function of other securities that are currently treated as Tier 1 or Tier 2 capital.
- 38. I appreciate that there is strong political resistance against such a development. Most of the arguments that are given, however, do not have a firm grounding in economic analysis. My joint paper with Admati, DeMarzo, and Pfleiderer discusses the matter in detail; I believe that Anat Admati will have some comments of her own, in which she spells these matters out.

Bonn, October 1, 2010,

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**Fallacies, Irrelevant Facts, and Myths
in the Discussion of Capital Regulation:
Why Bank Equity is *Not* Expensive**

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Martin F. Hellwig
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This draft, September 30, 2010

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This draft September 30, 2010

Comments Welcome

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Abstract

We examine the pervasive view that “equity is expensive,” which leads to claims that high capital requirements are costly and would affect credit markets adversely. We find that arguments made to support this view are either fallacious, irrelevant, or very weak. For example, the return on equity contains a risk premium that *must* go down if banks have more equity. It is thus incorrect to assume that the required return on equity remains fixed as capital requirements increase. It is also incorrect to translate higher taxes paid by banks to a *social* cost. Policies that subsidize debt and indirectly penalize equity through taxes and implicit guarantees are distortive. Any desirable public subsidies to banks’ activities should be given directly and not in ways that encourage leverage. Finally, suggestions that high leverage serves a necessary disciplining role are based on inadequate theory lacking empirical support.

We conclude that bank equity is *not* socially expensive, and that high leverage is not necessary for banks to perform *all* their socially valuable functions, including lending, taking deposits and issuing money-like securities. To the contrary, better capitalized banks suffer fewer distortions in lending decisions and would perform better. The fact that banks choose high leverage does not imply that this is socially optimal, and, viewed from an *ex ante* perspective, high leverage may not even be privately optimal for banks.

Setting equity requirements significantly higher than the levels currently proposed would entail large social benefits and minimal, if any, social costs. Approaches based on equity dominate alternatives, including contingent capital. To achieve better capitalization quickly and efficiently and prevent disruption to lending, regulators must actively control equity payouts and issuance. If remaining challenges are addressed, capital regulation can be a powerful tool for enhancing the role of banks in the economy.

Keywords: capital regulation, financial institutions, capital structure, capital regulation, “too big to fail,” systemic risk, bank equity, contingent capital, Basel.

JEL classifications: G21, G28, G32, G38, H81, K23.

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Executive Summary

There is a pervasive sense in discussions of bank capital regulation that “equity is expensive” and that equity requirements, while beneficial, also entail a cost. The arguments we examine, which represent many of those most often made in this context, are fallacious, irrelevant, or very weak. Our analysis leads us to conclude that *significantly* higher equity requirements entail large social benefits and minimal, if any, social costs. We list below some of the arguments made against high equity requirements and explain why they are either incorrect or unsupported.

Some common arguments made against significantly increasing equity requirements:

- *Increased equity requirements would force banks to “set aside” or “hold in reserve” funds that can otherwise be used for lending.* This argument confuses liquidity requirements and capital requirements. Capital requirements refer to how banks are funded and in particular the mix between debt and equity on the balance sheet of the banks. There is no sense in which capital is “set aside.” Liquidity requirements relate to the *type* of assets and asset mix banks must hold. Since they address different sides of the balance sheet, there is no immediate relation between liquidity requirements and capital requirements.
- *Increased equity requirements would increase banks’ funding costs because equity requires a higher return than debt.* This argument is fallacious, because the required return on equity, which includes a risk premium, must decline when more equity is used. Any argument or analysis that holds fixed the required return on equity when evaluating changes in equity capital requirements is fundamentally flawed.
- *Increased equity requirements would lower the banks’ Return on Equity (ROE), and this means a loss in value.* This argument is also fallacious. The expected ROE of a bank increases with leverage and would thus indeed decline if leverage is reduced. This change only compensates for the change in the risk borne by equity holders and does not mean that shareholder value is lost or gained. Shareholders willing to take additional risk can increase their average return by buying stock on margin.
- *Increased equity requirements would increase banks’ funding costs because banks would not be able to borrow at the favorable rates created by tax shields and other subsidies.* It is true that, through taxes and implicit guarantees, debt financing is subsidized and equity financing is effectively *penalized*. Policies that encourage high leverage are distorting and paradoxical, because high leverage is a source of systemic risk. The subsidies come from public funds. If some activities performed by banks are worthy of public support, subsidies should be given directly to those activities.
- *Increased equity requirements would be costly since debt is necessary for providing “market discipline” to bank managers.* While there are theoretical models that show that debt can

sometimes play a disciplining role, arguments against increasing equity requirements that are based on this notion are very weak. First, high leverage actually *creates* many frictions. In particular, it creates incentives for banks to take excessive risk. Any purported benefits produced by debt in disciplining managers must be measured against frictions created by debt. Second, the notion that debt plays a disciplining role is contradicted by the events of the last decade, which include both a dramatic increase in bank leverage (and risk) and the financial crisis itself. There is little or no evidence that banks' debt holders provided any significant discipline during this period. Third, many models that are designed to attribute to debt a positive disciplining role completely ignore the potential disciplining role that can be played by equity or through alternative governance mechanisms. Fourth, the supposed discipline provided by debt generally relies upon a fragile capital structure funded by short term debt that must be frequently renewed. Reduced fragility, which is a key goal of capital regulation, would be at odds with the functioning of this purported disciplining mechanism. Finally, one must ask if there are no less costly ways to solve governance problems.

- *Increased equity requirements would force or cause banks to cut back on lending and/or other socially valuable activities.* First, higher equity capital requirements do not mechanically limit banks' activities, including lending, deposits taking and the issuance of liquid money-like securities. Banks can maintain all their existing assets and liabilities and reduce leverage through equity issuance and the expansion of their balance sheets. That said, because equity issuance improves the position of existing creditors, and may also be interpreted as a negative signal on the bank's health, banks might privately prefer to pass up lending opportunities if they must fund them with equity. However, this "debt overhang" problem can be alleviated if regulators require undercapitalized banks to recapitalize quickly by restricting equity payouts and mandating new equity issuance. Once better capitalized, banks would make better lending and investment decisions, because they would have reduced incentives to take excessive risk and indeed would be less affected by distortions due to debt overhang.
- *The fact that banks tend to fund themselves primarily with debt and have high levels of leverage implies that this is the optimal way to fund bank activities.* It does not follow that just because financial institutions choose high leverage, this form of financing is privately or socially optimal. Instead, this observed behavior is the result of factors unrelated to social concerns, such as tax incentives and other subsidies, and to frictions associated with conflicts of interests and inability to commit in advance to certain investment and financing decisions.

Recommendations

- *Recognizing, as we have argued, that bank equity is not expensive, regulators should use equity requirements as a powerful, effective, and flexible tool with which to maintain the health and stability of the financial system.* High leverage is *not* required in order for banks

to perform all their socially valuable functions, such as providing credit and creating deposit services. High leverage is in fact quite harmful to their ability to do so and leads to socially suboptimal lending decisions.

- *Regulators should routinely use restrictions on equity payouts and the removal of discretion with respect to equity issuance to help banks, and to assure that they achieve and maintain adequate equity capitalization.* Prohibiting, for a period of time and for all banks, any dividends and other equity payouts, and possibly imposing equity issuance on a pre-specified schedule, is an efficient way to help banks build their equity capital quickly and efficiently without leading to the contraction of credit. If done under the force of regulation, withholding payouts or issuing additional equity would not lead to negative inferences about the health of any particular bank. It would also alleviate the debt overhang distortion that might lead banks to reduce lending.
- *If certain activities of the banking sector are deemed to require subsidies, then subsidies should be given in direct ways that alleviate market frictions and not through a system that encourages high leverage.* Tax shields and implicit government guarantees subsidize debt finance and effectively penalize equity as a form of financing banks. This policy is undesirable given the systemic risk and additional frictions brought about by high leverage.
- *Better resolution procedures for distressed financial institutions, while necessary, should not be viewed as alternatives to having significantly better capitalized banks.* Since such procedures are not likely to eliminate the cost of financial distress, reducing the likelihood that a resolution procedure is needed is clearly important, and higher equity requirements are the most effective way to do so.
- *Higher equity requirements should be considered superior to a “bailout fund” supported by bank taxes.* While charging banks upfront potentially could remove the subsidy associated with bailouts, failure to properly adjust the tax to the risk of individual banks could create significant distortions in bank lending and investment. Equity requirements, as a form of self-insurance, would be priced directly by financial markets.
- *Approaches based on equity are superior to those that allow contingent capital to be considered part of capital regulation, because there does not seem to be a compelling case that contingent capital has social value relative to equity.* Contingent capital is complicated to design and to value. Preserving the tax benefits of debt is not a legitimate reason for the “debt-like” feature of contingent capital, and the potential role of contingent capital in resolving any frictions has not been established. Simple approaches based on equity would provide more reliable cushions.

1. Introduction

As the financial crisis of 2007-2008 has compellingly shown, highly leveraged financial institutions create negative externalities. When a bank is highly leveraged, even a small decrease in asset value can lead to distress and potential insolvency. In a deeply interconnected financial system, this can cause the system to freeze, ultimately leading to severe repercussions for the rest of the economy.¹ To minimize social damage, governments may feel compelled to spend large amounts on bailouts and recovery efforts. Even when insolvency is not an immediate problem, following a small decrease in asset values, highly-leveraged banks may be compelled to sell substantial amounts of assets in order to reduce their leverage; such sales can put strong pressure on asset markets and prices and, thereby, indirectly on other banks.

Avoidance of such “systemic risk” and the associated social costs is a major objective of financial regulation. Because market participants, acting in their own interests, tend to pay too little attention to systemic concerns, financial regulation and supervision are intended to step in and safeguard the functioning of the financial system. Given the experience of the recent crisis, it is natural to consider a requirement that banks have significantly less leverage, i.e., that they hold relatively more equity to absorb inevitable variations in asset values.

A pervasive view that underlies most discussions of capital regulation is that “equity is expensive,” and that equity requirements, while having substantial benefits, also impose costs on the financial system. Bankers have mounted a campaign against increasing equity requirements. Policy makers and regulators are particularly concerned by assertions that increased equity requirements would restrict bank lending and would impede economic growth. Possibly as a result of such pressure, the proposed Basel III requirements, while moving in the direction of increasing capital, still allow banks to remain very highly leveraged.² We consider this very troubling, because, as we show below, the view that equity is expensive is flawed in the context of capital regulation.

We will examine various arguments that are made to support the notion that there are social costs, and not just benefits, associated with increased equity requirements. Our conclusion is that the social costs of *significantly* increasing equity requirements for large financial institutions would be, if there were any at all, very small. All the arguments we have encountered that suggest otherwise are very weak when examined from first principles and in the context of optimal regulation. They are based either on fallacious claims, on a confusion between private costs to banks and social costs to the public, or on models that are inadequate from both a theoretical and an empirical perspective.

¹ Similar observations are made, for example, Adrian and Shin (2010) and Adrian and Brunnermeier (2010).

² The proposed requirements set minimal equity levels to be between 4.5% and 7% of “risk weighted” assets.

The discussion is often clouded by a confusion between capital and liquidity requirements. This confusion has resulted in routine references in the press to capital as something banks must “set aside” or “hold in reserve.”³ Capital requirements refer to how banks are funded and in particular the mix between debt and equity on the balance sheet of the banks. There is no sense in which capital is “set aside.” Liquidity requirements relate to the *type* of assets and asset mix banks must hold. Since they address different sides of the balance sheet, there is no immediate relation between liquidity requirements and capital requirements. The discussion that follows is focused on capital requirements.

We begin by showing that equity requirements need not interfere with any of the socially valuable activities of banks, including lending, deposit taking, or the creation of “money-like” liquid securities that investors value. In fact, banks’ ability to provide social value might be *enhanced* by increased equity requirements, because they would be likely to make more *economically appropriate* lending decisions, since, among other things, better capitalized banks are less inclined to make excessively risky investments that benefit shareholders and managers at the expense of debt holders or the government.

Despite the fact that equity has a higher required return than debt because it is riskier, the use of more equity funding need not change the overall funding cost of banks. A bank that uses more equity financing lowers the riskiness of its equity (and perhaps also of its debt). Unless those who fund the bank are fooled so that securities are mispriced, simply shifting the way that risk is borne by different investors need not have any direct effects on the overall funding cost of the bank.⁴

Various distortions and frictions in the economy do affect banks’ cost of debt and equity finance. Some of the most important frictions and distortions are actually created by public policy. For example, most tax systems give an advantage to debt financing and penalize equity financing. Some of the arguments against higher equity capital requirements are based on the “costs” banks would incur if they had to give up some of this subsidized debt financing. From a public policy perspective these arguments are wrong since they inappropriately focus on private costs to the bank rather than social costs. Ideally, taxes should be structured to minimize the

³ For example, the *Wall Street Journal* reported on September 13, 2010 (“Banks Get New Restraints,” p. 1) that as a result of the proposed capital requirements banks would face “... tougher requirements on the capital they are required to hold in reserve to guard against future losses.” The *New York Times* editorial on September 14 also stated that “...banks will ... try to ...reduce the amount of capital they must set aside.” These statements are erroneous in reference to capital requirements; Basel III liquidity requirements have yet to be announced.

⁴ These observations constitute some of the most basic insights in corporate finance. Yet, numerous statements in the policy debate on this subject fail to take them into account and therefore are based on faulty logic. Thus, in many studies of the impact of increased equity requirements, including, for example, BIS (2010), the required return on equity is taken to be a constant number; yet this required return *must* go down if banks have more equity. While the fact that the required return would fall is mentioned in the text of BIS (2010), the empirical analysis still assume a constant required return on equity, and this rate is also used inappropriately in other parts of the study. The study by IIF also suffers from such shortcomings.

overall distortions they induce, which means that they should encourage behavior that generates positive externalities and discourage behavior that generates negative externalities. A tax system that encourages banks to take on socially costly excessive leverage is highly distortionary and dysfunctional. If the banking system needs to be subsidized, more effective and less costly ways must be found to do that. Taking the tax code as given is inappropriate in this context; all relevant aspects of public policy should be considered.

Implicit government guarantees associated with a “too big to fail” status constitute another distortion that favors debt over equity financing for many financial institutions. This phenomenon has been dubbed “privatization of profits and socialization of costs,” and banks benefit from it by being able to borrow more cheaply than they otherwise would. Although politicians are fond of saying that bailouts should *never* happen, it is impossible, and not even desirable, for governments to *commit* to never bail out a financial institution. It is true that fully charging banks for the guarantees would remove this subsidy, but it is extremely difficult for the government to do this, and incentives to take excessive risk remain a problem with any type of insurance plan. A more prudent approach is to require banks to have significantly less leverage, so as to lower the social cost associated with any implicit (or underpriced) guarantees and to minimize the likelihood of bank failure that would necessitate resolution or bailout. Again, if subsidizing banks is desirable, the government should find other, more direct ways, to do so without directly encouraging leverage.

Some have argued that higher equity capital requirements would be costly because debt plays a positive role in reducing frictions due to governance and asymmetric information. For example, it has been suggested that debt serves as a “disciplining device” to prevent managers from wasting or diverting funds. Short term debt, or long term debt when some of it needs to be renewed periodically, is said to provide “market discipline” because the fear that it might be withdrawn or not renewed leads managers to act more in line with the preferences of creditors, and even avoid taking excessive risk. Our assessment is that the theoretical and empirical foundations of these claims are very weak, and that the models that are used to support them are simply inadequate for guiding policy regarding capital requirements. Among other things, leverage in fact *creates* significant frictions and governance problems that distort the lending and investment decisions of financial institutions. These frictions are exacerbated in the presence of implicit guarantees, which also blunt any potential discipline of debt by removing the incentives of debt holders to engage in monitoring. Moreover, we argue that the events of the recent financial crisis are in fact quite difficult to reconcile with the notion that debt plays a positive role in providing *ex ante* discipline to bank managers. Finally, even if it debt *can* play a positive role in governance, we argue that in many cases additional equity would not interfere with this function, and also that debt is not *uniquely* able to provide discipline. We discuss a number of alternative ways to achieve the same results without resorting to socially costly leverage.

Another argument against higher equity capital requirements is based on the claim that equity is costly for banks to issue. Issuing equity can be costly if the banks shares are undervalued by the market or if the market interprets the decision to issue equity as a negative signal. We argue that these considerations are not valid reasons for not requiring banks to have significantly more equity. First, the negative signal that might be associated with the bank selling shares can be reduced or removed if banks have less discretion with respect to equity issuance. Similar to how large banks were all forced, or at least pressured, to accept TARP funds during the recent crisis, to help banks build capital, regulators can impose a time table for equity issuance so as to remove possible negative stigma associated with such issuance. Second, better capitalized banks need less external finance, as they have more retained earnings with which to fund their growth. Finally, better capitalized banks incur proportionately lower costs when issuing additional equity.

Since banks are actually highly leveraged, there is a temptation to conclude that such high leverage must be the optimal solution to some problem banks face. We argue that there is no justification for this inference. First, government subsidies give incentives to banks to use high levels of debt financing. In this regard, high leverage might be privately optimal for the banks, but this clearly does not make it socially optimal. Second, there are numerous reasons to conclude that high leverage is not even privately optimal for banks.⁵ High leverage can be the result of banks' inability to make commitments regarding future investments and financing decisions. Given continual incentives to increase leverage and shorten its maturity to usurp prior creditors, a bank's capital structure, as it evolves over time, is likely to have leverage that is excessive even from the narrow perspective of what is good for the bank and its shareholders.

How would significantly higher equity capital requirements affect the lending activities of banks? We argue that, since highly leveraged banks are subject to distortions in their lending decisions, better capitalized banks are likely to make *better* lending decisions, which are less subject to incentives for taking on risk or to problems related to "debt overhang" that can actually prevent banks from making valuable loans. There is indeed no reason for banks to refrain from any socially valuable activity, since these activities would not become more costly once any required subsidies are set at an appropriate level. Thus, there is no reason to believe that, if overall public policy forces banks to operate with significantly higher equity levels and significantly reduce their leverage, and if any subsidies are set in a socially responsible way, banks would refrain from making *any* loans that would lead to growth and prosperity. Highly leveraged banks might respond to increased capital requirements by restricting loans because of the "debt overhang" problem mentioned above, but this will be alleviated once banks are better capitalized. In the transition, regulators can forbid equity payouts and possibly mandate equity

⁵ Consistent with this, Mehran and Thakor (2010) find that various measures of bank value are positively correlated with bank capitalization in the cross section. Berger and Bouwman (2010) show that higher bank capital is important in banks' ability to survive financial crises.

issuance to make sure this does not happen. Additional equity also enhances the bank's ability to provide money-like securities that investors may value, since such securities become even less risky and more "informationally insensitive" when they are backed by additional equity.

We show that adding equity to banks' balance sheets need not have any negative effect on the aggregate production activities or asset holdings in the economy. In particular, if additional equity is used by banks to buy marketable securities, this does not affect the undertaking of all productive activities in the economy or the portfolios of final investors. If the banks buy securities that are liquid, the liquidity of the bank's assets will be enhanced, which is a potential additional benefit.

Finally, we argue that the case for contingent capital, i.e., debt that converts to equity under some conditions, has not been made against alternatives such as increased equity. Contingent capital is very complicated in terms of design and valuation. We do not see a compelling rationale for introducing it as part of capital regulation when simple equity will provide a more reliable cushion. Preserving the tax benefits of debt is not a legitimate reason, and the potential role of contingent capital in resolving frictions associated with governance has not been established.

A clear recommendation that emerges from our analysis is that prohibiting, for a period of time, dividend and other equity payouts for all banks is a prudent and efficient way to help banks build capital. If done under the force of regulation, these payout suspensions would not lead to any negative inference on the health of any particular bank. In addition, as mentioned above, regulators can remove the stigma associated with equity issuance, as well as frictions related to debt overhang, by requiring banks to issue equity on a pre-specified schedule.

Our discussion focuses on the social costs and benefits of using common equity as a way to fund banks. We do not consider other types of claims to be useful in providing a reliable cushion. Indeed, the recent crisis has shown that Tier 2 capital, i.e., subordinated debt, does not provide a reliable cushion. Proposals have been made to substitute "contingent capital," i.e., a debt-like security that converts to equity under some conditions, for subordinated debt to or using "bail-in" mechanisms to try to improve the cushion provided by Tier 2 capital. Our view is that, since there is no compelling case that the debt-like features of these securities provide social value, capital regulation should focus entirely on equity.

We do not address all the issues that regulators confront in regulating financial institutions. In particular, we do not discuss in detail which banks or financial institutions should be regulated, the distinction between large and small banks, or the issue of micro vs. macro prudential regulation. Our discussion applies most urgently to those institutions whose leverage imposes negative externalities on the financial system as a whole, i.e., "systemic risk" and which

are “too important” or “too interconnected” to fail. However, a workable definition of such “systemic” institutions raises a host of additional questions, which go beyond the scope of this paper. Another issue we do not elaborate on here is the risk weights currently used to determine the size of asset base against which equity is measured. As discussed in Brealey (2006) and Hellwig (2010), this system is easily manipulable and can lead to distortions in the lending and investment decisions of banks. Proposing a way to track the riskiness of banks’ assets on an ongoing basis is a challenge that at this point is beyond the scope of the current paper.

There have been hundreds of papers on capital regulation in the last decade, and particularly since the financial crisis. We cite here some papers that make recommendations similar or related to those we make here. Closest to us are Harrison (2004) and Brealey (2006) who also conclude that there are no compelling arguments supporting the claim that bank equity has a social cost.⁶ Poole (2009) identifies the tax subsidy of debt as distorting, a concern we share. However, he goes on to suggest that long term debt (possibly of the “contingent capital” variety) can provide both a meaningful “cushion” and the so-called “market discipline.” As we explain especially in Sections 5.1 and 8, we take issue with this part of his assessment. Turner (2010) and Goodhart (2010) also argue that a significant increase in equity requirements is the most important step regulators should take at this point. Acharya, Gujral, and Shin (2009), Acharya, Mehran and Thakor (2010) and Goodhart et al. (2010) suggest, as we do, that regulators use restrictions on dividends and equity payouts as part of prudential capital regulation. We take this recommendation a step further by suggesting the possibility of mandatory equity issuances as well, not just to control the actions of distressed institutions, but rather as a way to proactively help overcome informational frictions and avoid negative inferences associated with new issues. Such mandates are particularly important in managing a transition to a regime with significantly higher equity requirements. Finally, Kotlikoff (2010) proposes what he calls Limited Purpose Banking, in which financial intermediation is carried out through mutual fund structures. His proposal, like ours, is intended to reduce systemic risk and distortions, especially those associated with excessive risk taking. Our recommendations differ from his in that we allow for financial intermediation to be performed by the same type of structures that currently exist, i.e., intermediaries that can make loans, take deposits and issue other “money-like” claims.

2. The Benefits of Increased Equity Capital Requirements

Before examining the arguments that purport to show that increased capital requirements are costly, it is important to review some of the significant benefits associated with better capitalized banks. The recent financial crisis, as well as ones that have preceded it, have made it very clear that systemic risk in the financial sector is a great concern. Financial distress in one large

⁶ Many authors, including King (1990), Schaefer (1990), Berger, Herring and Szego (1995), Miller (1995), Brealey (2006), Hellwig (2009b), and French et al. (2010), have emphasized that the Modigliani-Miller Theorem must be the starting point of any discussion of capital regulation.

institution can rapidly spill over into others and cause a credit crunch or an asset price implosion. The effects of systemic risk events such as the one just experienced are not confined to the financial sector of the economy. As history has repeatedly demonstrated, these events can have extremely adverse consequences for the rest of the economy and can cause or deepen recessions or depressions. Lowering the risk of financial distress among those institutions that can originate and transmit systemic risk produces a clear social benefit.⁷

An obvious way to lower systemic risk is to require banks to have equity capital cushions that are significantly larger than what they had before the last crisis unfolded.⁸ In the build up to the last crisis important parts of the financial sector had become very highly leveraged. Indeed, several banks had balance sheets in which equity was only two or three percent of assets.⁹ Such a thin cushion obviously leaves little room for error. Even a moderate shock that reduces asset values by one or two percent puts such thinly capitalized banks on the brink of insolvency. Even if it is not actually insolvent, suspicions of its exposure may stop other institutions from providing the short-term funding that it relies on. In the last crisis, even before the breakdown of Lehman Brothers, there were several instances during which interbank markets froze because of such distrust among market participants. With greater capital cushions, there would be less risk of such systemic breakdowns from mutual distrust.

Another consideration concerns corrective measures when losses have occurred. If supervisors – or short-term creditors – are concerned with the bank’s capital ratio, then, following a reduction of capital through losses, the bank must either recapitalize or deleverage by selling assets. Deleveraging puts pressure on asset markets, inducing prices to fall, with negative repercussions for other market participants, who also have these assets on their books.

⁷ Indeed, BIS (2010) estimates that a 2% increase in capital ratios will reduce the probability of a financial crisis by 2.9%. The Bank of Canada (2010) estimates the gains that this would produce for the Canadian economy alone as equivalent to an annual benefit on the order of 2% of GDP.

⁸ It is interesting to note that banks in the U.S. and in the U.K. were not always as highly leveraged as they have been in recent decades. According to Berger, Herring and Szego (1995), in 1840 equity accounted for over 50% of bank total value, and the increase in leverage can be traced to additional measures to create a “safety net” for banks. Moreover, until the establishment of the FDIC in 1944, the liability of the equity issued by banks was not limited as it is today. Instead, bank equity had double, triple and sometimes unlimited liability, which meant that equity holders had to cover losses and pay back debt even after losing the entire amount they invested. Haldane (2009) shows a similar pattern in the U.K. For Germany, a similar decline is documented by Holtfrerich (1981); not surprisingly, however, the evolution here mirrors historical discontinuities associated with the two World Wars and the inflation of 1914-1923, as well as the long-term trend which set in long before 1914.

⁹ Of course, banks appeared to be better capitalized in percentage terms when their capital was measured relative to “risk weighted assets.” The risk weightings used in these measures are highly problematic. Banks have exploited the freedom given them by the risk-calibrated approach to determining capital requirements in order to dramatically expand the activities supported by the equity they had. Many of the risks that materialized in the crisis, however, had not even been considered in risk weights beforehand. Moreover, true leverage was often masked through accounting maneuvers, especially in connection with the so-called shadow banking system. On the shadow banking system, see Pozsar et al (2010). On the use of the risk-calibrated approach to expand activities supported by a given level of equity, see Hellwig (2009, 2010). Hellwig (2010) suggests that notions of measurement of risks that underlie the risk-calibrated approach are largely illusionary.

The extent of deleveraging depends on what the bank's capital position is. If bank capital is 3% of the balance sheet, then following a loss of 1 million dollars, the bank attempting to deleverage must liquidate more than 30 million dollars worth of assets just to re-establish that 3% ratio. The systemic repercussions on asset prices and on other institutions will be accordingly large. Capital requirements based on higher equity ratios would reduce the chances that such chain reactions occur, and would dampen those that do occur.

If governments see the need to avoid the social costs of systemic crises by stepping in to support their banking sectors, then an additional benefit of increased equity requirements comes from reducing the burden on taxpayers. This benefit is produced in two ways. First, increased equity requirements reduce the probability that bailouts will be necessary, since the equity cushion of the bank can absorb more substantial decreases in the asset value without triggering a default. Second, if a bailout does become necessary, the amount of required support would generally be lower with a larger equity cushion, since a larger portion of losses would be absorbed by the equity. Both the diminished probability of a systemic event and the decreased amount of support required in the event of a crisis significantly reduce the costs to taxpayers.

There are additional benefits of higher equity capital requirements beyond the major ones just given. These are generally related to the reduction in conflicts of interest and the more aligned incentives that are created with less leverage. In particular, more equity capital reduces the incentives of equity holders (and managers working on their behalf or compensated by return on equity (ROE)) to undertake excessively risky investments. This will be discussed in more detail in Sections 4.2 and 5.1 below.

3. Capital Structure Fallacies

Capital requirements place constraints on the capital structure of the bank, i.e., on the way in which the bank funds its operations. An immediate impact of changes in the capital structure is that they change the exposure of different securities to the riskiness of the bank's assets. In this section we take up statements and arguments that are based on faulty logic of this process and its implications. The debate on capital regulation should obviously not be based on fallacious statements, so it is important to make sure they are removed from the discussion.

3.1 Equity Requirements and Balance Sheet Mechanics

“More equity might increase the stability of banks. At the same time however, it would restrict their ability to provide loans to the rest of the economy. This reduces growth and has negative effects for all.” Josef Ackermann, CEO of Deutsche Bank (November 20, 2009, interview).¹⁰

¹⁰This and other quotes cited in the paper are intended to be representative of common arguments that have entered the policy debate on capital regulation. They may not reflect the complete or current views of those cited.

“The British Bankers' Association ... calculated that demands by international banking regulators in Basle that they bolster their capital will require the UK's banking industry to hold an extra pounds 600bn of capital that might otherwise have been deployed as loans to businesses or households.” *The Observer* (July 11, 2010)

Statement: “Increased capital requirements force banks to operate at a suboptimal scale and to restrict lending.”

Assessment: To the extent that this implies balance sheets must be reduced in response to increased equity requirements, this is false. By issuing new equity if necessary, banks can respond to increased capital requirements without affecting any of their profitable or socially valuable activities. Capital requirements do not require any capital to be set aside; rather, once any liquidity requirements are satisfied, all bank capital can be productively deployed to make loans or otherwise invest and earn market-determined (or higher) returns.

Statements such as the ones above predict that potentially dire consequences would result from increasing capital requirements, and these have received the attention of regulators and policy makers. While one should be concerned about the effect proposed regulations might have on the ability of banks to carry out their core business activities, increasing the size of the equity cushion does not in any way mechanically limit the ability of a bank to lend.

To see this, consider a very simple example. Assume that capital requirements are initially set at 10%: a bank's equity must be at least 10% of the value of the bank's assets.¹¹ For concreteness, suppose that the bank has \$100 in loans, financed by \$90 of deposits and other liabilities, and \$10 of equity, as shown in the initial balance sheet in Figure 1.

Now assume that capital requirements are raised to 20%. In Figure 1 we consider three ways in which the bank balance sheet can be changed to satisfy the higher capital requirement, fixing the value of the bank's current assets.¹² One possibility is shown in Balance Sheet A, where the bank “delevers” by significantly scaling back the size of its balance sheet, liquidating \$50 in assets and using the proceeds to reduce total liabilities from \$90 to \$40. In Balance Sheet B, the bank satisfies the higher 20% capital requirement by recapitalizing, issuing \$10 of additional equity and retiring \$10 of liabilities, and leaving its assets unchanged. Finally, in Balance Sheet

¹¹ To keep the examples straightforward, we consider simplified versions of capital requirements. Actual current capital requirements are based on risk adjustments and involve various measures of the bank's capital (e.g., Tier 1 and Tier 2). The general points we make throughout this article apply to more complex requirements.

¹² In this example, we are focusing on the mechanics of how balance sheets can be changed to meet capital requirements. We are intentionally ignoring for now tax shields and implicit government guarantees associated with a bank's debt financing, as well as how changes in a bank's capital structure alter the risk and required return of the bank's debt and equity. We discuss these important issues in detail in subsequent sections.

C, the bank expands its balance sheet by raising an additional \$12.5 in equity capital and using the proceeds to acquire new assets.

Figure 1: Alternative Responses to Increased Equity Requirements

Initial Balance Sheet		Revised Balance Sheet with Increased Capital Requirements			
Loans: 100	Equity: 10	Loans: 50	Equity: 10	Loans: 100	Equity: 20
	Deposits & Other Liabilities: 90		Deposits & Other Liabilities: 40		Deposits & Other Liabilities: 80
		A: Asset Liquidation		B: Recapitalization	
Loans: 100	Equity: 10	Loans: 100	Equity: 10	New Assets: 12.5	Equity: 22.5
	Deposits & Other Liabilities: 90		Deposits & Other Liabilities: 40	Loans: 100	Deposits & Other Liabilities: 90

Note that only when the bank actually shrinks its balance sheet, as shown in A, is the bank reducing the amount of lending it can undertake. In both B and C the bank can support the same amount of lending as was supported by the original balance sheet.

In balance sheet B some liabilities are replaced with equity. Specific types of liabilities, such as deposits, are part of a bank's "production function" in the sense that their issuance is related to the provision of transactions and other convenience services that the bank provides to its customers. Cutting back on these securities may not be desirable, as the provision of associated services may be both profitable for the bank and beneficial for the economy.¹³ That said, it is likely that at least a portion of a bank's liabilities play a pure financing role, and replacing these liabilities with equity will increase bank capital without reducing its productive lending and deposit-taking activity.¹⁴

¹³ For example, Gorton (2010), Gorton and Metrick (2009), Stein (2010) and others argue that short-term liabilities and deposits command a "money-like" convenience premium based on their relative safety and the transactions services that safe claims provide. Gorton and Pennacchi (1990) and Dang, Gorton and Holmstrom (2010) stress the importance of the "information insensitivity" of these claims in providing these services.

¹⁴ According to the FDIC website, as of March 31st, 2010, domestic deposits at U.S. commercial banks totaled \$6,788 billion, which represented 56.2% of total assets, while equity represented 10.9% of assets. This leaves 32.9% of the assets, which is almost \$4 trillion in non-deposit liabilities. Quite possibly, some of these liabilities can be converted to equity without affecting the provision of important bank services.

Balance Sheet C meets the higher capital requirements while keeping both the original assets (e.g. loans) and all of the original liabilities of the bank in place. Additional equity is raised and new assets are acquired. In the short run, these new assets may simply be cash or other marketable securities (e.g. Treasuries) held by the bank. As new, attractive lending opportunities arise, these securities provide a pool of liquidity for the bank to draw upon to expand its lending activity. One might worry that it would be costly or inefficient for the bank to hold additional securities or one might be concerned about the impact of such a change on the overall demand and supply of funding. We discuss these issues in detail in Section 7 and comment on implementation issues in the concluding remarks (Section 9).

To summarize, in terms of simple balance sheet mechanics, the notion that increased equity capital requirements *force* banks to reduce lending activities is simply false. Capital requirements do not force banks to “set aside” any capital. Banks can preserve or even expand lending activities by changing to Balance Sheets B or C. So, if higher capital requirements are to reduce lending activities, it must be that these changes involve some additional costs, or that certain frictions lead the bank to pass up profitable loans. In the sections that follow, we examine various arguments that are put forward in support of the notion that increased equity capital requirements entail higher costs or create distortions in lending decisions.

3.2 Equity Requirements and Return on Equity (ROE)

“Banks... do not want to hold too much capital because by so doing they will lower the returns to equity holders.” Mishkin and Aekin (2009, p. 444)

Statement: “Increased equity requirements will hurt bank shareholders since it would lower the banks return on equity (ROE).”

Assessment: This is false; a reduction in ROE does not indicate decreased value added. While increased capital requirements can lower the Return on Equity (ROE) in good times, they will raise ROE in bad times, reducing shareholder risk.

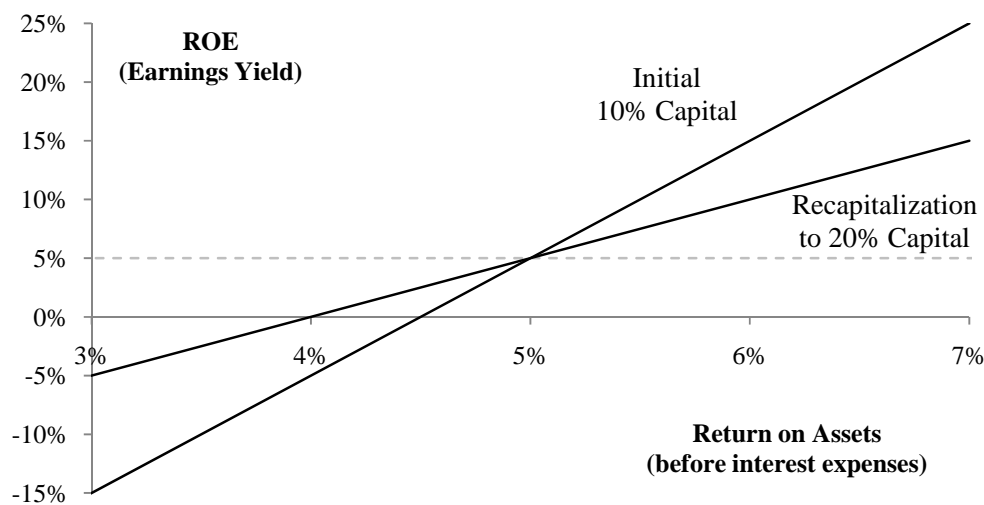
One concern about increasing equity capital requirements is that such an increase will lower the returns to the bank’s investors. In particular, the argument is often made that higher equity capital requirements will reduce the banks’ Return on Equity (ROE) to the detriment of their shareholders.¹⁵

¹⁵ Accounting ROE is defined as net income / book value of equity. A related financial measure is the *earnings yield*, which is net income / market value of equity, or equivalently, the inverse of the bank’s P/E multiple. The discussion in this section applies equally well to the earnings yield, replacing book values with market values throughout.

This argument presumes that ROE is a good measure of a bank's performance. Since ROE (or any simple measure of the bank's return) does not adjust for scale or risk, there are many potential pitfalls associated with this presumption. Using ROE to assess performance is especially problematic when comparisons are made across different capital structures. The focus on ROE has therefore led to much confusion about the effects of capital requirements on shareholder value.

We illustrate the consequence of an increase in equity capital on ROE in Figure 2. This figure shows how the bank's realized ROE depends on its return on assets (before interest expenses). For a given capital structure, this dependence is represented by a straight line.¹⁶ This straight line is steeper the lower the share of equity in the bank's balance sheet. Thus, in Figure 2, the steeper line corresponds to an equity share of 10%, the flatter line to an equity share of 20%. The two lines cross when the bank's ROE is equal to the (after-tax) rate of interest on debt, assumed to be 5% in the figure.¹⁷ Above that level, ROE is indeed lower with higher capital. Below the 5% level, however, ROE is higher with higher capital, as the cushioning effect of higher capital provides downside protection for equity holders and reduces their risk.

Figure 2: The Effect of Increased Equity on ROE



The figure illustrates the following key points:

¹⁶ More precisely, $ROE = (ROA \times A - r \times D) / E = ROA + (D/E)(ROA - r)$, where ROA is the return on assets, A is the total value of the firm's assets, E is equity, D is debt, and r is the (after-tax) interest rate on the debt.

¹⁷ If the bank had met the higher capital requirements by expanding its assets rather than recapitalizing (Case C in Figure 1), the "break-even" ROE would be the after-tax return of the new assets acquired by the bank.

- For a given capital structure, ROE does reflect the realized profitability of the bank's assets. But when comparing banks with different capital structures, ROE *cannot* be used to compare their underlying profitability.¹⁸
- Higher equity capital requirements will tend to lower the bank's ROE only in good times when ROE is high. They will raise the ROE in bad times when ROE is low. From an *ex ante* perspective, the high ROE in good times that is induced by high leverage comes at the cost of having a really low ROE in bad times.

On average, of course, banks hope to (and typically do) earn ROE well in excess of the return on their debt. In that case, the “average” effect on ROE from higher equity capital requirements would be negative. For example, if the bank expects to earn a 6% return on its assets, then it would expect a 15% ROE on average with 10% capital, and only a 10% ROE on average with 20% capital. Is this effect a concern for shareholders?

The answer is no. Because the increase in capital provides downside protection that reduces shareholders' risk, *shareholders will require a lower expected return to be willing to invest in a better capitalized bank*. This reduction in the required return for equity will offset the reduction in the average ROE, leading to no net change in the value to shareholders (and thus the firm's share price). Indeed, in the above example, if the equity investors required a 15% expected return initially, we would expect their required return to fall to 10% due to the reduction in risk with the increase in the firm's capital.¹⁹ Because shareholders continue to earn their required return, there is no cost associated with the increase in equity capital.²⁰

3.3 Capital Structure and the Cost of Capital

“The problem with [equity] capital is that it is expensive. If capital were cheap, banks would be extremely safe because they would hold high levels of capital,

¹⁸ For example, a manager who generates a 7% ROA with 20% capital will have an ROE of 15%. Alternatively, a less productive manager who generates a 6.5% ROA yet has 10% capital will have an ROE of 20%. Thus, when capital structures differ, a higher ROE does not necessarily mean a firm has deployed its assets more productively.

¹⁹ To see why, note from Figure 2 that doubling the bank's capital cuts the risk of the bank's equity returns in half (the same change in ROA leads to ½ the change in ROE). Thus, if shareholders initially required a 15% average return, which corresponds to a 10% risk premium to hold equity versus safe debt, then with twice the capital, because their sensitivity to the assets' risk (and thus their “beta”) has been halved, they should demand ½ the risk premium, or 5%, and hence a 10% required average return.

²⁰ As we have seen, because of ROE's failure to account for both risk and capital structure, it is not a useful measure of a manager's contribution to shareholder value. Most management experts prefer alternatives such as the firm's economic value added (EVA) or residual income. Residual income is defined as $(ROE - r_E) \times E$, where r_E is the firm's risk-adjusted equity cost of capital, and E is the firm's equity. Residual income thus adjusts both for the risk and scale of the shareholders' investment. Simple changes in capital structure will not alter the firm's residual income.

providing full protection against even extreme events. Unfortunately, the suppliers of capital ask for high returns because their role, by definition, is to bear the bulk of the risk from a bank's loan book, investments and operations" Elliott (2009, p. 12).

Statement: "Increased equity requirements increase the funding costs for banks because they must use more equity, which has a higher required return."

Assessment: This is false. Although equity has a higher required return, this does *not* imply that increased equity capital requirements would raise the banks' overall funding costs.

The example of the previous section exposes a more general fallacy regarding equity capital requirements. Because the required expected rate of return on equity is higher than that on debt, some argue that if the bank were required to use more of this "expensive" form of funding, its overall cost of capital would increase.

This reasoning reflects a misunderstanding of the way in which risks affect the cost of funding. While it is true that the required return on equity is higher than the required return on debt and it is also true that this difference reflects the greater riskiness of equity relative to debt, it is *not* true that by "economizing" on equity one can reduce capital costs. "Economizing" on equity itself has an effect on the riskiness and, therefore, on the required expected return of equity. This effect must be taken into account when assessing the implications of increased equity capital requirements for banks' cost of capital.

Figure 2 indicates that the random fluctuations in the bank's ROE that are induced by a given fluctuation in earnings are greater the less equity the bank has. When the bank has relatively more equity capital, a given earnings risk translates into less risk for its shareholders. Reflecting this reduction in risk, the risk premium in the expected ROE will be lower. If the additional equity capital serves to reduce the bank's bankruptcy risk, the interest rate on its debt will also be lower. These reductions of risk premia in required rates of return counteract the direct effects of shifting from debt finance to equity finance, from an instrument with a low required rate of return to an instrument with a higher required rate of return. The net effect need not increase the total funding costs of the bank at all.²¹

One of the fundamental results of corporate finance (Modigliani and Miller, 1958) states that, absent additional considerations such as those involving tax advantages or public subsidies to debt, increases in amount of financing done through equity simply re-distributes the total risk that must be borne by investors in the bank, i.e., the holders of debt and equity and any other

²¹ Continuing our earlier example (see fn. 11), given 10% equity capital the required return was 15% for equity and 5% for debt, for an average cost of $10\% \times 15\% + 90\% \times 5\% = 6\%$. With 20% equity capital the required return for equity falls to 10% (with a 5% cost of debt), leading to the same average cost of $20\% \times 10\% + 80\% \times 5\% = 6\%$.

securities that the bank may issue. The total risk itself is given by the risks that are inherent in the bank's asset returns. In a market in which risk is priced correctly, an increase in the amount of equity financing lowers the required return on equity in a way that, absent subsidies to bank debt and other frictions, would leave the total funding costs of the bank the same.

In light of this result, the following critically important insights should be the starting point of any discussion about capital requirements.²²

- Increasing capital requirements generally shifts how risk is distributed among shareholders and other bank creditors, and the required rates of return on equity and debt will adjust to reflect these changes in risk. These changes in capital structure per se do not change the bank's cost of funding. *There is no value that can be obtained by simply shifting risk from one security to another.*
- If changes in a bank's capital structure do affect the bank's cost of funding, it must be because of some frictions or distortions involved in issuing various securities, not simple risk changes. It is important to understand what these frictions and distortions are when considering the effects of changes in capital requirements.

The Modigliani-Miller analysis is often dismissed on the grounds that it does not apply to banks, which get much of their funding in the form of deposits, and, moreover, the assumptions underlying this analysis are said to be highly restrictive. Given that depositors get some of their returns through the convenience of transactions services, there is some truth to the notion that deposits are different. This observation does not, however, mean that banks are altogether different. The erosion of the equity of major banking institutions over the past two decades has *not* been a result of increased deposit finance of these institutions. It has, rather, been the result of tremendous growth in wholesale market finance (much, in particular, in the form of short-term repo borrowing; see Adrian and Shin (2010)). There is no reason for presuming that this form of borrowing in wholesale markets is exempt from the logic articulated above.

As for the presumed restrictiveness of the Modigliani-Miller assumptions, the key assumption is that investors in bank debt and equity understand that these securities become less (more) risky as the bank's capital increases (decreases) and that the market is able to price risk appropriately. The validity of this assumption, even for banks, is supported by substantial empirical evidence.²³ Indeed, it is the analog to the observation in debt markets that the yield on junior debt will increase with an increase in the amount of senior debt; or equivalently, yields vary inversely with seniority.

²² Extensive discussions of this result and various proofs can be found in any basic corporate finance textbook. See, for example, Allen, Brealey and Myers (2008), Berk and DeMarzo (2008), and Ross, Westerfield and Jaffe (2008).

²³ See, for example, Hanson, Kashyap, and Stein (2010).

The assumptions underlying the Modigliani-Miller analysis are in fact the very same assumptions underlying the quantitative models that banks use to manage their risks, in particular, the risks in their trading books. Anyone who questions the empirical validity and relevance of an analysis that is based on these assumptions is implicitly questioning the reliability of these quantitative models and their adequacy for the uses to which they are put – including that of determining required capital under the model-based approach for market risks. If we cannot count on markets to correctly price risk and adjust for even the most basic consequences of changes in leverage, then the discussion of capital regulation should be far more encompassing than the current debate.

4. Arguments Based on a Confusion of Private and Social Costs

In practice, changing the capital structure of a bank (or any firm) does more than shift how risk is distributed among those who fund its operations. For example, alterations in a bank's capital structure can change how much the bank pays in taxes and can influence how investment and other decisions are made by bank managers. In this and the following sections we address the potential costs and benefits of equity capital requirements when various distortions and frictions are taken into account.

In this section we address distortions and frictions that involve the interaction between banks and the government. There are two important ways in which government policy affects the investment and financing decisions of banks. The first involves taxes, mentioned above, and is common to banks and other corporations. In most countries where corporations must pay corporate taxes, interest payments on debt are considered a tax deductible expense. This gives debt financing an advantage over equity financing, because the more debt a profitable firm has, the lower its tax bill, other things being equal.

The second important feature of the interactions of banks and governments involves debt guarantees that the government may provide – in particular to banks that are deemed too important to fail. When investors believe that the government might step in to bail out banks in times of distress, banks can borrow at a lower rate than they would absent the possibility of a bailout. Unless the bank is forced to pay the government a fair insurance premium upfront, the government guarantee works like a subsidy that results in lower funding costs when debt, not equity, is used to finance a bank's operation.²⁴

²⁴ Explicit guarantees such as through FDIC insurance, are different in that banks are supposedly charged for them upfront. Such insurance is only provided to deposits that are considered socially valuable and where the threat of inefficient runs is great. See further discussion of this at the end of Section 4.2

As a result of both tax and implicit guarantees (for which they are not charged upfront), banks find debt a very attractive form of financing. It is therefore not surprising that bankers argue that equity capital requirements will increase their funding costs, since indeed more equity will reduce their ability to benefit from these subsidies. However, we argue below that this is not a legitimate reason for regulators to refrain from increasing capital requirements. In fact, it is quite paradoxical that the government *subsidizes* the leverage of the banks at the same time that it recognizes that this leverage is socially very costly and considers imposing stricter capital requirements to prevent the banks from taking advantage of this subsidy. If there are specific frictions that banks encounter in their activities and which prevent them from lending at a socially optimal level, the government might wish to resolve such frictions using subsidies. However, policies that encourage leverage should be avoided.

4.1 Taxes

“In the real world of tax biases in favor of debt... there clearly is a private cost penalty to higher equity requirements, and the case that tighter [capital] requirements increase the cost of long-term credit provision appears fairly clear.”
Turner (2010, p. 25)

Statement: “Increased equity requirements increase the funding costs for banks because they reduce the ability of banks to benefit from the tax shield associated with interest payments on debt.”

Assessment: If debt has a tax advantage over equity, this is true. However, it is irrelevant to capital regulation in the sense that *both capital regulation and taxes are matters of public policy*. The current tax code creates distortions by subsidizing leverage. These distortions can be eliminated, while preserving the same level of bank tax shields, at the discretion of the government. This would neutralize the tax impact of increased equity requirements.

Since, as discussed above, tax shields effectively subsidize debt financing, requiring banks to use less debt financing can raise banks’ cost of capital.²⁵ From a public-policy perspective, however, this effect is irrelevant as it concerns only the distribution of public money. The tax savings that a bank obtains by relying on debt rather than equity finance reduce the government’s tax revenue and require either a reduction in spending on public goods or an increase in taxes elsewhere. While the bank gains from the debt tax shield, the public loses, and ultimately, the argument concerns the optimal structure of taxation. Taxes should be structured to minimize the

²⁵ Note, however, this effect is mitigated if dividends or capital gains on shares are taxed at a lower rate than interest income at the level of personal income taxation. Whether debt actually has a tax advantage depends on whether the sum of corporate and investor-level taxes on equity income exceeds or falls short of interest income taxes at the personal level.

overall distortions they induce. In addition, taxes (and subsidies) should be set so as to encourage behavior that generates positive externalities and to discourage behavior that generates negative externalities.

By these criteria, refraining from requiring banks to have more equity capital on the grounds that this would raise their taxes makes no sense. If the prospect of saving on corporate income taxes induces banks to be highly leveraged, this generates a negative externality because the increase in leverage raises the probability of a bank failure, weakening the financial system and raising the possibility of taxpayer bailouts. Given these externalities associated with high leverage of financial institutions, tax policy should not encourage leverage. If anything, tax policy should be designed to make banks internalize the social costs imposed by high leverage.

Even abstracting from the external effects of default, a tax subsidy to debt finance induces a distortion in the allocation of funds between corporations that can borrow extensively and corporations that use more equity finance. Banks that can be highly leveraged because of implicit government guarantees enjoy an additional advantage over other firms, because high leverage allows them to capture a greater tax subsidy. While some of this advantage may be passed on to the firms to which banks provide loans, there is no reason to believe that this suffices to neutralize the distortion.

Whether the tax code should be changed with respect to corporate taxation more broadly or whether the distortions should be corrected at the level of the banking industry, , the current situation is clearly undesirable.

Some considerations of optimal tax theory actually suggest that corporate income should not be taxed (at least in expectation). In that sense the current tax code can be thought of as penalizing equity rather than subsidizing debt. (See Mankiw, Weinzierl, and Yagan (2010), as well as Boskin (2010)). Poole (2009) estimates that reducing the corporate tax rate to 15% and not allowing financial institutions to deduct interest would result in the same total corporate tax expense as was actually incurred by these institutions.

More generally, even without fundamentally changing the tax code, it is quite straightforward to neutralize the impact of increased equity capital requirements on the tax liabilities of banks. Any tax subsidies lost due to a reduction in leverage can be easily replaced with alternative deductions or tax credits. For example, the subsidy to small-business lending that may be seen as being implicit in the tax advantage of banks could be replaced by a tax subsidy at the level of the small businesses themselves, where the subsidy would be much better targeted and therefore much more effective.

4.2 Bailouts and Implicit Government Guarantees

Statement: “Increased equity requirements increase the funding costs for banks because they prevent banks from being able to borrow at the low rates implied by the presence of government guarantees.”

Assessment: This is again a statement about private and not social costs. Government guarantees that allow banks to enjoy cheap debt financing create numerous distortions and encourage excessive leverage and excessive risk taking. Because of the distorted incentives as well as the difficulty for governments to commit never to bail out banks, it is challenging to neutralize this effect by charging banks for the true cost of the guarantees on an ongoing basis. Equity cushions are particularly valuable, since they reduce the likelihood and cost of the guarantees.

Explicit or implicit government guarantees immunize the banks’ creditors against the consequences of a default by the bank. As a result, the default risk premium in the interest rates demanded by the bank’s creditors is lower and may even be zero. Institutions that benefit from such guarantees, e.g., institutions that are deemed to be “too big to fail,” are therefore able to borrow at lower interest rates. The savings in capital costs that are thereby achieved are the larger the more leverage the bank has.

From a public policy perspective, this effect of increased equity requirements is not relevant because, similar to the case of the tax advantage of debt, it concerns private, rather than social costs of bank capital. The lower borrowing rates benefiting banks and their shareholders have a counterpart in the default risks borne by the taxpayer. Any consideration of social costs must encompass the costs of these risks to taxpayers. Once this is taken into account, one sees that the effects of government guarantees on borrowing rates provide no reason to refrain from requiring banks to have more capital. By the same argument as before, if lower borrowing rates based on government guarantees induce banks to be highly leveraged, this imposes a negative externality on the rest of the economy because the increase in leverage raises the probability of distress and the resulting systemic risk.

The negative externalities here are likely to be even larger than with those associated with the tax benefits of debt finance. The tax benefits of debt finance are largest when the bank does well and makes profits. The subsidy from government guarantees is worth most when the bank does poorly and is unable to service its debt. From an *ex ante* perspective, this makes it attractive for the bank to engage in strategies that involve a positive default risk. Of course, some default risk may be unavoidable, but to the extent that there is a choice, the availability of explicit or implicit government guarantees of bank debt creates a bias towards choosing risky strategies to exploit the guarantees, providing shareholders with nice returns if they succeed and saddling the government with the losses if they fail.

As is well known, such a bias towards choosing an excessively risky strategy is present even without government guarantees. The mere existence of debt, with a payment obligation that is independent of the bank's asset returns, creates incentives for the bank's shareholders, or for its managers acting on the shareholders' behalf, to take risks according to the principle "heads, I win, tails, the creditor loses." Under these strategies, increases in default probabilities or default returns, which hurt the creditors, are traded for increases in returns in the event where everything goes well, which benefit shareholders. From the perspective of the debt holders, this is a *moral hazard* problem, i.e., it is a hazard that is not due to natural perils outside of the participants' sphere of influence, but due instead to the behavior of the banks and the bank's managers who control the use of the funds.

In the absence of any government guarantees, the bank's creditors would try to limit such moral hazard. If it were possible to write contracts so that the bank's strategy choices are fully committed *ex ante*, the parties would mutually agree to put such covenants into their contracts. If such commitments are ineffective, the creditors will ask for higher rates or even refuse to provide the bank with funds altogether. In all of those cases in which effective covenants cannot be written, the moral hazard will prevent the partners from choosing a fully efficient arrangement, but, given the constraints imposed by the bank's inability to fully commit its strategy *ex ante*, the arrangement they come up with may be presumed to be second best.

Explicit or implicit government guarantees can greatly reduce the need for the creditors to worry about their bank's strategy choices and default prospects. If the government can be expected to step in when the bank defaults, the creditor generally has no reason to refrain from lending to the bank or to demand a significant default risk premium. The resulting arrangement may be far from even second best.

Politicians are fond of saying that we must make sure bailouts *never* happen. In fact, it is extremely difficult, if not impossible, to *commit* never to bail out a financial institution. Indeed, it may not even be desirable to make such a commitment, since a bailout might be the preferred course of action during a crisis. For this reason the focus must be on structuring financial regulations to minimize or ideally eliminate the possibility that institutions will need to be bailed out. Some recent proposals for financial regulation involve the creation of a "resolution authority" that will have funds ready to help banks and other financial institutions in situations of financial distress. If the government charged a fee (a form of "bank tax") for the protection it is giving through this mechanism, and if this fee always reflected the true cost of the guarantees, then the subsidy associated with implicit guarantees would be removed. However, adapting the fee to the risks that are actually taken would be challenging. More importantly, if it is difficult to monitor risks, then individual banks would have incentives to take on additional risks. This

approach is not as effective as requiring significant increases in equity requirements. Equity, as a form of self insurance, will be priced based on its risk directly by financial markets.²⁶

It should be pointed out that systems providing “safety nets” to banks that are based on deposit insurance, the Fed’s discount window, and central banks serving as a “lender of last resort” can and do play a very positive role as a stabilizing force, particularly in preventing bank runs that have plagued banks in prior years. We are not arguing that these should be removed. Rather, we are observing that larger equity cushions are an effective way to increase the safety of the system and make it *less* reliant on implicit “too-big-to-fail” guarantees that are both costly and provide distorted incentives. Indeed, the entire system of capital regulation is the result of the recognition that incentives to take excessive risk arise as a result of demand deposit and other elements of the safety net of banks.

5. Arguments Based on Inadequate Theory

The distortions and frictions discussed in the previous section are the result of government policies that provide subsidies to banks by lowering their cost of debt financing. These distortions and frictions unambiguously encourage banks to take on high leverage that is socially costly. The clear implication is that these distortions and frictions should be removed or neutralized through changes in public policy. In this section, by contrast, we focus on frictions that are *inherent* to the environment in which banks operate and are therefore largely unavoidable. These frictions arise because different participants, including bank managers, various creditors, and equity holders, are likely to have different information, preferences, and control over the banks’ investment and financing decisions, and because it is difficult or costly for the various participants to write complete contracts or make credible commitments to actions that will be taken in the future.

Over the last 40 years, a large literature in finance and economics has studied these types of frictions. The parts of this literature that are most relevant to the debate on bank capital regulation are those having to do with financial contracting and the role that different types of securities play in either reducing or increasing these frictions. In this section we consider claims that debt has a positive role to play in alleviating informational and governance frictions, and that for this reason it might be costly to increase equity capital requirements.

In Section 5.1 we consider the claim that debt imposes discipline on bank managers and thus alleviates information and governance problems. We consider this claim to be unconvincing. First, this claim neglects the very significant frictions and governance problems that debt and

²⁶ Deposit insurance is, of course, a system that collects insurance fees and explicitly insures deposits. Extending this system to additional deposits can be considered and might make sense. However, this should only be appropriate for the type of deposits that create an important social benefit and not to all bank debt. In any event, this should not be viewed as an alternative to significant increases in capital requirements.

leverage actually create. These include, among other things, problems created by incentives to take excessive risk and the funding problems associated with “debt overhang,” problems that quite often lead to inefficient investment decisions. Second, the notion that debt provides discipline to managers simply does not fit the facts of the last decade.

In Section 5.2 we discuss the claim that information asymmetries between investors and managers might make it difficult or costly for banks to issue new equity. While acknowledging the validity of this claim, we argue that such concerns are in fact alleviated if banks have more equity to begin with. We also discuss how the transition to higher equity ratios might be handled by regulators.

Finally, in Section 5.3 we address the notion that observed financing patterns should be regarded as optimal private-sector responses to whatever frictions there are, i.e., that, because we observe banks to be highly leveraged, it follows that this high leverage is privately and perhaps even socially desirable. We point out that, even from a private perspective, contracting can only be optimal relative to the given constraints and, in particular, the given commitment possibilities. Because existing leverage generates incentives to issue additional debt, the high leverage that we observe is at least partly due to the banks’ inability to commit themselves to a leverage bound *ex ante*. In this situation, statutory equity requirements might provide a substitute for the missing ability to commit and in doing so may improve on private contracting even from the participants’ perspective.

5.1 Does Debt Provide Necessary Market Discipline?

“Debt is valuable in a bank’s capital structure because it provides an important disciplining force for management.” (Squam Lake Report (French et al. 2010, p. 55).)

Statement: “Debt, as a hard claim that must be periodically renewed, is necessary to provide market discipline that enhances corporate governance and prevents bank managers from taking excessive risk or mismanaging the firm.”

Assessment: While correct in some specialized theoretical models, this statement is false because the models on which it is based are inadequate for the purpose of the discussion of capital regulation. Debt finance actually generates and exacerbates governance and agency problems, and these problems can be quite severe. Moreover, the mechanisms that allow debt to deliver discipline do not actually work well for large financial institutions, and/or they are extremely costly as they depend on fragility and default. Debt is also not unique in its ability to provide discipline; alternative mechanisms exist that allow equity capital to be increased without

sacrificing the potential governance benefits of debt. Finally, discipline by debt holders did not appear to be effective in the events leading up to the financial crisis of 2007-2008.

A central problem of corporate governance is to ensure that the outside financiers of firms (including banks) can expect to get appropriate returns. This problem is difficult because management has control over the company's activities and has better information over what is going on. With a bank, the difficulty is compounded by the fact that certain assets, e.g., loans to small businesses, are particularly opaque and difficult to assess from the outside. Other assets may be much easier to assess because they can be traded in liquid markets, but then, this very tradability provides managers with the scope for reshuffling the bank's positions quickly, to their own personal advantage and, possibly, outside investors' disadvantage.²⁷

For non-financial firms, the most important governance concern seems to be about management wasting resources for their own private benefits or for empire-building. For financial firms, concerns about theft and concerns about risk management play a much bigger role. Given the ease with which financial assets can be moved around, theft is a major problem unless there is suitable surveillance ensuring that assets are not diverted; the Madoff case has just been the latest example. Surveillance prohibiting theft, however, might be easier than surveillance concerning excessive risk taking. Given the difficulty of assessing risk (even ex post), the ability to amplify risk via leverage, and the ease with which risk can be transformed through trading activities, it is crucial that managerial incentives be properly set.

The problem of excessive risk taking is compounded by the fact that it may be supported by shareholders. Equity holders have *no* interest in disciplining it and might even be complicit in undermining mechanisms to do so.²⁸ As already mentioned in Section 4.2, the presence of debt creates incentives for management, acting on behalf of shareholders, to engage in strategies that yield high returns when successful and negative returns when unsuccessful, increasing the likelihood and the extent of distress and insolvency.²⁹ Given the fixity of their claims, debt holders do not participate in the high returns in the event of success, but are burdened with the increased risk and increased cost of default (or, to the extent they are bailed out by the government, the burden will be shared with taxpayers). In contrast, shareholders benefit from the

²⁷ Opaqueness as a natural by-product of the bank's own activities in monitoring its loan clients is discussed in Diamond (1984), while the "paradox" of asset liquidity as enhancing transparency while expanding the scope for manipulations by bank management is the subject of Myers and Rajan (1998). More generally, models where debt contracts emerge as optimal are more appropriate for describing why the banks themselves structure their financing the businesses they loan to in the form of debt contracts. (Such models are sometimes called "costly state verification" models.) As we argue, these models do not imply that debt or high leverage are optimal as the way to finance the banks themselves, particularly in the context where such leverage produces systemic risk.

²⁸ Bolton, Mehran and Shapiro (2010) develop a model that includes shareholders, debtholders, depositors and an executive in which this problem can be seen. They propose debt-like compensation schemes that might be helpful.

²⁹ Bhagat and Bolton (2010), and Bebchuk, Cohen and Spamann (2010) show that incentives created by executive compensation led to excessive risk-taking by banks in the years leading to the financial crisis. Bebchuk and Spamann (2010) propose regulating bankers' pay in light of this problem.

high returns in the event of success but do not suffer from the increase in insolvency costs, since their liability is limited. The same is true of managers who are compensated based on equity holder returns. The phrase “heads, I win, tails, the creditor or the taxpayer loses” captures the essence of a problem that has led to many banking crises of the past.³⁰

With non-financial firms, the governance problem of excessive risk-taking is not so severe. First, because overall leverage is much lower, incentives to engage in excessive risk taking are generally much weaker. Second, debt holders impose restrictive covenants, monitor these covenants and intervene if the covenants are broken. Quite often, these debt holders are financial institutions with significant holdings so that there is no question about their incentives (and ability) to engage in the requisite monitoring activities.

With banks, matters are different. First, their leverage is much higher. Second, their debt holders tend to be more dispersed so that the public-good aspects of management discipline generated by monitoring are more important. Third, depositors who are insured do not have an incentive to spend resources on monitoring anyway. These features of bank finance reflect the fact that bank deposits provide an important “money like” transactions function in the economy, with many small depositors caring about the convenience of having funds available for transactions and being unable or unwilling to engage in effective monitoring. Fourth, bank creditors whose claims are implicitly guaranteed by the government, e.g. creditors in “too-big-to-fail” institutions, also have reduced incentives to monitor.

The literature on corporate finance and corporate governance and the literature on banking have extensively studied the impact of different means of financing on these governance problems. These literatures have identified potential governance benefits associated with debt financing, and some people cite these benefits when arguing against significant increases in equity requirements.

In this section, we discuss the main arguments regarding the disciplining role of debt in the context of banking. We distinguish two main lines of arguments:

- (i) that the hardness of the claim held by debtors imposes discipline on management and prevents waste;

³⁰ On excessive risk taking, see Jensen and Meckling (1976), Stiglitz and Weiss (1981); in the context of banking, disastrous examples are provided by the German banking crisis of 1931 (Born 1967, Schnabel 2004, 2009) and the American Savings and Loans Crisis of the eighties (Dewatripont and Tirole 1994, Kane 1989, and White 1991). In the latter crisis, the deregulation of the early eighties permitted *gambling for resurrection* by institutions that would have been declared insolvent if fair value accounting had been properly applied. Haldane, Brennan, and Madouros (2010) argue that observed increases in ROE are not necessarily a measure of increased value brought about by banks, but are more likely the result of risk taking strategies by banks. This is consistent with the suggestion that “risk shifting” is a significant problem in highly leveraged financial institutions.

- (ii) that, with debt finance, the threat of non-renewal of funds eliminates moral hazard, including management taking excessive risks.

In each case, we find the argument that debt is capable of providing governance benefits, let alone uniquely capable of doing so, suspect. Too little attention is paid to the fact that debt finance generates substantial governance problems of its own and that the problem of excessive risk taking or “risk-shifting” is more serious the more highly leveraged the institution is. Too little attention is also paid to the fact that the presumed benefits can also be provided by other devices when equity capital levels are increased. Finally, we note that the experience of the recent financial crisis does not support the case that debt provides effective discipline for banks.

Does Debt Provide Discipline Against Management Misbehavior?

“Capital requirements are not free. The disciplining effect of short-term debt, for example, makes management more productive. Capital requirements that lean against short-term debt push banks toward other forms of financing that may allow managers to be more lax.” (Squam Lake Report (French et al. 2010, p. 44).)

“Equity investors in a bank must constantly worry that bad decisions by management will dissipate the value of their shareholdings. By contrast, secured short-term creditors are better protected against the action of wayward bank management.” (Kashyap, Rajan and Stein (2008)).

From a corporate governance perspective, debt holders have the advantage that their claims are fully specified in advance. Thus, *as long as the bank is able to satisfy these claims*, what debt holders are paid is independent of how the bank is doing in its business, so that *debt is informationally undemanding*. When the bank is doing well, debt holders need not worry much how the bank’s management behaves or whether the management’s business reports are to be trusted. By contrast, outside shareholders have many reasons to worry. For example, they must worry whether management might be diverting funds to its own personal benefits, e.g., by spending excessive amounts on golf tournaments and corporate jets as occurred at RJR Nabisco. This so-called “free cash flow” problem can be particularly severe in mature companies whose managers may find too few profitable investment opportunities in their own area of expertise and therefore look to diversify into other areas.³¹

³¹ On debt as a device to mitigate diversion of company resources for the private benefits of management, see Jensen and Meckling (1976) and Hellwig (2009a). The notion that debt is informationally undemanding is discussed by Townsend (1979), Diamond (1984), Gale and Hellwig (1985), Gorton and Pennacchi (1990), and Dang, Gorton, and Holmström (2010). Debt as a solution to the free-cash-flow problem is discussed by Jensen (1986, 1989, and 1993).

These considerations seem to support the notion that, because debt is a hard claim, the governance problems associated with debt finance might be less serious and less costly than the governance problems associated with equity in reducing monitoring costs and making sure managers operate the firm as efficiently as possible. However, the conditioning statement “*as long as the bank is able to satisfy these claims*” in the preceding paragraph hides the fact that debt finance in fact generates and exacerbates frictions and governance problems that are potentially even more serious and harder to alleviate than the governance problems that might be associated with equity finance. Because of the limited liability of equity, debt gives rise to potential default and insolvency. If default is likely or, worse, if default has already occurred, the suggestion that debt is informationally not very demanding is clearly false. In such an event, sorting out the borrower’s assets and determining what the lenders get is quite costly and may require very large amounts of resources.³² Also, and most importantly, as already mentioned in Section 4.2 and in the introduction to this section, the presence of debt creates incentives for excessive risk-taking. The problem of excessive risk-taking is the more pronounced the more highly leveraged the firm is. It is particularly serious for banks with their extraordinarily high leverage.

The assessment that debt is valuable because it imposes discipline must therefore be viewed in proper context. Whereas the Squam Lake Report points to potential positive incentive effects of debt finance, it ignores the potential negative incentive effects. A proper analysis must consider the tradeoff between them. Along these lines we observe that non-financial firms, faced with the same tradeoff, routinely choose substantially lower levels of leverage than financial firms, yet we know of no evidence that they are more poorly governed.³³

We also question whether the so-called “free cash flow” problem, which focuses on management’s ability to withhold cash from shareholders and engage in wasteful investment, is the primary governance problem to which banks are exposed. In fact, the governance problem that is often alluded to when discussing financial firms in the popular press is not one that debt may solve. Rather, it is the problem of excessive risk taking, which is exacerbated with leverage.

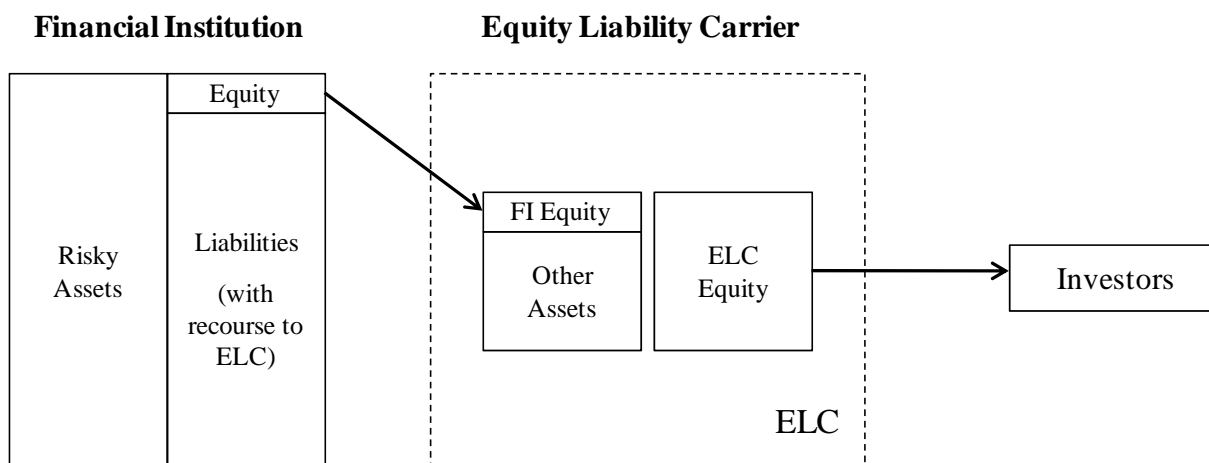
Finally, it is not clear why debt is or should be *uniquely* capable of providing managerial oversight for financial institutions. Fundamentally, managerial incentives are driven by compensation and retention schemes. Capital structure appears to be a rather crude instrument to provide such incentives, and one fraught with socially costly indirect consequences. If managerial oversight is the main motive for high bank leverage, then we would argue that policy makers should focus attention on supporting improved or alternative governance mechanisms, rather than continue to rely on the use of socially-costly high levels of leverage.

³² Beyond direct costs, there are generally significant indirect costs of financial distress and bankruptcy due to operational disruptions, as well as significant social costs imposed upon outside parties.

³³ On average, U.S. non-financial firms have maintained more than 50% equity historically.

As an example of one possible mechanism, consider the proposal of an Equity Liability Carrier (ELC) for financial institutions, introduced by Admati and Pfleiderer (2010). The structure is illustrated in Figure 3.

Figure 3: Increasing Cushions through a Separate Equity Liability Carrier



Under the ELC, existing bank equity, along with additional equity capital associated with increased requirements, are held in a separate holding company with governance that is independent of the bank itself. While the bank’s creditors have recourse to the ELC assets, bank managers do not.³⁴ In this way, bank managers continue to operate under the “discipline” of high leverage, but the ultimate costs of a default are largely absorbed by the ELC. As owners of the bank’s equity, the ELC board and its shareholders have a vested interest monitoring and ensuring the bank is efficiently managed (and given their exposure to the bank’s liabilities, they will guard against risk-shifting as well). As explained in Section 6 below, there is no reason that such a structure, or for that matter additional equity held directly by banks, would have a meaningful impact on the portfolio holdings of final investors.

Other mechanisms are surely possible. Rather than rely on mandatory interest and principal payments to provide discipline, well-capitalized banks could, for example, commit to a level of equity payouts, which, if not maintained, would trigger a shareholder vote to replace incumbent management. Such a mechanism would seem to provide virtually equivalent discipline without the costs of leverage, unless the commitment mechanism could be easily undermined by management.³⁵ In that case, government policy could and should be directed toward

³⁴ Note that the equity of the financial institution is not held publicly. Instead it is held by the ELC. The ELC is 100% financed by equity that is publicly held by investors.

³⁵ It is important to recognize that none of the existing literature considers such mechanisms. Indeed, any effective governance by equity holders is generally ruled out *ex ante*, with the objective of establishing the *potential* role of

strengthening corporate governance practices to allow for such commitment, rather than continue to allow high leverage.

Does the Threat of Non-Renewal of Debt Finance Provide Effective Discipline?

“The key to the market-discipline approach is placing private parties at risk with respect to undesirable behavior by banks. The mechanism for doing so is subordinated debt... Requiring banks to maintain minimum ratios of subordinated debt relative to insured debt ... imposes market discipline on banks, and thus limits banks’ incentives to take on risk. Bankers that take on excessive risk, or who manage assets poorly, will find it difficult to sell their subordinated debts, and will be forced to shrink their risky assets or to issue new capital to satisfy the discipline of private uninsured debt holders.” (Calomiris (1999).)

“A subordinated debt requirement entails much more market discipline because a bank must either go to the market every year to replace maturing debt or shrink. If a bank’s prospects appear poor to investors, its stock price will decline and it may be unable to sell more equity. But it is not forced to shrink under these circumstances, nor will regulators necessarily force a bank to shrink.” (Poole (2010).)

Beyond being a hard claim, the potential disciplining effect of debt is claimed to be enhanced whenever debt contracts, even long-term debt, must be repeatedly renewed. The presumption is that, in fear for their money, creditors will monitor the activities of their bank and, if they see something that they don’t like, they will refuse to renew their loans. It is further assumed that management will refrain from doing anything that might annoy the creditors in order to avoid the difficulties created by a failure to have the bank’s loans rolled over. Calomiris and Kahn (1991), for example, have argued that the “on demand” clause in certain deposit contracts serves to impose such discipline on bank management.³⁶ Because depositors whose deposits are insured, have no incentives to engage in the requisite monitoring, Calomiris (1999) has suggested that banks should issue additional debt – subordinate to any deposits and crucially, *uninsured*– to fulfill the disciplining role that depositors fail to supply (see Calomiris (1999)). Similarly, Poole (2010) suggests that discipline can be delivered by staggered tranches of junior, long-term debt that must be renewed, e.g. ten-year debt with 10% coming due each year.

debt in providing discipline. That debt *uniquely* satisfies this role is a much stronger statement, and one that to our knowledge is completely unsupported.

³⁶ See also Diamond and Rajan (2001), where demandable debt, with the threat of a run, serves to make the banker tougher in his negotiations with the bank’s own borrowers.

Whereas our preceding discussion has pointed to the fact that high leverage itself provides incentives for excessive risk taking, Calomiris (in the quote given above) suggests that even this moral hazard is eliminated by debt holders engaging in monitoring so as to penalize the bank if it takes on too many risks. Calomiris and Poole both suggest that the shrinkage of the balance sheet that would result from long term debt refusing to renew the debt is a better disciplinary device than regulators can otherwise achieve.³⁷ Note that even if one concludes that subordinated debt has some useful role to play, additional equity can still be added to the balance sheet, essentially placing it on top of the “useful” subordinated debt and other liabilities. This will reduce risk and the incentives for risk-shifting, all without reducing the disciplining function the subordinated debt might play.

At this point, however, any theory of the disciplining role of short-term (or renewable) debt must come to terms with the observation that, in the years leading up to the financial crisis of 2007-2008, there was a large expansion of short-term debt of banks. This debt finance, much of it in the form of repo contracts, was provided and repeatedly rolled over without any indication of debt holders exerting discipline. As documented by Adrian and Shin (2010), leverage at leading investment banks reached a peak towards the end of 2007, long after the crisis had broken into the open. By this time asset holdings from subprime mortgage securitization were firmly in place (i.e., the proverbial skeletons were already in the closets).

In the crisis, this short-term debt finance broke down. Short-term funding was withdrawn from conduits and structured investment vehicles in August 2007, from Bear Stearns in March 2008, and from Lehman Brothers in September 2008. These reactions did have serious consequences for the affected banks. However, given the unchecked buildup of positions prior to July 2007, it is difficult to think of these events as an instance of effective discipline of short-term lenders over bank managers. Indeed, the breakdowns of short-term funding appeared to be driven by public information rather than information acquired by the monitoring carried out by short term lenders. The August 2007 breakdown of conduit refinancing through asset-backed commercial paper was triggered by the substantial downgrades of Mortgage Backed Securities (MBS) and Collateralized Debt Obligations (CDOs) by the rating agencies, and by the insolvencies of two Bear Stearns Hedge Funds. The breakdowns of repo refinancing for Bear Stearns and Lehman Brothers were triggered by asset price declines, in particular, in these institutions’ share prices. None of these instances suggests that debt holder monitoring played an effective disciplining role of its own.

In addition to recent history, there are conceptual reasons to doubt the effectiveness of “debt renewal” as an optimal disciplining mechanism. Absent insolvency or market failure, debt can

³⁷ For a recent model that attempts to model the tradeoffs associated with the disciplinary role of rolling over debt, see Cheng and Milbradt (2010). In this model equity and the manager are not distinguished, and only the maturity structure of the debt is considered; the more fundamental question of optimal leverage is not addressed.

always be renewed at a sufficient yield. In that case, the only potential disciplining effect can come from the information that is provided when the debt is repriced. Any actual discipline for managers must still come through shareholders. And while there is potentially valuable information to be learned from the occasional repricing of the firm's debt, it is important to recall that the firm's equity is repriced on a daily or hourly basis, and generally provides even more information regarding the performance of the firm.³⁸ Because debt is informationally less demanding than equity, as long as debt holders believe that the bank is going to fulfill its obligations, they don't care how the bank is doing; in contrast, shareholders always care about the extra million dollars that the bank may be earning or losing. For this reason, monitoring incentives for shareholders with respect to the problem of waste and "free cash flows" are much stronger than for debt holders.³⁹ Moreover, debt holders may forego their own monitoring if they believe that they are protected by marketable collateral or government guarantees, or if they believe that stock prices provide enough of a clue as to where the bank is going.

Thus, debt only directly provides true discipline in the extreme scenario in which refinancing the debt is infeasible due to clear insolvency, or sufficient uncertainty regarding insolvency to induce market failure – a run on the bank. In this regard short-term debt finance also has a significant cost. The presumed disciplinary mechanism relies on uncoordinated behaviors, introducing an element of fragility into the system so that there is a positive probability of distress and inefficient destruction of asset values. Each lender's interest to be first in line if things go wrong may lead to a run taking place simply because each participant fears that the other participants are running. If the bank's assets are illiquid, such a run may result in an inefficient liquidation. The intervention of the short-term debt holders may thus impose large costs on the bank. As recent experience has shown, especially that related to the Lehman bankruptcy, there may be even larger costs for the rest of the financial system and the overall economy.

In the literature on the disciplinary role of short-term debt finance, the problem of fragility has been downplayed, even as the suggested mechanisms rely on fragility to deliver the discipline. The suggestion that short-term lenders may start a run merely because they expect others to do so, as in Diamond and Dybvig (1983), has been countered with the observation that, empirically, runs and other breakdowns of short-term refinancing are triggered by adverse information and should therefore be interpreted as a way of processing that information, possibly even one that is efficient.⁴⁰ In this view, fragility may be an unavoidable consequence of the fact

³⁸ It might be objected that share price levels do not provide direct information about the riskiness of the bank's assets, an item of concern for regulators and creditors, especially uninsured creditors. It should be noted, however, that the volatility of stock prices gives information about the riskiness of the assets. In addition, option markets exist for the publically traded equity of most large banks and option pricing reveals the market assessment of risk levels.

³⁹ Indeed, discipline from shareholders plays a potentially strong role when management incentives are linked to shareholder value; see Holmström and Tirole (1993).

⁴⁰ For theoretical analyses, see Chari and Jagannathan (1987) and Jacklin and Bhattacharya (1988). For an empirical assessment, see Calomiris and Gorton (1991).

that the debt holders' information is noisy. In other words, the possibility that a breakdown of short-term refinancing of a bank may be the result of self-fulfilling prophecies in the strategic interaction between different debt holders is not eliminated when the debt holders' behaviors are driven by their information.⁴¹ Thus, we cannot accept the view that the mechanism of market discipline by short-term debt holders is at all efficient.⁴²

It is important to observe that fragility is essential for the disciplining mechanism that short-term debt is presumed to provide.⁴³ However, because of the potential inefficiencies involved in fragility, regulators often seek to avoid the socially costly consequences of fragility through bailouts or other subsidies. But while bailouts may be justified *ex post*, knowing that they are probable *ex ante* works to undermine any discipline the leverage was intended to provide. Finally, it should be observed that virtually all proposals in the capital regulation share the objective of reducing fragility, thereby in fact undermining any capability, should it exist, for fragility to impose discipline.

In sum, we do not find any strong theoretical or empirical justification for the proposition that high leverage plays a necessary, significant positive role in the governance of large financial institutions. Given that the disciplinary benefits are not apparent, are likely to be small, and potentially can be achieved in other ways, and given the large social costs of highly leveraged and fragile banks, the disciplining argument is in our view not a reason for regulators to avoid imposing high equity capital requirements. Indeed, as we noted in Section 3.1 (and as will be discussed in further detail in Section 7), additional equity can be added to banks' capital structure *on top of existing deposits and any "useful" subordinated debt*. Doing so will further reduce incentives for risk-shifting without sacrificing any disciplining function of such debt.

5.2 Costs from Possible Undervaluation of Equity

“[F]ully two thirds of the CFOs (Chief Financial Officers) said that they were reluctant to issue common equity when they thought that it was undervalued.... Taken together, these findings suggest that a large percentage of companies are

⁴¹ For example, the model with multiple debt holders in Calomiris and Kahn (1991) exhibits multiple equilibria, an equilibrium with all depositors running even though information is good, as well as an equilibrium with no depositors running. In some models in which monitoring provides debt holders with private information, the equilibrium is unique, but may be excessively sensitive to the information that is available. However, in the presence of a public signal, such as the bank's stock price, equilibrium in these models may not even be unique, i.e., fragility due to multiple self-fulfilling prophecies may be an issue. See Morris and Shin (1998), Rochet and Vives (2004), Goldstein and Pauzner (2004), C. Hellwig (2002) and Angeletos and Werning (2006).

⁴² In Rochet and Vives (2004), individual information is noisy and aggregate information is not, but the withdrawal mechanism is ill suited to provide for an efficient use of the aggregate information.

⁴³ Fragility is essential to solve the information acquisition free-rider problem among debt holders, because it provides an incentive to collect information so that they can be first in line when things go wrong, benefitting at the expense of debt holders who are later in line. The lack of co-ordination among creditors that raises the possibility of a run is thus an integral part of the mechanism.

hesitant to issue equity because they feel their stock is undervalued.” (Graham and Harvey (2002, p.16-17).)

Statement: “Equity issuance is costly when managers perceive it to be undervalued or because equity issuance has a negative price impact.”

Assessment: This is not a valid reason to allow banks to have high leverage; better capitalized banks would suffer less from this problem, and there are ways to mitigate costs of issuing equity by reducing the banks’ discretion.

Bankers are reluctant to issue equity when they believe it is undervalued in the market. They are also averse to selling shares when they believe equity issuance would be met with a negative stock price reaction. Such a reaction will occur if investors fear that equity is relatively likely to be issued when managers believe the bank is weak.⁴⁴ Because of the negative “signaling” effect associated with issuing new shares, bank management may avoid issuing equity to meet increased capital requirements, and instead cut lending as a way to build up capital.

Note first that the negative signaling effect of equity issuance on stock prices can be neutralized by eliminating managers’ discretion regarding the issuance decision. Recall that in the original implementation of the Troubled Asset Relief Program (TARP) in 2009, the government did not give large banks the choice of whether to accept government investment or not, so as to mute any information that might be gleaned from the choices made by the banks. In a similar fashion, corporate insiders eliminate negative inferences that might be drawn from their stock sales by committing in advance to selling pre-specified amounts at pre-specified times. If increased equity capital requirements are accompanied by regulation mandating that all banks issue new equity at a pre-specified schedule, the “stigma” associated with equity issuance would be removed, and banks would not have a reason to reduce lending in order to satisfy capital requirements.

It is also very important to observe that if banks were better capitalized, they generally would have more retained earnings available to fund new investments, since they would have less to pay out in required interest payments. With higher retained earnings, banks could expand lending activity more rapidly without the need to raise external capital, which might involve issuing undervalued securities. Not only will better capitalized banks have less to pay out in required interest payments, they will also have reduced incentives to pay large dividends. This is because the more highly leveraged a bank is, the more the equity holders gain (at the expense of debt

⁴⁴This observation was first made in Myers and Majluf (1984) in the general context of firms raising outside capital. For a model where this effect is present in the context of banking, see Bolton and Freixas (2006).

holders or those guaranteeing the debt) from a given cash payout to equity.⁴⁵ The lowered incentive to pay dividends in better capitalized banks will lead to more retained earnings.

Note also that if a bank does issue equity, the cost associated with any under-pricing of equity is likely to be lower when a bank has higher capital. As we have shown in Section 3, higher capital lowers sensitivity of the value of equity to the value of the bank's underlying assets. Thus, if investors undervalue a bank's assets, the underpricing of its equity will be lower in percentage terms when the bank has more existing equity than in the case where it is highly leveraged. In that sense, managers and equity holders of better capitalized banks would find that the cost of raising external funds are not as significant as they would be if the bank were highly leveraged.⁴⁶

Finally, we observe that, while issuing equity might be costly for the bank's existing shareholders, buying underpriced equity benefits new investors. Thus, the costs for the bank's existing investors can be mitigated simply by giving them the option to participate in the new issue through a rights offering. In this case any costs shareholders incur due to under-pricing will be offset by gains on their new holdings.

To summarize, concerns about the costs associated with issuing equity due to the possibility that it is undervalued are not legitimate reasons to avoid imposing higher equity capital requirements on banks. Since information-related costs can be mitigated if bank managers have less discretion with respect to payout policies and the issuance of new equity, increased equity capital requirements can be implemented with new equity issuance in a relatively short period of time and without significant cost to existing shareholders.

5.3 Is Observed High Leverage Evidence that Equity Requirements are Socially Costly?

“The tendency for banks to finance themselves largely with short term debt may reflect a privately optimal response to governance problems.” (Kashyap, Rajan and Stein (2008).)

Statement: “The fact that banks voluntarily choose high leverage is evidence that such leverage must be optimal from a contracting perspective. Attempts to limit bank leverage will therefore be privately and socially costly.”

⁴⁵ In our view (and in the view of many others), the U.S. government should not have allowed large banks to continue paying dividends while at the same time providing TARP funds to recapitalize these institutions and encourage lending. Banks in England, by contrast, were forbidden from paying dividends during this period.

⁴⁶ More precisely, for a given dollar amount of equity raised, the cost from underpricing will be lower with higher capital. If the bank raises both equity and debt in the same proportion as its original capital structure, then the cost from underpricing will be independent of capital structure.

Assessment: This statement is false. First, systemic risks, as well as tax subsidies and implicit guarantees may make high leverage privately optimal to bank shareholders and managers even when it is in fact socially suboptimal. Second, managerial compensation that is linked to ROE exacerbates the incentives to undertake high leverage. Third, because of ongoing incentives to increase leverage at the expense of earlier creditors, it is likely that observed bank capital structure itself is at least partly due to the banks' imperfect ability to precommit their own future financing choices. Such constrained "optimality," which takes as given the bank's inability to commit, does not preclude the possibility that capital regulation might lead to better outcomes even from a private *ex ante* perspective.

There is the view that, even if we do not have a theoretical justification for it, high leverage must be efficient for banks *simply because that is the capital structure that banks have chosen*. While this "revealed-preference" of banks for high leverage is clear, the fact that banks are highly leveraged does *not* mean that regulation cannot improve over this outcome from a social, or even a private, perspective. As we show below, the mere existence of high leverage in financial institutions cannot be regarded as evidence that this outcome is privately or socially desirable.

As we observed in Section 4, there are reasons, such as taxes and implicit guarantees, that banks find debt an attractive form of financing. High levels of leverage could simply be the optimal response to these subsidies.⁴⁷ More generally, if default on debt involves external costs that are not borne by the contracting parties – i.e. the bank, its managers, or its outside financiers – then private contracting will lead to an excess of debt finance relative to what is desirable from a social point of view. Because banks have a private incentive to increase leverage in order to take advantage of subsidies, and because banks do not account for the negative externalities their own leverage creates, we cannot use their choice as a measure of the socially optimal level of bank leverage.⁴⁸

While it is clear why observed bank leverage is not socially optimal, it is tempting to presume that it is at least privately optimal from the perspective of bank managers and investors. This presumption, however, is unproblematic only if these financing patterns are committed to *ex ante*, before the bank is set up. If, at that time, *all* the prospective participants, present and future financiers, agree on a complete contract and *can foresee all contingencies*, the result can be

⁴⁷ Hanson, Kashyap and Stein (2010) argue that competition among banks pushes them to reduce funding cost as much as possible, and this drives them to be highly leveraged. In our view the main reason that leverage reduces banks' funding costs is because it allows them to take greater advantage of government subsidies associated with debt. In a model with competition, most of these advantages would be passed on to borrowers, but this does not justify high leverage, which is socially costly. As noted in Section 4.1, if the government wishes to subsidize the banks' borrowers, it should do so directly, and not indirectly through subsidies to bank leverage.

⁴⁸ In this regard a better benchmark for optimal leverage in the absence of subsidies may be real-estate investment trusts (REITs), which do not enjoy tax benefits from leverage nor are candidates for bailouts in the event of default. Historically, REITs have typically maintained equity capital in excess of 30%. (See Ooi, Ong and Li, 2008.)

presumed to be privately optimal. In practice, however, financing is determined by an ongoing process, with new contracts being concluded all the time. In this setting, there are reasons to believe that observed financing structures are not privately optimal, and that the extent of debt finance can be excessive even from the perspective of the participants themselves.

The basic problem is that new financing decisions affect the return prospects of incumbent debt holders and shareholders, i.e., they have an “external effect” on existing claim holders. These effects may be positive or negative in principle, but since managers who have incentive contracts that are based on equity performance typically make the decisions, decisions that cannot be committed to in advance would typically benefit equity and dilute the value of existing debt.⁴⁹ For example, if incumbent debt holders do not have strong defenses against a dilution of their claims by new borrowing, the bank’s management may have excessive incentives to engage in such borrowing.⁵⁰ We may presume that incumbent debt holders do as much as they can to protect themselves against such dilution by introducing appropriate covenants when they provide their funds to the bank. However, to the extent that such covenants are not complete, there is always a risk that the covenant has a loophole that provides room to engineer such a dilution anyway. Given these risks, observed market outcomes may involve too much use of contracts that dilute previous financiers’ claims relative to what would be privately optimal under perfect commitment.

Furthermore, once a bank is over-leveraged, either due to possible exploitation of existing debt holders as noted above, or from an adverse change in asset values due to market conditions, there are strong incentives for it to remain that way. Reducing leverage by issuing equity would improve the value of the bank’s debt, thus transferring resources from equity holders to debt holders. This so called “debt overhang” problem is a strong deterrent against raising new equity capital.⁵¹ The fact that managers and equity holders prefer to raise additional funds using debt rather than equity can be viewed as another manifestation of the risk-shifting incentive of shareholders discussed in Section 5.1. Whereas a new equity issue at this time would force the shareholders to accept a dilution of their positions as a way of bearing the loss, they avoid the dilution by gambling on, hoping to improve their position if the gamble succeeds.

⁴⁹ Positive external effects are to be expected if the inflow of new money enhances the bank’s prospects and saves the bank from an imminent default, and negative external effects are to be expected if the claims of the new financiers dilute the positions of the incumbents.

⁵⁰ This agency problem associated with debt, that equity holders have an incentive to take advantage of existing debt holders by diluting the value of their claim, is discussed in most corporate finance textbooks; see e.g. Berk and DeMarzo (2010). For a specific model, Bizer and DeMarzo (1992) demonstrate that even if existing debt holders have seniority, borrowers have an incentive to issue junior debt that reduces the value of senior debt by lowering its credit quality. The equilibrium level of leverage can then be well in excess of the ex ante optimum. A manifestation of the same problem, due to lack of commitment about the maturity structure of debt, is key to results in Brunnermeier and Oehmke (2010), who show that banks have an incentive to shorten the maturity of claims to “preempt” existing creditors. Thus, banks may have too much short-term debt relative to the ex ante optimum.

⁵¹ For the “debt overhang” problem of shareholders fearing that returns to new investments will be captured by debt holders, see Myers (1977).

The problem of moral hazard in ongoing financing relations also concerns dividend policies. If a bank is highly leveraged, the bank's shareholders — *and the bank's managers as well* — have strong incentives to have earnings paid out, rather than retained, since if earnings are retained there is the possibility that they will be used to satisfy the claims of the debt holders in financial distress. As a further manifestation of the debt overhang problem, the bank, by maintaining high payouts, effectively under-invests relative to the policy that would be chosen by a less highly leveraged bank.

Another reason it may be difficult for banks to reduce leverage arises if prospective new shareholders are worried that they don't know enough about the skeletons that the bank may still have in its closets. In that case, as discussed in Section 5.2, a new equity issue is likely to be perceived as an indication that the value of the assets of the bank is known by managers to be low. In this case they may insist on a low share price, too low perhaps to meet the incumbent shareholders' demand that their positions not be diluted. Absent a mandatory requirement to recapitalize the firm, bank managers are likely to be reluctant to do so for fear of such underpricing.

Another important consideration has to do with managerial compensation. Bank managers are often compensated in ways that are linked to the Return on Equity. This gives managers further incentives to choose high leverage, because this too helps magnify their compensation.

Thus, for the reasons we have outlined, high leverage is unlikely to be an optimal solution to a contracting problem, from either a social or private perspective. Banks have strong incentives to maintain high leverage to exploit both tax and distress-related subsidies, and ignore any systemic risk this leverage creates. Moreover, absent the ability to commit, heavily indebted banks have incentives to maintain or increase leverage and equity payouts in order to exploit existing debt holders. As a result, we should not use observed levels of leverage as an indication that increasing equity capital is socially undesirable.⁵²

6. Equity Requirements and Bank Lending

“Bankers warned higher capital requirements would inhibit economic growth. Regulators were doubtful but agreed to make some changes.” *The Wall Street Journal*, August 30, 2010.

Statement: “Increased equity requirements would have an adverse effect on the lending decisions of banks and will inhibit economic growth.”

⁵² This is consistent with the finding in Mehran and Thakor (2010) that bank valuation measures seem to be positively correlated with higher levels of equity capital in the cross section.

Assessment: This statement is false. High leverage distorts lending decisions and because of this, better capitalized banks generally make *better* lending decisions. In particular less leveraged banks are less inclined to make excessively risky investments or to pass up worthwhile loans due to frictions associated with high leverage.

We now turn to what seems to be the biggest concern many have expressed about increased capital requirements, namely the notion that increased requirements will cause banks to cut back on lending and to charge more on the loans they make. Based on the discussion in Sections 3-5 we are now in a position to offer a detailed analysis of this issue.

Before attempting to analyze the claims that increased equity requirements would lead to a “credit crunch,” we must remember that the biggest “credit crunch” in recent memory, the total freezing of credit markets during the recent financial crisis, was not due to too much equity but in fact to the extremely high levels of leverage in the financial system. In other words, credit crunches arise when banks are *undercapitalized*. If all banks have sufficient equity capital, they will have no reason to pass up economically valuable lending opportunities, and the risk of future credit crunches is reduced.

Arguments that increased equity capital requirements will adversely affect banks’ lending seem to fall into two categories. In the first category are arguments to the effect that, when banks have less equity than required, they will cut back on lending. In the second category are arguments to the effect that banks’ lending criteria are tied to the way they are funded and that, with a greater share of equity finance, lending criteria will be more restrictive. We examine these two types of arguments separately.

Arguments to the effect that banks cut back on lending because they have too little equity often are rooted in the belief that, with a “fixed amount” of bank capital, higher equity capital requirements can only be met by scaling back on loans and other investments. For some institutions, e.g., public banks in Germany, which have only limited access to the market, this belief may be justified. However, in the absence of such institutional constraints and other frictions, it is unjustified. As noted in Section 3, higher equity capital requirements do not need to be met by scaling back on loans and other investments. Banks can in fact continue their lending without scaling back *and* at the same time meet higher requirements, either by substituting equity for some liabilities (as suggested in Figure 1, Balance Sheet B) or by expanding the balance sheet (as suggested by Figure 1, Balance Sheet C).

Thus, the imposition of higher capital requirements does not *force* banks to restrict lending. However, as discussed in Section 5, undercapitalized banks might *choose* not to issue new equity -- and thereby pass up valuable lending opportunities -- because doing so would (i) help creditors

at the expense of shareholders (the “debt overhang” problem) and (ii) potentially send a negative signal to the bank’s investors regarding its future prospects. The problem of debt overhang is particularly relevant in the transition when higher capital requirements are imposed. It is also relevant in a crisis, when losses have eaten into bank equity. There is evidence that both of these concerns played a significant role in the recent crisis, and it is the reason that governments (through programs such as TARP in the U.S.) attempted to reduce bank leverage using capital injections and asset purchases.⁵³

To overcome this private disincentive to issue equity and recapitalize, the imposition of higher capital requirements should be accompanied by requirements for banks to quickly meet them by restricting payouts and issuing new equity.⁵⁴ Furthermore, if a bank fails to maintain sufficient equity capital, similar mandates should be triggered. Once appropriately recapitalized, banks are positioned to invest in any new profitable lending activities that arise.

Another type of argument that increased capital requirement will lead to a contraction of lending is based on the notion that changes in capital requirements will make some loans unprofitable that were previously profitable to make. This change in profitability will, it is argued, be due to the fact that these loans must be “funded” in a different way. The change in profitability will then lead to changes in banks’ lending decisions. In this context the appropriate question is not only whether better capitalized banks make different loan decisions than more highly leveraged banks, but also whether their lending decisions will be better or worse, *from a social perspective*. In fact, we will argue at the end of this section that if banks have significantly more equity, they are likely to make more *appropriate* lending decisions and we can expect the cost of credit to be as low as is economically justifiable.

More appropriate lending decisions may involve reductions in some kinds of lending. Such reductions, however, while annoying to the potential borrowers, may well be beneficial to the economy as a whole. For the economy as a whole, the objective is not to have as much lending as possible, but to have as much lending as is appropriate in view of investors’ willingness and ability bear risks. Excessive risk taking, as discussed in Section 5, may well take the form of excessive lending. This should be avoided.

⁵³ There is also a concern that, with capital requirements framed in terms of risk-weighted assets, bank loans would be most strongly affected by this scaling back. By cutting back on conventional banks loans, which carry a risk weight of 100%, banks can reduce capital needs much more than by reducing their holdings of bonds or asset-backed securities that have lower risk weights. Thus, as argued by Brealey (1996) and Hellwig (2010), the current system of risk-weights used in capital regulation might itself contribute to a credit crunch. Given the experience with asset-backed securities in the crisis, the risk weights driving this diversion of funds out of lending and into marketable securities seems inappropriate and distortionary.

⁵⁴ Hanson, Kashyap and Stein (2010) discuss the importance of debt overhang in potentially leading to lending contraction when banks are under-capitalized and make similar recommendations.

How does the way loans are “funded” affect their profitability? Some of the discussion of this issue and the effects that capital requirements will have on banks’ lending decisions appears to involve the fundamental fallacies about capital structure and banks’ cost of capital that were discussed in Section 3.3. In order to avoid these fallacies one must be very careful to properly account for changes in risk when considering how loans are made and funded. As an example, consider the following assessment by Acharya, Schnabl, and Suarez (2010, p. 33) of banks using conduits and structured investment vehicles in order to invest in mortgage-backed securities without backing them by equity capital.

“We can assess the benefits to banks by quantifying how much profit conduits yielded to banks from an ex-ante perspective using a simple back-of-the-envelope calculation. Assuming a risk weight of 100% for underlying assets, banks could avoid capital requirements of roughly 8% by setting up conduits relative to on-balance sheet financing. ... Further assuming an equity beta of one and a market risk premium of 5%, banks could reduce the cost of capital by $8\% \times 5\% = 0.004$ or 40 basis points by setting up conduits relative to on-balance sheet financing.

... banks earned about 10 basis points on conduit assets. ... it seems clear that conduits would not have been profitable if banks had been required to hold equity against their assets in conduits. In fact, banks would have made a loss of 30 basis points on each dollar invested. However, given that banks were not required to hold equity, they could earn a “profit” of 10 basis points.”

In this analysis, the profitability of investing in mortgage-backed securities is assessed by comparing expected returns on additional investments with required returns on particular financing instruments.⁵⁵ If no equity is used for refinancing, the investment earns 10 basis points over the calculated financing rates, while if 8% of the investment must be refinanced by equity, the investment falls 30 basis points short of the calculated financing rates. Of course, what is completely missing from this type of calculation is any consideration of risk. Whether a premium of 10 basis points over refinancing rates is considered satisfactory or not should depend on the amount of risk that is involved and on the premium that should be required to make this risk acceptable. In the assessment that is cited by Acharya et al. (2009), however, there is a complete neglect of the risk that the investment in mortgage-backed securities has imposed on the banks and their financiers. As we have seen in August 2007, this risk ended up being very real.

To make the fallacy involved in ignoring risk in the profit calculation completely obvious, consider the implications of this argument taken to the extreme. If one simply compares investment return with apparent financing costs to compute profitability as is done in the

⁵⁵Boot (1996) and Boot and Schmeits (1998) argue that in making investment decisions bankers use a type of “mental accounting” where they match the loans they make with particular sources of funding, and compare returns on that basis.

example above, then it follows that almost *any* bank and *any* firm can significantly increase its “profitability” by issuing debt and using the proceeds to buy the debt issued by firms with lower credit ratings. A firm with a rating of A might be able to issue debt at 6% and use the proceeds to finance investment in B-rated debt with an expected return of 7.5%, producing 150 basis points of “pure profit.” Of course, it is easily seen that this increases risk and the shareholders must be compensated for this. The true question is whether the extra 150 basis points in return compensates for the increased risk.

From a normative perspective, in a world without frictions and distortions, the decision on whether to make a particular loan or not should be *independent* of the bank’s capital structure, i.e., on how the bank is funded. The decision should depend only on whether the excess of the loan rate over the market rate of interest for risk free securities provides the bank with a sufficient premium to make the risks associated with the loan acceptable. This latter question in turn should depend only on the risk characteristics of the loan and on the assessment of these risk characteristics by investors in the market.⁵⁶ Neither the bank’s other assets, nor the bank’s capital structure should play a role.⁵⁷

The key ingredient of the analysis is the overall required return *that is appropriate for the investment*. The required return for the loan is determined by its riskiness as it is measured and priced in the market place of risky investments. From this perspective, the assessment cited by Acharya et al. (2010), which may well be a realistic description of how bankers would make this particular decision, appears as an instance of managers attempting to take on excessive risk at the expense of incumbent financiers, or of the taxpayers, and hoping they can enjoy the upside without needing to worry about the downside.⁵⁸ A bank that invests billions of dollars in mortgage-backed securities to earn 10 basis points above commercial-paper rates is raising expected returns to shareholders. However, to do so, it must bear the associated risks – risks from borrowing short to buy long-lived securities as well as the credit risks of mortgage-backed securities. These risks burden incumbent debt holders (and the government to the extent that it implicitly guarantees the bank’s debt) as well as shareholders. If markets are informed about these risks, the required rates of return on the bank’s securities must adjust. Unless the premium of 10 basis points is deemed to be sufficiently high, this adjustment makes incumbent debt holders and shareholders take a loss. If markets are not informed about these risks, which may

⁵⁶ In the simplest mean-variance model of risk pricing, the loan’s risk would be assessed in terms of its covariance with the market, and the requisite risk premium would be derived by weighting this covariance with the market price of risk.

⁵⁷ One may object that in practice bank loans tend to be opaque and market investors are unable to completely assess their risks and price them. This objection does not have any bearing on what should occur from a normative perspective. Indeed, it highlights the importance of understanding the criteria that the bank should be using. In the end, even if the bank does know more about the loan at the time it is originated, market investors will generally develop some understanding of the risk characteristics of the bank’s loan portfolio, and will use this understanding to price the bank’s securities in the market.

⁵⁸ This is an instance of the problem, discussed in Section 5.3, that issuing additional debt to fund new investments may be the result of a conflict of interest between equity holders (or managers) and previous financiers.

well have been the case in the situation that is described here, incumbent debt holders and shareholders will still be damaged when the risks come home, as they in fact did in August 2007.

As discussed in Section 4, it is true that increased equity capital requirements will remove some of the subsidies banks capture through high leverage, namely tax and implicit guarantees. If taking away these subsidies causes banks to lend less or to charge higher rates than is considered desirable, it may be desirable from a public-policy perspective to subsidize bank lending. If lending needs to be subsidized because it is important for the economy then, as we argued in Section 4, more targeted and less costly ways must be found to provide such subsidies than encouraging banks to be highly leveraged.

We now turn to the question of whether better capitalized banks will make better or worse lending decisions. The discussion in Section 5 suggests that, because of frictions associated with governance and information, highly leveraged banks are generally subject to distortions in their lending decisions. These distortions may lead them to make *worse* lending decisions than they would have made if they were better capitalized, involving either too much or too little lending relative to some social optimum. First, equity holders in a leveraged bank, and managers working on their behalf or compensated on the basis of ROE, have incentives to make excessively risky investments, and this problem is exacerbated when the debt has government guarantees.⁵⁹ Second, when banks are distressed, credit markets can freeze and certain loans will not be made due to a “debt overhang” problem. Valuable loans that are not made as a result of debt overhang *would be* undertaken if the bank were better capitalized, since in that case the value created by the loans would be captured by those who would fund it.

We have also argued that better capitalized banks, which have more internally generated funds with which to make new loans, would have less need to issue new claims and thus are less likely to have to issue undervalued equity. And it is possible for regulators to reduce the resistance of banks to issue equity or to withhold dividend payments that is due to negative market reaction to such actions. Thus, while banks might find it difficult to raise new equity if investors are suspicious that they have “skeletons in the closet,” it might be possible for regulators to alleviate some of this problem by mandating new equity issuance and limiting payouts so as to enhance banks’ ability to retain earnings until they build adequate cushions. In any case, this issue will not affect lending adversely once banks are better capitalized.

To summarize, under appropriately designed and significantly higher equity capital requirements, banks would be more likely to make better, more *economically appropriate*, lending decisions, and engage less in either too much or too little lending from a social

⁵⁹ It has been argued (perhaps with some hindsight bias) that a significant number of the loans that were made prior to the 2007-2009 financial crisis, such as some sub-prime mortgage loans, were ones that should not have been made and could not be justified by conventional lending standards.

perspective. To the extent that banks can quickly get to the point of being better capitalized (by adding equity without suffering negative consequences, as discussed in Section 5.2), there should be no concern with any negative impact on the economy of increased equity capital requirements.

7. Increased Bank Capital, Asset Allocations, and Liquidity

Our discussion so far has addressed the implications of higher equity requirements for the banks' funding costs and for their lending policies. Lending policies are likely to change as banks' lending incentives change, but, as we have argued, since incentives are better aligned, any change in lending policies is likely to be an improvement from a social welfare perspective. What then are the implications for bank deposit finance? After all, transactions services provided by deposits are a major function of the banking system.

We have argued in Section 3.1 that there is no need for banks to change their deposit base or even to reduce the amount of debt they have in response to an increase in equity requirements. Recall Balance Sheet C in Figure 1: A transition from the original balance sheet to Balance Sheet C would involve issuing new equity and using the proceeds to purchase additional assets such as marketable securities. We now address some concerns that might be raised regarding this way of creating a larger equity cushion.

One concern might be that it is costly or inefficient for banks to hold large positions of marketable securities that are unrelated to their core business. Among non-financial firms, however, it is common to hold cash and marketable securities. For a set of large technology firms, the size of these holdings is shown in Table 1.

Table 1: Cash Holdings of Large Technology Firms (June 2010)

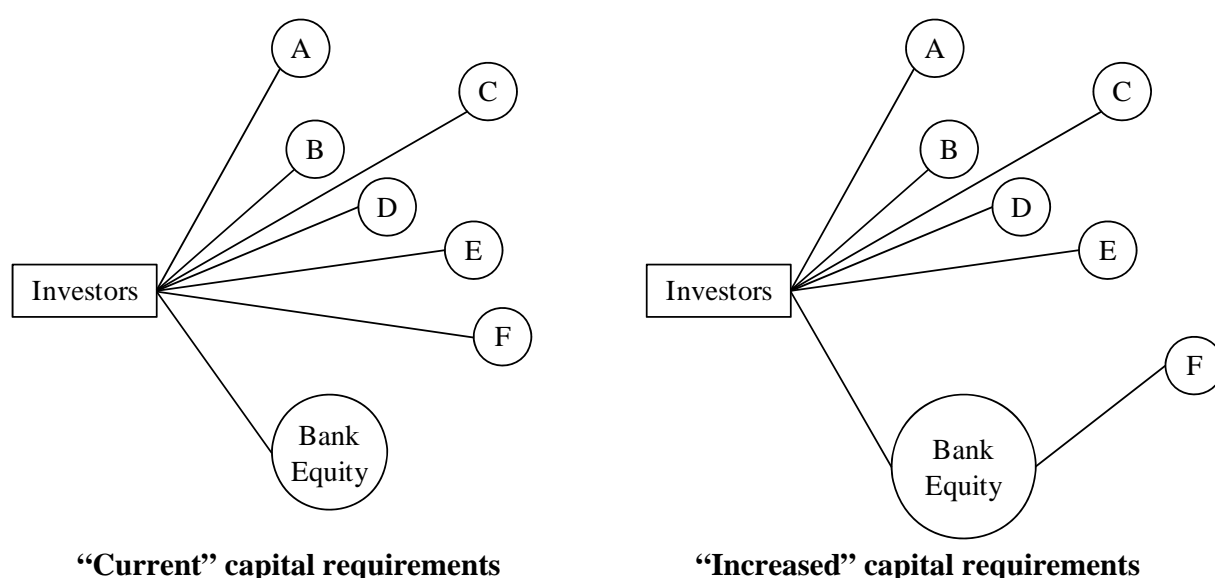
	Cash and Marketable Securities	Percentage of Total Value of Assets
Apple	41.7B	15.8%
Cisco Systems	35.1B	21.7%
Google	24.5B	15.0%
Intel	17.3B	13.2%
Microsoft	39.7B	14.7%

Non-financial firms may hold these reserves in anticipation of future investment opportunities and as a precaution against bad times. The fact that they do so seemingly indicates that, at least for them, the private benefits of holding these reserves exceed the costs. If holding cushions is feasible for these non-financial firms, why can't leveraged banks also have cushions

simply for the purpose of backing up their substantial debt obligations? Surely the concern that holding such securities is unrelated to core business of a bank is much less compelling than it is for non-financial firms.

From the perspective of the overall economy, one might ask whether, economically, it makes sense for banks to issue equity in order to hold marketable securities and thus to “intermediate” the holdings of securities in the economy. Doesn’t this reallocation distort the structure of the overall financial system? Figure 4 illustrates the implications of expanding the bank’s balance sheet using newly issued equity to acquire marketable securities.

Figure 4: Expanding a Bank’s Balance Sheets with Marketable Securities



The figure shows that if the bank issues more equity to buy marketable securities, there is not necessarily any effect on the aggregate assets – or the aggregate production activities – in the economy. On the left-hand side of the figure, investors hold securities A through F directly, as well as bank equity. On the right-hand side of the figure, investors hold securities A through E and a larger position of bank equity than before. Security F is now being held by the bank. Indirectly, however, investors are also “holding” this security as shareholders of the bank. Ultimately, directly or indirectly, all securities, representing claims against all assets in the economy, are held by final investors. All that is done by moving from the left-hand side to the right-hand side of Figure 4 is to arrange the claims in a different way. Aggregate asset allocations in the economy are not affected.

Thus, in the context of the entire economic system, expanding banks’ balance sheets does not change, and in particular does not prevent, the undertaking of any and all productive activities, and it also does not need to affect the risk-return profile of the holdings of individual and

institutional investors.⁶⁰ Those who hold diversified portfolios of assets still have access to the same combinations of risk and return, and the riskiness of bank equity, as modified by additional holdings, can be taken into account.⁶¹

This is not to say that there are no real effects of replacing the arrangement on the left-hand side by that on the right-hand side of Figure 4. First, on the right-hand side of Figure 4, the chain of transactions linking final investors to the issuer of security F is potentially longer; this longer chain might involve higher transactions costs.⁶² Second, the greater the equity that the bank has on the right-hand side of Figure 4, the more robust the bank is in “crisis” situations, when bank assets fall significantly in value. In such a situation, some of the value of security F is received not by the bank’s shareholders but by its creditors. The loss is borne by shareholders. From a social perspective, such an outcome is much better than a default that would have severe repercussions for the rest of the financial system. In addition, the fact that the loss is borne by the shareholders and not by creditors and the government reduces ex ante risk shifting incentives.

In terms of what types of securities banks would purchase if they need to add cushions but do not have valuable loans to make note that between January 2008 and August 2010, the outstanding U.S. treasury debt held by the public increased by \$2.4 trillion. This increase alone represents almost 20% of the total value of assets held by U.S. commercial banks, which is approximately \$12 trillion. These new assets, among others, could be used to increase banks’ equity by as much as 16.6%. The use of marketable securities to increase the equity cushion of banks, however, does not require that all or even most of these securities be completely liquid or “safe.” The addition of any security to the bank’s balance sheet acquired using the proceeds of an equity issuance decreases systemic risk.

Our discussion up to this point has been exclusively focused on the costs and benefits of increasing the equity capital requirements of banks. Another important regulatory issue concerns liquidity requirements for banks. A full discussion of liquidity requirements is beyond the scope of this paper, but it is useful to make a few observations about liquidity in the context of our analysis of increased equity requirements. Much of the focus on liquidity needs of banks is related to the fragility associated with highly leveraged banks that rely on short-term funding. Liquidity problems arise when short term funding is not renewed and banks may be forced to sell assets on short notice. Liquidity is important because a liquidity crisis can lead to distress for banks that are technically solvent. For such banks a significant “reserve” of liquid assets may be prudent. Liquidity reserves become less important when banks are much better capitalized. First, even if a bank uses short-term funding, the scenarios that require liquidity (e.g. a run on the

⁶⁰ The one exception to this is the redistribution of liability in a crisis away from the government and its taxpayers and toward bank equity holders.

⁶¹ To the extent that bank equity becomes less risky, those who would like to take on additional risk can create leverage by buying on margin, trading options in an exchange, etc.

⁶² However, if these securities were already held by other intermediaries, the effect may not be there at all.

bank) become less likely when the bank is better capitalized. Second, if the bank is better capitalized, the central bank or “lender of last resort” has less reason to worry that a liquidity crisis is actually a solvency crisis. Increased equity capital thus ultimately lowers the cost of central banks providing liquidity backstops.

We have argued that the social costs of banks holding thicker capital cushions are very small. We are not necessarily saying that the social costs of increased liquidity requirements are small. Cash is obviously the most liquid of assets, and it pays no (nominal) return. The cost of the liquidity provided by cash is the opportunity cost of not receiving a higher return from a less liquid security. Holding excessive amounts of cash (or other liquid assets whose return is low because of a liquidity premium) relative to the bank’s liquidity needs is costly because the bank pays an unnecessary liquidity premium. This inefficiency can be interpreted as a social cost.⁶³ As discussed above, however, additional equity does not necessarily have to be invested in cash, and it can either be put into profitable lending or invested in marketable securities that earn risk-adjusted, market-determined returns. Because increased equity requirements can reduce the need for liquidity as discussed above, they provide an additional benefit of reducing the total cost of liquidity that banks must bear.

Finally, banks play an important role in helping to satisfy demand for liquidity by issuing “money-like” securities. These are safe, liquid, and “informationally insensitive” securities in the sense that those who buy and sell them do not need to invest resources to figure out how to value them, and those trading them are less worried about trading with better informed counter parties.⁶⁴ In expanding the balance sheet we have not reduced the dollar amount of the banks liabilities and so we have not reduced the amount of money-like securities it issues. The increased capital cushion further reduces the probability of default of the bank, making the money-like securities even less risky and more informationally insensitive, and thus more liquid. Increased bank capital thus allows banks to reduce their demand for and increase their supply of liquid assets in the economy.

8. A Skeptical View of Contingent Capital in Capital Regulation

Contingent capital, i.e., debt that converts to equity in some scenarios, has recently been proposed, e.g., by Flannery (2002) and Squam Lake Group (French et al., 2010), as a security that regulators should encourage or perhaps require financial institutions to issue. This notion is being examined by the Basel committee as an alternative to at least some Tier 2 capital that

⁶³ For a formal treatment of the costs of inefficient holdings of liquid assets and the role of public liquidity provision, see Bolton, Santos and Scheinkman (2010)

⁶⁴ See, for example, Gorton and Pennacchi (1990), and Dang, Gorton and Holmström (2010).

could absorb some losses in a crisis. Related proposals involving mandatory conversion of debt to equity to help simplify bankruptcy procedures have been termed “bail-in.”⁶⁵

Clearly, once a bank is in difficulties, it is important to have mechanisms that provide for “expedited resolution” without having to go through all the potential inefficiencies of an insolvency proceeding. However, while such remedies are clearly valuable from an *ex post* perspective, contingent capital, as a security on the bank’s balance sheet, must be assessed from an *ex ante* perspective, and thus in the context of capital requirements for banks.⁶⁶ Indeed, *any* regulation regarding the types of securities that are issued by financial institutions must be assessed in this more general context and assessed within all possible strategies, including increasing equity requirements.

From this perspective, contingent capital appears as a form of hybrid capital, subordinated debt that is transformed into equity when the stipulated conversion conditions are realized. As such, it has both debt-like and equity-like features. From a public-policy perspective, the question must be why the particular combination of debt-like and equity-like features in contingent debt should be preferable to the combination that is obtained by issuing a combination of debt and equity in the first place. If we want to enhance the bank’s capital cushion, why not just require the cushion to come in the form of simple equity?

In many discussions it appears that one of the main motivations for having “debt-like” contingent capital is to preserve for the banks the tax subsidy associated with debt financing. As discussed in Section 4.1, however, preserving this subsidy is not justified from a public-policy perspective.⁶⁷ There are many other complications that arise with contingent capital, particularly how triggers and conversion rules should be designed so as to make it an effective cushion and also prevent potential for manipulation by investors or managers, especially close to such times when the triggers are potentially reached.⁶⁸ Given these and other complications, and the fact that

⁶⁵ On the bail-in concept see, for example, “From Bail-Out to Bail-In,” *The Economist*, January 30, 2010.

⁶⁶ Contingent capital is often discussed in the narrow context of how regulators would handle distressed financial institutions at the time of systemic crisis. For example, in French et al. (2010), contingent capital is discussed in a chapter that is distinct from the discussion of capital regulation (and in fact these two chapters are separated by a chapter on compensation).

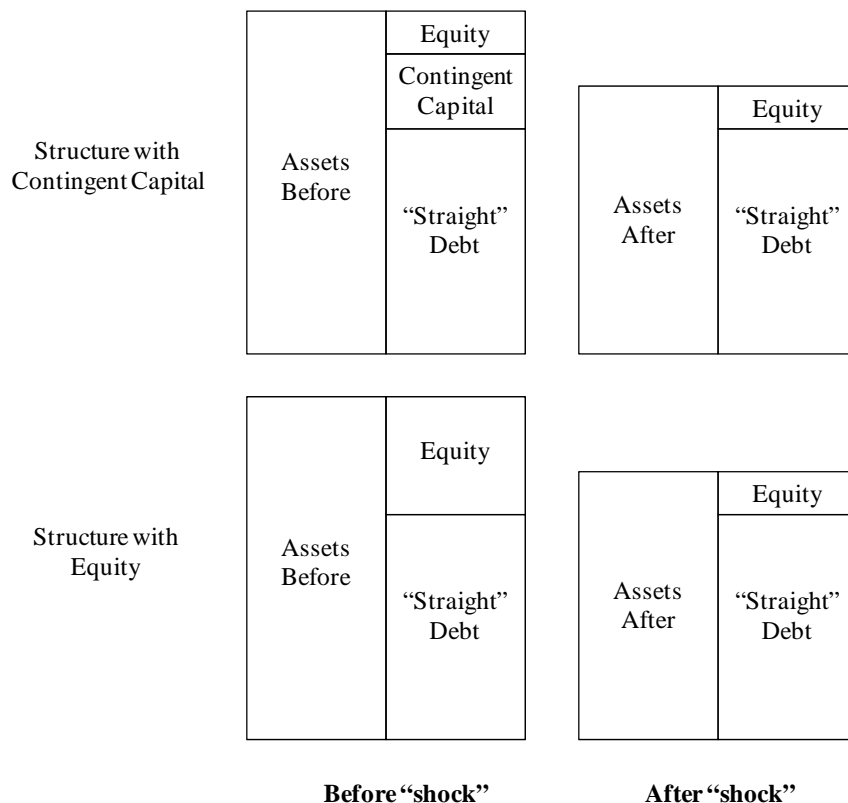
⁶⁷ In fact, since contingent debt holders do not have “creditor’s rights,” it is not even clear whether interest paid on contingent debt is tax deductible according to current U.S. law. This indeed illustrates the fact that contingent capital has equity-like feature and its issuance shifts some downside risk to contingent capital holders. In a well-functioning markets, these investors will have to be compensated for bearing this risk.

⁶⁸ For discussions of various issues related to how triggers should be set and the potential for a “death spiral” if the conversion decision can be manipulated through short-term trading see Duffie (2010), Sundaresan and Wang (2010), and McDonald (2010). Pennacchi, Vermaelen and Wolff (2010) propose a version of contingent capital that they call COERCs (Call Option Enhanced Reverse Convertibles”), which are designed to avoid many of the potential complications and the potential for manipulation that might arise with other versions of contingent capital. COERCs have the feature that equity has the option to repay the debt to avoid dilutive conversion.

it has not been established that contingent capital alleviates any inherent frictions, we are skeptical that going down this route is a worthwhile approach⁶⁹.

Figure 5 compares creating cushions using contingent capital to doing so using simple equity instead of contingent capital.

Figure 5: Comparing Contingent Capital to Equity



The top panel illustrates how contingent capital is meant to provide a cushion in the event of a crisis. An event that causes asset values to decline leads to the conversion of contingent capital to equity. The balance sheet before the crisis (the top left hand side) is transformed into the balance sheet on the top right hand side. In the bottom panel we trace the same development, but in this case we assume that additional equity was used to provide the additional cushion instead of contingent capital. The outcome is of course the same. The major difference is that with equity there is no need to go through the process of mandatory conversion, and the potentially problematic process and uncertainties leading up to the actual conversion are avoided.⁷⁰

⁶⁹ A similar conclusion is reached in Goodhart (2010).

⁷⁰ In this figure we are implicitly assuming that the "straight debt" is safe or insured, so its value does not change from "before" to "after." If the bank had some straight debt that is not insured, then its value might decline in this

The proponents of contingent capital seem to regard it as a device to resolve some of the difficulties that stand in the way of a recapitalization through the market once the bank is in difficulties. By having an automatic conversion of debt into equity, the bank may avoid the debt overhang problem described earlier, which prevents certain valuable loans from being made. If investors anticipate such a possibility, however, they would require high rates of interest on these securities as compensation for the risk to which they are exposed. (This conclusion follows from the same basic insights discussed in Section 3.3.) From this perspective, it is not clear why, apart from the banks' private tax considerations, provision of an additional cushion by contingent capital should be preferable to provision of such a cushion by additional equity. One can in fact think of equity as contingent capital that is converted *ab initio*.

In this context, it is also useful to go back to the experience of the crisis. According to the Basel Committee on Banking Supervision (2009), one flaw in pre-crisis arrangements had been the poor quality of capital, different regulators in different countries having different standards as to which securities they treated as capital and which ones they did not. In many cases, various hybrid securities were included in Tier 1 capital, certain forms of subordinated debt in Tier 2 capital. When the crisis came, these securities did not always provide the cushion they should have provided. Indeed, some governments were afraid of domino effects of defaults and extended their bailouts to even these securities.

Relative to the various forms of hybrid securities and subordinated debt securities, contingent capital would seem to have the advantage that conversion would be automatic, without insolvency proceedings. While we share the view that insolvency proceedings are too complicated, lengthy, and costly, we are not convinced that automatic conversion would solve the problem. First, if the holders of these securities are sufficiently important, government temptation to bail them out will be no less than it was for subordinated and hybrid securities in the current crisis. Second, while the conversion itself may be automatic, when the bank is in difficulties, holders of these securities may want to sell them before the conditions for conversion arise. In other words, the attempt to smooth matters in a later stage may just pull some of the frictions forward in time.

We have seen no compelling argument that contingent capital that has a debt-like structure prior to conversion has a positive impact on governance problems sufficient to justify including it in capital regulation. The skepticism that we expressed in Section 5.1 concerning the potential role of debt in resolving governance problems extends to the "debt-like" features of contingent capital. In sum, in our view the case for including contingent capital as part of capital regulation has not been established against simpler approaches based on equity.

transition, because the lower asset value might expose it to an actual default risk. This does not change the conclusion that the structure with equity leads to the same results as the one with contingent capital.

9. Conclusions and Policy Recommendations

In this paper we have examined various claims and arguments that assert that increasing equity requirements for large banks entails significant costs. We find that these claims and arguments, when analyzed from first principles, are very weak and not compelling. Why do we hear these arguments? One possible answer is given in the table on the last page, which summarizes our analysis of the various claims. We see that managers and bank shareholders have some strong incentives to maintain high leverage for banks and to resist increased equity capital requirements. In particular government subsidies that reward debt financing (and penalize equity financing) benefit managers and shareholders. These subsidies would be reduced if equity capital requirements were increased. Of course, arguments made by bankers against increased capital requirements are not automatically invalid just because it might be in their interest to oppose this stricter regulation. Rather, political and regulatory authorities should be especially skeptical when evaluating claims that are not supported by strong arguments. As we have shown above, the most important claims that are advanced in this context are based on fallacies, irrelevant facts, or insufficiently rich theories.

The debate over capital regulation is a bit reminiscent of the battle over expensing stock options some years ago. The issue in that debate concerned inconsistencies in the treatment of employee compensation on the income statement. Whereas compensation in cash and restricted stock was recognized as an immediate expense for the calculation of earnings, employee stock options were not recognized as an expense as long as the options were not “in the money” when they were issued. When the Financial Accounting Standards Board (FASB) attempted to change this accounting treatment in 1994 by requiring that options be expensed in a way that reflected their true cost, a fierce political battle ensued.

Opponents of option expensing made three types of arguments. The first was that a company incurs no cost in granting executive stock options when they are issued, since the options are not in the money. Of course, this statement is simply fallacious. The second statement that was often made was that executive options are difficult to value with precision. But while this statement is true, because the value of these options depends, for example, on the difficult to model exercise decisions of employees, it is basically irrelevant. Just because the options are difficult to value does not mean that valuing them at *zero* is appropriate.⁷¹ The third argument made against expensing options asserted that expensing options would have a *real and negative* impact on the economy, by somehow preventing entrepreneurial firms from obtaining financing, which would impede growth and reduce the competitiveness of the U.S. economy. These assertions were ultimately based on some form of investor irrationality, since they implied that investors would

⁷¹ In fact, companies often value complex liabilities, such as health care costs of retirees, in preparing accounting statements.

be misled by changes in accounting rules even though these changes had no effect on the underlying economics of the firm.

All of the above arguments were made at various times, but of course it was the claims about the “real” effects of expensing options that were most effective with politicians. In fact, in 1994 the U.S. Congress threatened to dismantle FASB unless it backed off from the plan to expense options. A decade later, after World Com, Enron, and other corporate scandals, it suddenly became politically palatable to expense options, and FASB went ahead to change the rules with minimal objections from Congress. And the result? There has been no evidence that this change in accounting rules had any negative economic impact whatsoever.

Quite similarly, as we have discussed, the arguments against high equity capital requirements fall under the same three categories: those that are fallacious, those that are true but irrelevant, and those that are unpersuasive. Because the social benefits of significantly reducing bank leverage are significant, and because there are no significant social costs of increasing equity requirements for banks, politicians and regulators should not be overly concerned with threats that credit markets will be adversely affected by increasing equity requirements. High equity requirements need not interfere with any of the valuable intermediation activities undertaken by banks. Regulators should therefore take steps to impose significantly higher equity requirements as quickly as possible.

Given the above assessment, what is the appropriate equity capital requirement? Various empirical studies, e.g., BIS (2010), Bank of Canada (2010), and IIF (2010), have attempted to answer this question using a variety of models to estimate the costs and benefits of increased equity requirements. Going through the different empirical models that are used in these documents is beyond our scope here. However, it appears that the methods of analysis used in most of these studies fall prey to many of the concerns we have identified in this paper. For example, in BIS (2010) the analysis uses a *fixed* estimate for the cost of equity that is based on historical averages, ignoring the fact that decreased leverage would necessarily lower the risk premium on equity. Moreover, the approach in most of these studies assumes that if bank margins or ROE decline, or bank taxes increase, these effects translate to social costs, which is incorrect. Calculations of the benefits of increased equity requirements in these analyses also do not take into account potential improvements in the quality of lending decisions that better capitalized banks are likely to make. While some of these might be hard to measure, we suspect that upon closer examination the net social benefits of increased equity requirements have been under-estimated in these studies. This under-estimation might be quite substantial if, as we have argued, the social costs are significantly over-estimated.⁷²

⁷²Kashyap, Stein and Hanson (2010), who also point out fallacies associated with not adjusting required returns to the reduced riskiness of equity that results from higher equity requirements, focus on the legitimate concerns related to regulatory arbitrage and shadow banking, which we mention below. However, in their estimate of the impact of increased equity requirements on lending costs, they still take the tax code as given, neglecting the fact that such

To attempt to give even a rough, order-of-magnitude answer to the question of what appropriate equity requirements *should* be, one must in principle refer to how capital ratios are calculated, something that we have not addressed in this paper. While important institutions have vaunted themselves as having 10% core capital relative to risk-weighted assets under Basel rules, this measure has often meant only 1% to 3% capital relative to the overall balance sheet (i.e., unweighted assets). The notion of using risk-weighted assets for capital regulation is based on the fact that the riskiness of the assets should in principle guide how much of an equity cushion is prudent for regulators to require. In the recent financial crisis, however, we have seen that assets that had zero risk weights in the banks' models could suddenly experience severe problems.⁷³ Any system of capital regulation must come to terms with these issues.

Leaving aside the issue of how one accounts for the riskiness of banks' assets, and taking as a benchmark current levels of risk, one can discuss capital requirements in terms of unweighted equity ratios, i.e., equity capital relative to total assets (off-balance sheet as well as on-balance sheet) held by the bank. Historical comparisons (e.g., evidence provided in Haldane (2009)) suggest that equity capital ratios as high as 20% or 30% on an unweighted basis should not be unthinkable. Another benchmark can be gleaned by considering Real Estate Investment Trusts (REITs), which do not enjoy tax benefits from leverage nor are they candidates for bailouts in the event of default. According to Ooi, Ong and Li (2008), REITs typically maintain equity capital in excess of 30% of assets. Based on all of these observations, we believe equity capital ratios equivalent to 10% of unweighted assets, and possibly higher, should be seriously considered and thought of as feasible.

The above is not to suggest that setting "a number" for the unweighted or weighted equity ratio is all there is to capital regulation. An ever-present and important challenge in capital regulation is achieving international harmonization and determining on an ongoing basis the appropriate set of institutions that should be regulated. Issues related to the cyclical dynamics implied by rigid equity requirements must also be considered carefully by regulators.⁷⁴ It is also critical that regulators be able to assess the *true* leverage of banks and prevent them from using various tricks to hide their actual exposure, as we now discover has been the case for a number of financial institutions. The shadow banking system, as explored by Poszar et al. (2010), must be understood by regulators and steps must be taken to ensure that the financial reporting of

transfers are not themselves a social cost. As discussed in Section 5.2, we also take issue with their recommendation that regulators give banks significant time to adjust to higher equity requirements due to information asymmetries and the "stigma" associated with equity issuance. Instead, we recommend payout restrictions and possibly mandatory equity issuance that in fact alleviate these problems and accelerate the capitalization process.

⁷³ Given this experience, Hellwig (2010) has suggested that the notion of measuring risks is itself quite an illusion and that in practice the risk-calibration approach provides banks with too much scope for manipulating their models so as to "economize" on equity capital by not recognizing risks.

⁷⁴ See Goodhart (2010) and Hanson, Kashyap and Stein (2010) for a discussion of this issue, and some specific proposals.

banks provides useful and accurate information about their actual leverage and financial health in order to prevent the phenomenon of “regulatory arbitrage.”

How would banks get to the point of having much larger equity cushions? Should they be given many years to build up their equity capital? It is widely argued, and recent policy proposals recommend, that banks be given a very long time to adjust to new capital requirements. Kashyap, Stein and Hanson (2010) based their recommendation on the claim that, as suggested in Myers and Majluf (1984), equity issuance might be costly if investors fear that managers issue equity only when it is overpriced, which may make banks reluctant to issue new equity to satisfy capital requirements. We have suggested, however, that this problem can be alleviated if regulators actually remove some of the discretion that banks might otherwise have with respect to equity issuance, thereby eliminating the stigma associated with it. By setting schedules for banks so that they must issue equity at specific times, investors will no longer be justified in making negative inferences about any particular bank based on the fact that it is issuing equity. As we noted, this approach is similar to what the U.S. Treasury did when forcing all large banks to accept Troubled Asset Relief Program (TARP) funds so as to remove any stigma associated with taking the funds.

Our discussion produces another clear-cut policy recommendation, which provides an efficient way to increase equity cushions. Whatever is the target equity ratio, and, again, we believe it should be significantly higher than current policy debate suggests, we urge regulators to *prohibit banks, for a period of time, from making any payments to equity*. This restriction would force banks to retain earnings as they build their equity capital. Paying dividends, particularly in a situation of distress or when leverage is high, is in fact one of the ways in which the conflict of interest between equity holders on one hand and debt holders or the government on the other manifests itself, since by paying dividends, equity is able to withdraw funds which might otherwise be used to pay debt. There is evidence that equity payouts, at least in the U.S. exacerbated the recent financial crisis.⁷⁵ If done under the force of regulation, withholding dividends would not lead to any negative inference on the health of any particular bank.⁷⁶

Banks clearly serve an important function in the economy by providing credit and creating liquid deposits. As we have argued, high leverage is *not* required for them to be able to perform

⁷⁵Banyi, Porter and Williams (2010) document an increase in stock repurchases by U.S. financial institutions prior to 2007, including specifically those who later received TARP funds. According to Acharya, Gujral, and Shin (2009), large U.S. banks paid \$130 billion in dividends during 2007-2008, years in which they were in distress and where most were also being provided with additional funding from the government Acharya, Gujral, and Shin (2009), Acharya, Mehra and Thakor (2010) and Goodhart et al (2010), suggest that regulators use restrictions on dividends as part of prudential capital regulation.

⁷⁶ Note that banks' stock prices will likely fall as a result of implementing such policies because current prices reflect the value of government subsidies as well as shareholders' ability, absent such dividend prohibition, to generate cash payout on a regular basis without too much concern about the solvency of the bank. Forcing banks to retain earnings and to build up their equity capital reduces the value of these subsidies (a benefit to taxpayers), and in addition would provide significant social benefits.

these socially valuable functions. If one believes that certain activities performed by banks and financial institutions need to be subsidized because the free market does not lead to the best outcome, then subsidies should be given directly to those activities rather than through a system that encourages dangerous levels of leverage and excessive risk taking and effectively penalizes equity finance.

The main message we would like to deliver to regulators is that they should not be overly concerned with threats that a substantial increase in equity requirements will have significant negative effects on the economy and growth. Once regulators accept our assessment that, at least starting from the current situation, bank equity is *not* expensive, capital regulation can become an effective, powerful and flexible tool with which the health and stability of the financial system can be maintained. Given appropriate systems for tracking the systemic risks of important financial institutions, regulators can use their judgment to adjust the equity requirements of all banks according to economic conditions, possibly using tools such as payout restrictions and mandatory equity issuance, in a manner analogous to the use of margin requirements by financial exchanges to maintain the safety of transactions.⁷⁷ We are confident that financial markets will adjust quickly to such a system with no substantial adverse effects, and that the overall impact will be to enhance the role of the financial sector in the broader economy.

We have based our analysis of the costs and benefits of increasing equity requirements for banks on what we assess to be the fundamental economic issues involved. We expect that some will disagree with our conclusions. Any discussion of this important topic in public policy should be fully focused on social costs and benefits. Moreover, any assertions that are made should be based on sound arguments and persuasive evidence. Unfortunately, the level of policy debate on this subject that we have seen is not always consistent with these standards.

⁷⁷ For example, Hart and Zingales (2010) propose that regulators use market information to determine when to force banks to recapitalize. As mentioned in Duffie (2010), regulators might be able to force banks to increase equity capital through mandatory rights offerings.

“Reasons” given for why increased equity capital requirements would be costly	Is the statement true?	Would this “reason” give incentives to bank managers to object to increased capital requirements?	Would this “reason” give incentives to bank shareholders to object to increased capital requirements?	<u>From a public policy perspective, is this a legitimate reason for not significantly increasing capital requirements?</u>
Increased equity requirements would prevent banks from operating at the optimal scale.	No. Equity can be added to the balance sheet without changing the bank’s core business.	It should not, because it is false.	It should not, because it is false.	No! It is false.
Increased equity requirements reduce the average ROE (Return on Equity) for banks.	Generally Yes.	Yes if compensation depends on ROE.	It should not, because risk is reduced and the value of equity would not change.	No! This is irrelevant to value creation.
Increased equity requirements would increase banks’ total funding costs, because banks would be forced to use more equity, which has a higher required rate of return.	No. Changing the capital structure changes how risk is distributed but not the overall cost of funding.	It should not, because it is false.	It should not, because it is false.	No! It is false!
Increased equity requirements would decrease the size of the interest tax shields banks can obtain through debt financing.	Yes.	Perhaps, but this depends on their compensation and preferences.	Yes, because shareholders benefit from subsidies.	No! Tax shields subsidize the use of debt, but it makes no sense to encourage leverage since it generates negative externalities and distortions.
Increased equity requirements reduce banks’ ability to use cheap debt financing that is subsidized by implicit government guarantees.	Yes.	Yes if compensation is related to equity value.	Yes, because shareholders benefit from subsidies.	No! Guarantees subsidize the use of debt, but it makes no sense to encourage leverage since it generates negative externalities and distortions.
Increased equity requirements would reduce managerial discipline and thus interfere with effective governance.	Very unlikely to be true.	No.	It should not, because there are alternative ways to create effective governance.	No! Claims that debt disciplines managers are not supported by adequate theories or by empirical evidence.
Increased equity requirements would lead banks to restrict lending if they perceive their equity to be under-valued.	Possibly true.	Perhaps.	Perhaps.	No! Better capitalized banks have more retained earnings for lending; any negative impact of equity issuance or payout restrictions can be mitigated by reducing banks’ discretion.

References

- 1) Acharya, Viral V., Irvind Gujral, and Hyun Song Shin (2009) “Dividends and Bank Capital in the Financial Crisis of 2007-2009,” Working paper.
- 2) Acharya, Viral V., Philipp Schnabl, and Gustavo Suarez (2010) “Securitization without Risk Transfer,” Working paper.
- 3) Acharya, Viral V., Hamid Mehran, and Anjan Thakor (2010) “Caught between Scylla and Charybdis? Regulating Bank Leverage when there is Rent Seeking and Risk Shifting,” Working paper.
- 4) Admati, Anat R. and Paul Pfleiderer (2010), “Increased Liability Equity: A Proposal to Improve Capital Regulation of Large Financial Institutions,” working paper.
- 5) Adrian, Tobias and Hyun Song Shin (2010), “Liquidity and Leverage,” *Journal of Financial Intermediation*, 19, 418-437.
- 6) Adrian, Tobias and Markus K. Brunnermeier (2009), “CoVaR.” *Federal Reserve Bank of New York Staff Report* 348.
- 7) Angeletos, George-Marios, and Iván Werning (2006), “Crises and Prices: Information Aggregation, Multiplicity, and Volatility,” *American Economic Review* 96, 1720-1736.
- 8) Bank of Canada (2010), “Strengthening International Capital and Liquidity Standards: A Macroeconomic Impact Assessment for Canada.”
- 9) Banyi, Monica, Susan Porter, and Susan Williams (2010), “Stock Repurchases and TARP in the Banking Industry,” Working paper.
- 10) Basel Committee on Banking Supervision (BIS, 2009), “Strengthening the Resilience of the Banking Sector.”
- 11) Basel Committee on Banking Supervision (BIS, 2010), “An Assessment of the Long-Term Economic Impact of Stronger Capital and Liquidity Requirements.”
- 12) Bebchuk, Lucian A., Alma Cohen, and Holger Spamann (2010), “The Wages of Failure: Executive Compensation at Bear Stearns and Lehman 2000-2008,” *Yale Journal of Regulation*, 27, 257-282.
- 13) Bebchuk, Lucian A. and Holger Spamann (2010), “The Wages of Failure: Executive Compensation at Bear Stearns and Lehman 2000-2008,” *Yale Journal of Regulation*, 27, 257-282.
- 14) Berger, Allen N., Richard J. Herring, and Giorgio P. Szego (1995), “The Role of Capital in Financial Institution,” *Journal of Banking and Finance*, 19, 393-430.
- 15) Berger, Allen N., and Christa H.S. Bouwman (2010), “Bank Capital, Survival, and Performance around Financial Crises,” working paper.
- 16) Berk, Jonathan and Peter M. DeMarzo (2008), “*Corporate Finance*,” Prentice Hall.
- 17) Bhagat, Sanjai and Brian Bolton (2010), “Investment Bankers’ Culture of Wonerishp?” Working paper.

- 18) Bizer, David and Peter M. DeMarzo (1992), "Sequential Banking," *Journal of Political Economy* 100, 41-61.
- 19) Bolton, Patrick and Xavier Freixas (2006), "Corporate Finance and the Monetary Transmission Mechanism," *Review of Financial Studies*, 19, 829-870.
- 20) Bolton, Patrick, Tano Santos and Jose Scheinkman (2010), "Outside and Inside Liquidity," *Quarterly Journal of Economics*, forthcoming.
- 21) Bolton, Patrick, Hamid Mehran and Joel Shapiro (2010), "Executive Compensation and Risk Taking," working paper.
- 22) Boot, Arnoud W.A. (1996), "Comments on "Market Structure, Monitoring and Capital Adequacy Regulation" by Thomas Gehrig", *Swiss Journal of Economics and Statistics*, 132, 703-706
- 23) Boot, Arnoud W.A. and Anjolein Schmeits (1998), "Challenges to competitive banking: a theoretical perspective," *Research in Economics* (1998) 52, 255–270.
- 24) Boskin, Michael J. (2010), "Time to Junk the Corporate Tax," *The Wall Street Journal*, May 6, 2010.
- 25) Brealey, Richard A., Stewart C. Myers, and Franklin Allen (2007), "*Principles of Corporate Finance*," 9th Edition, McGraw-Hill Irwin.
- 26) Brealey, Richard A. (2006), "Basel II: The Route Ahead or Col-de-sac?," *Journal of Applied Corporate Finance*, 4, 34-43.
- 27) Brunnermeier, Markus and Martin Ohemke, (2010), "The Maturity Rat Race," Working paper.
- 28) Calomiris, Charles W. (1999), "Building an Incentive Compatible Safety Net," *Journal of Banking & Finance*, 23, 1499-1519.
- 29) Calomiris, Charles W. and Gary Gorton (1991), "The Origins of Banking Panics," in: G. Hubbard (ed.), *Financial Markets and Financial Crises*, University of Chicago Press, Chicago, 109-173
- 30) Calomiris, Charles W. and Charles M. Kahn (1991), "The Role of Demandable Debt in Structuring Optimal Banking Arrangements," *American Economic Review*, 81, 497-513.
- 31) Chari, Varadarajan V., and Ravi Jagannathan (1988), "Banking Panics, Information, and Rational Expectations Equilibrium," *Journal of Finance* 43, 749-760.
- 32) Cheng, Ing-Haw and Konstantin Milbradt (2010), "The Hazards of Debt: Rollover Freezes, Incentives, and Bailouts," Working paper
- 33) Dewatripont M, and Jean Tirole (1994), "A Theory of Debt and Equity: Diversity of Securities and Manager-Share-holder Congruence," *Quarterly Journal of Economics*, 109, 1027-1054.
- 34) Diamond, Douglas W., and Phillip H. Dybvig (1983), "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy* 91, 401-419.

- 35) Diamond, Douglas W., (1984) "Financial Intermediation and Delegated Monitoring," *Review of Economic Studies* 51, 193-414.
- 36) Diamond, Douglas W., and Raghuram G. Rajan (2000), "A Theory of Bank Capital," *Journal of Finance*, 55, 2431-2465.
- 37) Diamond, Douglas W., and Raghuram G. Rajan (2001), "Liquidity Risk, Liquidity Creation and Financial Fragility," *Journal of Political Economy* 109, 287-327.
- 38) Duffie, Darrell (2010), "*How Big Banks Fail and What to Do About It*," Princeton University Press, forthcoming.
- 39) Elliott, Douglas J. (2009), "Bank Capital and the Stress Tests," Working paper.
- 40) Flannery, Mark J. (2005), "No Pain, No Gain? Effecting Market Discipline via Reverse Convertible Debentures," Chapter 5 of Hall S. Scott, ed. *Capital Adequacy Beyond Basel: Banking Securities and Insurance*, Oxford: Oxford University Press.
- 41) French, Kenneth R., et al. (2010), "*The Squam Lake Report: Fixing the Financial System*," Princeton University Press, Princeton, NJ.
- 42) Gale, Douglas M. and Martin F. Hellwig (1985), "Incentive-Compatible Debt Contracts: The One-Period Problem," *Review of Economic Studies* 52, 647-663.
- 43) Goldstein, Itay, and Ady Pauzner (2005), "Demand-Deposit Contracts and the Probability of Bank Runs," *Journal of Finance* 60, 1293-1327.
- 44) Gorton, Gary B (2010), *Slapped by the Invisible Hand: The Panic of 2007*, Oxford University Press.
- 45) Gorton, Gary B. and George Pennacchi (1990), "Financial Intermediation and Liquidity Creating," *Journal of Finance*, 49-71.
- 46) Gorton, Gary B. and Andrew Metrick (2009), "Securitized banking and the run on repo," NBER Working Paper No. 15223.
- 47) Goodhart, Charles (2010), "How Should We Regulate the Financial Sector?" Chapter 5 of *The Future of Finance*, LSE.
- 48) Goodhart, Charles, M. U. Peiris, D.P. Tsomocos, and A. P. Vardoulakis (2010), "On Dividend Restrictions and the Collapse of the Interbank Market," *Annals of Finance*, February.
- 49) Graham, John R., and Campbell Harvey (2002), "How do CFOs Make Capital Budgeting and Capital Structure Decisions," *Journal of Applied Corporate Finance*, Spring, pp. 8-23.
- 50) Grossman, Sanford J., and Oliver D. Hart (1980), "Takeover Bids, the Free-Rider Problem, and the Theory of the Corporation," *Bell Journal of Economics* 11, 42-64.
- 51) Haldane, Andrew G. (2009), "Banking on the State," Presented at the Federal Reserve Bank of Chicago 12th Annual International Banking Conference, September 25, 2009.
- 52) Haldane, Andrew, Simon Brennan and Vasileios Madouros (2010), "What is the Contribution of the Financial Sector: Miracle or Mirage?" Chapter 2 of *The Future of Finance*, LSE.

- 53) Hanson, Samuel, Anil K. Kashyap, and Jeremy C. Stein (2010), "A Macroprudential Approach to Financial Regulation," *Journal of Economic Perspectives*, Forthcoming.
- 54) Harrison, Ian (2004), "Banks, Capital and Regulation: Towards an Optimal Capital Regime for a Small Open Economy," Working paper, Reserve Bank of *New Zealand*.
- 55) Hart, Oliver and Luigi Zingales (2010), "A New Capital Regulation for Large Financial Institutions," Working paper.
- 56) He, Zhiguo and Wei Xiong (2009), "Dynamic Debt Runs," Working paper.
- 57) Hellwig, Christian (2002), "Public Information, Private Information, and the Multiplicity of Equilibria in Coordination Games," *Journal of Economic Theory* 107, 191-222
- 58) Hellwig, Martin F. (2009a), "A Reconsideration of the Jensen-Meckling Model of Outside Finance," *Journal of Financial Intermediation* 18, 495-525.
- 59) Hellwig, Martin F. (2009b), "Systemic Risk in the Financial Sector: An Analysis of the Subprime-Mortgage Financial Crisis," *De Economist*, 157, pp 129-207
- 60) Hellwig, Martin F. (2010), "Capital Regulation: Business as Usual?" Working paper.
- 61) Holmström, Bengt, and Jean Tirole (1993), "Market Liquidity and Performance Monitoring," *Journal of Political Economy* 101, 678-709.
- 62) Holtfrerich, Carl-Ludwig (1981): "Die Eigenkapitalausstattung deutscher Kreditinstitute 1871-1945," *Bankhistorisches Archiv, Beiheft* 5, 15-29.
- 63) Institute of International Finance (IIF, 2010) "Interim Report on the Cumulative Impact on the Global Economy of Proposed Changes in the Banking Regulatory Framework."
- 64) Jacklin, Charles J., and Sudipto Bhattacharya (1988), "Distinguishing Panics and Information-Based Bank Runs: Welfare and Policy Implications," *Journal of Political Economy* 96, 568-592.
- 65) Jensen, Michael C. (1986), "Agency Costs of Free Cash Flow, Corporate Finance and Takeovers," *American Economic Review, Papers and Proceedings* 76, 323-329.
- 66) Jensen, Michael C. (1989), "Eclipse of the Public Corporation," *Harvard Business Review*, September-October 1989, 61-74.
- 67) Jensen, Michael C. (1993), "The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems," *Journal of Finance* 48, 831-880.
- 68) Jensen, Michael C. and William H. Meckling (1976), "Theory of the Firm: Managerial Behavior, Agency Costs and Capital Structure," *Journal of Financial Economics* 3, 305-360.
- 69) Kane, Edward J. (1989), *The S & L Insurance Mass, How Did It Happen?* Urban Institute Press, Washington.
- 70) Kashyap, Anil K., Raghuram G. Rajan, and Jeremy C. Stein (2008), "Rethinking Capital Regulation," September 2008, Federal Reserve Bank of Kansas City Symposium.

- 71) Kashyap, Anil K., Jeremy C. Stein, and Samuel Hanson (2010), "An Analysis of the Impact of "Substantially Heightened" Capital Requirements on Large Financial Institutions," Working Paper.
- 72) King, Mervyn (1990),"International Harmonisation of the Regulation of Capital Markets: An Introduction," *European Economic Review*, 34, 569-577.
- 73) Mankiw, Gregory N., Matthew C. Weinzierl, and Danny Yagan (2009), "Optimal Taxation in Theory and Practice," Harvard Business School Working paper.
- 74) Mehran, Hamid and Anjan Thakor (2010, "Bank Capital and Value in the Cross Section," *Review of Financial Studies*, forthcoming.
- 75) Kotlikoff, Laurence J. (2010), "*Jimmy Stuart is Dead: Ending the World's Financial Plague Before it Strikes Again*," John Wiley & Sons, Inc.
- 76) McDonald, Robert L. (2010), "Contingent Capital with a Dual Price Trigger," Working paper.
- 77) Miller, Merton H. (1995), "Does the M&M Proposition Apply to Banks?" *Journal of Banking and Finance*, 19, 483-489.
- 78) Modigliani, Franco and Merton H. Miller, (1958), "The Cost of Capital, Corporation Finance, and the Theory of Investment" *American Economic Review*, 48, 261-297.
- 79) Morris, Stephen, and Hyun Song Shin (1998), "Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks," *American Economic Review* 88, 587-597.
- 80) Myers, Stewart C. (1977), "Determinants of Corporate Borrowing," *Journal of Financial Economics* 5, 147-175.
- 81) Myers, Stewart C. and Nicholas S. Majluf (1984), "Corporate Finance and Investment Decisions When Firms Have Information that Investors Do Not Have," *Journal of Financial Economics* 13, 187-222.
- 82) Myers, Stewart C. and Raghuram G. Rajan (1998), "The Paradox of Liquidity," *Quarterly Journal of Economics* 113, 733-771.
- 83) Ooi, Joseph T. L., Seow-Eng Ong, and Lin Li (2008), "An Analysis of the Financing Decisions of REITs: The Role of Market Timing and Target Leverage," *Journal of Real Estate Finance and Economics*, 40, 130-160.
- 84) Poole, William, (2009), "Moral Hazard: The Long-Lasting Legacy of Bailouts," *Financial Analysts Journal*, Nov/Dec, 1-7.
- 85) Pennacchi, George, Theo Vermaelen and Christian C.P. Wolff (2010), "Contingent Capital: The case for COERCs," Working paper.
- 86) Poole, William, (2010), "Ending Moral Hazard," *Financial Analysts Journal*, Nov/Dec, 17-24
- 87) Pozsar, Zoltan, Tobias Adrian, Adam B. Ashcraft, and Haley Boeskey (2010), "Shadow Banking," Federal Reserve Bank of New York Staff Report 458.

- 88) Rochet, J-C., and Xavier Vives (2004), "Coordination Failure and the Lender of the Last Resort: Was Bagehot Right After All?" *Journal of the European Economic Association* 2, 1116-1147.
- 89) Ross, Stephen A., Randolph W. Westerfield, and Jeffrey Jaffe (2008), "*Corporate Finance*," 8th Edition, McGraw-Hill Irwin.
- 90) Schaefer, Stephen M. (1990), "The Regulation of Bank and Securities Firms," *European Economic Review*, 34, 587-597.
- 91) Schnabel, Isabel (2004), "The German Twin Crisis of 1931," *Journal of Economic History*, 64, 822-871.
- 92) Schnabel, Isabel (2009), "The Role of Liquidity and Implicit Guarantees in the German Twin Crisis of 1931," *Journal of International Money and Finance*, 28, 1-25.
- 93) Stein, Jeremy C. (2010), "Monetary policy as financial-stability regulation," Working Paper, Harvard University.
- 94) Stiglitz, J. E. and A. W. Weiss (1981), "Credit Rationing in Markets with Imperfect Information," *American Economic Review* 71, 393-410.
- 95) Sundaresan, Suresh and Zhenyu Wang (2010), "Design of Contingent Capital with Stock Price Trigger for Conversion," Working paper.
- 96) Townsend, Robert M. (1979), "Optimal Contracts and Competitive Markets with Costly State Verification," *Journal of Economic Theory* 21, 265-293.
- 97) Turner, Adair (2010), "What do Banks do? Why do Credit Booms and Busts Occur and What can Public Policy Do about it?" Chapter 1 of *The Future of Finance*, LSE.
- 98) White, Lawrence J. (1991), "*The S&L Debacle: Public Policy Lessons for Bank and Thrift Regulation*," Oxford University Press, New York.

SYSTEMIC RISK IN THE FINANCIAL SECTOR: AN ANALYSIS
OF THE SUBPRIME-MORTGAGE FINANCIAL CRISIS**

BY

MARTIN F. HELLWIG*

Summary

The paper analyses the causes of the current crisis of the global financial system, with particular emphasis on the systemic elements that turned the crisis of subprime mortgage-backed securities in the United States, a small part of the overall system, into a worldwide crisis. The first half of the paper explains the role of mortgage securitization as a mechanism for allocating risks from real estate investments and discusses what has gone wrong and why in the implementation of this mechanism in the United States. The second half of the paper discusses the incidence of systemic risk in the crisis. Two elements of systemic risk are identified. First, there was excessive maturity transformation through conduits and structured-investment vehicles (SIVs); when this broke down in August 2007, the overhang of asset-backed securities that had been held by these vehicles put significant additional downward pressure on securities prices. Second, as the financial system adjusted to the recognition of delinquencies and defaults in US mortgages and to the breakdown of maturity transformation of conduits and SIVs, the interplay of market malfunctioning or even breakdown, fair value accounting and the insufficiency of equity capital at financial institutions, and, finally, systemic effects of prudential regulation created a detrimental downward spiral in the overall financial system. The paper argues that these developments have not only been caused by identifiably faulty decisions, but also by flaws in financial system architecture. In thinking about regulatory reform, one must therefore go beyond considerations of individual incentives and supervision and pay attention to issues of systemic interdependence and transparency.

Key words: mortgage securitization, subprime-mortgage financial crisis, systemic risk, banking regulation, capital requirements

JEL Code(s): G01, G29, G32

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1 INTRODUCTION

Since August 2007, financial markets and financial institutions all over the world have been hit by catastrophic developments that had started earlier in 2007 with problems in the performance of subprime mortgages in the United States. Financial institutions have written off losses worth many billions of dollars, Euros or Swiss francs, and are continuing to do so. Liquidity has virtually disappeared from important markets. Stock markets have plunged. Central banks have provided support on the order of hundreds of billions, intervening not only to support the markets but also to prevent the breakdown of individual institutions. At last, governments in the United States and Europe are stepping in to support financial institutions on a gigantic scale.

Because of their losses, many financial institutions have been forced to recapitalize; others have gone under, some of them outright and some by being taken over by other, presumably healthier institutions. Among the affected institutions, we find some that had been deemed to be at the forefront of the industry in terms of profitability and in terms of their competence in risk management, as well as some whose viability had been questioned even before the crisis. As yet, it is not clear how far the crisis will go.

Public reaction to these developments has mainly focussed on moral hazard of bank managers. Sheer greed, so the assessment goes, led them to invest in mortgage-backed securities, exotic financial instruments that they failed to understand, and to disregard risks when the very term “subprime lending” should have alerted them to the speculative nature of these assets. As the crisis developed, their lack of forthrightness and/or understanding was evidenced by their failure to come clean and write off their losses all at once. They seemed to prefer revealing their losses piecemeal, a few billions one week and another few billions the next.

In absolute terms, the numbers involved seem large. As of April 2008, the International Monetary Fund (IMF) was predicting aggregate losses of 945 billion dollars overall, 565 billion dollars in US residential real-estate lending, and 495 billion dollars from repercussions of the crisis on other securities. By October 2008, the IMF had raised its loss prediction to 1.4 trillion dollars overall, 750 billion dollars in US residential real-estate lending, and 650 billion dollars from repercussions of the crisis on other securities. By September 2007, total reported write-offs of financial institutions are said to have reached 760 billion dollars; global banks alone have written off 580 billion dollars.¹

In *relative* terms, the meaning of these numbers is unclear. They seem both, too large and too small, too large relative to the prospective losses from

1 [International Monetary Fund \(2008a,b\)](#).

actual defaults of subprime mortgage borrowers and too small to explain the worldwide crisis that we are experiencing.

The losses that the IMF predicts for US residential real-estate lending mainly concern mortgage-backed securities (MBS). In particular, non-prime mortgage-backed securities account for some 450 out of 565 billion dollars in the April estimate, 500 out of 750 billion in the October estimate. The outstanding volume of these securities is estimated as 1.1 trillion dollars. The estimates of 450 billion or 500 billion dollars of losses on these 1.1 trillion dollars of outstanding securities correspond to average loss rates of 40–45%.² If the borrower's original equity position was 5%,³ a loss rate of 40–45% implies a decline in the value of the property by 45–50%. The average actual decline of residential real-estate prices in the United States from their peak in 2006 to the second quarter of 2008 has been around 19%.⁴ Relative to this number, the IMF's loss estimate seems extraordinarily high. To put the argument in another way: If I assume that price declines will end up at 30%, rather than 50%, with a 5% equity share of borrowers, I get a 25% loss rate, for a total loss of 275 billion dollars on the total 1.1 trillion dollars of outstanding non-prime securities. This is still a substantial number, but significantly smaller than the IMF's estimate of 500 billion dollars.

The IMF's estimates of losses on mortgage-backed securities are *not* actually based on estimates of the incidence of borrower defaults.⁵ These estimates reflect declines in market valuations. In well functioning markets, we would expect these valuations to reflect expectations of future debt service. However, since August 2007, markets have not been functioning well. For some securities, indeed, they have not been functioning at all; in these cases, the losses reflect expectations of what the market valuations would be if markets were

2 According to the IMF's Global Financial Stability Report of April 2008 (2008a), mortgage-backed securities as such were subject to a discount of 30% in the market and MBS collateralized debt obligations (MBS CDOs) subject to a discount of 60%. When applying these ratios to the outstanding 400 billion dollars of MBS CDOs and to the $1100 - 400 = 700$ billion dollars of mortgage-backed securities that are not accounted for by MBS CDOs, one obtains the IMF's loss estimates of 240 billion and 210 billion for these two sets of securities, for a total of 450 billion dollars. In the Global Financial Stability Report of October 2008, the discount for MBS CDOs has been raised to 72.5%; and the loss estimates have risen accordingly.

3 The actual down payment rate in subprime mortgage contracts was 6% on average, in Alt-A mortgage contracts 12% on average. For mortgage contracts concluded in 2004 or 2005, the property appreciation that occurred until the summer of 2006 would provide an additional buffer.

4 According to the S&P/Case-Shiller U.S. National Home Price Index; see *indices* at <http://www.standardandpoors.com>.

5 As of the first quarter of 2008, the delinquency rate, i.e., the share of mortgages with payments outstanding 90 or more days, was 6.35% altogether, the foreclosure rate 2.47% (Mortgage Bankers Association, <http://www.mortgagebankers.org/NewsandMedia/PressCenter/62936.htm>). Among adjustable-rate subprime mortgages, i.e. the instruments with the *lowest* overall creditworthiness, 25% were delinquent or in foreclosure (Bernanke 2008).

functioning.⁶ The IMF itself has suggested that, for at least some of these securities, market prices may be significantly below the expected present values of future cash flow and therefore, that market values may not provide the right signals “for making long-term value-maximizing decisions”.⁷ At 5–15%, its own estimates of loss rates for unsecuritized non-prime mortgages are much below the 30–72.5% losses in market values of mortgage-backed securities.⁸ To some extent therefore, the crisis must be seen as a result of market malfunctioning as well as flawed mortgage lending.

The dependence on market valuations explains the ongoing nature of the write-offs that we have observed. The fact that every few months or even every few weeks, a bank has discovered that its losses are even greater than it had previously announced is not due to a lack of forthrightness or to stupidity, but to continued changes in actual or presumed market valuations. As time has passed, markets have become ever more pessimistic. As market pessimism grew, market valuations of securities declined ever more, and the banks had to take yet more write-offs.

A few decades ago, many of these write-offs would not have been taken. If a bank had declared that it was going to hold a loan or mortgage to maturity, it would have held the loan at book value until the debtor's solvency came into doubt, without even asking what the market valuation of the security might be. The write-offs that we have seen are an artefact of the modern form of *mark-to-market*, or *fair value* accounting which has become a part of the infrastructure of risk management and of the statutory regulation of banks. Remarkably, this accounting system is used even in situations where the markets in question have broken down.

There were good reasons for switching to fair value accounting. Under the old regime, the financial straights of the savings and loans industry in the United States in the early eighties were not appropriately recognized and dealt with. As of 1980 or 1981, about two thirds of these institutions were technically insolvent. They held large amounts of mortgages that they had provided to homeowners in the sixties with maturities of some 40 years, at fixed rates of interest, typically around 6%. The interest rates which these institu-

6 Thus, one reads: “The markets for many of these financial instruments continue to be illiquid. In the absence of an active market for similar instruments or other observable market data, we are required to value these instruments using models.” in the Financial Report for the Fourth Quarter of 2007 that was issued by the Swiss bank UBS.

7 [International Monetary Fund \(2008a, 65ff\)](#).

8 For unsecuritized *prime mortgages*, the IMF's prediction went from a loss rate of 1.1% in April to a loss rate of 2.3% in October, from 40 billion to 80 billion dollars; for prime mortgage-backed securities, estimated losses of market values went from zero to 80 billion dollars, again 2.3% of the amount outstanding. Given the size of the stock of prime mortgages, the worsening of prospects here explains most of the difference between October and April estimates.

tions had to pay in order to keep their depositors were well above 10%. The discrepancy between the 6% that they earned on old mortgages and the much higher rates that they paid their depositors affected their annual statements of profits and losses, but was not reflected in their balance sheets. The mortgages from the sixties, which did not have any solvency problems, were carried at face value in the books even though the market value of a security that pays 6% would be much less than its face value when newly issued securities pay more than 10%. Under fair value accounting, these mortgages would not have been carried at face value, the solvency problem of the S&Ls would have been recognized, and, presumably, early corrective action would have been taken. Because the problem was not recognized and appropriately dealt with, the so-called “zombie banks” had the freedom to go out and “gamble for resurrection”, i.e., to engage in highly risky lending strategies. When the risks came home to roost in the late eighties, the cleanup cost a multiple of what a cleanup in 1980 would have cost.⁹ The fact that, in today’s crisis, some institutions have acknowledged their losses and obtained new equity capital – and others have gone under – provides us with some assurance that these institutions will not be subject to temptations like those that the savings and loans industry in the United States succumbed to in the eighties.

However, the imposition of fair value accounting for loans and mortgages enhances the scope for *systemic risk*, i.e., risk that has little to do with the intrinsic solvency of the debtors and a lot to do with the functioning – or malfunctioning – of the financial system. Under fair value accounting, the values at which securities are held in the banks’ books depend on the prices that prevail in the market. If these prices change, the bank must adjust its books even if the price change is due to market malfunctioning and even if it has no intention of selling the security, but intends to hold it to maturity. Under currently prevailing capital adequacy requirements, this adjustment has immediate implications for the bank’s continued business activities. In particular, if market prices of securities held by the bank have gone down, the bank must either recapitalize by issuing new equity or retrench its overall operations. The functioning of the banking system thus depends on how well asset markets are functioning. Impairments of the ability of markets to value assets can have a large impact on the banking system.

In this lecture, I will argue that this systemic risk explains why the subprime-mortgage crisis has turned into a worldwide financial crisis – unlike the S&L crisis of the late eighties. I recall hearing warnings at the peak of the S&L crisis that overall losses of US savings institutions might well amount to some 600–800 billion dollars, no less than the IMF’s estimates of losses in subprime mortgage-backed securities. However, these estimates never translated into market prices, and the losses of the S&Ls were confined to the

9 See, e.g., Kane (1985, 1989), Benston et al. (1991), Dewatripont and Tirole (1994).

savings institutions and to the deposit insurance institutions that took them over. By contrast, the critical securities are now being traded in markets, and market prices determine the day-to-day assessments of equity capital positions of institutions holding them. This difference in institutional arrangements explains why the fallout from the current crisis has been so much more severe than that of the S&L crisis.

This assessment affects the lessons for regulatory reform that we should draw from the crisis. Public discussion so far has focussed on greed and recklessness of the participants. If the crisis was just the result of greed and recklessness, it would be enough for regulatory reform to focus on risk incentives and risk control, i.e., to make sure that the scope for recklessness in banking is reduced as much as possible.

I am not denying that reckless behaviour played an important role in generating the crisis. However, there is more to the crisis than just reckless behaviour. Systemic interdependence has also played an important role. Moreover, participants did not know the extent to which systemic interdependence exposed them to risks. Risk taking that, with hindsight, must be considered excessive was not just a result of recklessness, but also a result of an insufficient understanding and of insufficient information about systemic risk exposure.

Therefore, regulatory reform must also address the risks generated by such interdependence and by the lack of transparency about systemic risk exposure. The best governance and the best incentives for risk control at the level of the individual institution will not be able to forestall a crisis if the participants do not have the information they need for a proper assessment of risk exposure from systemic interdependence. Regulatory reform must either see to it that participants get this information or else, that the rules to which participants are subjected provide for a certain robustness of risk management and risk control with respect to the incompleteness of the participants' information about their exposure to systemic risk.

In the following, Section 2 will provide a general introduction to the problem of how to allocate risks that are associated with residential real estate. In this section, I will also explain why, in principle, the securitization of such risks should be regarded as a good idea, if it is done properly. Section 3 will give an overview over residential-mortgage securitization in the United States with a view to explaining what went wrong, in particular, why the moral hazard that is caused by securitization went by and large unchecked. The analysis here will distinguish between the different roles played by the different participants, mortgage originators, investment banks, rating agencies, and investors. Section 4 will explain the effects of systemic interdependence in the crisis, beginning with systemic risk that was due to some participants having highly unsound refinancing structures, and then focussing on the interplay between market malfunctioning, fair value accounting, an insufficiency

of bank equity and the procyclical effects of prudential regulation in the crisis. The concluding remarks in Section 5 draw some conclusions for the reform of prudential regulation that now stands high on the political agenda.

2 MATURITY MISMATCH IN REAL-ESTATE FINANCE AND THE ROLE OF SECURITIZATION

2.1 *The Problem of Maturity Mismatch in Real-Estate Finance*

Before I turn to the actual crisis, I briefly discuss the structure of housing and real-estate finance. A fundamental fact to keep in mind is that residential housing and real estate account for an important part of the economy's aggregate wealth, in many countries more important than net financial assets.¹⁰ Another fact to keep in mind is that houses and real estate are very long-lived assets. Economic lifetimes of these assets are on the order of several decades, much longer than the time spans for which most people plan their savings and investments.

The discrepancy between the economic lifetimes of these assets and the investment horizons of most investors poses a dilemma. If housing finance were forthcoming only from investors with matching long-term horizons, there simply would not be very much of it. The ordinary saver puts funds into a savings account or similar asset where they can be withdrawn at a few months' notice, perhaps even at will. A term account may have a maturity of a few years, but this is still far short of the forty or more years of economic life of a house. Hardly anybody is willing to tie his funds up for such a long time span. Even people who plan so far ahead want to give themselves the option to change their investments at some intervening time.

If housing finance is obtained from investors with shorter horizons, someone must bear the risk that is inherent in the fact that, when the initial contract is signed, it is not clear what will happen when the financier wants to liquidate his position. This risk can be born by the homeowner. He can get a ten-year mortgage and hope that, when the mortgage comes due, it will be easy to refinance or to sell the house. The risk can also be borne by the investor. He can provide a forty-year mortgage and hope that, if he wants to liquidate this mortgage prematurely, it will be easy to find a buyer. The risk can also be borne by a financial intermediary like yesteryear's savings and loans institution in the United States, which was providing homeowners with forty-

10 For a sample of OECD countries, Slacalek (2006) gives mean ratios of housing wealth to income of 4.89 and of net financial wealth to income of 2.68 in 2002. For the United States, these ratios are given as 3.01 and 3.84, the only case other than Belgium where net financial wealth exceeds housing wealth. The estimates of Case et al. (2005) suggest that this finding for the United States is a result of the stock market boom since the early eighties.

year mortgages and was itself financed by savings deposits, with maturities ranging from one month to seven years.

Whatever the arrangement may be, if we observe that the risks induced by maturity mismatch are coming out badly, we should not complain that these risks have been incurred at all. If no one was willing to take these risks on, our housing stock would be limited to what can be financed by investors with suitably long horizons. We should have much less housing, and our standards of living would be much lower. The quantity and quality of housing that we have are obtained by using the funds of investors with short time horizons to finance housing and real-estate investments with very long time horizons. The risks that this mismatch creates are necessary by-products of the comfort that we enjoy.

One must, however, ask whether the mechanisms that determine the extent and the allocation of these risks are functioning well or whether these mechanisms have serious shortcomings.

Why should we think of the maturity mismatch in real-estate investment as a source of risk at all? Why can't we just say that in a well-functioning system of financial markets, finance is always forthcoming at the going price? There are two snags: Financial markets are not always well functioning, and the going price may be unaffordable.

The going price may be unaffordable: Market conditions change all the time; in particular, market rates of interest change all the time. If the risk associated with maturity mismatch is borne by the homeowner, he may find that, at the time of refinancing, the market rate of interest is so high that he is unable to service his debts at this rate. If the risk associated with maturity mismatch is borne by the investor, e.g., through a long-term fixed-rate security, he may find that, when he wants to sell the security, its price in the market is rather low.¹¹ Because the market price of an old fixed-rate security is low if the market rate of interest for new loans is high, the debtor's refinancing risk and the investor's asset valuation risk are actually two sides of the same coin, reflecting the fact that, if market rates of interest go up, long-lived assets with given returns become relatively less attractive.

Financial markets are not always well functioning: We often think of financial markets as being so well organized that one can always find a trading partner, buying or selling, at "the going price" plus or minus a very small margin. While this may be true for the markets for government bonds or certain large stocks, many financial markets do not have this property.

11 By a precisely symmetric consideration, investors holding short-term assets may find that, if they want to reinvest their funds after all, the rate of interest at which they can do so is rather low (and long-term assets are expensive to buy). A systematic account of the different risks associated with changes in market rates of interest is given in Hellwig (1994a).

Information and incentive problems make trading partners wary lest the offer they are considering should be harmful to them.

Akerlof (1970)'s famous model of the used-car market is paradigmatic for the problem. In Akerlof's analysis, people who know their cars to be of good quality are less willing to sell them at "the going price" than people who know their cars to be "lemons", i.e., poorly made.¹² At any given price, potential buyers appreciate that the cars that are being offered at this price represent a negative or "adverse" selection. In the absence of a mechanism for quality certification, the average price of a used car that is traded in the market must therefore involve a discount relative to the price that would be paid for a car whose quality is known to correspond to the average for that make and year. Trading volume is therefore less than it would be under complete information. Nor does the problem stop there: The discount itself is likely to discourage further car owners from offering their cars for sale. The adverse-selection problem is thereby exacerbated. This may require a further discount in the price, which in turn can exacerbate the adverse-selection problem. In extreme cases, the market may break down completely, i.e., no car may be traded even though, in terms of the underlying needs and preferences, it would be mutually beneficial to have trades that reallocate cars from people who need them less to people who need them more.

Like the potential buyer of a used car, the buyer of a financial security must worry about the quality of what he buys. If he suspects that the security is being offered because the seller knows that the security has a problem, he will not be willing to buy it unless he is given a large discount. Because the potential sellers' reactions to the discounts depress quality even more, trading volume can be reduced to a bare minimum; as in the used-car market, there may even be a complete market breakdown. Thus, an investor who has provided long-term finance to a homeowner may find it difficult to sell his claim to another investor when he needs the money – the other investor is afraid of his knowing something about the borrower's solvency. Alternatively, a homeowner who has taken out a mortgage of limited maturity may find it difficult to refinance because investors have doubts about his ability to service his debt.

The history of real-estate finance provides ample material to illustrate the risks associated with maturity mismatch in real-estate finance. In many countries, for a very long time, real-estate finance was provided through fixed-rate mortgages. As mentioned above, in the United States before 1980, these mortgages were provided by savings and loans institutions that were themselves financed by short-term deposits at regulated rates of interest, of 3–5%.

12 In Germany, the term would be, „Montagsauto“, a car that was put together on a Monday when workers were still dreaming of their weekend exploits, rather than watching what they were doing.

However, in the late seventies and early eighties, when nominal rates of interest were high, these institutions found that their depositors were leaving them for money market funds that were offering interest rates above 10%. The problem of illiquidity which this posed was solved by a deregulation of deposit rates. However, with deposit rates shooting up to the level that was needed to compete with money market funds, the profitability of these institutions was squeezed by the discrepancy between deposit rates and mortgage rates that had been contracted long ago. Indeed, because of this squeeze, a substantial portion of the United States savings and loans industry was technically insolvent at the time of deregulation.¹³

Given this experience, market participants went looking for new arrangements. In the early eighties, real estate finance moved from fixed-rate to adjustable-rate mortgages. The interest rate risk was thus shifted to the borrowing homeowners, in many European countries as well as the United States. However, when market rates of interest rose again in the late eighties, mortgage lenders found that many of their borrowers were unable or unwilling to fulfil their obligations at the newly adjusted rates; in technical language: the interest rate risk that the lenders thought they had gotten rid of had merely been transformed into a counterparty credit risk.¹⁴ They also were unpleasantly surprised to find that, when they tried to repossess the properties, the proceeds were low because the high market rates of interest were depressing property values. High interest rates inducing high default rates and depressing property values were a key ingredient in the banking crises that hit many European countries and Japan as well as the United States in the late eighties and the early nineties.¹⁵

2.2 *The Role of Securitization*

Another approach to the problem of risk allocation in real-estate finance was provided by securitization. This financial innovation was developed in the eighties in the United States. In the nineties, reliance on securitization greatly expanded so that, by the end of the decade, it accounted for the bulk of real-estate finance. Under securitization, sometimes referred to as the originate-and-distribute model of mortgage finance, the originating institution, traditionally a bank or a savings institution, will transfer mortgage titles to a *special-purpose vehicle*, a specialized institution that puts a large set of

13 See Kane (1985, 1989), Benston et al. (1991).

14 The shift to adjustable-rate instruments in the first half of the eighties is deemed to explain at least part of the increase in credit risk in this decade; see Hendershott and Shilling (1991), Schwartz and Torous (1991).

15 In the UK, the brunt of the crisis was actually borne by the insurance industry that had provided the building societies with credit insurance on the basis of the idea that default on a loan is an insurable event!

mortgages into a package and that refinances itself by issuing “mortgage-backed securities”, i.e. securities whose claims are defined with reference to the returns that are earned by the package of mortgages. The risks of mortgage finance are thus transferred from the originating institution to the special purpose vehicle and to the holders of the mortgage-backed securities.

The mortgage-backed securities themselves are not just defined as percentages of the mortgage portfolio, but are structured into *tranches*, which are ranked according to their priorities. In the simplest case, there are three such tranches. The first tranche, usually referred to as the *senior tranche*, has a contractually specified claim on the mortgage portfolio. If the return on the mortgage portfolio falls short of this claim, the holders of the senior tranche get the entire return and share it according to the shares of the senior tranche that they hold. If the return on the mortgage portfolio exceeds the claim of the senior tranche, the claim of the senior tranche is paid off. The second tranche, usually referred to as the *mezzanine tranche*, also has a contractually specified claim on the mortgage portfolio. However, this claim is subordinated to the claim of the senior tranche. If the return on the mortgage portfolio falls short of the claim of the senior tranche, the holders of the mezzanine tranche get nothing. If the return on the mortgage portfolio lies between the claim of the senior tranche and the sum of the claims of the senior and mezzanine tranches, the holders of the mezzanine tranche get the entire excess of the return over the claim of the senior tranche and share it according to the shares of the mezzanine tranche that they hold. If the return on the mortgage portfolio exceeds the sum of the claims of the senior and mezzanine tranches, the claim of the mezzanine tranche is also paid off. The holders of the final tranche, usually referred to as the *equity tranche*, receive what is left after the senior and mezzanine tranches have been served. If the return on the mortgage portfolio falls short of the claims of the senior and mezzanine tranches, the holders of the equity tranche do not receive anything. Otherwise they receive the excess of the return on the portfolio over the claims of the senior and mezzanine tranches.

Does this arrangement make economic sense? Before I discuss its flaws and before I explain how these flaws contributed to the current crisis, I want to stress that the system of real-estate finance based on mortgage-backed securities has some eminently reasonable features. First, this system permits the originating institution to divest itself of the interest rate risk that is associated with real-estate finance. The experience of the US savings & loans industry has shown that depository institutions are not well able to bear this risk. The experience with adjustable-rate instruments has also shown that debtors are not well able to bear this risk and that the attempt to burden them with it may merely transform the interest rate risk into a counterparty credit risk. Securitization shifts this risk to a third party.

In principle, shifting this risk away from the originating institution and its debtor makes sense because there are other market participants who are better able to bear this risk. Some market participants actually have long investment horizons and therefore do not consider the interest risk of real-estate finance to be a risk at all. Thus, an insurance company or a pension fund has liabilities with maturities of twenty years or more, not too far removed from the economic life of a real-estate investment or the maturity of a mortgage instrument. If such an institution invests in a long-term fixed-rate instrument, i.e., a mortgage or a mortgage-backed security, the question of how the market values this instrument at intervening dates is irrelevant because there is no point in liquidating this investment anyway and the institution's ability to fulfil its obligation to its own financiers depends on the returns from the security rather than the market's assessment. Indeed, for an insurance company or pension fund, a fall in the value of long-term securities that is induced by an increase in interest rates tends to be unproblematic. The very increase in interest rates provides the institution with scope to earn higher returns on new investments and thereby to better fulfil its obligations to its insurance and pension customers.¹⁶

Even if one cannot *a priori* distinguish between short-term and long-term investors, the securitization of long-term investments can still make economic sense. Thus, in the context of a model in which investors do not know beforehand when they will want to consume, Hellwig (1994a) shows that it is optimal to have an arrangement where people stipulate the amounts of short-term and long-term assets that they want to hold, with the proviso that, if they find that they want to consume early, they should bear the interest-induced valuation risk of long-term investments, and, if they want to consume late, they should bear the interest-induced reinvestment risk of short-term investments. All risks that are associated with changes in interest rates should thus be shifted to final investors. Securitization provides one way to achieve this.

The marketing of these securities also provides room for improvements in the worldwide risk allocation. It is fashionable these days to deride European bankers who invested in US mortgage-backed securities without understanding anything about real-estate markets in the United States. However, before we adjust our regulations to prohibit such adventures in the future, we should recall that experiences with real estate finance in domestic markets have not been that propitious either. A paradigmatic example is again provided by the

16 For such institutions, the relevant form of interest rate risk is actually the risk, considered in fn. 11, that, if it invests short-term, the rate of return on reinvestments after the first investments have matured may be too low relative to their obligations to insurance customers and pension savers. Thus, in the second half of the nineties, life insurers in Germany were squeezed by the difference between the rates of return that they had promised their customers in the early nineties and the rates of return that they could earn in the market after the rate decline of the mid-nineties.

United States savings and loans industry. Under the old regime, before deregulation, some states had rules requiring their savings banks to invest in mortgages for properties in the very state. Such a rule was a major cause of the S&L crisis in Texas in 1986, which preceded the general S&L crisis by more than a year: Following the collapse of oil prices in 1985, the Texan economy went into a recession, and real-estate prices in Texas fell. Savings and loans institutions in this state were hit by this Texas-specific risk because the regulation in question did not permit them to diversify their risks across states. A lack of geographic diversification of real-estate finance also played a role in the various banking crises of the late eighties and early nineties, in particular the crises in the Scandinavian countries and in Switzerland.¹⁷ The experience of German banks with real-estate finance in the *Neue Länder*, the former GDR, in the early nineties was similarly unpropitious.¹⁸

As a matter of principle, it makes economic sense for institutions in Europe or Japan to be holding securities related to real-estate investments in the United States and other countries as well as their own. By holding securities related to real-estate investments in different countries, they obtain a better diversification of risks in their portfolios. To be sure, such investments can be fraught with information and incentive problems. However, such problems arise even if one invests in one's own country, sometimes even more poignantly than if one invests abroad.¹⁹

The formation of *packages* and *tranches* also makes economic sense; it can serve to defuse the very information and incentive problems that would otherwise prevent the sharing of risks between investors. By comparison to a single mortgage, an asset that is backed by a *package* of mortgages benefits from diversification of default risks across the different mortgages in the package. Packaging also provides for standardization. A package is more likely to be

17 For Sweden and Finland, see Berglöf and Sjögren (1998), Englund (1999) and Takala and Virén (1995), for Switzerland, Staub (1998b). The Swiss case is particularly interesting: Whereas many cantonal and regional banks whose fields of operations were limited to Switzerland, or even to the canton or region where they were located, became insolvent as a result of the crisis in real-estate markets and real-estate lending, the big banks were able to compensate their losses in these activities by profits in internal derivatives markets.

18 In this context, it is worth mentioning that, in the breakdown of the German mortgage lender Hypo Real Estate in October 2008, a major role seems to have been played by bad loans on real estate in the *Neue Länder* from the early nineties, which had been taken over from HVB, the institution that had created Hypo Real Estate before it was itself taken over by Unicredito. (Another factor in the breakdown was the excessive reliance of a major subsidiary on short-term refinancing; the role of excessive maturity transformation in the crisis will be discussed in Section 4 below.)

19 For evidence on this point, see the accounts of the Scandinavian crises in Berglöf and Sjögren (1998), Englund (1999) and Takala and Virén (1995). In Germany, Deutsche Bank's providing mortgage finance for a building with a purported 5000 m² of office space when the actual area was 2000 m² has become legendary.

considered as a part of a standardized class of assets than any one specific mortgage would be. Such standardization can reduce the kind of “lemons” problem that I discussed above. Whereas the attempt to sell a single mortgage or an asset backed by a single mortgage would raise the suspicion that the seller knows this particular mortgage to be having problems, a package that involves a mix of such securities is less likely to raise such suspicions, especially, if a rating agency confirms that the mix conforms to some sort of average of securities of this kind. Thus, until last year, market participants thought that they knew what an AAA-rated senior-tranche mortgage-backed security was and were not afraid that someone offering this security for sale was doing so because he had inside information on default prospects of the mortgage borrowers. Standardization by packaging provides for marketability in a way that would hardly be available for individual securities.²⁰

Tranching should be understood as a way of reducing moral hazard in origination. Past experience suggests that the distribution of losses in lending is highly skewed. On the basis of this experience, losses on a diversified portfolio of mortgages could be expected to be below 10% with a probability close to one; losses above 10% could be deemed to be quite unlikely. Splitting the claims to the portfolio returns into tranches as described above would thus leave the holder of the equity tranche holding practically all of the risk. If the claims of senior and mezzanine tranches together amount to no more than 95% of the aggregate of claims on mortgage borrowers, the holders of senior and mezzanine tranches would be almost immune from default risks attached to the underlying securities. These risks would mainly affect the equity tranche. If the equity tranche was held by the originating institution, this institution would in fact have the proper incentives to investigate the credit-worthiness of the borrowers before lending them money and originating the mortgage; after all, the risks of making a mistake in this decision would mainly hit the originating institution itself.²¹

In theory, therefore, the system of securitization of real-estate finance through mortgage-backed securities seems like a good way to shift a substantial part of the risks that are due to the mismatch between the economic lifetimes of real-estate investments and the horizons of investors away from the originating institutions and their debtors without impairing the incentives of originating institutions to be careful about the real-estate investments that they financed. The system would thus seem to provide a substantial improvement in the allocation of risks in the worldwide financial system.

What then went wrong? In several important respects, the practice was different from the theory: First, moral hazard in origination was *not*

20 [Duffie \(2007\)](#). A general treatment of the role of standardization is provided by [Gale \(1992\)](#).

21 For a more detailed account of the argument, see [Franke and Krahnen \(2006\)](#).

eliminated, but was actually enhanced by several developments. Second, many of the mortgage-backed securities did not end up in the portfolios of insurance companies or pension funds, but in the portfolios of highly levered institutions that engaged in substantial maturity transformation and were in constant need of refinancing. Third, the markets for refinancing these highly leveraged institutions broke down in the crisis.

I now turn to these problems and discuss the causes of the current crisis. The following section discusses the problem of moral hazard in origination and analyses the flaws in mortgage securitization that underlay the current crisis. Subsequently, Section 4 discusses the systemic repercussions that turned the subprime-mortgage crisis into a world financial crisis.

3 MORAL HAZARD IN MORTGAGE SECURITIZATION: THE ORIGINS OF THE CRISIS

3.1 *Moral Hazard in Origination*

At a conference on financial contracting in April 2007, one presentation began with a picture of a building with the advertisement “For Sale! Price: 130.000 \$, Cash Back: 20.000\$”. At first sight, this advertisement poses a puzzle. Why should a seller ask for 130.000\$ and at the same time promise to repay the buyer 20.000\$? Why not just set a price of 110.000\$? The puzzle disappears if one considers that the sales price of 130.000\$ would appear in the mortgage loan application to the bank. If the bank accepted this number at face value, it would provide a larger loan than it would if it knew that the effective price is only 110.000\$. By reporting an inflated sales price, the buyer and seller together were attempting to defraud the bank.

The presenter went on to provide empirical evidence that the incidence of such fraud, also the incidence of collusion between property appraisers and borrowers, was significantly higher when the originating lender was planning to put the mortgage into a package of mortgages that would be sold for securitization than when he was planning to hold the mortgage himself.²² Such findings indicate that there has been significant moral hazard in the origination of mortgages that were due to be securitized. Presumably, lenders who were planning to hold the mortgages themselves had greater incentives to fight fraud on the side of borrowers. Indeed, a lender who plans to resell the entire mortgage may not worry about the debtor’s ability to pay at all and merely aim at increasing volume so as to earn more fees by originating and reselling mortgages.

Moral hazard is, in principle, present in any financial transaction. A person who works with his or her own money has greater incentives to take care

22 Ben-David (2006/2008).

of what happens with the investment than a person who works with somebody else's money.²³ In the case of a financial institution, this moral hazard is particularly bothersome because the institution's assets are very diverse and highly fungible. This makes it difficult for outside investors to monitor the institution's activities and to take corrective actions if they see something going wrong.²⁴ In the theory of financial institutions, therefore, the paradigmatic model of *viable* financial intermediation, due to [Diamond \(1984\)](#), postulates an intermediary holding a fully diversified portfolio of assets, with outside finance taking entirely the form of debt, with claims that are independent of the returns which the intermediary earns on his portfolio: If the claims on the financial intermediary are independent of returns on the intermediary's assets and if diversification ensures that the probability of default is zero, any benefits of taking greater effort in managing assets, e.g., more thorough monitoring of loans clients, accrue entirely to the intermediary. The problem of moral hazard in relations between the intermediary and his financiers is thereby eliminated altogether.

Whereas the Diamond model relies on the virtues of debt finance in dealing with moral hazard when there is *no* default risk, we also know that, if there is a default risk, debt finance provides the borrower with an incentive to take excessive risks, i.e., risks that would not be incurred if his investment strategy was determined by mutual agreement with his financiers. The incentive arises from the consideration that, whereas extra returns in the event of success accrue to the debtor, an increase in the probability of default harms the creditors, according to the principle "heads, I win – tails, my creditors lose".²⁵

Given the theoretical analysis, one always had to suspect that the securitization of credit risks would be a source of moral hazard that could endanger the viability of the system.²⁶ The system of splitting the claims to a portfolio of assets into tranches can actually be seen as a response to this concern. We can think of the senior and mezzanine tranches as senior and junior debt. *If* the originating institution were holding the equity tranche and *if*, because of packaging and diversification, the probability of default, i.e., the proba-

23 [Jensen and Meckling \(1976\)](#).

24 [Diamond \(1984\)](#), [Myers and Rajan \(1998\)](#).

25 [Jensen and Meckling \(1976\)](#), [Stiglitz and Weiss \(1981\)](#).

26 See [Hellwig \(1998a,b\)](#). Based on [Diamond \(1984\)](#), already [Hellwig \(1994a\)](#) had suggested that a securitization of the interest rate risk inherent in long-term assets would have to be engineered in such a way that asset-specific return risks would stay with the intermediary since otherwise the intermediary would have too little incentive to take care in selecting and monitoring loan clients. [Hakenes and Schnabel \(2008\)](#) provide a formal model of the moral hazard in origination that is generated by credit risk transfer. Because the counterparties are aware of the moral hazard and prices are set accordingly, in their model, the overall welfare effects of credit risk transfers are positive despite the moral hazard that they generate.

bility that portfolio returns fall short of the sum of senior and mezzanine claims, were (close to) zero, we would (almost) be in the world of the Diamond model where moral hazard in banking is negligible. Why then did this system fail?

The answer to this question is straightforward: Both “ifs” in the preceding statement were not satisfied. Originating institutions did *not*, in general, hold the equity tranches of the portfolios that they generated; indeed, as time went on, ever greater portions of equity tranches were sold to outside investors.²⁷ Moreover, default probabilities for senior and mezzanine tranches were significant because, by contrast to the Diamond model, packaging did not provide for sufficient diversification of returns on the assets in mortgage-backed portfolios.

Except when default risk on the individual mortgage is altogether eliminated, the returns on different mortgages are necessarily correlated. The returns that lenders earn in default depend on property values. Property values depend on common as well as asset-specific factors. Whereas asset-specific factors, such as geographic location or the characteristics of the neighbourhood, are likely to be independent and can therefore be diversified away, common factors, such as the susceptibility to changes in interest rates or to changes in macroeconomic conditions, cannot be diversified away. Because they affect all real-estate properties at the same time, they necessarily introduce a correlation into the default risks that are associated with different mortgage securities. For example, an interest rate increase that depresses property values enhances the prospect that any borrower’s equity in his property might become negative and that he might prefer to walk away rather than to stay and continue servicing the loan. Because of these correlations, diversification in the portfolios underlying the mortgage-backed securities was less effective, and default risks for senior and mezzanine tranches were more significant than had been anticipated.

3.2 *Mortgage Lending in the Years Before the Crisis*

For a long time, moral hazard in origination seems to have been reasonably contained. The creation of mortgage-backed securities was almost entirely in the hands of *Fannie Mae* and *Freddie Mac*, as the Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation are commonly called. These government-sponsored enterprises²⁸ provided the buyers of mortgage-backed securities with a guarantee for the promised debt

27 Duffie (2007), Dodd (2007).

28 The term government-sponsored enterprises refers to the fact that, although these institutions have been privatized in the late sixties, they are deemed to serve a public purpose and therefore enjoy certain tax privileges, as well as access to the US Treasury for liquidity needs.

service; at the same time, they imposed certain minimum standards on mortgage debtors, namely, high credit scores reflecting large down payments, low ratios of debt service to documented available income, and reliable credit histories of mortgage borrowers. For mortgages that met these standards, so-called “prime mortgages”, delinquency rates and default rates were – and still are – very low.²⁹

Fannie Mae and Freddie Mac had in fact played a key role in the development of the markets for mortgage-backed securities. When they began to buy mortgages, to package them, and to sell the mortgage-backed securities in the open market, the mortgage-backed securities were acceptable to investors because Fannie Mae and Freddie Mac also provided guarantees for the promised payments from these securities. The origins of Fannie Mae and Freddie Mac as government institutions led many investors to believe that, even though these institutions had been privatized, their guarantees had some kind of backing from the government³⁰ and could therefore be deemed to be reliable.³¹

However, in the years since 2000, Fannie Mae and Freddie Mac have been challenged by competition from other financial institutions, in particular, private investment banks, which did not guarantee their issues of mortgage-backed securities in the same way as Fannie Mae and Freddie Mac. The share of the government-sponsored enterprises in the issuance of mortgage-backed securities went from 76% in 2003 to 43% in 2006.³² At the same time, there was a relative decline in prime mortgage lending and a significant increase in subprime mortgage lending, i.e., in the issuance of mortgages that did not

29 The difficulties that Fannie Mae and Freddie Mac have had in the crisis had more to do with their being pressured by the political system to provide support for subprime mortgage-backed securities in 2007 than with problems in the prime mortgages that had been their main business. However, one suspects that the expansion in prime mortgage lending between 1995 and 2003 may have been accompanied by a decline in borrower quality. This would be the analogue for prime mortgages of findings of [Demyanyk and Van Hemert \(2008\)](#) showing that, since 2001, in subprime mortgage lending, there have been declines in borrower quality that go beyond the effects of changes in observables such as down payment rates, credit scores and the like.

30 Since the privatization of these institutions in the late sixties, this belief would not have had any basis in the law. Even so, the developments since July 2008 have shown that this belief was justified. The position of Fannie Mae and Freddie Mac in the system of housing finance in the United States is too important for the government to look aside when these institutions run into trouble.

31 Thus, at the time when the system of mortgage-backed securities was developed, the neglect of moral hazard induced by securitization was at least partly due to a reliance of market participants on government guarantees.

32 See [Dodd \(2007\)](#). The challenge in the market was preceded by political discussions about these institutions’ roles including accusations by the US Government of errors in dealing with new accounting rules for derivatives. These discussions induced the government-sponsored enterprises to retrench their activities in the market.

meet the standards of the government-sponsored enterprises. The share of *subprime mortgages* rose from around 9% of new mortgages in the early 2000's to above 40% in 2006.³³ By the end of 2006, subprime mortgages accounted for some 14% of the total stock of outstanding securitized mortgages (7% in 2001).³⁴

These changes have caused the quality of mortgages to go down. According to the [International Monetary Fund \(2007\)](#), the share of the stock of securitized mortgages in which the loan accounted for more than 90% of the property value went from about 5% in 2001 to 14% in 2006; the share of securitized mortgages with limited documentation of income went from 7% in 2001 to 18% in 2006. These changes in mortgage quality are linked to the rise of nonprime lending: Average down payments in near prime mortgages, the so-called Alt-A mortgages, and in subprime mortgages were 12% and 6%, respectively, substantially below down payments in prime mortgages; in many instances, there was no down payment at all. In 2006, there was less than full documentation of income in 81% of Alt-A and 50% of subprime mortgages, as opposed to 36% of prime mortgages.³⁵

These years also saw the resurrection of adjustable-rate mortgages. Their share of the stock of outstanding mortgages went from 6% in 2001 to 26% in 2006.³⁶ In 2006 indeed, 92% of newly issued subprime mortgages, 68% of newly issued Alt-A mortgages, and 23% of newly issued prime mortgages had adjustable rates.³⁷ The lesson of the eighties, that adjustable rates cause credit risk to be higher, seems to have been lost – perhaps forgotten, perhaps also neglected because, after all, the credit risk would affect the holders of mortgage-backed securities rather than the originators of the mortgages.

33 Chomsisengphet and Pennington-Cross (2006), DiMartino and Duca (2007), [International Monetary Fund \(2007\)](#).

34 DiMartino and Duca (2007), [International Monetary Fund \(2007\)](#). These two sources differ on the importance of Alt-A (near prime) mortgages. Whereas DiMartino and Duca assess the stocks of Alt-A mortgages and of prime mortgages at 6% and 80% of the total, the IMF puts Alt-A mortgages at 12% and prime mortgages at 74% of the total, 65% as prime mortgages held by government-sponsored enterprises and 9% held by non-agency private institutions. However, whereas the IMF's numbers refer to securitization-related mortgages, DiMartino and Duca seem to be referring to all mortgages. In any case, given the problems of drawing precise lines between different classes and given the question of data reliability, these numbers should be taken with a grain of salt, indications of orders of magnitude, rather than precise measures.

35 DiMartino and Duca (2007). The fact that 36% of prime mortgages involved less than full documentation of income indicates that, even in this part of the market, lending standards had declined.

36 [International Monetary Fund \(2007\)](#).

37 DiMartino and Duca (2007). The [International Monetary Fund \(2007\)](#) gives the shares of adjustable-rate mortgages as 85% for subprime mortgages, 55–60% of Alt-A and prime mortgages and less than 20% for mortgages securitized by Fannie Mae and Freddie Mac.

The changes in mortgage quality are reflected in their performance, or mal-performance, in the crisis. Since 2006, delinquency rates and foreclosure rates have steadily gone up. According to the Mortgage Bankers Association, at 6.35%, the delinquency rate, i.e., the share of mortgages with payments outstanding 60 days or more, in the first quarter of 2008 was the highest (on a seasonally adjusted basis) since they began collecting the data in 1979. At 2.47%, the foreclosure rate, i.e., the share of outstanding mortgages in foreclosure proceedings has more than doubled since the end of 2006. As a function of the number of months since the conclusion of the mortgage contract, delinquency rates on mortgages issued in 2006 have been rising more steeply and have been higher than delinquency rates in any previous year in this decade; delinquency rates on mortgages issued in 2007 are even worse.³⁸

As one would expect, the problems are concentrated in the subprime segment of the market: Delinquency rates in this segment are on the order of 25%, as opposed to 10–12% for Alt-A mortgages and 1–2% for prime mortgages.³⁹ Adjustable-rate subprime mortgages, with a share of 7% of the total outstanding mortgage stock, account for about 39% of foreclosures. By contrast, fixed-rate prime mortgages, with a share of 65% of the total outstanding mortgage stock, account for only 18% of foreclosures.⁴⁰ The doubling of the foreclosure rate over the past year thus seems to have been largely a consequence of the previous expansion of subprime lending.

Striking though they are, in and of themselves, these numbers do not necessarily prove that the system went astray. They prove that there was a relaxation of credit standards and an expansion of lending to riskier borrowers, and theory makes us speculate that this was due to moral hazard in origination. However, an advocate of the expansion of subprime lending might argue that previous credit standards were too restrictive, denying the benefits of home ownership to an unnecessarily large part of the population. The development and expansion of subprime lending did serve to expand the share of Americans living in their own homes from around 63.4% to just below 69.2%.⁴¹ Among the new home owners, many are *not* subject to foreclosure proceedings and may still be happy about their moves.

An advocate of the expansion of subprime lending might also argue that there is nothing intrinsically bad about higher credit risks, provided the creditors are aware of these risks and price them properly. The development in subprime lending was said to have been made possible by improvements

38 International Monetary Fund (2008a), Demyanyk and Van Hemert (2008).

39 International Monetary Fund (2008a).

40 For fixed-rate subprime mortgages, the corresponding shares are 6% of the total and 11% of foreclosures, for adjustable-rate prime mortgages, 15% of the total and 23% of foreclosures. All numbers are taken from the Mortgage Bankers Association, <http://www.mortgagebankers.org/NewsandMedia/PressCenter/62936.htm>.

41 DiMartino and Duca (2007).

in credit scoring techniques, transferring such techniques from automobile loans to home loans.⁴² Interest rates on subprime mortgages were said to properly reflect the higher credit risks, providing for risk premia where risks were higher.⁴³ Couldn't it be the case that the government-sponsored entities Fannie Mae and Freddie Mac had simply not been sufficiently innovative?

I do not actually share this view. I merely present it in order to show how difficult it is to assess a development that has gone astray. Once things have gone wrong, hindsight suggests that these loans should not have been made. However, hindsight is not a useful guide. The question must be whether we have evidence that, *beforehand*, it was, or should have been, clear that these loans should not be made.

At this point, I return to the example by which I introduced the discussion of moral hazard in origination. Telling the bank that the sales price is 130.000\$ when, effectively, it is only 110.000\$ is an instance of fraud. A report of the United States [Financial Crimes Enforcement–Network \(2006\)](#) in fact shows that over the past decade, mortgage fraud has increased dramatically, going from 1318 reported instances in 1996 to 25989 reported instances in 2005, an almost twentyfold increase. Annual rates of increase were around 30% from 1996 to 2002 and then jumped to 77% in 2003, 93% in 2004 and 41% in 2005. It is hardly a coincidence that the most dramatic increases occurred in the very years when the system of mortgage finance and mortgage securitization underwent the structural changes that I have described. Greater allowances for risk have gone along with reduced attention to fraud. The econometric analysis of [Ben-David \(2006/2008\)](#) provides evidence of the link between the incidence of fraud and securitization.

In this context, it is worth noting that, even though the increases in delinquencies and foreclosures are concentrated in adjustable-rate subprime mortgages, they do not seem to be triggered by the resetting of interest rates. The IMF points out that foreclosures seem to take place well ahead of the resetting of interest rates and suggests that “the deterioration thus far has been a function of fraud, speculation, over-extension of borrowers, and the effects of weak underwriting standards”.⁴⁴

An econometric study by [Demyanyk and Van Hemert \(2008\)](#) of delinquencies in a large sample of mortgage loans shows that the decline in the quality of subprime mortgages actually transcends anything that we can attribute to observable characteristics such as adjustable rates, low credit scores, low down payments, or high ratios of debt service to income. For subprime mortgages of different years since 2001, the study finds that, even after everything else is taken into account, there is a positive effect of vintage on delinquency

42 [DiMartino and Duca \(2007\)](#).

43 [Chomsisengphet and Pennington-Cross \(2006\)](#).

44 [International Monetary Fund \(2008a, fn. 7\)](#).

rates 12 months after origination of the mortgage contract. The probability of such a delinquency on a mortgage issued in 2006 is higher than the corresponding probability for a mortgage issued in 2005, the latter again is higher than the corresponding probability for a mortgage issued in 2004, and so on. Moreover, the difference is *not* fully explained by the decline in the quality of characteristics such as credit scores, down payments, etc. In full accord with the IMF's reference to "weak underwriting standards", there seems to have been a decline in the quality of subprime mortgages even beyond the worsening of their observable characteristics. The regression results indicate that this "unexplained" quality decline has been going on since 2001. However, before 2006, the effects of this quality decline on delinquency rates were outweighed by the effects of increases in property prices, which provided mortgage borrowers with additional equity, increasing their stakes in their properties and also providing a basis for taking out additional loans in order to service their outstanding debts.⁴⁵

The study of Demyanyk and Van Hemert also shows that *differential* risk premia for subprime mortgages went down at the very same time as risks in these mortgages went up. In the sample they studied, the difference between the average interest rate on fixed-rate subprime mortgages and the average interest rate on fixed-rate prime mortgages was well above 300 basis points (3 percentage points) in 2001. Following a steady decline from 2001 to 2004, this difference reached 100 basis points in that year, and then jumped back up to around 150 basis points where it stayed until the end of 2005; in 2006, it rose towards 200 basis points, still significantly less than where it had been in 2001.

This behaviour of risk premia on subprime mortgages is something of an anomaly. The decline from 2001 to 2004 has no parallel in other parts of the financial system, e.g., in the behaviour of risk premia on bonds with low credit ratings. Therefore it cannot be ascribed to a general increase in investors' willingness to incur risks. In the absence of an increase in the willingness to bear risk, risk premia on subprime mortgages should have gone up, rather than down, so as to reflect the decreasing quality of these titles. Given that the opposite happened, one must have doubts about the notion that interest rates on subprime mortgages were appropriately set to reflect the higher credit risks on these securities.

45 Demyanyk and Van Hemert (2008) also show that the assessment is unchanged if foreclosure rates, rather than delinquency rates, are considered. Hakenes and Schnabel (2008) attribute such quality deterioration to intensifying competition by originators, Rona-Tas and Hiß (2008) to the effects of increased gaming by mortgage borrowers (and brokers?) on the reliability of credit scores.

3.3 *Negligence in Securitization: Blindness to Risk in the Competition for Turf*

The fact that risk premia on subprime mortgages went down even as risks in subprime mortgages went up indicates that the expansion of subprime mortgage lending was driven by the supply of funds rather than the demand for funds in these markets. Increased mortgage lending was driven by investors seeking an outlet for their money. Mortgage originators, as well as home purchasers and home owners mostly seem to have been responding to the opportunities that this offered.⁴⁶ The question is therefore why investors were so keen to put their funds into subprime mortgage finance that they allowed risk premia to go down even as risk in subprime lending went up.

Some of the answer to this question is provided by a report that the Swiss bank UBS sent to its shareholders in April.⁴⁷ With losses exceeding 30 billion US dollars, UBS has been particularly hard hit by the crisis. They had played a very active role in the creation of MBS CDOs, collateralized debt obligations whose collaterals consisted of packages of subprime mortgage-backed securities, and they had also acquired such MBS CDOs on their own account. In the past, they had prided themselves on having one of the most competent systems of risk management and risk control in the world. The report tries to assess where and why their system failed. Its main findings can be summarized as follows:

- There was an excessive emphasis on revenue and growth, with insufficient attention given to risk and risk capacity. The focus on growth was motivated by a concern that UBS was falling behind leading competitors in investment banking. The “competitive gap” was deemed to be particularly large in the area of fixed-income securities. Activities in asset-backed securities, mortgage-backed securities, and adjustable-rate mortgages “were identified as significant revenue growth opportunities”.
- There never was any “holistic” or comprehensive assessment of this strategy and of the risks that it involved. Risk management and risk control put excessive confidence in credit ratings provided by rating agencies and failed to provide their own analysis of credit risks in the underlying securities. They also put excessive confidence in received quantitative methods of analysis, stress tests and estimates of value at risk using statistical models based on time series data of the past five years. At the same time, they neglected possible correlations between the risk involved in “warehousing” securities in the process of securitization and the risk inherent in the securities that were held on the bank’s own account. They also paid insufficient attention to systemic risks such as failures of counterparties to

46 Demyanyk and Van Hemert (2008); see also Kiff and Mills (2007).

47 UBS (2008).

hedging arrangements or a disappearance of liquidity from relevant markets. Finally, they failed to take account of new information, e.g., about rising delinquency rates, or of the role of correlations induced by the common dependence of the performance of residential mortgage-backed securities on the overall development of the US housing market.

- Because of a reorganization that had taken place in 2005, the subsidiary in charge, UBS Investment Banking, was suffering from a lack of risk management expertise in the area of fixed-income securities. Risk incentives were also inappropriate: If additional revenue was earned for the bank by investing in subprime mortgage-backed securities rather than a government bond or by securitizing portfolios consisting of mezzanine claims, rather than senior claims, on a mortgage portfolio, the manager would earn a reward for the additional revenue without any deduction for additional risks. If a more effective and more expensive hedging arrangement to reduce risks was replaced by a less effective and cheaper one, the manager would earn a reward for saving on costs without any deduction for the lower quality of the hedge.
- Control from above was ineffective. Because of piecemeal reporting to Senior Group Management and because of fragmented control structures, there was no forum where the investment bank's strategy of expanding activities in subprime mortgage-backed securities would be discussed in a comprehensive manner and, possibly, challenged. The problem was compounded by a lack of established operational principles for the management and control of risks at the level of the overall balance sheet of the institution. For a long time, UBS Investment Banking successfully resisted the imposition of such principles and of hard limits on its holdings of illiquid assets and on its overall balance sheet. They only accepted such limits in July 2007, when the severity of the crisis could no longer be overlooked. Until then, their engagements in mortgage-backed securities had kept growing at a high rate.

Competition for market shares with insufficient regard for risks and costs is a well known cause of financial difficulties. In the financial sector, such competition has often been observed in banking systems following market liberalization. Relevant examples are provided by the United Kingdom, where the lifting of credit controls in 1971 was followed by such competition leading to the Secondary Banking Crisis in 1973,⁴⁸ and Sweden, where deregulation in the mid-eighties was followed by such competition leading to the banking crisis of 1992.⁴⁹ In such markets, participants tend to be driven by a notion that the early phase of development determines long-run turfs, and that, to be “with it”, one has to succeed in this competition for turf.

48 Reid (1982).

49 Englund (1999).

The UBS Report to Shareholders suggests that something similar happened in the markets for mortgage securitizations since 2003. As the government-sponsored enterprises pulled back and private institutions developed the markets for mortgage-backed securities, these institutions competed to stake out their turfs in this new line of business, which held a prospect of high fees. In the competition for the mortgage originators' business, the imposition of quality standards for mortgages had lower priority – and, in the absence of guarantees of the sort that had been issued by Fannie Mae and Freddie Mac, the credit risks were passed on to the purchasers of the mortgage-backed securities.

3.4 Flaws in Securitization: The Role of MBS Collateralized Debt Obligations

As mentioned above, UBS was not so much involved in the securitization of mortgages as in the securitization of mortgage-backed securities themselves. As a latecomer in this line of business, coming from abroad, they may have been at a competitive disadvantage, relative to US investment banks, in establishing the relations to mortgage originators that would have been needed to get into mortgage securitization as such. By contrast, the securitization of mortgage-backed securities through MBS CDOs was seen as a significant revenue growth opportunity.

In contrast to the above assessment that mortgage securitization is, in principle, a good thing if incentive problems are kept under control, I have serious doubts about this second layer of securitization, i.e., the securitization of portfolios of mortgage-backed securities, rather than portfolios of mortgages. As I have outlined above, securitization can be useful because it provides the means for reallocating risks from where they originate to parties that are better able to bear them. In this operation, the packaging of securities is useful because the associated diversification of asset specific risks provides for standardization. The division of claims on the package into tranches that are ranked according to priority is useful if the originators hold on to the equity tranches and thus have the proper incentives to look after the quality of the portfolio they are securitizing. For the second layer of securitization, the benefits seem ephemeral, and the potential incentive effects large:

- If the first layer of securitization has been properly handled, the mortgage-backed securities as such should be eligible for inclusion in the portfolios of pension funds, life insurance companies and other investors that are better able to bear the risks associated with the long-term commitment of funds in real estate. To achieve this purpose, a second layer of securitization should not be needed.
- If the first layer of securitization has been properly handled, there should also be no significant benefits from additional diversification through

a second layer of packaging. To be sure, a second layer of packaging will provide for additional risk diversification. However, if the mortgage-backed securities that are being packaged are themselves truly marketable, such diversification benefits could also be reaped by investors putting multiple mortgage-backed securities into their own portfolios. Transactions costs of their doing this on their own would probably not be much larger than the 120 or so basis points that UBS obtained as a fee for securitizing mezzanine mortgage-backed securities.

- As outlined in the UBS report, the division of claims into tranches with different priorities was *not* used to provide proper incentives. As a matter of fact, UBS Investment Bank held on to the senior tranches of MBS collateralized debt obligations and sold the junior tranches, including the equity tranches, in the open market. Given the belief that the senior tranches were safe, they did not have much of an incentive to look after the quality of the assets they were securitizing. The UBS report indicates that, indeed, they did not.
- To the extent that the second stage of securitization provided a ready market for the securities created in the first stage, it further diluted incentives for institutions handling the first stage to actively control the quality of the mortgages that they were packaging together. As the chain of financial intermediation became longer, the scope for moral hazard associated with such intermediation was increased.

An advocate for the creation of MBS collateralized debt obligations might object that these considerations neglect the role of regulation and certification. Regulation prevents certain institutional investors from acquiring securities that have low credit ratings or are unrated. For such investors and such securities, the argument that, once the securities are sufficiently standardized to be marketable, the investor can perform the diversification on his own would not be applicable. If statutory regulation requires a life insurance company to restrict its holdings to securities with credit ratings of A or better, this insurance company will not be able to acquire a diversified portfolio of mezzanine MBS with a credit rating of BBB or worse. If statutory regulation subjects banks to minimum equity requirements that are calibrated to the ratings of the assets they hold, the banks may find that a diversified portfolio of mezzanine MBS with a credit rating of BBB is too costly in terms of required regulatory capital. In these cases, one might argue that a second layer of securitization is useful because the additional diversification that it provides makes it possible to give an AAA credit rating to the senior tranche of a portfolio of BBB mezzanine MBS and therefore to make additional funds from such regulated institutions available for housing finance. The above criticism of this second layer of securitization would be moot because, even though the

BBB mezzanine MBS are fully marketable, statutory regulation prevents some market participants from investing in these securities directly.

At this point, however, one must ask whether the second layer of packaging provides enough additional diversification to warrant an AAA credit rating for the senior tranche of a portfolio of BBB mezzanine mortgage-backed securities. This would only be reasonable if the returns on the different securities were sufficiently independent so that defaults on several of them at once were deemed much less likely than a default on any one of them, and the senior claim on the portfolio could in fact be considered to be safe. By contrast, if the returns on the different securities were correlated, the probability of defaults on multiple securities at once and therefore the probability of a default on the senior claim on this portfolio might not be so different from the probability of default on any one security. In this case, there would be no reason for giving an AAA credit rating to the senior tranche of a portfolio of BBB mezzanine mortgage-backed securities.⁵⁰

The major credit rating agencies seem to have thought that securities were sufficiently independent to warrant high ratings for senior MBS collateralized debt obligations – until July 2007. Then, all of a sudden, in August 2007, they downgraded many of these securities and many of the underlying mortgage-backed securities. Most securities were not just downgraded by one grade, but by several grades, even by three or more grades.⁵¹ For corporate debt, such downgrading by several grades at once is almost unheard of. The fact that, in the summer of 2007, there was so much downgrading by multiple grades suggests that the analysis underlying the previous ratings had been fundamentally flawed and that, at last, the rating agencies had come to realize this.

3.5 Flaws in Risk Assessment: The Failure of the Rating Agencies

For an outside observer, it is hard to tell what precisely has been wrong with the credit ratings of mortgage-backed securities before July 2007. I suspect that the risk models on which these ratings had been based were overoptimistic about default risks on the underlying mortgages and about correlations between the different mortgages and the different mortgage-backed securities. Both forms of overoptimism are related, and both have implications for the functioning of the second as well as the first stage of securitization.

There seems to have been a view that the individual borrower's ability to service his debt is of lesser importance if the property that serves as collateral

50 Duffie (2007) insists that MBS CDOs only make economic sense if the different MBS are sufficiently independent. He also warns that empirical estimates of correlations are notoriously unreliable. The criticisms voiced here apply a fortiori to higher stages of securitization, such as "CDO-squared" securities, where the collateral itself consists of MBS CDOs.

51 Dodd and Mills (2008).

TABLE 1 – S&P/CASE-SHILLER U.S. NATIONAL HOME PRICE INDEX (Q1 2000 = 100)

Q2 of Year	S&P/Case-Shiller US National Home Price Index	Rate of Change Over Previous Year
2000	103.77	9.50%
2001	112.69	8.60%
2002	122.24	8.50%
2003	134.2	9.80%
2004	152.92	13.90%
2005	176.7	15.60%
2006	189.93	7.50%
2007	183.56	−3.60%
2008	155.32	−15.30%

Source: Standard & Poors, see indices at <http://www.standardandpoors.com>.

for the loan is increasing in value. This view is actually corroborated by the finding of Demyanyk and Van Hemert, mentioned above, that, before 2006, the effects of the decline in the quality of mortgage borrowers were outweighed by the effects of increases in property prices. However, the view that property appreciation will reduce credit risk in a mortgage contract leads to an overoptimistic assessment of default risks if the property appreciation itself is overestimated. Moreover, if one fails to take account of the common factors that are driving real-estate prices, this view also leads to an overoptimistic assessment of correlations between the different borrowers' default risks. Both flaws came home to roost when, in mid 2006, real-estate prices in the United States began to turn down, and, as mentioned above, delinquency rates on recently issued mortgages rose to unprecedented levels.

The view that residential real estate was increasing in value reflected current and past experience. Table 1 documents the movement of real estate prices in the United States since 2000. The first column gives the value of the S&P/Case-Shiller U.S. National Home Price Index at the end of the second quarter of each year.⁵² The second column translates these numbers into rates of growth over the preceding twelve months. From 1999 to 2003, real-estate prices in the United States grew at roughly 9% per year. In 2003, their growth rate jumped, to 14% for 2003/2004 and more than 15% for 2004/2005. From 2005 to 2006, their growth was again slower. In June 2006, their growth turned negative, i.e., real-estate prices began to decline, first slowly and, then, from 2007 to 2008, quite dramatically, by over 15%.

52 I have chosen the second quarter because the peak in 2006 occurred in this quarter, and the acceleration of the downturn in 2007 began between the second and third quarters.

TABLE 2 – SELECTED INTEREST RATES IN THE UNITED STATES

Year	Federal Funds	US Treasury 10 Years	Conventional Mortgages
2000	6.24	6.03	8.06
2001	3.88	5.02	6.97
2002	1.67	4.61	6.54
2003	1.13	4.01	5.82
2004	1.35	4.27	5.84
2005	3.22	4.29	5.86
2006	4.97	4.80	6.41
2007	5.02	4.63	6.34
2008	2.00	3.89	6.48

Source: Board of Governors of the Federal Reserve System, <http://www.federalreserve.gov/releases/h15/>.

A nationwide decline of residential real-estate prices like that of the past two years has not been experienced in the United States since the Great Depression, if then. To be sure, there had been a downturn in the early nineties, but this downturn had been concentrated in a few states and regions. At the national level, at that time, the S&P/Case-Shiller U.S. National Home Price Index declined by no more than 4%.⁵³ Following a few years of stagnation and sluggish growth, real-estate prices in the United States had again picked up speed in the late nineties. The experience of the early 2000's seemed to justify the view that real-estate prices could only go up.

However, any more detailed assessment would have suggested that the observed price increases had been driven by singular developments that could not be expected to go on forever. For example, there had been a significant decline in nominal interest rates in the United States. As shown in Table 2, the (short-term) Federal Funds Rate went from 6.24% to 1.13%, the rate for ten-year Treasury Bonds from 6.03% to 4.01%, and the rate for conventional mortgages from 8.06% to 5.82%. This decline in interest rates must have given a boost to real-estate prices. However, it should have been clear that such a decline in interest rates could not continue forever, and might even be reversed, as indeed it was in 2005 and 2006. The boost that the decline in interest rates had given to real-estate prices should have been expected to be reversed if rates were to go up again.

Another development that should have been perceived as one-time, not to be repeated, involved the changes in arrangements for housing finance itself.

53 From 76.42 in Q2 1990 to 73.43 in Q1 1991.

Improvements in institutional arrangements for real-estate finance, like the securitization of mortgages, can and should cause real estate to appreciate. However, such an effect lasts only as long as perceptions of the new opportunities cause new and additional funds to flow into real-estate finance. It is bound to come to an end when financing structures have adjusted and real-estate prices have reached the new level that corresponds to the new structures.

Without a proper appreciation of the distinction between a one-time price increase and an ongoing appreciation process, ratings and investment decisions that are based on observed appreciations have elements of a bubble, in which observed price increases induce exaggerated return expectations, these return expectations in turn induce a further inflow of funds, this inflow of funds induces further price increases, and so on, until the bubble bursts because prices are too much out of line with any realistic valuations of the returns that the assets can actually generate. When the bubble bursts, the spiral is likely to be reversed as investors appreciate the risks to which they are exposed and try to get out of the assets that are now depreciating and thereby accelerate the depreciation itself.

It is probably not a coincidence that real-estate appreciation accelerated at roughly the time in 2003 when investment banks moved aggressively into mortgage securitization. At the time, market rates of interest were at their absolute minimum. Subsequently, when monetary policy became more restrictive and interest rates began to rise again, the effects of the expansion of mortgage finance seem to have even outweighed the effects of the interest rate increases. By mid 2006, real-estate prices were almost 90% higher than in the first quarter of 2000.⁵⁴ At this point, real-estate prices began to decline, and delinquency rates on mortgages began to rise.

The decline of real-estate prices since 2006 has affected almost the entire United States. Out of 20 metropolitan areas for which there are separate listings of the S&P Case-Shiller Home Price Index, from mid 2006 to mid 2008, only one exhibits a noticeable price increase,⁵⁵ three have approximately constant prices, and sixteen exhibit significant price declines; this latter group contains eight metropolitan areas with price declines exceeding 25%. In the downturn as well as the upturn, housing prices across the United States were highly correlated. While I have not been able to find any data on this, I would expect delinquencies on mortgages to be similarly correlated. The correlations reflect the fact, that in the downswing, as well as the upswing, real estate markets across the United States were affected by the same changes in financing

54 By contrast, from 1994 to 2000, the value of the index had increased by less than 30%, from 78 to 100.

55 Charlotte, North Carolina, +5%.

conditions, namely changes in interest rates and changes in the availability of housing finance.

Given these observations, I suspect that, for a long time, the rating agencies failed to investigate the structure underlying the increases in real-estate prices since 2000 and that, therefore, they underestimated the probability of a downturn in real-estate prices and the associated danger for mortgage lenders. I also suspect that they underestimated the correlations in real-estate prices and in mortgage delinquencies. Both failures would explain why, for a very long time, they provided high ratings to mortgage-backed securities, sometimes quite far down to the bottom of the mezzanine level. An underestimate of correlations would also explain why they provided high ratings to the senior tranches of MBS collateralized debt obligations when the securities in the collateral had low ratings or even were unrated.

In this context, it is of interest to note that, in these activities, the rating agencies had a conflict of interest, not unlike the conflict of interest that had affected the performance of the “gate keepers” to the stock market, accounting firms and financial analysts, in the late nineties. Like the accounting firms then, the rating agencies had consulting branches, and these consulting branches were advising customers on how best to package mortgages or mortgage-backed securities and how best to tranche the claims for securitization. Too critical a stance in rating the resulting securities would have raised questions about the competence of the rating agency’s consulting branch. Perhaps, the agencies, too, were fascinated with growth in this consulting business without properly appreciating the risks for their reputations and for the viability of their rating business. Perhaps also, they failed to appreciate that the lesson taught by the fall of Arthur Anderson in the wake of the Enron scandal might be relevant for credit rating agencies as well as accounting firms.

At this point, the credit rating agencies might insist that, in their analyses of credit risk for mortgages, mortgage-backed securities, and MBS collateralized debt obligations, they were using the most modern statistical and econometric techniques and that these analyses met any professional standard of risk analysis. I am, however, wondering whether, in this respect, they may not have been too professional, more precisely, too confident in the ability of quantitative empirical models to actually measure default probabilities and correlations.⁵⁶ I am sceptical about the power of statistics and econometrics in the sort of nonstationary environment that we have had in these years. My scepticism increases when I consider that, by contrast to price movements in organized markets, defaults on loans are relatively rare events for which it is difficult to have reliable statistics even in a stationary environment, and

56 For a discussion of these issues, see my contribution to [Hellwig and Staub \(1996\)](#).

that, by their very nature, statistical assessments of correlations tend to be even less reliable.⁵⁷

In short, I suspect that the UBS report's criticism of excessive confidence in quantitative methods of analysis at the expense of a "holistic" assessment of risks applies to the credit rating agencies as well as to UBS itself. In the case of the rating agencies, this failure was all the more serious as market participants were relying on their ratings, excessively so as the UBS report points out.

3.6 Flaws and Biases of Internal Controls and "Market Discipline"

There remains the question of who bought the mortgage-backed securities and MBS collateralized debt obligations and why. Again, a part of the answer is provided by the UBS report. UBS Investment Banking actually held on to the "super senior" tranches of the securities they created. Initially, they had also sold these tranches to investors in the market, but then, the managers in charge considered that the yields on these securities exceeded the costs that UBS was assessing for the requisite funds and decided to hold on to them in order to earn additional returns.

The risks involved in holding these securities were seriously underestimated. To some extent, they were hedged through insurance arrangements, but, because of overoptimism and an excessive reliance on the assessments of credit rating agencies, for most securities, the hedges covered only a fraction of the exposure; moreover, no attention was paid to the possibility that the counterparties to the hedges might themselves be in trouble and that this was most likely to happen at the very time when they would be called upon to step in and replace losses from borrower defaults.⁵⁸ Also no attention seems to have been paid to correlations of risks on these securities with the risks involved in warehousing securities in the process of securitization. Indeed, once the credit risk of a position was hedged, this risk was deemed to be neutralized and did not appear any more in the quantitative risk analysis of the bank. In the actual course of events, these hedged positions were a major source of losses, partly because hedges were incomplete, partly because counterparties were in trouble.

57 This difficulty is also stressed by Duffie (2007).

58 The role of correlations between underlying risks and counterparty credit risks in hedging arrangements is discussed in Hellwig (1995). The problem appeared conspicuously in the Thai crisis of 1997 when international banks, which had tried to eliminate exchange rate risk by denominating loans in dollars rather than baht, found out that, after the devaluation of the baht, Thai entrepreneurs, who were earning money in baht, had difficulties servicing their dollar-denominated debts to Thai banks, which in turn then had difficulties servicing their debts to international banks.

The UBS report conveys a picture of people who were frantic in the pursuit of returns while treating risk management and risk control as a matter of routine, to be handled by standard techniques, without much need for additional reflection. The report relates this picture to the use of incentive schemes that focus on short-run returns, with insufficient adjustment for risk and too little weight given to the long-run survival of the institution.

I suspect that the problem is *not* just one of incentive schemes. Incentive schemes and the prospects of high bonuses are just one of the factors that affect people's behaviours. One also has to take account of career concerns⁵⁹ and of peer pressure. If, as of 2005, one of the managers involved had questioned whether a large scale investment in MBS CDOs really made sense, he or she would have run the risk of becoming a pariah in the organization. If everybody in the reference group takes it for granted that a new business opportunity is highly profitable, the expression of scepticism is taken as a proof of ignorance and is likely to be withheld. Indeed, the fear of being ostracized can be contagious so that expressions of scepticism may be withheld even though many of the participants share them.⁶⁰

Whether the style of discourse that is cultivated by the organization leaves room for effective expressions of scepticism or not is partly a question of how the organization is being run. This is where the UBS report's concerns about the failure of Senior Group Management to demand and the failure of UBS Investment Banking to provide a holistic risk assessment of mortgage securitization activities come in.

In part, however, this issue transcends the individual institution and involves the financial community as a whole. If the Chairman of the Executive Board of Deutsche Bank asserts that his institution must aim for a 25% annual rate of return on equity because such a return is the norm which "the market" expects from a leading bank, one may feel uneasy about the implications of this kind of targeting for the style of discourse and for the choice of strategy inside the institution, but one must realize that the external pressures to which he is referring are very real ones.

59 On career concerns, Schütz (1998) reports that, at the old UBS, Union Bank of Switzerland, which merged with Swiss Bank Corporation in 1997 to form the new UBS, the board member responsible for investments wanted to become CEO and knew that, to achieve this, he had to produce profits. In his domain of responsibility, the derivatives trading department in London provided 100 millions of Swiss francs one year and 150 millions the next year, while risk control was severely reduced. Shortly after he had actually become CEO, in 1997, the profits turned into 650 millions of losses!

60 For a detailed account of the argument, see Kuran (1995). In my contribution to Staub (1998c), I discuss the role of rhetoric and social interdependence in discourse as a source of contagion on the upswing, as well as the downswing. The experience of being treated as someone who clearly is not "with it" is one that I have often had in the nineties when I was suggesting that, with mortgage securitization, there might be a problem of moral hazard in origination; see also fn. 26.

Over the past two decades, we have seen the rise of “market discipline” as a paradigm for corporate governance and of “shareholder value” as a key objective for the public corporation. Markets are said to impose discipline on corporate executives, inducing them to seek out profitable new ventures and to eliminate unnecessary costs in order to raise “shareholder value”. The underlying mechanisms are not entirely clear; after all, “markets” as such are not actors in any sense, and market participants do not have strong rights to actually intervene in company affairs.⁶¹ Even so, “market discipline” seems to play a very effective role. I suspect that this role is based on the acceptance of “shareholder value”, i.e., the market price of the company’s stock, as a key concern in boardroom deliberations, and that acceptance of “shareholder value” as a relevant concern is due to the dependence of executive remuneration on stock prices.⁶² Corporate executives are then under pressure to satisfy the community of financial analysts, institutional investors, and the media because, in the very short run, this community’s perceptions of the company determine stock price movements and stock price movements are important for the remuneration of many in the top layers of management.⁶³

In such an environment, there is little room for deviating from the norms set by the expectations of financial analysts, institutional investors, and the media. If these norms are derived from the benchmarking of different institutions in the same sector, the bank as a whole is subject to peer pressure in the market just as its managers are subject to peer pressure inside the organization. If other banks exhibit high growth in an innovative business activity like the securitization of mortgages and if financial analysts and institutional investors take this as a benchmark in assessing one’s bank, there is little room for questioning the implications of this growth for risk. If other banks are earning a 25% rate of return on equity and if financial analysts and institutional investors take this as a benchmark in assessing one’s bank, there is little room for questioning this benchmark.

In particular, there is no room for asking what risks are taken in order to achieve the 25% rate-of-return benchmark. From the theory of capital markets, we know that, on average, higher rates of return can be achieved by

61 Indeed, at the very time when it was becoming politically correct to refer to “shareholder value” in boardroom discussions, in the early nineties, corporate management in the United States, with the support of state legislatures and the courts successfully installed measures that all but eliminated hostile takeovers and made it all but impossible for outside shareholders to interfere with the corporation against the wishes of management; see Useem (1993).

62 For a detailed, critical discussion of “market discipline”, see Hellwig (2005).

63 This interpretation of “shareholder value” rhetoric as a justification of managerial enrichment raises the question why “shareholder value” did not play much of a role before 1990. Possibly, the opportunities and the needs for corporate restructuring that became apparent in the eighties and that have been pursued all through the nineties shifted the balance from a system involving remuneration through power and incumbency to one involving remuneration through a share in the profits from restructuring.

pursuing riskier strategies. If two assets have the same expected return, but one is riskier than the other, the riskier asset must trade at a discount relative to the safer one. On average, therefore, the rate of return on the riskier asset is higher. Quite possibly, therefore, the reported 25% rate-of-return benchmark for leading banking institutions reflects risk taking as well as efficiency. Perhaps also these institutions have simply been “economizing” on equity, using a small capitalization to support a large volume of activity. After all, we have seen the equity of institutions like Deutsche Bank or UBS going down from somewhere near 10% of their overall balance sheets in the early nineties to somewhere between 2 and 3% in the recent past.

An adherent of “market discipline” will object that, surely, markets take account of the risks that a bank is taking and will penalize the bank if these risks are excessive. From this perspective, the relative decline in bank equity should be regarded as a source of efficiency gains, enabling the bank to expand its business and thus make better use of the equity capital that it has. If the strategy did involve undue risk taking, stock prices would have been depressed, and management would be penalized.

I am sceptical about this argument. I have yet to see an analyst’s or a journalist’s report commenting on the risks of a bank’s strategy as well as the returns that this strategy has yielded over the preceding year. I have yet to see such a report questioning the risk implications of a bank’s “economizing” on equity. To be sure, when the risks come home to roost and the institution is in trouble, everybody comments that its strategy has been too risky. However, beforehand, at the time when the strategy is being implemented, such comments are rare. There is a reason for this: Returns are relatively easy to measure and to communicate to the audience that one is addressing. Risks are difficult to measure and even more difficult to communicate.⁶⁴ I therefore believe that “market discipline” as a mechanism of corporate governance is intrinsically biased in favour of strategies that involve greater risk taking.⁶⁵

64 This argument is closely related to the argument of [Holmström and Milgrom \(1991\)](#), that, if there are several dimensions to managerial effort, in this case, expected returns and risks, the provision of strong incentives in one dimension may counterproductive in another dimension, where performance measurement is subject to greater uncertainty.

65 From a welfare perspective, I would add that the risk concerns of shareholders are not the same as the risk concerns of creditors and that a system of “market discipline” that is driven by shareholder interests alone is likely to induce excessive risk taking in the sense that risks for creditors, depositors and deposit insurance are not given sufficient weight. The literature on “market discipline”, e.g. [Calomiris and Kahn \(1991\)](#) or [Calomiris \(1999\)](#), does have models of “market discipline” by depositors, as well as shareholders, but I have yet to see an analysis of “market discipline” by different groups of investors with conflicting interests.

3.7 *Yield Panic*

Among the investors in mortgage-backed securities or MBS collateralized debt obligations, we also find many that were *not* subject to “market discipline”. State-owned banks from Germany were “sponsoring” American entities, so-called “conduits” and “structured investment vehicles” that invested large amounts of money in subprime-mortgage-backed securities. Private investors and non-financial institutions put money into hedge funds that bought equity tranches of such portfolios of mortgages or mortgage-backed securities.

These market participants seem to have been driven by what I would like to call *yield panic*. The past decade has been a period of low interest rates, real as well as nominal, and of low interest margins for financial intermediaries. For many investors and many financial institutions, this raised the problem of how to earn the returns that they needed to cover their expenses. An example is provided by the Landesbanken, state-owned banks in Germany, which were major buyers of mortgage-backed securities. In the past, the Landesbanken had thrived because the state guarantees that they had gave them an AAA rating, which allowed them to refinance themselves at very low rates of interest. When the European Commission banned the state guarantees as state aid violating the EC Treaty, their refinancing costs rose and their interest margins all but disappeared. With at best weak market positions in retail banking markets and in lending to industry, they had lost their business model and were looking for new ways to how to earn the money that they needed to cover their expenses. For them, the extra basis points that were offered by mortgage-backed securities looked very attractive.

In a constellation with low interest rates and low interest margins, the fear of not being able to earn the returns that one needs can easily induce an investor to abandon the caution with which he would have proceeded in normal times. Whereas one usually thinks of investment excesses as being the result of irrational exuberance, i.e., excessive optimism, one should appreciate that fear can be just as powerful. If the long-term interest rate stands between 4 to 5% and you refinance yourself at rates between 3 or 4% there isn't much of a margin on which to cover your costs and earn a return on equity. At that point, a premium of some 50 basis points, i.e., half a percentage point *per annum*, on a mortgage-backed security may be very tempting. If this security has a rating of AAA or AA, i.e., it has been certified by the rating agencies as being extremely safe, there really is no risk involved, or is there?

The investor might still have asked himself why the security carried a premium of 50 basis points at all. After all, a premium of 50 or so basis points owed its existence to the fact that, even though they had the same credit ratings, these securities were *not* deemed to be the equivalent of an AAA or AA government bond. However, to cite a market participant: “Who is going to do

a *due diligence* for just a few basis points?” This would have been very costly, perhaps even impossible, given that a typical mortgage-backed security might be backed by a package of some 30,000 individual mortgages. Moreover, it might have shown that this opportunity to earn extra returns was not so innocent after all. Investors preferred to be satisfied with the ratings that had been provided by the rating agencies. There were hardly any additional assessments of these securities’ risks.

Concerns about returns and yields also motivated the many private investors and nonfinancial institutions who put their money into hedge funds and private-equity firms in these years. The drastic growth of these institutions in the years since 2000 must be ascribed at least partly to the frantic search for yield in a world of low interest rates and depressed stock markets.⁶⁶ In this world, hedge funds and private-equity firms held out the promise of additional returns based on the managers’ ability to capture the “alpha” factor associated with asset-specific prospects if only it was possible to discern and to realize them. However, if I look at the information that these institutions provided, I wonder as to what the investors thought they were doing. The notion that a fifty-million-dollar investor “has a right to one telephone call a year” is not unheard of. The fact that investors were willing to put up with something like this is itself a testimony to their, too, having been affected by yield panic.

Hedge funds enter the present story because, along with investment banks, they were buying the equity tranches of portfolios of mortgages or mortgage-backed securities.⁶⁷ As I explained above, negative incentive effects of mortgage securitization on mortgage origination would have been contained if equity tranches had been held by the institutions that originated the securities, requiring them to bear the brunt of any default on the underlying mortgages. As markets developed, however, the obsession of investors with high yields created a market for the equity tranches as well as the more senior tranches. Regulated institutions were barred from buying these unrated securities, but hedge funds and investment banks, being unregulated, were eager to avail themselves of the high yields that the equity tranches seemed to offer.⁶⁸ Private investors and non-financial institutions were eager to participate in these high yields. Little attention seems to have been paid to the moral hazard in origination and securitization that was thereby induced or reinforced.

66 According to Crockett (2007), total funds managed by hedge funds more than doubled between 2002 and 2006, growing from under 800 billion dollars to around 1600 billion dollars, at an annual rate of roughly 19%.

67 Dodd (2007), Kiff and Mills (2007).

68 Duffie (2007).

3.8 *A Summary Assessment of Subprime Mortgage Securitization*

Putting the different pieces of the puzzle together, one obtains the following picture: In the years since 2000, with low interest rates, low intermediation margins, and depressed stock markets, many private investors were eagerly looking for securities offering better yields and many financial institutions were looking for better margins and better fees. The focus on yields and on growth blinded them to the risk implications of what they were doing. In particular, they found it convenient to rely on the rating agencies assessments of credit risks, without appreciating that these assessments involved some obvious flaws. Given the hunger of investment banks for the business of securitization and the hunger of investors for high-yielding securities, there was little to contain moral hazard in mortgage origination, which, indeed, seems to have risen steadily from 2001 to 2007. For a while, the flaws in the system were hidden because real-estate prices were rising, partly in response to the inflow of funds generated by this very system. However, after real-estate prices began to fall in the summer of 2006, the credit risk in the underlying mortgages became apparent.

For purposes of analysis, it is useful to distinguish between errors of judgment and flaws in governance. Errors of judgment are unavoidable, and one can at best hope to contain the implications of such errors for others. Flaws in governance, by contrast, can be avoided if enough attention is paid to the governance implications of the structures that one is developing. I see the following major flaws in governance:

- Because the institutions responsible for origination did not hold any equity shares, they did not have much of an incentive to take care in borrower creditworthiness assessments. Similarly, following the retrenchment of Fannie Mae and Freddie Mac, the institutions involved in securitization did not have much of an incentive to impose and enforce creditworthiness standards to be met by originators.⁶⁹ Both, originating and securitizing institutions, were more interested in volume than in quality control.
- Too much depended on the rating agencies' assessments. This dependence was partly due to statutory regulation requiring certain insurance companies or pension funds to only hold AAA or AA rated securities or to statutory regulation making bank capital requirements depend upon these ratings. Too little attention was paid to the conflict of interest that arose because the rating agencies were providing consulting services on the very things that they were also rating.

69 By contrast, Fannie Mae and Freddie Mac providing guarantees for the securities that they put on the market had incentives to maintain standards for prime mortgages. This is also true for the German *Pfandbrief* system where the issuance of the *Pfandbrief*, a mortgage-backed security, does not eliminate the liability of the originator or the issuer.

- Mechanisms of corporate governance and incentives, external (“market discipline”) as well as internal (“internal risk control”), were too weak to force the people in charge of actually doing things to provide a comprehensive account of the implications of their activities for the overall risk exposure of the institution. Possibly also, the separation of cultures between investment bankers and credit officers reduced the awareness of credit risks on the side of the investment bankers who were involved.

The second of these flaws, together with a failure to understand the relevant correlations, seems to have been mainly responsible for the growth of the markets in MBS collateralized debt obligations (MBS CDOs) and MBS CDO collateralized debt obligations (“MBS CDO²”), which otherwise would not have had any *raison d'être*. The existence of these markets in turn created an easy outlet for low-quality mezzanine securities and thereby enhanced the problem of insufficient risk control in origination and in the first stage of securitization.

4 SYSTEMIC RISK IN THE CRISIS

4.1 *Why Did the Subprime-Mortgage Crisis Bring Down the World Financial System?*

Given the flaws in the system of subprime mortgage finance and securitization in the United States, the collapse of this system should not have come as a surprise. Indeed, long before the outbreak of the crisis, quite a few observers had warned that residential real-estate markets were experiencing a bubble and the only question was when the bubble would break.⁷⁰ However, the flaws in subprime mortgage finance and securitization and the collapse of this system provide only one part of the explanation for the current financial crisis. They cannot explain why, since August 2007, the fallout from the subprime mortgage crisis has shaken the entire financial system of the world. This development has taken everybody by surprise.

Even in the spring of 2007, when market participants and regulators were already aware that subprime-mortgage markets in the United States were in a state of crisis, nobody yet seems to have anticipated the repercussions that were to follow. For instance, the International Monetary Fund's Global Financial Stability Report of April 2007 gives a fairly detailed account of problems with subprime mortgages and mortgage-backed securities in the United States, but concludes that the problem would not affect the rest of the financial system. Citing the results of stress testing by investment banks, the report suggests that, even if housing prices in the United States were to

70 From Robert Shiller, one of the creators of the S&P/Case-Shiller real-estate price indices, such a prediction is reported in *Barrons*, June 2005.

decline by 12% per year for five years in a row, AAA- and AA-rated subprime-mortgage-backed securities, some 85% of the total issue, would *not* be affected at all – “this suggests that the amount of potential credit loss in subprime mortgages may be fairly limited.”⁷¹

One might object that, being based on stress testing by investment banks, this assessment in April 2007 was vitiated by the very flaws in risk modelling that had enabled the growth of subprime mortgage finance in the first place. However, even with a more realistic or a more pessimistic view about subprime mortgages, there is a puzzle because the overall volume of this market was not all that large. The 2007/2008 Annual Report of the Bank for International Settlements (BIS) expresses the puzzle well when it asks: “How could problems with subprime mortgages, being such a small sector of global financial markets, provoke such a dislocation?”

As mentioned in the introduction, the IMF estimates that the total volume of non-prime mortgage-backed securities in the United States amounts to some 1.1 trillion dollars.⁷² In absolute terms, this is a large number. However, this number amounts to less than one fifth of the value of all residential mortgage-backed securities in the United States (5.6 trillion dollars), less than one tenth of the value of all residential mortgages in the United States (13 trillion dollars), less than one twentieth of the value of residential real estate in the United States (20–30 trillion dollars), and presumably less than one fortieth of the value of total private wealth in the United States.⁷³

More to the point, the estimated 500 billion dollars of losses in non-prime mortgage-backed securities are much smaller than stock market losses after the burst of the technology bubble in 2000;⁷⁴ they are also smaller than the

71 [International Monetary Fund](#) (2007, p. 7). In a similar vein, the 2006/2007 Annual Report of the Bank for International Settlements (BIS), published in June 2007, mentions the subprime mortgage crisis as a threat for financial stability, without, however, conveying any sense of urgency. In late June, at the 6th Annual BIS Conference, on “Financial System and Macroeconomic Resilience”, nobody, myself included, seems to have had an inkling of the crisis that was about to unfold.

72 The April 2007 Global Financial Stability Report of the IMF gave an estimate of 824 billion dollars of subprime mortgage-backed securities; I cannot tell whether the difference between the more recent estimates and this one is due to growth in 2007 or to the inclusion of Alt-A along with subprime mortgage-backed securities.

73 Comparisons are made on the basis of numbers given in [International Monetary Fund](#) (2007) and [Slacalek](#) (2006).

74 For US stocks traded on the New York Stock Exchange alone, stock market capitalization declined from 11.5 trillion dollars at the end of 1999 and at the end of 2000 to 11.0 trillion dollars at the end of 2001 and to 9.0 trillion dollars at the end of 2002; for US stocks traded on NASDAQ, the decline went from 5.2 trillion dollars at the end of 1999 to 3.6 trillion dollars at the end of 2000, 2.7 trillion dollars at the end of 2001, and 2.0 trillion dollars at the end of 2002. Data are taken from the World Federation of Exchanges at

600–800 billion dollars of losses that, at the peak of the S&L crisis around 1990, were guesstimated as losses of the US savings and loans industry. Yet, the effects of the burst of the stock market bubble and of the S&L crisis on the global financial system were rather more limited; in the case of the S&L crisis, these effects were hardly noticeable. Why then has the impact of the subprime mortgage crisis on the rest of the financial system been so much more severe?

The difference between these other crises and the subprime mortgage crisis is not in the magnitude of the primary losses, but in the systemic linkages and repercussions. In the stock market decline of the early 2000's, the brunt of the burden was borne by final investors, either directly, or through the values of their holdings in pension funds and the like. In the S&L crisis, the failing institutions were taken over and closed by the government; the depositors were paid off, and the assets were disposed of without undue haste. In each case, financial institutions other than the ones that were immediately implicated had to adjust to changed circumstances,⁷⁵ but they did not have to shoulder significant portions of the actual losses. By contrast, in the subprime mortgage crisis, there has been no surgical separation of failing assets and failing institutions from the rest of the financial system.

In the following, I will argue that the overall impact of the crisis on the world financial system is due at least as much to the incidence of systemic risk as to the difficulties with subprime mortgages themselves. I will also argue that there were serious flaws in financial system architecture and that these flaws have greatly magnified the effects of the subprime mortgage crisis. Lack of transparency meant that the extent of systemic risk exposure could not be foreseen by the participants. In thinking about lessons for the future, therefore, we need to go beyond considerations of governance and individual incentives and pay attention to systemic interdependence and transparency.

The incidence of systemic risk over the past year has been due to the interaction of unsound banking practices, an excessive reliance on markets, and market malfunctioning in the crisis. In the remainder of this section, I will explain these flaws, their origins and their effects, and indicate how they interacted in the crisis.

Footnote 74 continued

<http://www.world-exchanges.org/publications/TA1300.pdf>, <http://www.world-exchanges.org/publications/TA1301.pdf>, and <http://www.world-exchanges.org/publications/TA1302.pdf>.

75 For instance, the S&L crisis eliminated US saving institutions as buyers of junk bonds that served to finance hostile takeovers. Together with high interest rates, this contributed to the end of the takeover wave in 1989; the insolvency of Drexel, Burnham, Lambert seems to have been the main “domino effect”.

4.2 *Excessive Maturity Transformation*

The major surprise of the past year has been the extent of leverage and of maturity transformation in real-estate finance on the basis of mortgage-backed securities. Whereas, in previous years, most discussions about financial stability had focussed on hedge funds and their leverage, the leverage of hedge funds, on the order of 50% on average, was dwarfed by the leverage of the conduits and structured investment vehicles (SIVs) that had been set up by the banking industry for the purpose of investing in asset-backed securities. Here, leverage ratios close to 100% were the rule, rather than the exception. Moreover, while these institutions were investing in long-term securities, they refinanced themselves by issuing asset-backed commercial paper, i.e., very short-term debt, and were in constant need of refinancing.⁷⁶

In Section 2 above, I have explained that such maturity transformation is a major source of risk for the institution that engages in it. It is also a major source of systemic risk. If there is any shock to the availability of funds for refinancing, the individual institution is in trouble because it needs funds to repay its short-term debt. If it cannot find an alternative source of finance, it must have a fire sale of its long-term assets. This fire sale depresses the assets' prices in the market. The decline in the assets' prices puts pressure on all institutions that hold such assets. Under mark-to-market accounting, the other institutions will be forced to recognize losses immediately. Even if they do not recognize the losses immediately, it suffices that market participants know that these institutions hold such assets and begin to have doubts about them. If such doubts induce investors to withdraw their funds from these other institutions, there may well be a chain reaction, in which one domino falls after the other. Such a chain reaction can occur even if there is no doubt about the underlying long-term assets; any shock to the confidence of investors in the refinancing markets can trigger it.

Since August 2007, we have been observing precisely such a process of chain reactions. In that month, the system of holding long-term asset-backed securities through conduits and SIVs that were refinanced in the commercial paper market broke down. At the time, this system held about 1 trillion dollars worth of long-term securities,⁷⁷ equivalent to some 90% of subprime mortgage-backed securities or some 17% of all mortgage-backed securities. The breakdown of this system contributed to the implosion of markets for these securities and the subsequent spread of the crisis through the entire financial system, which greatly magnified the overall impact of the subprime mortgage crisis.

76 A detailed description of conduits and SIVs is provided in Chapter 3 of the IMF's Global Financial Stability Report in April 2008.

77 Dodd and Mills (2008).

The breakdown was triggered by the rating agencies downgrading various asset-backed securities by several grades at once and by two hedge funds trying to cut their losses by liquidating such securities. Both events raised serious questions about the securities' values and about the solvency of institutions that were holding them, in particular, conduits and SIVs that did not have any equity worth speaking about. These questions were quickly extended to cover the money market funds that had been investing in the commercial paper of conduits and SIVs. The French bank Paribas suspended withdrawals from its money market funds on the grounds that the values of the funds' assets could not be properly determined. Most money market funds then feared withdrawals from their investors as well as losses from their loan clients and moved out of the commercial paper of conduits and SIVs. These institutions then found themselves in a situation not unlike that of the US savings and loans institutions in 1980, before the deregulation of deposit rates, when depositors left them in droves to place their money with money market funds and they were at a loss as to how to refinance the long-term mortgages in their portfolios.

Many conduits and SIVs actually had fallback promises of liquidity assistance from the banks that had sponsored them. However, this liquidity assistance did not cover all refinancing needs so that some fire sales had to occur anyway. Moreover, in view of the sad state of the markets for the assets held by conduits and SIVs and in view of the large amounts that were involved, the assistance that these institutions obtained from their sponsors raised doubts about the sponsors themselves.

Some of the sponsors, like Industriekreditbank (IKB) or Sächsische Landesbank in Germany, each with double-digit-billion dollar stakes in these operations, found that the liquidity assistance to which they were contractually committed – and the losses that this assistance would entail – by far exceeded their capacity to bear losses. Their commitments to the conduits they had sponsored in fact amounted to more than four times their own equity; the losses inherent in these loan commitments to insolvent institutions were sufficient to bankrupt them. Industriekreditbank managed to avoid bankruptcy only because its corporate mother, the federally owned Kreditanstalt für Wiederaufbau, provided new equity capital in what was then thought to be a large amount. For Sächsische Landesbank, the State of Saxony as owner had to underwrite the recognized losses before selling the bank. Without the owner's willingness to provide compensation for the losses, these banks would have gone under right away.

Market participants, as well as outsiders, were very much surprised by these developments. To be sure, market participants knew all along that conduits and SIVs had been used to invest in asset-backed securities. They also

knew that sponsoring banks were committed to provide these institutions with liquidity if refinancing through the market broke down. However, they do not seem to have had much of an idea as to the scope of these operations – in terms of aggregates as well as their implications for the sponsoring banks. The fact that around 1 trillion dollars worth of securities were held by conduits and SIVs does not seem to have been known. The fact that the sponsoring banks' commitments were high enough to bankrupt these banks was not known either. Given the banks' assessments that these commitments were not likely to be called upon, they had not appeared in their balance sheets. Only when the conduits needed them were the banks forced to lay them open, all at once revealing their implications for bank solvency.

The surprise that was thus generated itself affected the market participants' further reactions. If I see a bank in trouble because of commitments that I had not known about, I wonder whether Bank X may be in a similar situation. After all, didn't Bank X also have a stake in MBS CDOs? And didn't they also make a commitment of liquidity assistance to some conduit or SIV? Given the revelations that have just been made about Bank Y, I must expect that Bank X may have a multi-billion dollar skeleton in its closet, and should therefore refrain from doing any business with Bank X.

This kind of reaction explains the almost complete drying up of interbank markets in August 2007 and on repeated occasions since then. The breakdown of refinancing was thus not limited to conduits and SIVs, but affected the entire worldwide banking system. It was particularly damaging to independent investment banks and similar institutions that rely on the open market rather than depositors for most of their funding.

Massive central-bank interventions, in August 2007 and later, have tried to substitute for the missing liquidity in markets. However, the central banks could not provide more than a stopgap. Short of buying the securities themselves, the central-bank intervention could not eliminate the systemic problem that, with the breakdown of conduit and SIV refinancing, there was a large overhang of long-term asset-backed securities that needed refinancing at a time when the fundamental value of these assets was questionable and the associated risks were seen as a potential threat to any institution that was holding them.

4.3 Market Malfunctioning in the Crisis

Even if there had been no doubts about the quality of asset-backed securities, the breakdown of the maturity transformation of conduits and SIVs would have caused a significant adjustment in the markets for these securities, driving security prices down as investors would ask for higher maturity premia

and higher risk premia to hold the assets that conduits and SIVs were no longer able to refinance.⁷⁸ Given the uncertainty about the quality of asset-backed securities, the adjustment had to be all the more severe.

As the crisis unfolded, participants in the various relevant markets behaved as one would expect them to behave when there is significant apprehensiveness about the quality of the assets, the quality of counterparties, and the evolution of the financial system in the near future. They withdrew funding and insisted on large discounts on any assets of unknown quality.

To some extent, this behaviour can be seen as an instance of Akerlof's 'lemons' problem: In a crisis situation, in which there is asymmetric information about the quality of assets that are being traded, any potential investor must fear that the seller is trying to unload his rotten apples while keeping the good ones. Similarly, with asymmetric information about the solvency of a potential borrower, any investor must fear the rotten apples in the borrower's portfolio. To protect himself against this danger, he refuses to buy the assets or to provide a new loan. At the very least, he insists on a large discount.

In a crisis, such reactions can also involve an element of panic. Given the surprises that they just experienced with the multiple-step downgrades of mortgage-backed securities by the rating agencies and with the discovery of large-scale maturity transformation by conduits and SIVs, investors may have been wondering what other surprises might be in store for them. Institutional investors, e.g., the managers of money market funds and hedge funds may also have been wondering how their own financiers would react to the news. Anyone who had to fear his own financiers' reactions would have felt compelled to reduce risks and increase liquidity in his own portfolio.

Given these considerations, we should not be surprised by the IMF's assessment⁷⁹ that market prices seem to have dropped significantly below the expected present values of future cash flow from the mortgage borrowers or their properties. As mentioned in the introduction, a simple back-of-the-envelope calculation indicates that, for market values of mortgage-backed securities to be in line with discounted present values of future cash flow from the mortgage borrowers or their properties would require an expectation that property values will decline by 45–50%. Given that, until June 2008, the average actual decline had been 19% and no metropolitan area had seen declines

78 Table 1 above shows that, even for conventional mortgage, risk premia have gone up dramatically. By 2008, the spread between conventional mortgages and 10-Year Treasuries has risen to 259 basis points, approximately a hundred basis points higher than in the years 2004–2006 and still more than fifty basis points above its previous maximum in 2000.

79 International Monetary Fund (2008a).

above 33%,⁸⁰ such an expectation would seem to be extraordinarily pessimistic.⁸¹

The notion that the market values of securities may be significantly below the expected present values of future cash flows from these securities seems incompatible with the theory of asset pricing in informationally efficient markets. However, the contradiction is apparent rather than real. Any notion that asset prices should correspond to expected present values of future cash flows presumes (i) that the parties holding these expectations have sufficient funds to bet on their expectations by taking long positions and (ii) that little attention needs to be paid to risk premia and liquidity premia. If limitations of funds or worries about refinancing prevent participants from taking long positions, there is no reason why market prices of assets shouldn't fall significantly below expected present values of future cash flows.⁸² Indeed, theoretical analyses have shown that at a time when long-term investments have been sunk and reserves of liquid assets are scarce, market reactions to even small shocks can be quite extreme as market participants fear for their own viability and hoard liquidity. In such situations, investors may require very large discounts before they are willing to acquire long-run assets.⁸³ In the real world, such effects are reinforced by 'lemons' concerns, as well as the element of panic that follows a dramatic surprise, when important assumptions underlying one's world view have just been refuted.

This malfunctioning of markets in a crisis is one reason why receivers usually find it important to take time to unwind the positions of bankrupt institutions. Going back in history, we find that, by 1997, after the Swedish banks had been reprivatized, the losses from the crisis of the early nineties were deemed to be about half as large as had been expected in 1992, when the

80 Phoenix, Tampa, and Miami had price declines just below 33%. Four metropolitan areas had declines between 25 and 30%; quite a number had declines of 10% or less. See indices at www.standardandpoors.com. In any case, these cross-regional variations in real-price declines should not matter if proper attention has been paid to cross-regional diversification in the formation of packages of mortgages for securitization.

81 To be sure, loss rates on mortgages and mortgage-backed securities will depend on correlations as well as averages. Borrowers with below-average down payment rates or borrowers with above-average declines in property values are more likely to default than others. However, if the reliance on averages introduces a downward bias into the back-of-the-envelope calculation in the introduction, there also is an upward bias from my treatment of the borrower's equity position: The 5% equity share that I assumed lies below the 6% average down payment rate of subprime mortgage borrowers and below the 12% average down payment rate for Alt-A mortgage borrowers. Further, until the summer of 2006, property values had been going up. For the average property purchased in 2004, the borrower's equity as of 2006 would have risen by more than fifteen percentage points, for one that had been acquired in 2005 the increase would still have amounted to roughly seven percentage points.

82 Shleifer (2000).

83 Allen and Gale (2004a,b).

crisis broke into the open.⁸⁴ By 1998, losses from the savings and loans crisis in the United States were assessed at 160 billion dollars, less than a third of the 600–800 billion US dollars that were talked about around 1990.⁸⁵

4.4 *The Role of Fair Value Accounting*

Market malfunctioning in the crisis would not have mattered if institutions had been independent of markets. In fact, the exposure of financial institutions to what was happening in markets has been much greater in this crisis than in previous ones. To the extent that financial institutions need markets for refinancing, some dependence on markets can always be taken for granted.

However, in the present financial crisis, the system of *mark-to-market* or *fair value accounting* has created an additional channel through which market events influence the well-being of financial institutions. Under this system, financial institutions value the assets that they hold at those prices at which they could sell them in the market if they had to sell them immediately. In cases where markets for the securities are not functioning, market prices of securities with similar characteristics are used as a standard of reference. In cases where markets for securities with similar characteristics are also not functioning, econometric models are used to provide estimates of what the securities could be traded for if the markets were functioning.

Under this regime, the institution in question cannot just claim that it wants to hold the security until maturity and that balance sheet valuations should therefore rely on assessments of fundamentals, rather than market valuations. The fact that, in this crisis, asset-backed securities have probably been substantially undervalued by markets is quite irrelevant for the institutions' accounts.⁸⁶

The introduction of fair value accounting was motivated by the experience of the savings and loans crisis in the United States. As mentioned in the introduction, in the early eighties, savings and loans institutions in the United States were carrying long-term mortgages with fixed interest rates of 6% *p.a.* at face value in their books even when market rates of interest were around 15%. In the absence of fair value accounting, they did not have to acknowledge that, at current market rates of interest, the discounted present value of the debt service they could expect was much below the face value of these mortgages. The fact that, because of this discrepancy, the greater part of these institutions was technically insolvent, in the sense that the discounted present

84 Englund (1999).

85 Curry and Shibut (2000).

86 For systematic discussions of fair value accounting and the issues it raises, see the Chapter 2 of the April 2008 issue and Chapter 3 of the October 2008 issue of the IMF's Global Financial Stability Report (International Monetary Fund 2008a,b).

value of the debt services they could expect was below their liabilities, never was acknowledged in their balance sheets. Technically insolvent institutions were left to “gamble for resurrection”. With fair value accounting, those long-term mortgages with fixed interest rates of 6% would have been written down to acknowledge the decline in discounted present values of future debt service. Insolvencies would have been acknowledged in the early eighties already, and the resolution of the crisis would have been much less costly.

More generally, if financial institutions carry assets at market values or “as-if” market values, they are forced to quickly acknowledge adverse developments and to take corrective actions without undue delay. Indeed, with proper incentives for the institution’s financiers, shareholders and creditors, fair value accounting is deemed to provide the information that is needed for these financiers to exert “market discipline” so as to induce the needed corrections.⁸⁷

However, such “market discipline” is problematic if the markets in question are not functioning well. If, as discussed above, the market value of a security is below the expected present value of its future cash flows, a system of mark-to-market accounting induces a write-off which is appropriate only if the bank wants to liquidate the security and is unnecessary or at least excessive if the bank wants to hold the security to maturity. As I discussed before, such discrepancies between expected present values of future cash flows and market prices are likely to arise in a financial crisis – and seem to have affected subprime mortgage-backed securities on a large scale.

In such situations, a reliance on fair value accounting is problematic. The ensuing write-offs will force the bank to take corrective actions. Given the decrease in book equity that such write-offs induce, the corrective actions are likely to involve some deleveraging, i.e. some sale of assets to reduce leverage. If the assets in question are the very assets for which markets are not functioning, the book losses turn into real losses, which they might not have done if the bank could have held on to the assets.⁸⁸ When the IMF is suggesting that, in the present crisis, market values of assets may not provide the right signals “for making long-term value-maximizing decisions”,⁸⁹ it is pinpointing this very problem.

Presumably, an institution’s accounting system should provide the institution’s management with proper guidance for choosing value-maximizing

87 The classic theoretical piece on “market discipline” for banks is [Calomiris and Kahn \(1991\)](#); for policy recommendations, see, e.g., [Calomiris \(1999\)](#). The conflict between “market discipline” by shareholders and “market discipline” by creditors, which I discussed in fn. 65 above, plays no role in this literature.

88 For theoretical treatments of the problem, see [Allen and Carletti \(2006, 2008\)](#), [Allen and Gale \(2006\)](#).

89 [International Monetary Fund \(2008a, pp. 65f\)](#).

decisions. In a crisis situation in which markets are not well functioning, fair value accounting is not suitable for this task.

The problem transcends the individual institutions. If book losses under fair value accounting force a bank to take corrective actions, these actions themselves will feed back into the financial system.⁹⁰ The bank's attempts to adapt its activities to its reduced book equity position and therefore to scale down its asset holdings will put additional strain on markets and reinforce the downward pressure on asset prices. The combination of market malfunctioning and fair value accounting thus can have strong, mutually reinforcing, procyclical effects, deepening the financial crisis and inducing a downward spiral in the financial system.

4.5 The Insufficiency of Bank Equity Capital

The procyclical effects of market malfunctioning and fair value accounting were and continue to be reinforced by the insufficiency of equity buffers in financial institutions. This insufficiency appears in several guises. First, the hidden banking system of conduits and SIVs was operating with hardly any equity at all. They had no buffers to absorb the shock of July/August 2007. Some buffers were provided by sponsoring banks, especially those that decided to integrate their conduits or SIVs into their own balance sheets. However, these support operations raised questions about the sponsoring banks' own equity positions.

Second, banking institutions worldwide have been "economizing" on equity. In order to earn as high a rate of return on equity as possible, they have greatly expanded the scale of operations that the equity base would support. As I have already mentioned, the equity positions of institutions like Deutsche Bank or UBS have therefore gone from somewhere near 10% of their overall balance sheets in the early nineties to somewhere between 2 and 3% in the recent past.

This relative decline of equity positions concerned the capital that banks held in fulfilment of capital adequacy requirements as well as the buffers that they held in excess of required capital. A decline in required capital was made possible by changes in statutory rules relating to the prudential regulation of bank capital. The changes in rules provided banks with the option to determine regulatory capital requirements by assessing value-at-risk in the context of their own quantitative risk models, which they had developed for their own risk management. In particular, following the 1996 Amendment to the

90 Blum and Hellwig (1995, 1996).

Basel Accord (“Basel I”),⁹¹ the great internationally active banking institutions were able to determine capital requirements for *market risks* on the basis of these internal models. The amount of capital they needed to hold against any given asset was thereby greatly reduced.⁹²

The equity buffers that banks hold in excess of required capital have also been reduced. In the past, at least in Europe and Japan (before 1991), banks had consistently carried more equity than regulators required. Some of this equity was openly in their books, some of it was kept in the form of hidden reserves that they managed so in order to smooth their earnings reports. Since the early nineties, these buffers have been reduced to a bare minimum. To some extent, this is due to losses in the early nineties, from small business lending and real-estate lending in the second half of the eighties, eating these buffers up; moreover, the intensification of competition in the financial sector left little room to rebuild them. To some extent also, the reduction of buffers has been due to the conscious strategy choices of banks trying to “economize” on equity. The professionalization of risk management on the basis of quantitative risk modelling seemed to permit a reduction of buffers without seriously impairing the institution’s viability. The possibility that the quantitative models might be seriously flawed was not given much attention.⁹³

However, the relative decline in equity capital has made banking institutions more vulnerable to unforeseen shocks – or to the consequences of flaws in their risk modelling and risk management. Vulnerability appears at two levels. First, the small size of buffers of equity capital in excess of regulatory requirements means that banking institutions do not have much leeway to absorb a shock, but have to take corrective action almost immediately. Second, the small size of equity capital altogether means that, when a shock comes, solvency can quickly become an issue.

When the market prices of asset-backed securities began to drop in the second half of 2007 and fair value accounting required this drop to be acknowledged in the books, the institutions that held such securities had to react almost immediately. Some of them managed to obtain new equity. Others had to begin to deleverage, i.e., to reduce their lending or to sell assets in order to adapt the scale of their operations to their reduced equity. Given the need to satisfy regulatory requirements, they did not have much choice on whether they thought that market values of assets provided the right signals “for making long-term value-maximizing decisions”. Because the equity capital that they held in excess of regulatory requirements did not suffice to

91 In public discussion, the regime change tends to be associated with the recent replacement of “Basel I” by “Basel II”. In fact, the change of paradigm came already with the 1996 Amendment to “Basel I”.

92 On this point, see the contribution of Zuberbühler to [Hellwig and Staub \(1996\)](#).

93 For expressions of this view, see [Wuffli \(1995\)](#) and Gumerlock’s contribution to [Hellwig and Staub \(1996\)](#).

absorb the shock, their behaviour was determined by an automatism under which asset price declines translated into write-offs and write-offs translated into asset sales. Through this automatism, the pressure on asset prices was increased further. From the perspective of the individual bank, the automatism was problematic because, for at least some of the assets in question, with book values far below fundamental values, it would have been better not to realize the book losses. From the perspective of the financial system as a whole, the automatism was problematic because it provided yet another element to the downward spiral.

By now, the book losses – or real losses – have become large enough to erode the solvency of important institutions. Of particular interest is the case of Fannie Mae and Freddie Mac, the government sponsored enterprises that had started the business of mortgage securitization. As mentioned above, these institutions had been securitizing prime, rather than subprime mortgages. However, they were severely undercapitalized. By the summer of 2008, their equity was eroded by losses, partly because the crisis began to reach prime, as well as subprime mortgages, partly because in 2007, under pressure from the US Congress, they had tried to support the market by buying subprime mortgage-backed securities which they subsequently had to write down.

Most recently, the failure of the United States to also bail out Lehman Brothers had a direct impact on banks and final investors worldwide that had deposited funds with Lehman Brothers. At least as importantly, it suggested that bailouts of banks could not be taken for granted, and, therefore, that it might be wiser not to lend any money to any bank. The result was yet another breakdown of interbank markets. Because, by this time, there was a sense that the difficulties affected the entire financial system and that it concerned the solvency, rather than the liquidity positions of banks, this breakdown was even more daunting than the one of August 2007. When a bank has a liquidity problem, the problem can be neutralized by central banks lending against collateral. When the bank has a solvency problem, the problem can only be neutralized by the finance minister and, ultimately, the tax payer.⁹⁴

4.6 Systemic Effects of Prudential Regulation

The preceding discussion of the role played by bank equity brings out a deleterious systemic effect of the currently existing regime of prudential regulation of banks through capital adequacy requirements. As currently practiced, this regime is highly procyclical, allowing banks to expand in goods times and forcing them to contract in bad times. Such behaviour of the bank reinforces

94 On the respective roles of central banks, bank supervisors, and finance ministers in a crisis, see the last section of [Hellwig \(2007\)](#).

fluctuations in the rest of the financial and economic system. Over the past year, the feedback mechanisms that are thus created have been operating with a vengeance.

To explain these mechanisms, I go back to the distinction I made before between equity capital that is needed to fulfil the requirements of statutory regulation and equity capital that is held as a buffer, in excess of statutory capital requirements. Underlying this distinction is a *paradox of banking regulation*: Any position in the bank's balance sheet that serves as a buffer against unforeseen contingencies ceases to serve this buffer function when a regulator imposes a rule stipulating a minimum amount for this position. The paradox has been known for a long time from minimum reserve requirements: Deposits with the central bank or cash that are held to meet minimum reserve requirements are *not* providing the bank with a reserve that it can use when there is an unexpected shortfall of cash inflows. These funds only serve to meet the regulatory requirement. Similarly, equity capital that is held to meet capital adequacy requirements provides the bank with an imperfect sort of buffer against unforeseen losses. To be sure, such capital ensures that losses do not immediately make the bank insolvent. However, it does not give the bank a breathing space in which to adjust its strategy. This latter purpose is only served by equity buffers *in excess* of capital requirements.

Once equity buffers in excess of capital requirements are exhausted, any additional loss eats into the capital that is needed to meet the regulatory requirement. To avoid running afoul of the regulation, the bank must either obtain new equity capital, which, in a crisis situation, is not easily done, or it must adapt its holdings of risky assets to the reduced equity capital, i.e., it must sell marketable assets, withdraw deposits from other banking institutions, or reduce lending to its loan clients. All these actions have a negative impact on the rest of the financial and economic system.

The procyclical nature of the existing regime of capital adequacy regulation has always been a subject of criticism. In the past, this criticism had mainly been concerned with the behaviour of *flow variables in the macroeconomy*. A typical argument would be that a macroeconomic recession is reinforced by capital regulation because the downturn affects borrowers' debt service to banks, the worsening performance of debt reduces banks' profits and, hence, the rate at which they add to their equity and the capacity they have for new lending.⁹⁵ This mechanism is said to have contributed to the credit crunch that affected the US economy around 1990.

The current crisis has shown that these early warnings about the effects of the existing regime of capital adequacy regulation were much too optimistic. Under fair value accounting, bank losses concern revaluations of assets, i.e., *stock variables*, not just the flows of debt service from borrowers. To avoid

95 Bernanke and Lown (1991), Blum and Hellwig (1995, 1996), Hellwig (1995).

running afoul of capital adequacy regulation after such losses in stock variables, it is not enough to reduce the flow of new lending, but some adjustment is needed in the stocks of assets held by the bank.⁹⁶ The effects that such an adjustment in stock variables has on the rest of the financial and economic system, holders of assets that the bank needs to sell, counterparties to deposits that the bank is withdrawing or to loans that it is rescinding, are much more dramatic than the effects of a credit crunch that is limited to new lending. The past year has provided ample evidence.

4.7 Systemic Risk in the Crisis: An Interim Summary

The preceding account can now be summarized as follows. When the downgrades of mortgage-backed securities by the rating agencies let the subprime-mortgage financial crisis break out into the open in July and August 2007, market participants were surprised by the extent of the downgrading. They were also surprised by the extent of the liquidity and solvency problems that were associated with conduits and SIVs and the breakdown of these institutions as channels for holding asset-backed securities. Both these surprises induced a sense of panic, leading investors to position themselves defensively, without much willingness to contribute to making the needed adjustment as smooth as possible.

Since then, the interplay of market malfunctioning in the crisis, fair value accounting, insufficiency of bank capital, regulatory requirements and corrective actions of banks has involved the financial system in a downward spiral that has yet to come to an end. Government interventions may end up preventing the worst, though, at least for a while, political systems in European countries as well as the United States seem to have been bent on contributing to the downward spiral by having frequent and contentious discussions about interventions whose scope and credibility were not very transparent.

As yet, we have to see the repercussions of the defensive behaviour of financial institutions for the financing of the real sector of the economy. To the extent that firms in the real sector are unable to obtain financing for large investment projects or are unwilling to even apply for financing for such projects because they have doubts about the continued availability of funds as the project is being carried out, such repercussions are to be expected. The ensuing macroeconomic downturn will subject the financial system to additional stress.⁹⁷

96 This effect of combining capital adequacy regulation with mark-to-market accounting is pointed out in [Blum and Hellwig \(1996\)](#), however, without a full appreciation of the impact on the financial system.

97 In the assessment of losses from the crisis in the Global Financial Stability Report of October 2008 ([International Monetary Fund 2008b](#)), the difference between the total loss estimate of 1.4 trillion dollars and the estimate of 750 billion dollars from US residential

These developments provide the answer to the question of the Bank for International Settlements, cited above, how the crisis in subprime mortgage-backed securities, such a small sector of global financial markets, could provoke such a worldwide dislocation. If it hadn't been for the systemic repercussions that I have described, the losses in residential mortgage-backed securities would not have reached the 500 billion dollars estimated by the International Monetary Fund, and even these 500 billion dollars would not have been able to cause a crisis of the dimensions that we are seeing.

In the theoretical literature on financial systems, systemic risk, i.e., the risk that problems at one institution endanger the rest of the financial system, is typically ascribed to one of three mechanisms:⁹⁸

- *Domino effects through contractual relations* occur if one institution's going under requires other institutions to write down the contractual claims that they have on the failing institution.
- *Domino effects through asset prices* occur if the impaired institution has to liquidate assets, this liquidation depresses asset prices, and the decline in asset prices affects the solvency of all institutions that hold such assets.
- *Information contagion effects* occur if observations of difficulties at one institution induce investors to be worried about other institutions and to withdraw funding from them. Such worries arise if one suspects that the other institutions may have followed similar strategies or if one suspects that the other institutions may be threatened by domino effects, through contractual relations or through asset prices.

In the downturn that we have been experiencing, all three of these effects have been at work. The breakdowns of conduits and SIVs as well as some of the credit insurers and, most recently, the failure of Lehman Brothers exerted domino effects through contractual links on sponsors, clients, creditors, and, not least, the insurers of the risk that Lehman Brothers might default.⁹⁹ The interplay of markets, fair value accounting, regulatory requirements, and corrective actions of banks with insufficient equity can be seen as a chain of

Footnote 97 continued

real-estate lending tries to take account of these further repercussions. Actually, this difference only comprises losses on other kinds of debt instruments, commercial asset-backed securities, corporate loans, and the like. It does not comprise, e.g., stock market losses, which, according to the World Federation of Exchanges, have amounted to some 15 trillion dollars worldwide from June 2007 to September 2008, 3 trillion dollars just on the New York Stock Exchange; see "domestic market capitalization" at <http://www.world-exchanges.org/WFE/home.asp?menu=395\&nav=ie>.

98 Staub (1998a) and Hellwig (1998b) only refer to domino effects through contractual relations and to information contagion. The importance of dominoes effects through asset prices is stressed by Schnabel and Shin (2004) and Allen and Carletti (2006, 2008).

99 The crisis of the large insurance company AIG, which followed almost immediately, was in large part due to their having provided such insurance.

domino effects through asset prices. Finally, information contagion played a crucial role in shaping defensive retrenchment in interbank markets as well as asset markets.

Given this account, it is important to understand what went wrong. As mentioned in the introduction, public discussion of the crisis tends to focus on moral hazard and on the greed of bank managers. For the mortgage securitization that triggered the crisis, we have seen above that moral hazard in origination and moral hazard in securitization indeed played a role, driven by flawed incentives and flawed perceptions of risk. For the systemic repercussions of the initial crisis, the matter is less clear. In the following, I will argue that, here, we must distinguish between the contribution to systemic risk that came from excessive maturity transformation through conduits and SIVs and the contribution to systemic risk that came from the interplay of market malfunctioning, fair value accounting, and the insufficiency of bank equity.

4.8 *Excessive Maturity Transformation – Who is to Blame?*

As I see it, there is no excuse for the way in which certain banks used conduits and structured-investment vehicles in order to avoid capital requirements for holding asset-backed securities and to avail themselves of extra returns from maturity transformation. Hardly a risk in banking is as well known as the risk that is taken if one tries to earn money by using relatively cheap short-term funds to finance a longer commitment. Recent decades have provided many examples. The bankers involved must have known that a conduit with hardly any equity capital that issued commercial paper to finance the holding of long-term asset-backed securities was basically a time bomb waiting to explode. The question is why they engaged in this operation anyway.

One answer to this question is provided by Table 2 above: From 2002 to 2004, yield curves were very steep. Money market rates – and commercial paper rates! – were significantly below 2%, ten-year treasury rates between 4 and 5%, ordinary mortgage rates around 6%. The margin between the interest rates on ordinary mortgages and the interest rates on short-term securities was on the order of four to five percentage points. Such a margin provided an enormous temptation to “play the yield curve”, i.e. to borrow short in order to lend long. For many institutions, this temptation was too much to resist. Yield mania and yield panic blinded them to associated risks in their refinancing choices as well as in their investments in asset-backed securities.

In this context, the monetary policy of the United States must take some of the blame. The low money market rates in 2002–2004 were largely the result of the Federal Reserve Bank’s trying to counteract the macroeconomic effects of the stock market downturn that had begun in March 2000 and

accelerated after September 11, 2001. Given the downturn that was occurring, the Federal Reserve Bank's activism may have been understandable, especially in view of the fact that 2004 was going to be an election year. Already twice before under the Chairmanship of Alan Greenspan, the Federal Reserve Bank had engaged in such activism, first, by flooding the markets with liquidity after the 1987 crash, and, second, by lowering money market rates in 1990 when US commercial banks appeared to be on the threshold of a major crisis;¹⁰⁰ from 1990 to 1994, monetary policy enabled the commercial banks to rebuild their equity, earning record profits one quarter after the other by playing the yield curve.

A closer look at both these episodes would have shown that such activism was not without risks: There are good reasons to believe that the quandary of US commercial banks in 1990 had been caused by a combination of excessive lending in 1988, when monetary policy was extremely easy, and the interest rate increase in 1989, when recognition of the inflation that had been fuelled in 1988 induced the central bank to step on the brakes. There are also good reasons to believe that the financial turbulence that followed the relatively small interest hike in 1994 was largely due to the interest rate vulnerability of institutions that had been playing the yield curve. Thus, in both episodes, a phase of monetary ease seems to have induced behaviour that made financial institutions vulnerable to the effects of monetary tightening. However, this lesson from these earlier episodes seems to have been overlooked.¹⁰¹

To some extent, the willingness of banking institutions to engage in maturity transformation through conduits and SIVs may also have been due to their underestimating their own commitments in these ventures. After all, they were separate legal entities, with assets and liabilities that were kept separate from the sponsoring institutions' balance sheets. Commitments to provide liquidity in case of need were not put into balance sheets either; presumably, such commitments did not have to be put into the accounts if the sponsoring bank's management considered it more likely than not that the commitment would not be called upon. In the crisis, of course, the commitments were called upon, and some banks found that, for the sake of their reputations, it was necessary to accept liabilities of their conduits and SIVs even beyond their own legal obligations.

100 On this crisis, see [Bernanke and Lown \(1991\)](#), [Boyd and Gertler \(1994\)](#).

101 If the turnaround in US residential real-estate markets is seen as being induced by the tightening of monetary policy in 2005 and 2006 (see [Table 2](#)), then at least the onset of the current crisis can be said to have followed the same pattern as the earlier crises. However, it seems hardly appropriate to blame the crisis on tight monetary policy in 2005 and 2006; the development that I have described above seems like a bubble that was bound to burst sometime. As for Japan in 1991, the tightening of monetary policy merely provided the pinprick.

As a naïve academic, I have been wondering why commitments to provide liquidity in case of need would not have fallen under the prohibition of excessively large loans to single clients, at least for those institutions where such prohibitions are an integral part of prudential regulation. In Germany, for instance, the law stipulates that loans to a single client must not exceed 25% of equity capital. A loan of more than four times the equity capital is not compatible with this regulation, yet, this is what Industriekreditbank and Sächsische Landesbank promised to provide to their conduits in case of needs. A lawyer might argue that a promise to provide such a loan is not the same as the loan itself, that the promise has been a conditional one, that it has been split into multiple smaller promises, and that all these considerations make a difference in law. In substance, these considerations do not make a difference, and, to me, these banks' promises of liquidity assistance to their conduits smack of illegality.

In the end, of course, conduits and SIVs turned out not to be so independent after all, but had to be taken onto the sponsoring banks' balance sheets. This outcome suggests that it would have been better to treat them as integrated subsidiaries from the very beginning, i.e., to enter their assets and liabilities into the sponsoring banks' balance sheets. At the very least, this would have improved transparency about their doings. It would also have forced the sponsoring banks to put equity capital behind these institutions' holdings of asset-backed securities. This might have slowed their growth and diminished the danger they posed for the system.

4.9 *Excessive Confidence in Quantitative Models as a Basis for Risk Management*

For institutions that were not sponsoring conduits or SIVs, the assessment of behaviour is less clearcut. To be sure, with hindsight, it is clear that some of their strategies were disastrous, for themselves as well as the financial system as a whole. However, hindsight is not a good guide. For each decision, there is a risk that it may turn out badly. If this risk is realized, i.e., if the decision has indeed turned out badly, one cannot automatically infer that the decision should not have been taken. The question is whether there are reasons to believe that the decision was flawed from an *ex ante* perspective, without the benefit of hindsight.

In thinking about this question, it is important to appreciate that, before July 2007, nobody knew about the extent of the systemic risk that was created by the activities of conduits and SIVs. Given the lack of transparency about exposure to systemic risk from these institutions, it is difficult to blame the portfolio managers and risk managers at institutions like UBS for not having taken this risk into account. One might as well blame the architect of the

World Trade Center for not having taken the risk into account that kerosene-filled airplanes might be flown into the building.

However, risk managers, risk controllers, and, most importantly, top management at institutions like UBS can be faulted for not having taken account of the possibility that there might be risks that they had failed to consider. They relied on the quantitative risk models that they had developed and believed in their ability to control risks on the basis of these models. Their exposure to systemic risks from conduits and SIVs had not been incorporated into the models – and could not have been incorporated because they did not have the requisite information. However, as a matter of common experience, one might have reflected that quantitative risk models are necessarily imperfect and, therefore, that some provision should be made for possible flaws in risk modelling.

The development and use of quantitative models since the eighties has provided tremendous gains in the quality of risk assessment, risk management, and risk control of financial institutions. Most importantly, these models have contributed to a much better understanding of what the risk exposure of banks really is. Before the advent of quantitative risk modelling, risks in banking were not well understood, and this was one reason for the financial crises of the eighties and nineties. The *de facto* insolvency of a significant part of the savings and loans industry in the United States in the early eighties had resulted from a failure to understand the risk implications of the maturity mismatch in these institutions' balance sheets. The banking crises of many countries in the late eighties and early nineties had resulted from a failure to properly recognize risks and correlations of risks in real-estate and small-business lending. In both instances, the flaws were not even in the measurement of risks, but in their conceptualization. The relevant questions, namely what could these lending activities and what could correlated risks in these activities mean for the bank as a whole, had not even been asked. The use of quantitative risk modelling as a basis for a comprehensive system of risk control ensured that these questions were at least asked and that answers corresponded to the state of the art in risk analysis.¹⁰²

This being said, one must recognize that the reliability of a quantitative risk model is limited. Statistical inference from empirical data presumes that, at some level, the data can be interpreted as instances of experiments with common underlying parameters and independent disturbances; reliance on this inference for decision making presumes that the common underlying parameters will still be relevant in the future. In practice, however, the data

102 The account in [Staub \(1998a\)](#) gives some indication of how revolutionary the change in bank management was. See also [Schütz \(1998\)](#).

that can be used as inputs for quantitative risk models do not exhibit the stationarity and independence properties that the statistical theory assumes.¹⁰³

In particular, correlations are subject to change over time. Even with the best of data, correlations are therefore hard to ascertain empirically, and risk models are notoriously unreliable about correlations.¹⁰⁴ Yet the importance of correlations is shown very clearly by the account that was given in Section 3 of the common dependence of mortgage-backed securities on the factors that were underlying the development of US real-estate markets. The impact of systemic risk in the crisis, provoking a downward spiral in many markets at once, provides another illustration. The quantitative risk models had not taken these systemic risks into account. Nor could they have done so, given the lack of relevant information and data.

When I first raised the issue of exposure to systemic risk at a conference in Basel in 1995, the discussant, Peter Wuffli, who at the time was Chief Financial Officer of Swiss Bank Corporation, answered squarely that systemic risk must be dealt with by the central bank because the individual banking institution was unable to do so.¹⁰⁵ At the time, I thought that this response was an instance of moral hazard induced by the presence of a lender of the last resort. However, after years of thinking about the problem, I have come to accept the assessment that, given the complexity and the fluidity of the network of interbank relations, there is no way in which the quantitative risk model of an individual bank could satisfactorily take account of the institution's exposure to systemic risk. This being said, I wonder why the quantitative risk model of an individual bank should be accepted as the sole basis for determining the amount of equity capital that the bank must have to meet regulatory requirements.

This brings me back to the observation that the incidence of systemic risk in the crisis has been exacerbated by an insufficiency of equity capital in banks. As the system of risk management on the basis of quantitative risk models was being implemented, banks were becoming more conscious of the desirability of "economizing" on equity capital and of the possibility of using the quantitative risk models for this purpose. Some of the economizing on equity capital involved improvements in the attribution of equity capital to different activities, based on improvements in the awareness and measurement of these activities' risks. Some of the economizing on equity capital led to the relative decline in equity that I referred to above as one of the elements shaping the dynamics of the downward spiral of the financial system since August 2007. One may assume that the loss of resilience

103 For a detailed discussion of why it is difficult to assess the quality of a quantitative risk model, see my contribution to [Hellwig and Staub \(1996\)](#).

104 On this point, see again [Duffie \(2007\)](#).

105 See [Hellwig \(1995\)](#) and [Wuffli \(1995\)](#).

that was caused by the reduction in equity capital was to some extent outweighed by the improvements in the quality of risk management and risk control. However, there may also have been something akin to the effect that the instalment of seat belts or anti-blocking systems in cars induces people to drive more daringly.¹⁰⁶ A greater feeling of protection from harm or a stronger sense of being able to maintain control may induce people to take greater risks. Professional enthusiasm about the new risk control technology may give rise to overconfidence or even hubris.

I appreciate that, in the assessment of insufficiency of equity capital, as in other matters, it is important to avoid succumbing to hindsight bias. *Ex post*, it is clear that equity capital was insufficient, but then, as the crisis has developed, one may suppose that, within the range that may realistically be considered, any amount of equity would have proved insufficient. However, one may also suppose that, if the banks had had greater equity buffers, they would have had greater leeway in determining their reactions to the crisis and the downward spiral might have gone less far than it has.

At this point, I come back to the discussion of biases in bank governance in Section 3.6 above. As discussed there, discourse inside the banks and in relations between the banks and the representatives of “market discipline” seems to have focussed on yield, without questioning the implications for the institution’s exposure to risk. The ability to control risk through model-based risk management was taken for granted, to be handled as a matter of routine. In the case of the Swiss bank UBS, this attitude provided the investment banking branch with the means to prevent any comprehensive risk assessment of their activities by Senior Group Management until the summer of 2007. The very same attitude seems to have been responsible for the extent to which such institutions were “economizing” on equity.¹⁰⁷

Above, I have suggested that the focus on yield at the expense of risk may be reinforced by governance mechanisms that rely on “market discipline” in the name of “shareholder value”, and that the ease of measuring returns and of communicating about returns as opposed to measuring risks and communicating about risks introduces a bias in favour of strategies that involve

106 The classic reference on this point is [Peltzman \(1975\)](#).

107 For UBS and *Crédit Suisse*, the Financial Stability Department of the Swiss National Bank has raised concerns about the insufficiency of equity capital since at least 2001 and had put forward proposals to supplement existing capital regulation by a leverage ratio which would install an overall floor for the equity ratio; see [Bichsel and Blum \(2001, 2005\)](#), [Blum \(2008\)](#). Prior to the crisis, these proposals met with the response that the size of the balance sheet was not a good indicator of risk because, for many assets and liabilities, returns and obligations were so highly correlated that the net impact of these positions on the risk of the bank was negligible and hardly any equity was needed to cushion this risk. The notion that there might be limits to the ability of quantitative models to assess the “negligibility” of risks, which underlay the Swiss National Bank’s concerns, does not seem to have entered the banks’ decision making.

greater risk taking. All these arguments are relevant for assessing strategies of “economizing” on equity as well as strategies of investing in high-yield securities.

Even if risks to shareholders are properly taken into account, a system of “market discipline” in the name of “shareholder value” is unlikely to also take into account the risk implications of the bank’s strategy choice for its creditors and for the financial system as a whole. It might do so if excessive risk taking at the expense of lenders would lead to immediate withdrawals of funds and would thereby harm the profitability of the institution.¹⁰⁸ However, before the crisis broke out into the open in August 2007, there was little evidence of such “market discipline” from the creditors of banks, let alone such “market discipline” from shareholders fearing such creditor reactions.

4.10 *Regulatory Capture*

In principle, the risk implications of banks’ strategic choices for their creditors and for the financial system as a whole provide the main rationale for statutory prudential regulation of banks. As mentioned above, the relative decline in the equity capital of banks that we have seen since the nineties has partly been due to banks availing themselves of the option provided by the 1996 Amendment to the Basel Accord of determining regulatory capital for market risks on the basis of their own quantitative risk models, rather than the crude ratios that had been used before and that were still being used in the so-called standard approach. The criticism that there was an excessive reliance on quantitative risk models, must therefore be directed at bank regulators and supervisors as well as bank managers.

Acceptance by the regulators of the model-based approach to determining regulatory capital requirements was the result of intense lobbying by prominent banking institutions in the first half of the nineties. In 1993, the Basel Committee on Banking Supervision issued a draft proposal for the determination of bank capital requirements for market risks on the basis of crude ratios of the sort that was used for credit risks under the 1988 Basel Accord (“Basel I”). The banking industry responded with intensive criticism, arguing that such regulation would represent a step back from the very sophisticated risk management procedures that they themselves had started to implement on the basis of quantitative models. Two years later, in 1995, a modified proposal was presented, which gave banks the option to use a model-based approach, rather than the approach that had been originally proposed (now called the *standard approach*). Another eight months later, this modified approach was codified in the 1996 Amendment to the Basel Accord.

108 This is the mechanism envisaged by Calomiris (1999).

The banking industry was certainly right in claiming that, as a way of dealing with market risks, the standard approach was clumsy and would have represented a step back from the sophisticated risk management methods that they were already using. The banking industry was also right in suggesting that they knew more about risk management than the regulators. However, in this discussion, the notion that there is a difference between private interests and the public interest in risk management and risk control of a bank seems to have been lost. I think of this process as *regulatory capture by sophistication*.¹⁰⁹

The question of how to protect the public interest against possible flaws in the quantitative risk modelling of banks does not seem to have been given much attention.¹¹⁰ The quality of professional risk modelling in sophisticated banking institutions seems to have been taken for granted. The possibility that the model designers might simply fail to properly appreciate an important risk factor does not seem to have been considered. In the end, this possibility materialized when, e.g., risk modellers at UBS neglected the role of residential real-estate prices in the United States as a common factor underlying all mortgage-backed securities. Nor was any attention paid to the possibility that the bank's quantitative risk model might be inherently incapable of capturing exposures to systemic risk that result from the activities of other institutions about which one is not informed, from excessive maturity transformation by SIVs to the counterparty risks of monoline insurers to whom one has transferred the credit risks of mortgage-backed securities.

The capture of regulators by the industry was facilitated by the political constellation: A body of representatives from regulatory authorities and central banks of the G-10 countries, the Basel Committee on Banking Supervision was developing principles aiming at international co-ordination and harmonization of banking regulation when the sector itself was undergoing tremendous structural change, driven by revolutions in information processing, communications and risk management technologies and promising to open great new fields of business activity. For the participants from different countries, these negotiations involved the future competitive positions

109 For a bank supervisor's expression of strong unease about this process, its outcome, and its implications for the amount of capital that banks would be required to have, see the contribution of Zuberbühler to Hellwig and Staub (1996).

110 Hellwig and Staub (1996) documents a panel discussion with members of the regulatory community and members of the banking community on these issues. My own contribution pointed out that (i) the Supervisory Framework for Backtesting of Models that the Basel Committee had provided did "not seem to recognize the fundamental conceptual difficulties of doing statistical inference in a nonstationary world" and (ii) it was incongruous to "believe in the integrity of senior (bank) management in its dealing with risk control if at the same time we believe that senior management is not to be trusted to manage risks properly unless it is subjected to a capital adequacy requirement".

of “their” home institutions as well as the safety and soundness of globally operating banks. In particular, for countries with banking institutions at the forefront of change, most prominently the United States, the introduction of the option to rely on a model-based approach seemed like a chance to have “their” institutions benefit from their advantages in global competition in newly developing markets. Even if the bank regulators involved in the negotiations may have had their doubts about the change, the political environments from which they came provided them with little leeway to express these doubts, let alone have them prevail in the international deliberations.

A similar logic may have been at work in the late nineties when Federal Reserve Board Chairman Greenspan, Treasury Secretary Rubin, and Securities and Exchange Commission Chairman Levitt, all three of them with strong ties to the investment banking community, used their influence to stop attempts to bring derivatives trading into the domain of statutory regulation, if only to impose transparency about trades, positions, and participating parties. More transparency here might also have meant transparency about conduits and SIVs.

4.11 *Conceptual Weakness of Regulatory Thinking*

The regulatory community’s vulnerability to capture is partly explained by the lack of a coherent conceptual framework for thinking about what prudential regulation is doing. When asked why a capital adequacy requirement is useful, a typical bank regulator will answer that it promotes the *safety and soundness of banks*, the ultimate objective of all banking regulation. When asked how a capital adequacy requirement contributes to promoting the safety and soundness of banks, he will argue that a more highly capitalized bank is less likely to go bankrupt. When asked whether this argument wouldn’t call for a capital requirement of 100%, i.e., an all-equity-financed bank, he will tend to agree and then talk about the need to take account of the fact that bankers consider equity capital to be very costly. This intellectual stance does not provide a good basis from which to argue with bankers bent on reducing their capital requirements.

In the past, capital requirements had not been at the centre of the stage in banking regulation. Banking regulation had relied on a mixture of asset allocation rules and deposit rate regulation. These rules had been developed in the thirties, after the Great Depression, and they worked until the seventies, in a period when banking rarely crossed national borders and it was easy to reduce or even eliminate competition in banking by national regulation and/or cartel agreements. However, in the seventies and eighties, most of these rules were dismantled because, as the financial sector underwent structural change, they were seen as being dysfunctional, weakening the position

of domestic banks in competition with other banks internationally and in competition with non-bank intermediaries, and weakening their ability to cope with increased risk in a world of wide fluctuations in interest rates and exchange rates.¹¹¹

Capital regulation began to take centre stage in the mid eighties, when bank regulators from the G-10 countries got together to create a framework for prudential regulation in the face of increasing globalization of financial activities. Acceptance of the *home-country principle*, leaving all supervision to the regulatory authorities of the bank's home country with no additional supervision by authorities of other countries in which the bank might be active, was coupled with an agreement on harmonized principles for such regulation.¹¹² The result, as codified in the Basel Accord of 1988, focussed on capital requirements, perhaps because the experience of the savings and loans crisis had sensitized the American participants to the dangers of undercapitalized, or even negatively capitalized, institutions "gambling for resurrection", perhaps also because, by contrast to asset allocation rules and deposit rate regulation, capital requirements were the one instrument where harmonization across countries was not obviously nonsensical.¹¹³ However, there had not been any theoretical or empirical work on the effects of capital requirements on the financial system and the overall economy, let alone the differences between the effects of different rules for computing capital requirements.¹¹⁴

Even now, twenty years after the first Basel Accord, the intellectual foundations of capital regulation are weak; the weakness concerns the new Basel Accord ("Basel II") as well as the original one. Some of the flaws in regulatory thinking have contributed to the downward spiral in the crisis that we have experienced.

111 On this development, see Baltensperger and Dermine (1987), Englund (1990), Méritz (1990), Vives (1990), OECD (1992).

112 For an example of regulatory thinking at the time, see Carosio (1990).

113 However, even here, one may question whether, e.g., real-estate loans in different countries should be treated as being equally risky; see Schaefer (1990).

114 For criticisms of the lack of theoretical or empirical foundations, see King (1990) and Schaefer (1990). Both point out that neither the regulatory community nor the academic community have any framework for assessing the bankers' claim that equity capital is very costly: Are these private costs to bank managers that have to go to the market to get additional equity capital? Or are these social costs because additional equity for a bank means less equity for other purposes? According to the Modigliani-Miller Theorem of corporate finance, it is not clear that there would be any social costs. Hellwig (1996) compares "the speed with which the regulatory community moved from the April 1993 and April 1995 proposals to the actual Amendment to the Capital Accord to Incorporate Market Risks of January 1996 to the time and expenses it takes for a private company to get a new drug approved for sale" and notes that "both the 1988 Accord and the 1996 Amendment to the 1988 Accord were enacted with hardly any evidence about the economic effects of capital requirements for banks."

In my view, prudential regulation under the Basel Accords has the following major shortcomings:

- The purpose of capital regulation is unclear.
- The dynamics of capital regulation are neglected.
- The systemic dimension of capital regulation is ignored.

In the following, I will explain these points as well as their significance in the current crisis.

The purpose of capital regulation is unclear: In the regulatory and academic literatures, I see at least three rationales for capital regulation:¹¹⁵

- Equity capital provides a buffer against insolvency.
- Equity capital affects incentives for risk taking.¹¹⁶
- Capital regulation provides room for intervention by the supervisor at a time when the bank is not yet subjected to insolvency proceedings.¹¹⁷

One might consider that the difference does not matter if, in fact, capital regulation can serve all three purposes. However, the rule for determining required capital will depend on which of the three purposes one is thinking of. If one is thinking of equity capital as a buffer against insolvency risk, one is concerned about the *total risk* to which the institution is subjected. The risk weights of different assets should then be tied to the total contribution that each asset makes to the institution's risk. If one is thinking of equity capital as an incentive device, one must be concerned about incentive effects at the margin and attune the risk weights of different assets to the *marginal impact* of increases in the different asset positions on the institution's risk. With correlations of returns on the different assets, there is no reason why risk weights attuned to marginal risk contributions should coincide with risk weights attuned to total risk contributions. Finally, if capital requirements are there to provide room for supervisory intervention before the onset of bankruptcy, there is no reason why risk weights of assets should matter at all. In this case, it seems more important to make sure that the intervention threshold cannot be manipulated and to have a plan for how to intervene when the threshold is reached. To the extent that different assets should carry different weights at all, the different weights should probably be attuned to differences in marketability of these assets, because these differences affect the difficulty

115 For evidence of the heterogeneity of rationales, see the discussion documented in [Blattner \(1995\)](#).

116 Formal models to this effects have been provided by [Rochet \(1992\)](#), [Dewatripont and Tirole \(1994\)](#).

117 This was the rationale for the system of graduated responses stipulated by the Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991 in the United States.

of the corrective intervention in the crisis.¹¹⁸ There is thus a potential for conflict between the different purposes of capital regulation. As far as I know, this conflict has never been addressed, let alone resolved.

*The dynamics of capital regulation are neglected:*¹¹⁹ Explicitly or implicitly, most thinking about the impact of capital regulation on risk in banking comes from a two-period framework. In this framework, there is a first period in which the bank chooses its liabilities, equity capital, deposits, subordinated debt, etc., and its assets; then, in the second period, returns are earned and distributed to the different financiers. Little attention has been paid to the fact that banks do not operate in a two-period world and that, in the real world, there are repeated refinancing choices and portfolio choices to be made. In the real world, one must think not only about the impact of the *initial* imposition of capital requirements, but also about the impact of imposing capital requirements in *subsequent* periods.

For this purpose, it is not enough to think about “tomorrow” as a new “period one” in the two-period framework of analysis. To see this, observe, first, that the bank’s equity position “tomorrow” depends on the fate of its investments “today”, the assessed values of long-term investments that still have some time to go, as well as actual returns from short-term investments that have already matured. Second, as of “tomorrow”, the long-term investments from today may not be liquid. Such illiquidity affects the bank’s ability to adjust its asset portfolio to the requirements of capital regulation “tomorrow”. Third, the bank managers’ anticipation “today” of the impact of capital requirements on its business opportunities “tomorrow” may have incentive effects on the bank’s portfolio choice “today”.¹²⁰

Given these additional concerns that arise in a world with repeated, ongoing financing choices and portfolio choices of banks, any mechanical extension of results and recommendations from a two-period framework to such a world with more than two periods is questionable, if not harmful. For instance, a policy of enforcing capital requirements mechanically in each period can contribute to a bank’s insolvency risk if, following a market downturn, such a policy forces the bank to liquidate assets at a time when cur-

118 Remarkably, this question has not been given much attention. Even in the United States, supervisors have shied away from filling the provisions of FDICIA with substance.

119 For an extensive discussion of this point, see Hellwig (1995).

120 Blum (1999) presents a model showing that, if one considers the incentive effects of tomorrow’s capital requirements on today’s behaviour, the requirements can be counterproductive, in the sense that they lead to more risk taking, rather than less. If bank managers appreciate that every extra dollar of profits that they earn on “today’s” investment enhances their loan capacity “tomorrow” by 12.5 dollars, they may be inclined to choose a strategy “today” which provides them with big opportunities of exploiting this additional leverage if it succeeds and leaves the regulators with a mess if it fails.

rent market prices are significantly below the expected present value of future returns.

In view of these additional concerns, the *key question for capital regulation in a world with repeated, ongoing refinancing and portfolio choices of banks should be how the bank's assets and liabilities are to be adjusted over time* when losses have caused a drop in equity capital. Neglect of this question – and of the concerns that underlie it – has been responsible for the detrimental effects of regulation that were discussed in Section 4.6 above, in particular, the interplay of fair value accounting, capital regulation, and the induced corrective actions of banks in the downward spiral.

The systemic dimension of capital regulation is ignored: When asked why statutory regulation is needed to provide for the safety and soundness of banks, i.e., why the safety and soundness of banks cannot be left to the contractual relations between banks and their creditors, a bank supervisor will refer to the need to forestall systemic risk, as well as the need for investor protection. In the actual regulation, however, systemic risk plays no role. There seems to be a view that solvency regulation and supervision of all institutions, one by one, is enough to forestall systemic risk. I consider this view to be mistaken and dangerous.

To be sure, if the regulators are able to prevent each and every banking institution from going under, there is no systemic risk. However, I don't see the present system of banking regulation as being able to do this; moreover, I don't see any realistic prospect for achieving this aim by improvements in regulation and supervision.

Because of systemic interdependence, the individual bank's risk exposure cannot be ascertained by just looking at the bank's assets and liabilities, on balance sheet and off balance sheet. If the bank's asset position involves a certain risk and the bank has hedged this risk by contracting with a third party, the effectiveness of the hedge depends on the third party's ability to fulfil its obligations when needed. If the risk in question is of macroeconomic dimension, an interest rate risk, exchange rate risk, or a housing-price risk, the counterparty's ability to fulfil its obligation depends on how many similar contracts it has concluded with other market participants. If risk correlations across contracts are such that the counterparty to the hedge must deliver on many of them at the same time, this in itself may destroy the counterparty's viability. The difficulties that the monoline insurers of credit risk in mortgage-backed securities have had over the past year – or the more recent crisis of AIG – provide a telling example of the problem. To assess whether the risk in the bank's asset position is really neutralized by the hedge with the third party, the bank's supervisor would have to be informed about the counterparty credit risk of the hedge contract and about the correlation of this counterparty credit risk with the risk against which the bank is hedging. To ascertain the counterparty credit risk and its correlation with the risk

against which the bank is hedging, the supervisor would have to know the total exposure of the counterparty, across all contracts, to the risk that it is providing the hedge for.¹²¹

Similarly, to know the bank's exposure to systemic risk from the effects of other market participants' difficulties on asset markets and asset prices, the supervisor would have to know the balance sheets of the other market participants. On this point, a telling example is provided by the exposure of banks all over the world to the systemic risks induced by the excessive maturity transformation of conduits and SIVs, which nobody had appreciated prior to August 2007. If the positions of other market participants are not known, there is no way the supervisor can correctly assess the bank's exposure to such systemic risk just by looking at the bank's balance sheet.

In a sense, the view that a supervisor can assess the bank's solvency risks just by looking at the bank's assets and liabilities, on balance sheet and off balance sheet, is just as much the result of overconfidence, a neglect of the possibility that there might be things that one has failed to consider, as the view that a quantitative risk model provides a fully accurate assessment of the bank's risk position.

A member of the regulatory community might respond that, if the information about systemic risks to which the bank is exposed is not available, then there is nothing one can do about the problem. Here, as for the individual bank, I would respond that, at the very least, there should be an awareness of the issue, and this awareness should play a role in regulatory thinking, e.g., make for some scepticism concerning an all-out reliance on the bank's own risk models. I would also respond that, once one begins to appreciate that there is a problem, one may actually begin to think about possible sources for the requisite information. For instance, one might think about aggregating the financial reports of different participants in the financial system, or in one part of the financial system, in order to obtain a view as to what the aggregate risk position of the group in question is.¹²² If such an exercise had been performed on conduits and SIVs,...

A second issue concerns the systemic implications of regulatory intervention when an institution is in difficulties. This complements the concern, raised above, that the mechanical imposition of capital requirements may

121 A commentator has suggested that the problems of counterparty credit risk and its correlations with underlying macro risks are mitigated if the counterparties themselves are subject to supervision ensuring their viability. To the extent that the "if" in this statement is valid, this is true. However, the crisis shows that, in the presence of macro shocks affecting the entire financial system or of a macro shock that the financial system is generating all on its own, there is little assurance that supervision of the counterparties will ensure their viability. Indeed, if one looks at the various banking crises of the nineties, one finds that regulatory requirements had often been overfulfilled – until the crisis broke.

122 The basic idea is developed in Hellwig (1994b).

increase the bank's insolvency risk by forcing it to sell assets in an illiquid and panicky market in which these assets are undervalued. Besides the negative effects on the bank itself, such an intervention also has negative effects on the asset markets and thereby on other market participants. At this point in my discussion, I hardly need to add that such negative effects of corrective actions of banks have played a significant role in the crisis.

5 TOWARDS REGULATORY REFORM

The crisis has given rise to many calls for regulatory reform. Unfortunately, many of these calls, including calls from politicians in positions of responsibility, are little more than spontaneous reactions to the observation that something has gone wrong. If something has gone wrong, it must be because there has been too little regulation and too little supervision. The question what has gone wrong and what kind of regulatory reform is needed is rarely addressed. The notion that the regulation we currently have may actually have exacerbated the crisis is not even considered. Many statesmen and politicians seem to be using the call for regulation to forestall such crises in the future as an opportunity to promote their pet projects, just as, in 2002, Iraq was made out to be the key to 9/11.

This is not the place to go into the subject of regulatory reform in any detail. I will merely draw some conclusions from the analysis that I have presented.

5.1 *The Originate-and-Distribute Model of Mortgage Securitization*

Populist propaganda in Europe is suggesting that, if only European banks had avoided those junk mortgages in the United States, they would not have run into trouble. I consider this propaganda to be dangerous. From experience, we know that excessive real-estate speculation can be a problem in any country. From the late eighties and early nineties, we have examples from Sweden, Switzerland, France, Germany, Japan. . . In each case, lack of diversification meant that the speculation ended up having significant negative effects on originating banks and the domestic financial system. These effects could have been much reduced if the mortgages in question had been securitized and the risks shared internationally.

In thinking about the reform of mortgage securitization, it is therefore important not to throw out the baby with the bathwater. From the above analysis, it is fairly clear what needs to be done. Rules concerning liability of originators and/or securitizers must be introduced or strengthened. For example, it might make sense to require originators to retain an equity portion on each mortgage they transfer to a securitizer.

It is probably sensible to prohibit the higher stages of securitization (MBS CDOs, MBS CDO²s, etc.). However, I see little prospect of these securities returning anyway. More importantly, it might make sense to have some system of oversight which examines whether newly created securities provide effective improvements to the scope for reallocating risks and sharing risks through markets or whether these securities are just there to circumvent statutory regulation of risk taking by insurance companies and the like.

The role of rating agencies needs to be reconsidered. To eliminate conflicts of interest, there should be a rule banning an agency from rating a security issued by an entity for which the agency itself or one of its subsidiaries has provided consulting services.

5.2 Rethinking the Role of Prudential Regulation

The performance of regulators and supervisors before and in the crisis has been marred by a lack of information about the extent to which the institutions they were supervising were exposed to systemic risk. This lack of information was in part due to the fact that important players, such as conduits, SIVs and hedge funds, were unregulated and did not even have to provide information about their positions. Because the information was not available, nobody appreciated the systemic risks in these institutions' positions. Such lack of transparency is unconscionable.

The fact that important players were not regulated stems from a view that the main task of prudential regulation is to protect investors and that such protection is only needed for small unsophisticated investors who find it difficult to protect themselves in the jungle of the financial system. For financial institutions like hedge funds, and presumably also conduits and SIVs, such concerns did not seem to justify a need for regulation; these institutions' investors were deemed to be large enough and sophisticated enough to fend for themselves.¹²³

However, the events of August 2007 show that it is not enough to think about investor protection. Prudential regulation should also be concerned with the protection of the financial system. The financial system as a whole and the different markets that compose it should be protected from the kind of surprise that was experienced then. For this purpose, prudential regulation should be extended to *all* major participants in this system.

I am *not* proposing that all participants should be subject to the same set of rules. Indeed, I will argue below that rules should be differentiated in order to take account of differences in the roles and differences in the liability structures of different participants. However, all participants above a certain

123 Whether a fifty-million dollar investor in a three-billion dollar hedge fund is really important enough to fend for himself, is an open question.

size should be required to provide the supervisory authorities with information about their positions so that the supervisory authorities can obtain some transparency about the system's risk exposure. The reason for imposing such a requirement is not to protect investors, but to protect the system of markets in which these institutions are active and the counterparties of these institutions in these markets.

The same reasoning suggests that distinctions between on-balance-sheet and off-balance-sheet positions of banks and other financial institutions should be abolished or at least reduced to a bare minimum. One suspects that regulatory acceptance of such distinctions until now may have had more to do with political lobbying and regulatory capture than with any substantive argument about differences in risk exposure.

The regulators and supervisors themselves should begin to think about the safety and soundness of the financial system as well as the safety and soundness of individual institutions. Given their tradition, this will not be easy. From a legal perspective, regulatory intervention is always based on rules that govern the relation between the regulator and the individual institution. If regulatory intervention is to be based on concerns about the safety and soundness of the financial system as well as the safety and soundness of the individual institution, these rules must be changed. As yet, however, we have no idea how systemic concerns can be introduced into the rules governing the bilateral relation between the regulator and the individual financial institution.

However, some steps in the desired direction should be easy:

- Regulators and supervisors should develop a framework for processing the information that they obtain from individual institutions so as to provide an overview over the overall risk exposure of the financial system, as well as certain subsets of financial institutions with similar roles and similar liability structures. For this purpose, they will need to co-operate internationally, perhaps even to overcome the sectoral fragmentation of prudential regulation and supervision in the United States.¹²⁴
- The regulation and supervision of different types of institutions should be tailored to their specific positions in the financial system. A case in point is provided by the regulation of insurance companies. As mentioned in

124 One commentator has suggested that this suggestion is at odds with the criticism, expressed elsewhere in this paper, of excessive reliance on the risk models that are currently in use. I fully appreciate that the attempt to obtain a quantitative view of system risk exposure is even more ambitious than the attempt to measure the risk exposure of the individual bank. However, the point of my criticism of banks' risk models is not that these models are useless, but that any use that is being made should be tempered by an awareness of their potential failings. Having such models and using them with a grain of scepticism is certainly better than not having them at all. The same is true for the assessment of system risk exposure.

Section 2 above, life insurers, with a long horizon on the liabilities side of their balance sheets, would be ideal holders of long-term securities associated with real-estate. One reason why they have not done so to such a large extent – and one reason why, in the crisis, they have not much been able to step in and profit from the discrepancy between expected present values and market prices – is that they have also been using fair value accounting. Indeed, the banking lobby, furious at insurers competing with banks in derivatives markets, has been militating for the introduction of capital regulation of insurers on roughly the same lines as banks. Homogenization of the regulation of different institutions may seem like a good idea for a banker who wants to eliminate competition, but comes at a great cost for the financial system because homogenization of participants reduces its resilience. Given that the liabilities of life insurers and banks have different maturities and different risk profiles, there is actually no substantive reason for this homogenization of regulation.

- Systemic thinking should be used in assessing risk exposures of individual institutions, if only to question the reliability of the quantitative models that are being used; systemic thinking should also be used in considering the question, raised above, of how an institution's assets and liabilities are to be adjusted over time when losses have caused a drop in equity capital. A supervisor who first is happy to see a life insurance company invest in the bonds of highly rated banks and then, in the crisis, finds that the insurance company is too heavily exposed to the risks of the banking sector and therefore ought to divest these bonds right away must himself be regarded as a systemic risk.
- The different regulatory and legal communities ought to think about robust and simple procedures for unwinding positions when a financial institution becomes insolvent. Ten years ago, one reason for not letting Long Term Capital Management (LTCM) go under right away was the fear of chaos created by the need to unwind a maze of contracts in multiple jurisdictions that had been concluded with hundreds of counterparties. Since then, as far as I can tell, no progress whatsoever has been made on the problem of how to deal with such an event.

5.3 *Towards a Reform of Capital Adequacy Regulation*

Turning to the approach that is taken to deal with the individual institution, I believe that there must be some component of capital regulation that is independent of whether the bank's risk model is right or not. This recommendation follows directly from the observation that the systemic risk that had been inherent in the excessive maturity transformation by conduits and SIVs could not have been anticipated by other institutions – or their risk models – because the requisite information had not been available. To be sure, exten-

sions of reporting requirements and improvements in transparency will reduce this problem. However, as a matter of principle, I don't believe that statistical risk models will ever be fully appropriate. To some extent, taking account of this problem will be in the bank's own interest. To the extent that the bank's risk impose externalities on the rest of the financial systems, markets, institutions, and investors, this problem should also be considered in prudential regulation.

The Swiss National Bank has suggested that the issue might be dealt with by the imposition of a crude leverage ratio, i.e., a requirement that a bank's debt must not exceed $x\%$ of a bank's balance sheet, without any attempt to distinguish how risky the bank's assets are.¹²⁵ By contrast to the model-based approach, a leverage ratio regulation would set a fixed lower bound on the relation between the bank's equity capital and its balance sheet.

However, such a rule is very mechanical. More consideration must be given to its incidence over time, as the bank is adjusting assets and liabilities in response to current profits and losses. Here, a leverage ratio rule is likely to share the procyclical features of current capital regulation. If current losses reduce a bank's equity, the leverage ratio goes up, and the leverage ratio rule may require a divestiture of assets even though, in a panicky market, such a divestiture is detrimental to the bank as well as the financial system.¹²⁶

The procyclical impact of such regulation is reduced if the leverage ratio is set at a low level or, equivalently, required capital is much higher than it has been in the recent past. If the maximum-leverage ratio is low, or the minimum-capital ratio is high, the impact of profits and losses on the bank's scope for action is relatively small. In more concrete terms: under the 8% capital ratio of Basel I, an additional dollar of equity provides the bank with the scope to make 12.50\$ of additional loans. If the capital ratio was 30%, the scope for additional loans would be reduced to 3.33\$. Lower leverage ratios or higher equity ratios reduce the multiplier for reactions to changes in bank equity.¹²⁷

At this point, the institutions concerned will protest that equity capital is expensive. I have yet to see a convincing argument showing that this protest is referring to social costs, rather than just the private costs to the bank manager of having to go to outside financiers and having to explain to them what he is doing and why his activities should merit their entrusting him with their money.¹²⁸

125 See Bichsel and Blum (2001, 2005), Blum (2008).

126 Given that a maximum-leverage-ratio is the same as a minimum-equity-ratio, this observation cannot be surprising. The leverage ratio proposal can be interpreted as a kind of "Basel 0" – capital regulation without risk weights.

127 The importance of this multiplier is stressed by Blum and Hellwig (1995, 1996) and Blum (1999).

128 On this point, see again King (1990) and Schaefer (1990).

Going beyond marginal adjustments in the existing system of capital regulation, it would be desirable to reduce procyclical effects of the regulation directly by having a system of graduated interventions that allows for an adjustment of a bank's assets and liabilities over time in a non-mechanical fashion, moreover one that takes account of the effects of intervention on the financial system, as well as the bank. This would require a major reform of the system of capital regulation.

At this point, unfortunately, there is little prospect of such a reform. With all the intellectual and emotional capital that has been vested in it, the Basel Process seems to be progressing at full speed. The regulatory community is busy with the implementation of the new Basel Accord ("Basel II"), in which the crude weights that the 1988 Accord had used for credit risks are replaced by more sophisticated risk weights derived from external or internal credit ratings on the basis of quantitative models of credit risks. I consider it likely that the implementation of this new Basel Accord will actually strengthen the features of regulation that have contributed to making the current financial crisis as serious as it is. As yet, however, questions about the role of prudential regulation in the crisis do not seem to have raised substantial doubts about "Basel".

An underlying problem is that any system of banking regulation that is less mechanical than the one we currently have requires bank supervisors to take a more managerial role. Graduated responses to a bank's difficulties, taking account of the systemic environment, require an exercise of judgment. Banks do not like to subject themselves to such exercises of judgment from bureaucrats, and bureaucrats do not like to take responsibility for such exercises of judgment. At this point, bank supervisors do not even have the resources, in particular the qualified personnel, which would be needed for such a task.

Mechanical rules of prudential regulation are also popular because they are seen as being cheap to implement. To check whether a bank's balance sheet satisfies certain ratio requirements does not require much effort. Performing stress tests on the basis of a bank's quantitative risk model is more demanding, but not so much more, if the regulator doesn't have to develop the model himself. We can in fact think of the Basel Process as an endeavour to design a system of regulation that acknowledges the complexity of financial decision making in the real world while preserving the cheapness of a mechanical approach to banking regulation.

However, if I look at the current crisis, I wonder whether this isn't a case of being penny-wise and pound-foolish. By comparison to the costs of prudential supervision, the stakes for our economies, our societies, and, not least, our public budgets are enormous. They should warrant a larger investment of financial resources and of intellectual capital to design a system of prudential

regulation that is better able to deal with the dynamics and the systemic aspects of risk in banking and finance.¹²⁹

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REFERENCES

- Akerlof, G. (1970), 'The Market for 'Lemons': Quality Uncertainty and the Market Mechanism', *Quarterly Journal of Economics*, 84, pp. 488–500.
- Allen, F. and E. Carletti (2006), 'Credit Risk Transfer and Contagion', *Journal of Monetary Economics*, 53, pp. 89–111.
- Allen, F. and E. Carletti (2008), 'Mark-to-Market Accounting and Cash-in-the-Market Pricing', *Journal of Accounting and Economics*, 45, pp. 358–378.
- Allen, F. and D.M. Gale (2004a), 'Financial Intermediaries and Markets', *Econometrica*, 72, pp. 1023–1061.
- Allen, F. and D.M. Gale (2004b), 'Financial Fragility, Liquidity, and Asset Prices', *Journal of the European Economic Association*, 2, pp. 1015–1048.
- Allen, F. and D.M. Gale (2006), 'Systemic Risk and Regulation', in: M. Carey and R. Stulz (eds.), *The Risks of Financial Institutions*, University of Chicago Press, Chicago, pp. 341–375.
- Baltensperger, E. and J. Dermine (1987), 'Banking Deregulation in Europe', *Economic Policy*, 4, pp. 63–109.
- Bank for International Settlements (2007), '77th Annual Report: April 1, 2006 – March 31, 2007', Basel 2007.
- Bank for International Settlements (2008), '78th Annual Report: April 1, 2007 – March 31, 2008', Basel 2008.
- Ben-David, I. (2006/2008), 'Manipulation of Collateral Values by Borrowers and Intermediaries', Discussion Paper, Graduate School of Business, University of Chicago, http://search.ssrn.com/sol3/papers.cfm?abstract_id=991387.
- Benston, G.J., M. Carhill and B. Olovsson (1991), 'The Failure and Survival of Thrifts: Evidence from the Southeast', in: R. Hubbard (ed.), *Financial Markets and Financial Crises*, University of Chicago Press, Chicago, pp. 305–384.
- Berglöf, E. and H. Sjögren (1998), 'Combining Arms' Length and Control-Oriented Finance: Evidence From Main-Bank Relationships in Sweden', in: K.J. Hopt, H. Kanda, M.J. Roe, E. Wymeersch, and S. Prigge (eds.), *Comparative Corporate Governance: The State of the Art and Emerging Research*, Clarendon Press, Oxford.

129 For an earlier plea along these lines, see Hellwig (1995). The argument there points to the fact that some managerial involvement of supervisors – or representatives of deposit insurance agencies – is justified by the fact that, if things go wrong, the damage will at least partly be borne by depositors or the deposit insurance agency. On this point, see also Dewatripont and Tirole (1994).

- Bernanke, B.S. (2008), 'Mortgage Delinquencies and Foreclosures, Speech at the Columbia Business School 32nd Annual Dinner', <http://www.federalreserve.gov/newsevents/speech/Bernanke20080505a.htm>.
- Bernanke, B.S. and C. Lown (1991), 'The Credit Crunch', *Brookings Papers on Economic Activity*, 2, pp. 205–247.
- Bichsel, R. and J. Blum (2001), 'Gearing Ratios', *Swiss National Bank, Quarterly Bulletin*, 3, pp. 48–58.
- Bichsel, R. and J. Blum (2005), 'Capital Regulation of Banks: Where Do We Stand and Where Are We Going?', *Swiss National Bank, Quarterly Bulletin*, 4, pp. 42–51.
- Blattner, N. (1995), 'Panel Discussion – Statements and Comments', *Schweizerische Zeitschrift für Volkswirtschaft und Statistik/Swiss Journal of Economics and Statistics*, 131, pp. 819–830, <http://www.sjes.ch/papers/1995-IV-18.pdf>.
- Blum, J.M. (1999), 'Do Capital Adequacy Requirements Reduce Risks in Banking?', *Journal of Banking and Finance*, 23, pp. 755–771.
- Blum, J.M. (2008), 'Why 'Basel II' May Need a Leverage Ratio Restriction', *Journal of Banking and Finance*, 32, pp. 1699–1707.
- Blum, J.M. and M. Hellwig (1995), 'The Macroeconomic Implications of Capital Adequacy Requirements for Banks', *European Economic Review*, 39, pp. 739–749.
- Blum, J.M. and M. Hellwig (1996), 'Die makroökonomischen Wirkungen von Eigenkapitalanforderungen für Banken', in: D. Duwendag (ed.), *Finanzmärkte, Finanzinnovationen und Geldpolitik*, Schriften des Vereins für Socialpolitik, NF 242, Duncker und Humblot, Berlin, pp. 41–71.
- Boyd, J. and M. Gertler (1994), 'The Role of Large Banks in the Recent US Banking Crisis', *Federal Reserve Bank of Minneapolis Quarterly Review*, 18, pp. 2–21.
- Calomiris, C.W. (1999), 'Market-Based Banking Supervision', *The Financial Regulator*, 4, pp. 33–36.
- Calomiris, C.W. and C.M. Kahn (1991), 'The Role of Demandable Debt in Structuring Optimal Banking Arrangements', *American Economic Review*, 81, pp. 497–513.
- Carosio, G. (1990), 'Problems of Harmonization of the Regulation of Financial Intermediation in the European Community', *European Economic Review*, 34, pp. 578–586.
- Case, K.E., J.M. Quigley and R.J. Shiller (2005), 'Comparing Wealth Effects: The Stock Market versus the Housing Market', *Advances in Macroeconomics*, 5(1), Article 1, available at: <http://www.bepress.com/bejm/advances/vol5/iss1/art1>.
- Chomsisengphet, S. and A. Pennington-Cross (2006), 'The Evolution of the Subprime Mortgage Market', *Federal Reserve Bank of St. Louis Review*, 88, pp. 31–56.
- Crockett, A. (2007), 'The Evolution and Regulation of Hedge Funds', in: Banque de France (ed.), *Financial Stability Review – Special Issue on Hedge Funds*, April 2007, pp. 19–28, http://www.banque-france.fr/gb/publications/rsf/rsf_042007.htm.
- Curry, T. and L. Shibut (2000), 'The Costs of the Savings and Loan Crisis: Truth and Consequences', *FDIC Banking Review*, 13, pp. 26–35.
- Demyanyk, Y. and O. Van Hemert (2008), *Understanding the Subprime Mortgage Crisis*, mimeo. Stern School of Business, New York University, <http://ssrn.com/abstract=1020396>.
- Dewatripont, M. and J. Tirole (1994), *The Prudential Regulation of Banks*. MIT-Press, Cambridge, USA.
- Diamond, D.W. (1984), 'Financial Intermediation and Delegated Monitoring', *Review of Economic Studies*, 51, pp. 393–414.

- DiMartino, D. and J.V. Duca (2007), 'The Rise and Fall of Subprime Mortgages', *Economic Letter: Insights from the Federal Reserve Bank of Dallas*, 2, pp. 11.
- Dodd, R. (2007), 'Subprime: Tentacles of a Crisis', *Finance and Development*, 44, Nr. 4, pp. 15–19, <http://www.imf.org/external/pubs/ft/fandd/2007/12/dodd.htm>.
- Dodd, R. and P. Mills (2008), 'Outbreak: U.S. Subprime Contagion', *Finance and Development*, 45, Nr. 2, pp. 14–18, <http://www.imf.org/external/pubs/ft/fandd/2008/06/dodd.htm>.
- Duffie, D. (2007), *Innovations in Credit Risk Transfer: Implications for Financial Stability* mimeo. Stanford University, Stanford, CA, <http://www.stanford.edu/duffie/BIS.pdf>.
- Englund, P. (1990), 'Financial Deregulation in Sweden', *European Economic Review*, 34, pp. 385–393.
- Englund, P. (1999), 'The Swedish Banking Crisis: Roots and Consequences', *Oxford Review of Economic Policy*, 15, pp. 80–97.
- Financial Crimes Enforcement Network: Regulatory Policy and Programs Division, Office of Regulatory Analysis (2006), 'Mortgage Fraud: An Industry Assessment Based on Suspicious Activity Report Analysis', Washington, <http://www.fincen.gov/news-room/rp/reports/pdf/MortgageLoanFraud.pdf>.
- Franke, G. and J.P. Krahnen (2006), 'Default Risk Sharing Between Banks and Markets: The Contribution of Collateralized Debt Obligations', in: M. Carey and R. Stulz (eds.), *The Risks of Financial Institutions*, University of Chicago Press, Chicago, pp. 603–631.
- Gale, D.M. (1992), 'Standard Securities', *Review of Economic Studies*, 59, pp. 731–755.
- Hakenes, H. and I. Schnabel (2008), *Credit Risk Transfer in Banking Markets with Hard and Soft Information*, mimeo. Max Planck Institute for Research on Collective Goods, Bonn.
- Hellwig, M. (1994a), 'Liquidity Provision, Banking, and the Allocation of Interest Rate Risk', *European Economic Review*, 38, pp. 1363–1389.
- Hellwig, M. (1994b), 'Banking and Finance at the End of the Twentieth Century', WWZ Discussion Paper 9426, University of Basel, Switzerland.
- Hellwig, M. (1995), 'Systemic Aspects of Risk Management in Banking and Finance', *Schweizerische Zeitschrift für Volkswirtschaft und Statistik/Swiss Journal of Economics and Statistics*, 131, pp. 723–737, <http://www.sjes.ch/papers/1995-IV-9.pdf>.
- Hellwig, M. (1996), 'Capital Adequacy Rules as Instruments for the Regulation of Banks', *Schweizerische Zeitschrift für Volkswirtschaft und Statistik/Swiss Journal of Economics and Statistics*, 132, pp. 609–612, <http://www.sjes.ch/papers/1996-IV-6.pdf>.
- Hellwig, M. (1998a), 'Banks, Markets, and the Allocation of Risks in an Economy', *Journal of Institutional and Theoretical Economics*, 154, pp. 328–345.
- Hellwig, M. (1998b), 'Systemische Risiken im Finanzsektor', *Zeitschrift für Wirtschafts- und Sozialwissenschaften*, Beiheft 7, pp. 123–151.
- Hellwig, M. (2005), 'Market Discipline, Information Processing, and Corporate Governance', in: K.J. Hopt, E. Wymeersch, H. Kanda and H. Baum (eds.), *Corporate Governance in Context: Corporations, States, and Markets in Europe, Japan, and the US*, Oxford University Press, Oxford, UK, pp. 379–402.
- Hellwig, M. (2007), 'Switzerland and Euroland: European Monetary Union, Monetary Stability and Financial Stability', in: Swiss National Bank (ed.), *The Swiss National Bank 1907–2007*, Neue Zürcher Zeitung Publishing, Zürich, pp. 741–779.
- Hellwig, M. and M. Staub (1996), 'Report on a Panel "Capital Requirements for Market Risks Based on Inhouse Models – Aspects of Quality Assessment"', *Swiss Journal of Economics and Statistics*, 132, pp. 755–776, <http://www.sjes.ch/papers/1996-IV-22.pdf>.

- Hendershott, P.H. and J.D. Shilling (1991), 'The Continued Interest-Rate Vulnerability of the Thrifts', in: R. Hubbard (ed.), *Financial Markets and Financial Crises*, Chicago, University of Chicago Press, pp. 259–282.
- Holmström, B. and P.R. Milgrom (1991), 'Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership and Job Design', *Journal of Law, Economic sand Organization*, 7(suppl.), pp. 24–52.
- International Monetary Fund (2007), 'Market Developments and Issues, Global Financial Stability Report', Washington, DC, April 2007, <http://www.imf.org/External/Pubs/FT/GFSR/2007/01/text.pdf>.
- International Monetary Fund (2008a), 'Containing Systemic Risks and Restoring Financial Soundness, Global Financial Stability Report', April 2008, <http://www.imf.org/External/Pubs/FT/GFSR/2008/01/index.htm>.
- International Monetary Fund (2008b), 'Financial Stress and Deleveraging: Macro-Financial Implications and Policy, Global Financial Stability Report', October 2008, <http://www.imf.org/External/Pubs/FT/GFSR/2008/02/index.htm>.
- Jensen, M. C. and W.H. Meckling (1976), 'Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure', *Journal of Financial Economics*, 3, pp. 305–360.
- Kane, E.J. (1985), *The Gathering Crisis in Federal Deposit Insurance*. MIT-Press, Cambridge, USA.
- Kane, E.J. (1989), *The S & L Insurance Mess: How Did It Happen?*. Urban Institute Press, Washington, DC.
- Kiff, J. and P. Mills (2007), 'Money for Nothing and Checks for Free: Recent Developments in U.S. Subprime Mortgage Markets', International Monetary Fund Working Paper 07/188.
- King, M. (1990), 'International Harmonization of the Regulation of Capital Markets', *European Economic Review*, 34, pp. 569–577.
- Kuran, T. (1995), *Private Truths, Public Lies – The Social Consequences of Preference Falsification*. Harvard University Press, Cambridge, Massachusetts.
- Méltitz, J. (1990), 'Financial Deregulation in France', *European Economic Review*, 34, pp. 394–402.
- Myers, S.C. and R.G. Rajan (1998), 'The Paradox of Liquidity', *Quarterly Journal of Economics*, 113, pp. 733–771.
- OECD (1992), *Banks Under Stress*. OECD Publications, Paris.
- Peltzman, S. (1975), 'The Effects of Automobile Safety Regulation', *Journal of Political Economy*, 83, pp. 677–725.
- Reid, M. (1982), *The Secondary Banking Crisis 1973–1975: Its Causes and Course*. Macmillan, London.
- Rochet, J.-C. (1992), 'Capital Requirements and the Behaviour of Commercial Banks', *European Economic Review*, 36, pp. 1137–1178.
- Rona-Tas, A. and S. Hiß (2008), 'The Art of Corporate and the Science of Consumer Credit Rating', Paper Presented at the 38th World Congress of the International Institute of Sociology.
- Schaefer, S.M. (1990), 'The Regulation of Banks and Securities Firms', *European Economic Review*, 34, pp. 587–597.
- Schnabel, I. and H.S. Shin (2004), 'Liquidity and Contagion: The Crisis of 1763', *Journal of the European Economic Association*, 2, pp. 929–968.
- Schütz, D. (1998), *Der Fall der UBS*. Weltwoche-Verlag, Zürich.
- Schwartz, E.S. and W. N. Torous (1991), 'Caps on Adjustable Rate Mortgages: Valuation, Insurance, Hedging', in R. Hubbard (ed.), *Financial Markets and Financial Crises*, University of Chicago Press, Chicago, pp. 283–302.

- Shleifer, A. (2000), *Inefficient Markets: An Introduction to Behavioral Finance*. Oxford University Press, Oxford, UK.
- Slacalek, J. (2006), 'What Drives Personal Consumption? The Role of Housing and Financial Wealth', Discussion Paper 647, Deutsches Institut für Wirtschaftsforschung, Berlin, <http://www.diw.de/documents/publikationen/73/44944/dp647.pdf>.
- Staub, M. (1998a), 'Inter-Banken-Kredite und systemisches Risiko', *Schweizerische Zeitschrift für Volkswirtschaft und Statistik/Swiss Journal of Economics and Statistics*, 134, pp. 193–230, <http://www.sjes.ch/papers/1998-II-5.pdf>.
- Staub, M. (1998b), 'The Term Structure of Interest Rates and the Swiss Regional Banking Crisis – Empirical Evidence and its Limits', *Schweizerische Zeitschrift für Volkswirtschaft und Statistik/Swiss Journal of Economics and Statistics*, 134, pp. 655–683, <http://www.sjes.ch/papers/1996-IV-19.pdf>.
- Staub, M. (1998c), 'Report on a Panel "International Contagion: What Is It and What Can be Done Against It?"', *Schweizerische Zeitschrift für Volkswirtschaft und Statistik/Swiss Journal of Economics and Statistics*, 134, pp. 715–721, <http://www.sjes.ch/papers/1998-IV-23.pdf>.
- Stiglitz, J.E. and A.M.Weiss (1981), 'Credit Rationing in Markets with Imperfect Information', *American Economic Review*, 71, pp. 393–410.
- Takala, K., und M.Virén. (1995), 'Bankruptcies, Indebtedness and the Credit Crunch', Bank of Finland Discussion Paper No. 28/95, Helsinki.
- UBS (2008), 'Shareholder Report on UBS's Writedowns', <http://www.ubs.com/1/e/investors/shareholderreport/remediation.html>.
- Useem, M. (1993), *Executive Defense: Shareholder Power and Corporate Reorganization*. Harvard University Press, Cambridge.
- Vives, X. (1990), 'Deregulation and Competition in Spanish Banking', *European Economic Review*, 34, pp. 403–411.
- Wuffli, P. (1995), 'Comment on the Paper by Professor Hellwig, Systemic Aspects of Risk Management in Banking and Finance', *Schweizerische Zeitschrift für Volkswirtschaft und Statistik/Swiss Journal of Economics and Statistics*, 131, pp. 139–140.