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The Future of Securitization

BY NOW, THE so-called credit crisis is more than a year old. Over its course, the crisis has caused enormous casualties, forcing large international banks to write off hundreds of billions of dollars. While most of those losses were borne by private investors, namely bank shareholders, the state has had to absorb considerable casualties as well, particularly in the United States, the United Kingdom, and Germany. Bailouts were experienced in Germany (IKB, Sachsen LB), in the United Kingdom (Northern Rock), and most dramatically in the United States (Freddie Mac, Fannie Mae, Bear Stearns, AIG). Finally, a huge \$700 billion rescue package was passed in the United States, and various countries in Europe followed with similar state support packages. Accumulated losses of financial intermediaries were estimated at more than \$500 billion as of early September 2008 (table 4-1)—an amount equal to about 20 percent of the U.S. budget (3.6 percent of U.S. GDP in 2007 or 18 percent of Germany's 2007 GDP).

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Table 4-1. *Accumulated Write-Downs by Region*

US\$ billions

<i>Region</i>	<i>Total</i>	<i>3Q2008^a</i>	<i>2Q2008</i>	<i>1Q2008</i>	<i>4Q2007</i>	<i>3Q2007</i>
Worldwide	516.3	18.1	115.1	168.0	167.9	47.2
United States	263.0	18.1	70.3	69.3	75.9	29.4
Europe	229.5	0.0	41.3	89.3	81.3	17.6
Asia	23.9	0.0	3.4	9.4	10.7	0.4

Source: DZ Bank (2008).

a. Preliminary figures.

The epicenter of the crisis lies in the so-called subprime segment of the U.S. housing market, where loan-to-value ratios have risen over time, often exceeding 1. The cooling down of the U.S. real estate market in the first half of 2007, sometimes characterized as the bursting of a housing price bubble, led to write-downs of the banks' loan books. There were two major channels of contagion, one direct, the other more indirect, which shifted loan losses to investors. As for the direct channel of contagion, investors who had held chunks of banks' loan portfolios—for example, in the form of tranches of securitized portfolios—experienced significant write-downs of their financial claims. Investors holding commercial paper were almost universally bailed out by the sponsoring bank or by the state if the former was in distress itself. Examples of loss-taking institutions are Citibank, Merrill Lynch, UBS, and HSBC, among many others (table 4-2).

Then there is the indirect channel of contagion, following from the dramatic rise in credit default swap (CDS) spreads and lending rates in the interbank market, where lending rates reached record levels for an extended period and the inter-

Table 4-2. *Top Five Loss-Taking Institutions*

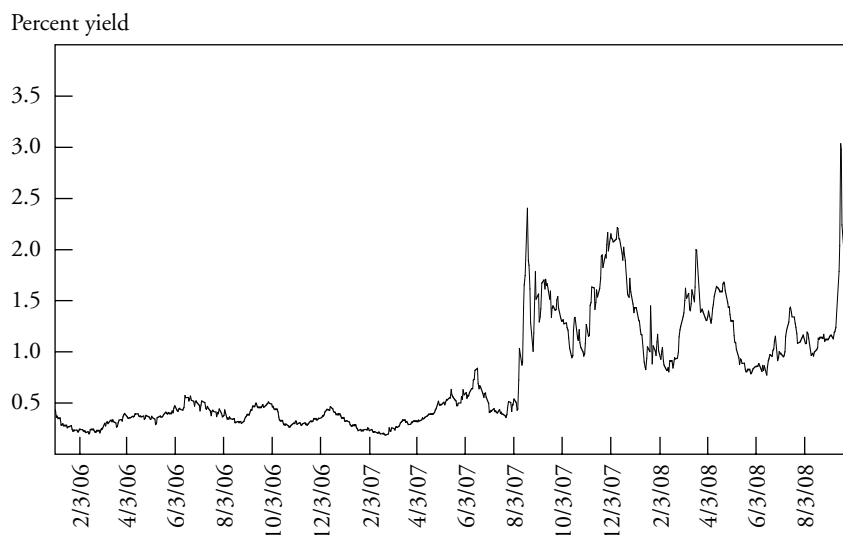
US\$ billions

<i>Firm</i>	<i>Total</i>	<i>3Q2008^a</i>	<i>2Q2008</i>	<i>1Q2008</i>	<i>4Q2007</i>	<i>3Q2007</i>
Citigroup	55,1	0,5	11,7	19	18,2	5,7
Merrill Lynch	52,2	6,1	9	9,7	18	10,6
UBS	44,2	0	6	19,2	14,4	10,6
HSBC	27,4	0	9,5	4,2	10	3,7
Wachovia	22,7	0,3	13	4,4	3,2	1,8

Source: DZ Bank (2008).

a. Preliminary figures.

Figure 4-1. *Spread between Three-Month LIBOR and Three-Month Treasury Bills^a*



Source: Bloomberg (2008).

a. TED spread, in percent, from third quarter 2005 to third quarter 2008.

bank market became shallow. For some institutions, like Bear Stearns and Northern Rock in March 2008 and Lehman Brothers in September 2008, interbank lending became virtually impossible, and these institutions became illiquid.¹ While Northern Rock was bailed out and Bear Stearns was taken over by JPMorgan Chase with the help of a government subsidy, Lehman Brothers went bankrupt. The indirect channel affected mainly institutions that relied heavily on interbank lending, investment banks in particular. Extremely high levels of LIBOR over risk-free rates (see figure 4-1) and an unprecedentedly small supply of funds in the interbank market forced banks to boost their liquidity reserves. The write-downs of their asset portfolios diminished the banks' equity capital and forced them to raise capital from investors, including sovereign Wealth Funds.

Furthermore, the breakdown of the interbank market urged central banks, notably the Fed, the Bank of England, and the European Central Bank (ECB), to

1. On a single day, March 13, 2008, the liquid assets of Bear Stearns shrank from \$12.5 billion to \$2 billion and credit lines were closed.

provide ample access to liquidity for banks. While not being a bailout, the provision of large quantities of central bank lending facilities saved several large banks from becoming illiquid. These central bank interventions were initially intended to be of a short, transitory nature, but such facilities have been extensively used for now more than a year, and there are no signs of a decline in interventions. In the course of providing liquidity assistance, some central banks are said to have taken huge stocks of low-quality collateral on their books.

The broad and extended loss of confidence in the liquidity and solvency of financial institutions, which caused the breakdown of the interbank market, is probably the most distinguishing characteristic of the current financial crisis. It also differentiates this event from many earlier episodes of financial market turmoil, as, for instance, the Asian or the Russian crisis (see Allen and Gale 2007 for a survey).

Given the medley of terrifying headlines that filled the international newspapers during 2008, the call for new and stricter bank supervision rules is anything but surprising. For example, in April 2008, the Financial Stability Forum and the Bank of England proposed regulatory measures to restore the overall confidence of investors in the functioning of the global financial system.² After September 15, Black Monday, governments claimed even more strongly that the observed market failure needed to be cured through more regulation related to improving

- prudential oversight of capital, liquidity, and risk management, allowing for countercyclical capital adjustments³

- transparency and regulation, facilitating the pricing and ensuring the tradability of complex financial instruments on secondary markets

- the rating process, stipulating different rating scales for structured and non-structured products

- the sophistication of supervisors with respect to risk control.

In addition, there has been intense discussion on how to avoid the adverse interaction (“downward spiral”) between declining asset prices and deteriorating balance sheets that has required equity capital infusions to banks. The International Accounting Standards Board now has relaxed the conditions under which banks are allowed to deviate from marking their assets to market. In addition, banks are permitted to reclassify assets from the trading book to the bank book if

2. Financial Stability Forum (2008); Bank of England (2008).

3. See also Kashyap, Rajan, and Stein (2008) on this last point, which emphasizes time-varying capital requirements and state-contingent capital infusions.

the assets are held to maturity. The proposed reform of accounting standards is also intended to lower the suspected pro-cyclicality of the prevailing Basel 2 capital standards, which allegedly is driven by negative spiral effects.⁴

But is tighter regulation reasonable? History teaches us that changes in the regulatory framework are long-lived and very hard to adjust once they are in place. History also suggests that regulatory overreaction often follows financial crises, with Sarbanes-Oxley being a recent example (see Coates 2007). Furthermore, the case for or against a particular regulatory action should be well founded on an economic analysis of the causes and determinants of the current crisis.

Although we agree that the current situation reveals a market failure, we first analyze its causes on the microlevel, by looking at financial intermediaries. Since factual knowledge is lacking, the attribution of causes to what we observe in markets should be followed by detailed empirical checks in the future. Since such checks probably will take years to complete, we present our current understanding now, conceding limited empirical knowledge. We believe that incentives in banks, financial value chains, and rating agencies are at the core of the problem. Incentive misalignment in banks and in financial value chains tends to lower the quality of financial products, thus destabilizing asset valuation. Moreover, incentive misalignment tends to raise the leverage of financial intermediaries. Both effects undermine transparency with respect to asset quality and the risk position of financial intermediaries if ratings turn out to be unreliable. The unreliability of ratings appears to be driven by incentive misalignment within the rating agencies. This cocktail of effects inevitably destabilizes financial markets and the financial system. We therefore argue that incentives need to be changed not only to align the interests of managers and shareholders, but also to give managers incentives to preserve financial stability. These changes can be effective only if there is enough transparency about financial assets and financial intermediaries. Intermediaries providing little transparency about their financial strength endanger financial stability and therefore should be required to provide higher equity capital.

That said, we readily concede that macroeconomic factors, particularly low interest rates, ample liquidity, and the sudden drop in house prices, have contributed

4. See Goodhart and Persaud (2008a) on this. We do not take up a detailed discussion of accounting standards in this chapter; however, we believe the impact of fair value accounting on the crisis to be grossly exaggerated. Furthermore, departing from fair value principles in the midst of a crisis may increase rather than decrease uncertainty because balance sheets and profit-and-loss (P&L) statements are likely to become even more opaque if fair value is abandoned. We believe opacity to be one of the major reasons for the demise of interbank lending and market illiquidity.

greatly to the severity and the depth of the crisis. We maintain, however, that the fundamental structural cause of the crisis is one of incentive misalignment.

Drawing on recent academic literature, including our own research, we try to provide a consistent description of what has happened in the market for structured finance. Understanding the mechanics of structured finance is essential to understanding why it ~~is~~ was possible that so many experts—economists, financial engineers, bankers—were caught by surprise when the crisis hit in the late spring of 2007. We then discuss the actions that we believe are required to correct the problems. More generally, we discuss the promise that securitization holds for the future as well as its limits.

What Happened? A Brief Account

The current crisis has produced large numbers of distressed loans, mortgage-backed loans in particular. That is nothing new; as Reinhart and Rogoff (2008) shows, this type of crisis is recurring and appears to be related to economic downturns following boom phases. We do not ask what drives these repetitive crises; we ask instead what about the current crisis is new, hoping to find constructive approaches to revising the way that assets are securitized .

The historical events leading up to the current crisis have recently been described by several authors. Brunnermeier (2009) and the Bank for International Settlements (2008), for example, give a detailed account of major events leading to the crisis. Along general lines, one may distinguish first a buildup phase and three subsequent waves of devaluation of bank assets. The buildup ~~starts~~ roughly in the mid-1990s, when the technique of securitization was gradually applied to a wider range of asset classes, from real estate investments to car loans and credit card debt. Simultaneously, the design of ABS (asset-backed security) transactions became more complex, starting with straightforward issues and culminating in collateralized debt obligation cubed (CDO³) transactions with hard-to-replicate stochastic properties. Over the entire build-up period, spreads on credit instruments remained stable and relatively low.

Though there were early whistleblowers—for example, the annual reports of the Bank for International Settlements (BIS) since 2006—the first serious signs of a crisis appeared in July 2007, when two of Bear Stearns's hedge funds got into trouble and had to be bailed out by the mother company, the investment bank. Only a few days later, the first wave of devaluations struck the financial industry, accompanied by the first wave of downgraded ratings. The devaluations made refinancing almost impossible for asset-backed commercial paper (ABCP) programs. While there are now write-offs in many parts of the banking industry, the

first institution to run into deep trouble was a European bank at the far end of the financing chain, IKB in Germany, followed by Sachsen Landesbank. These two overexposed semi-state-owned institutions had to be bailed out, mostly by the German state and German banks. Soon thereafter, Northern Rock, a British retail mortgage bank that had copied the U.S. subprime lending model, was rescued and nationalized following a run on the bank.

The second phase of the crisis lasted roughly one year, from September 2007 through summer 2008. Banks in the United States, the United Kingdom, Germany, Switzerland, Belgium, and the Netherlands, particularly warehousing banks, were experiencing regular, large, quarterly asset write-downs (tables 4-1 and 4-2), while the interbank market almost completely dried up. Central banks intervened, opening additional discount windows, which grew over time, resulting in ever larger liquidity infusions. The infusions were accompanied by a rising volume of government paper issues, largely neutralizing the money supply. Simultaneously, investment banks around the world tried to raise additional capital, giving sovereign wealth funds from China and other Asian countries the opportunity to enter the market. However, the speed at which capital was eroding was not matched by the buildup of new capital.

The third phase of the crisis started in the summer 2008, when the world's biggest private real estate financiers, Freddie Mac and Fannie Mae, had to be taken over by the U.S. federal government. The resulting additional problems in the interbank market swamped the investment banks, which, one after the other, lost much of their market capitalization before they were either liquidated (Lehmann Brothers) or taken over by a commercial bank (Bear Stearns, Merrill Lynch) or they transformed themselves into commercial banks (Goldman Sachs, Morgan Stanley).

The three phases of the crisis (as of fall 2008) were accompanied by different government reactions. While the regulators did not care much about securitization markets before summer 2007, they responded by selectively rescuing institutions like Bear Stearns, IKB, and Northern Rock. Only in the second phase did they become willing to nationalize institutions, in particular Fannie Mae and Freddie Mac, to stabilize the market. In the third phase, still under way today, governments have come up with a variety of measures, like bank deposit guarantees, interbank loan insurance, the bailout of poorly performing bank assets—such as U.S. Treasury Secretary Henry Paulson's Troubled Asset Relief Program (TARP)—and the provision of equity capital to troubled banks, whether compulsory for all banks (in the United States) or voluntary (in Germany).

The steady intensification of state intervention is one remarkable feature of this crisis. The opaqueness of financial markets and institutions is a second unique feature. Investors obviously retreat from markets when asset or counter-

party risk cannot be reasonably estimated. A third remarkable feature is the complete breakdown of interbank markets, which gives central banks a big role to play, effectively substituting for interbank lending.⁵

Why Did It Happen? The Costs and Benefits of Securitization

We used results from the academic literature on contract design to assess the contribution of asset securitization to market efficiency and (investor) welfare, examining both theory and evidence, the latter often scarce. We find that some key assumptions of the textbook securitization model were in effect not met and that the theory was descriptively false. We find four key arguments for a positive contribution of securitization, which require further discussion:

—improved risk allocation: enhancing economy-wide risk sharing through contingent claims (achieving market completion)

—responsible disintermediation: preserving incentives for lenders to monitor obligors in a lending relationship with funding by third parties

—transparency of traded assets: disentangling information-sensitive and information-insensitive assets (creating tradable high-quality claims from a pool of lower-quality, illiquid assets)

—transparency of the risk profile of financial intermediaries engaged in securitization to help to stabilize their funding.

As a corollary to the second and third arguments, we argue that secondary market liquidity of complex financial instruments is directly related to the reliability (accuracy, stability, and validity) of announced asset quality—that is, unbiased rating, which, in turn, is a function of responsible disintermediation.

Risk Transfer and Diversification

Theory tells us that improving worldwide risk allocation and enhancing investor diversification should be major benefits of securitization. By securitizing otherwise nontradable assets, like credit card debt and corporate and consumer loans, the creditor can transfer asset risks to other financial intermediaries and private investors (households). Eventually risks are always borne by private investors, whether risks are intermediated or not. Therefore a bank may retain some risks that, under normal market conditions, are effectively borne by its shareholders.

5. While we focus on crisis prevention in this chapter, we emphasize the formative role of crisis management on future crisis prevention. The high tide of government interventions seen today probably will reshape the incentives of tomorrow's bankers just as much as any forthcoming regulation; it therefore needs to be taken into consideration as well.

However, securitized claims are easier to trade than loan portfolios, just as bonds are easier to trade than loans.

Another benefit of securitization derives from the fact that the underlying asset typically is a portfolio of claims rather than a single claim. Investing in a securitization tranche therefore corresponds to buying a highly diversified claim; no extra effort is needed to diversify individually, at presumably higher transaction costs. This benefit resembles the benefit realized by buying exchange-traded funds instead of a large number of individual stocks.

The available empirical evidence on market growth is consistent with the theoretical benefits mentioned above. Figure 4-2 portrays the strong worldwide growth in securitization issuance until 2006, indicating strong reallocation of default risks. Even though statistics on the allocation of securitization tranches are still almost nonexistent, the available figures on write-downs of bank asset positions give some indication (see tables 4-1 and 4-2).

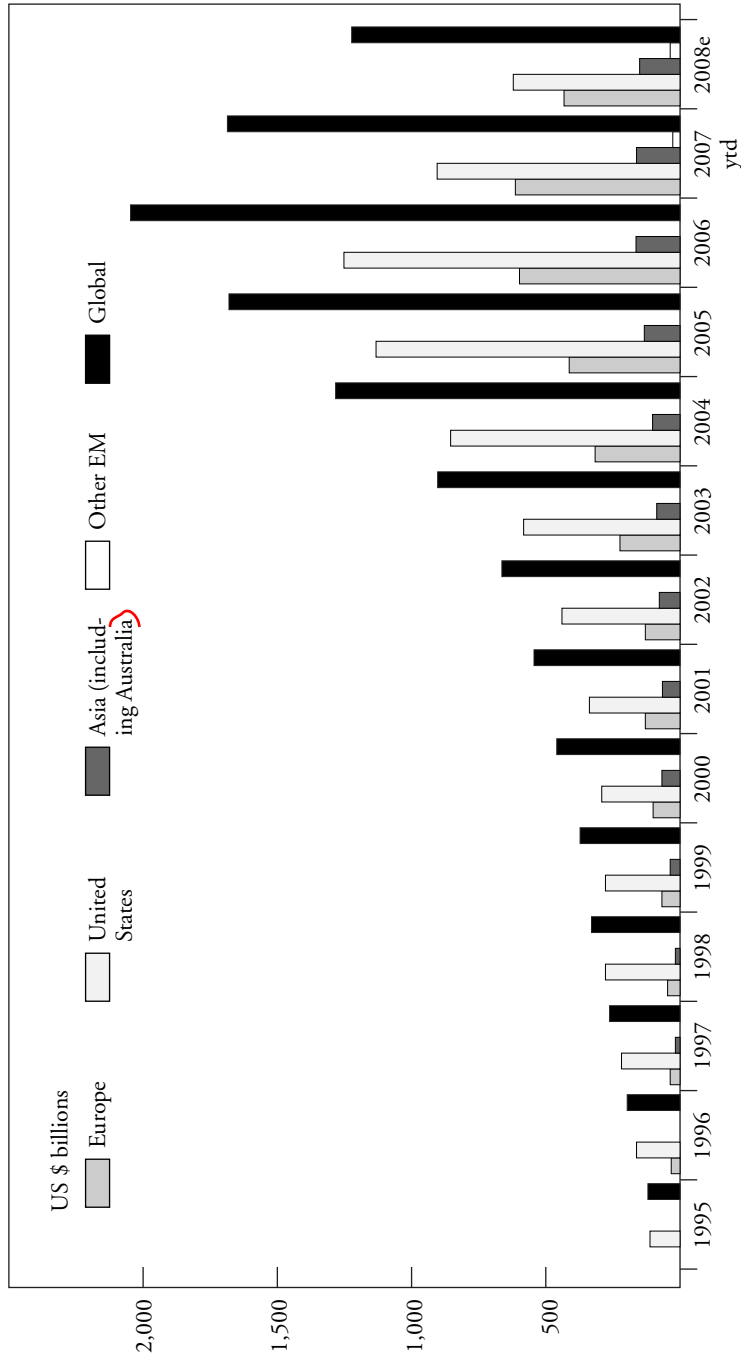
These write-downs include all bank assets. They are not confined to securitization tranches; they also include loans—in particular, leveraged loans related to mergers and acquisitions. As shown in table 4-1, at the beginning of September 2008, banks worldwide had written off \$516 billion, 51 percent of which related to U.S. banks, 45 percent to European banks, and the rest to Asian banks.

These figures indicate that European banks have bought a large share of securitized risks and leveraged loans, consistent with the above theory on the gains of diversification. Previous crises in the U.S. real estate sector were domestic, with little recognition in Europe and outside the United States in general, suggesting that securitization helped the current crisis to spread around the world. Therefore, we conclude that securitization contributed to broad, worldwide dissemination of risk.

The empirical evidence also supports the existence of strong diversification benefits. Usually the loans pooled in a transaction involving residential mortgage-backed securities (RMBSs) add up to a par value of at least \$1 billion per transaction. Since a single loan typically does not exceed a par value of \$0.5 million, often many more than 2,000 different residential mortgage-backed loans are pooled in a single transaction. The ensuing diversification benefit is very strong even though regional risk or loan-type risk (such as risks of subprime loans versus those of other types of loans) may be strong. Similarly, diversification is very good in credit card, auto loan, and corporate loan securitizations, while it tends to be not as broad in corporate bond transactions.⁶

6. In a study of 169 European securitizations of corporate loans and bonds, Franke, Herrmann, and Weber (2007) finds an average Moody's diversity score of 88 for corporate loan securitizations but only 45 for corporate bond securitizations. The diversity score ranges between 1 (no diversification) and 135.

Figure 4-2. *Global Issuance of Asset-Backed Securities^a*
 Global ABS issuance 2007 year to date and 2008 projection



Source: HSBC Global Research (2007).
 a. Data include cash ABS publicly announced and rated but not necessarily publicly placed with investors over the past months.

Risk Transfer and Asymmetric Information

The benefits of securitization come at a cost related to the problems implied by information asymmetries. Securitization is a technology that attempts to handle the inherent conflict between efficient decisionmaking and optimal worldwide risk allocation. Efficient decisions are supported if the decisionmaker has to bear all the consequences of his or her decision. That is typical of the bank-based model, in which a bank takes the lending decision and retains the loan on its books until maturity, forgoing benefits from improved risk allocation. In the market-based model, the bank takes the lending decision but transfers the risks to other parties. Thus, risk allocation is improved, but decisionmaking is no longer efficient. The latter follows because, in a world of asymmetric information, the bank inevitably tries to benefit from adverse selection and moral hazard, rendering its decisions second best. Securitization combines the bank- and the market-based models to use their strengths and avoid their weaknesses. However, the empirical evidence so far raises large questions about the securitization model.

Securitization is one way to use the screening technology of originators without being constrained by their ability to generate funds on their own balance sheet. Therefore, securitization facilitates specialization among financial intermediaries. It may increase the scale of operations of these institutions and, at the same time, broaden the investor base willing to fund their assets directly rather than through bank deposits or bank bonds—and to bear the accompanying risk. To the extent that securitization leads to better risk allocation and to more investors bearing the risks, potential welfare benefits arise.

However, securitization raises agency problems on various levels. First, conflict arises between the originating bank and investors buying securitization tranches. Second, additional conflicts arise if loan origination and servicing is not done by the bank but split into several specialized jobs and delegated to various agents in a value chain. Third, there is an agency problem between bank managers and bank shareholders. Fourth, bank shareholders may be interested in bank policies that benefit them at the expense of financial stability—that is, losses are imposed on third parties.

Two-Tier Agency Relationships: Theory

If all securitization activities are concentrated in one bank, then, apart from borrowers, only the bank and investors are involved. We first address the agency conflict between the bank and investors. Information asymmetries between banks as lenders and tranche investors give rise to adverse selection and moral hazard. This is a typical agency problem. The lending bank grants the loans and transfers

the risk of the loans to the investors. The bank has a strong incentive to overstate the quality of the loans in order to buy protection against default losses at lower cost. Investors anticipate that problem and charge higher credit spreads. However, if loan quality deterioration is imperfectly recognized by investors and rating agencies alike, as was the case in the subprime market of 2006, credit spreads on securitization tranches are downward biased. That bias inflates securitization profits and enhances adverse selection as long as the credit spreads on the underlying loans correctly reflect the loan quality. More generally, mispricing in one market creates arbitrage opportunities through risk transfer. Gorton (2008) points to product complexity as another reason for adverse selection. While the seller understands the product, the buyer does not; therefore the buyer may be systematically misled and eventually pay too much.

Besides adverse selection, the bank servicing the loans may be subject to moral hazard. Once default risk is transferred, the bank has little incentive to monitor the obligors or to restructure a loan if necessary to reduce the default risk. From standard agency theory, the conflict between the principal and the agent leads to a second-best contract in which the agent bears more default risk than in a first-best contract. The optimal share of the risk held by the agent is a compromise between optimal incentives and optimal risk allocation; thereby the interests of the principal and the agent are partially aligned.

In securitization transactions, the “magic trick” of incentive alignment is achieved by a contractual device that is very familiar from insurance contracts—the deductible.⁷ Of all the issued tranches with different ranks, the lowest-ranked tranche is supposed to be retained by the issuer. That note is called the first loss piece, or the equity tranche. By construction, the first loss piece fully absorbs all default losses up to its notional amount; therefore it pays a very high coupon. In many cases, the first loss piece will have lost a substantial part of its face value before it matures, explaining its widespread characterization as “toxic waste.”

In true sale transactions, the equity tranche represents the first loss piece. In synthetic transactions, the junior credit default swap by which the originator buys protection from an investor may contain a threshold and only default losses beyond that threshold are reimbursed by investors. That threshold then, is the first loss position of the originator unless the originator buys insurance from oth-

7. Despite the terminology, the contractual design in structured finance closely resembles designs practiced in the reinsurance industry over centuries. Nonproportional reinsurance in the form of aggregate excess loss leads to payoff patterns similar to those observed in standard ABS transactions. For an early description of reinsurance contracts, see Kopf (1929). Doherty and Smetters (2005) discusses alternative ways and means to align incentives from an insurance perspective. The optimality of deductibles is shown by Arrow (1971).

ers. In addition to the threshold, there may be an unrated tranche, issued by a special-purpose vehicle, which is strictly subordinate to all rated tranches. In this case, the threshold and the unrated tranche together may be considered the first loss piece.

If the bank fully retains the first loss piece, then it retains most of the default risk, since the size of the first loss piece is typically considerably larger than the expected loss of the asset pool (see Franke and Krahnert 2006). That strongly mitigates the aforementioned information asymmetry problems, but it also strongly limits risk transfer and hence is a strong barrier to optimal risk allocation. Agency theory, however, does not require the bank to fully retain the first loss piece. As in insurance contracts, the insured may retain a deductible of, for example, 15 percent of the damage up to a given limit, and that may be sufficient to effectively constrain moral hazard. Similarly, if the bank retains, say, 15 percent of the first loss piece, that may be sufficient to effectively and credibly constrain adverse selection and moral hazard. Whether that is true or not is an empirical issue.

Securitization not only tranches the underlying portfolio into a first loss piece and a more senior remainder of the issue but also splits the rest into several tranches according to strict rules of subordination. The basic technique used in securitization consists of pooling the payment streams of a given asset pool and routing the cash flow to different classes of bonds, called tranches, in order to offer a wide variety of claims of different quality. That enables different groups of investors to buy the claims that fit their needs best. Strict subordination implies, for each payment date, that investors buying part of the lowest tranche, the first loss piece, will receive payments only after all other investors buying senior tranches have satisfied their interest and principal claims in full. Similarly, a mezzanine tranche will receive payments only after all tranches senior to the mezzanine tranche have been fully served, and so on to the highest, most senior tranche, which will be served before all other tranches.

However, the first to be served is the originating bank, which gets fees for arranging and servicing. Often this bank also is the swap counterparty for the special-purpose vehicle, allowing it to collect additional fees hidden in the swap terms. Therefore the originating bank has a first profit position, which is a super-senior position and hence almost risk free. To illustrate the first profit position, consider a true sale transaction. Usually the market value of the underlying portfolio exceeds the par value by 3 to 7 percent, but the par values of all tranches together never exceed the par value of the underlying portfolio. The surplus is translated into the first profit position. The originator may also be able to sell part of the first profit position through net interest margin or interest-only certificates. The first profit position motivates the originator to expand the transaction

volume so as to generate higher profits, irrespective of default risk. The super-seniority of the first profit position creates another wedge between the originator and investors.

The properties of pooling and tranching have been analyzed in the security design literature, in particular by Greenbaum and Thakor (1987), Duffie and DeMarzo (1999), Plantin (2003), DeMarzo (2005), and Franke and Krahnén (2006). These studies show that under certain conditions relating to information distribution, risk management capacity, and risk aversion, tranching can emerge as an optimal contractual device to allocate cash flows. In particular, tranching allows for incentive alignment when the underlying assets are subject to moral hazard or adverse selection. Securitization thus should arrive at the optimal trade-off of the costs and benefits of improved risk allocation among the agents in the economy.

As argued above, agency theory tells us that the party affecting through its activities the level of default losses should bear a substantial portion of those losses. Hence the originating bank should retain a substantial part of the first loss piece. Mezzanine tranches often carry below-investment grade ratings because their default probability is substantial. In Plantin (2003), mezzanine tranches are marketed to sophisticated investors—that is, investors with comparatively high monitoring capability—because buyers of mezzanine tranches face a substantial probability of being hit by default losses before the bond matures, implying the need to take over the monitoring task from the holder of the first loss piece. Once the first loss piece is completely absorbed, the mezzanine tranches effectively take over the role of the most junior claim. Since the task of monitoring requires special expertise, mezzanine note holders are likely to be sophisticated investors, like investment banks or hedge funds, effectively shielding senior tranche holders from the cost of incentive misalignment—that is, from a further decrease in asset quality.

This brings us to another hypothesized contribution of securitization to welfare, namely the creation of information-insensitive senior tranches. More precisely, senior tranches are information insensitive in the sense that their payoff strongly depends on macroeconomic tail risk, not idiosyncratic or firm-specific risk.⁸ That allows remote investors like households or pension funds to fund the asset pool directly without having to worry about firm-specific information or monitoring of the originating bank. Information-insensitive tranches require no

8. On a more general level, securitization may be interpreted as completing the market, since the tranches issued in the process of securitization are nonproportional claims on the underlying risk. Their payoffs depend on macro factors; therefore securitization may be seen as a technique to create state-contingent claims. Investors buy notes carrying predominantly tail risk characteristics. Such securities are called senior bonds, and in today's markets a large fraction of those bonds carry a standardized risk load, rated triple A, signaling a very low expected default probability.

risk management expertise of their buyers and therefore are well suited for remote investors. Information-sensitive tranches, however, should be purchased by sophisticated investors only. This benefit of strict subordination should clearly contribute to the welfare gains achieved by securitization. Therefore, theory predicts substantial first loss piece retention by the originating bank in a typical securitization transaction, while mezzanine tranches are held by sophisticated investors and the most senior tranches are held by remote investors.

Information insensitivity of senior tranches is also of great relevance to the emergence of a secondary market for such instruments. With insensitivity to firm-level information, notes can be traded among investors essentially without recourse to firm-level information and therefore without fear of adverse selection and moral hazard. That reduces the information cost for traders and stabilizes the market value of senior tranches.

In summary, apart from the benefits of improved risk allocation, we find three characteristics of securitization transactions that are potentially relevant to the valuation of these instruments. First, incentive alignment between originator and investor is achieved through an adequate level of recourse, typically through full or partial retention of the equity piece.⁹ Second, incentive alignment is further secured by mezzanine investors, since they are potential substitutes for the holders of the equity tranche if portfolio losses reach higher levels. That is why mezzanine tranches are held by sophisticated investors. Third, senior tranches are exposed to systematic tail risk only, making these notes an ideal asset class for non-informed investors like households and pension funds.

Three statements regarding the originating banks can be made. First, securitization allows banks to transfer tail risk from bank balance sheets to investors outside the financial sector, relying on senior tranches. Second, securitization does not lead to unlimited risk transfer, as equity tranches tend to be retained. That is also in the interest of the bank because it reduces its cost of buying protection. Third, transferring part of its loan book to the capital market enables a bank to take new risks. It may even lead to more aggressive risk taking if investors are not aware of it, allowing the bank to benefit from additional adverse selection and moral hazard.

Two-Tier Agency Relationships: Evidence

Eventually risks have to be borne by individuals. In an intermediated world, risks are borne to some extent by the intermediaries, but given the substantial costs of intermediary insolvency, their insolvency risk should be limited. The

9. This presupposes that the equity piece is large enough to cover a suitable quintile of the loss distribution. There are functionally equivalent alternatives to equity piece retention, like contractually specified conditional recourse of investors to the originator.

securitization of bank loans is widely seen as one such mechanism, reducing insolvency risk by the transfer of at least part of the loan default risk to other players. Whether securitization achieves that objective depends on various effects. First, to what extent are default risks actually transferred in real-world securitization transactions? Second, does the risk transfer in securitizations reduce or increase the overall risks taken by securitizing banks? Third, does the risk transfer in securitizations undermine the quality of bank lending? Fourth, does risk transfer render risk allocation in financial markets more opaque? The last two questions are dealt with in more detail in the following discussion.

First, we analyze the size and the allocation of the first loss piece (FLP). In a sample of forty European securitization transactions, Franke and Krahnén (2006) finds that in most transactions, the FLP covers a quintile of more than 85 percent of the portfolio loss rate distribution.¹⁰ Of course, that number depends strongly on the ratings assigned to the underlying asset pools as well as on the default correlations assumed in the simulations. Our correlations are similar to those of the rating agencies. Given the high loss absorption by the first loss piece, forcing the originator to fully retain it would largely eliminate any transfer of default risk. But full retention is probably not necessary, as argued above. Nevertheless, we might expect the originator to retain a portion of 15 to 25 percent. If investors know about first loss retention, they can obtain more accurate estimates of default risk and condition their expectations accordingly.

Surprisingly, however, the allocation of risk in securitization transactions is one of the industry's well-guarded secrets. Originating banks never appear to commit in public to retaining a certain fraction of the FLP. Perhaps they consider it important to maintain their freedom to change their position in the FLP over time; perhaps they expect some investors to believe, naively, that they retain a large fraction. They may be afraid, therefore, to disappoint investors by announcing low fractions. On the other hand, anecdotal evidence indicates that smart investors buy rated tranches only if the originator promises to retain some minimum fraction of the FLP. However, in the year before the outbreak of the subprime crisis, anecdotal evidence showed an increasing number of transactions being issued with no retention of the FLP.¹¹ The opacity regarding the allocation

10. For further studies that confirm the extreme riskiness of the first loss piece, see Haensel and Krahnén (2007) and Franke, Herrmann, and Weber (2007). Both studies find that the FLP bears, on average, between 80 and 90 percent of the expected default losses of the securitized portfolios. Those numbers are derived from replicating the loss rate distribution of the underlying asset portfolios, since the allocation of expected losses to individual tranches is not public information. Furthermore, the numbers cannot be used to gauge effective risk transfer, since that depends on whether a tranche is retained by the originator.

11. We have no hard evidence to back up this claim; we rely here on information obtained during private conversations with managers in the industry.

of the FLP is complemented by the opacity regarding the size of the almost risk-free first profit position. Although some servicer fees may be declared in the offering circular, investors know little about the size of the first profit position.

Buyers of the FLP risk presumably are mostly banks and, to a lesser extent, hedge funds and insurance companies.¹² Bank for International Settlements (2008), a study based on surveys conducted by the Basel Institute of leading international banks, notes that equity tranches were acquired predominantly by asset managers, active traders, and institutional investors;¹³ retention is not even mentioned in the study. Again, even though the empirical evidence is quite limited, the theoretical prediction that for the most part the originator retains a substantial fraction of the FLP is very likely wrong.

That conjecture regarding FLP risk transfer is supplemented by the opacity concerning the transfer of rated tranches, mezzanine and senior. Originators do not inform the public of their sale of rated tranches, making it difficult for outsiders to estimate the risk of the underlying portfolio kept by the originator on its book. The naive view that the rated tranches are mostly sold to outsiders has been questioned, too. Citibank assumes that most AAA-rated tranches are retained within the banking sector. According to Tett (2008), banks bought about 30 percent of the AAA-rated tranches; structured investment vehicles (SIVs) and conduits, about 20 percent; and money market funds, about 25 percent, for a total of 75 percent. The BIS study also argues that over the past few years, issuers increasingly have retained the senior and super-senior tranches. In addition, monoline insurers have taken on a considerable share of senior risk, curtailing risk transfer to remote investors.¹⁴

Even though the risk of money market funds is, in legal terms, borne by the buyers of those funds, in effect the issuing banks cannot impose substantial losses on them since money market investments are perceived to be almost risk free. And rightly so, since issuers of money market funds typically extend liquidity guarantees on the funds that, in the event of prolonged illiquidity, imply fund buyers hold a put option against the issuer. Therefore banks appear to hold most of the AAA-rated risk.

That conclusion is also supported by the restricted evidence regarding synthetic securitization transactions. Franke, Herrmann, and Weber (2007) finds

12. According to the *Credit Derivatives Report* of the British Bankers Association, in the credit default derivatives market of 2006, banks sold 59 percent of the default risk while they bought 44 percent. Hedge funds sold 28 percent and bought 32 percent, and insurance companies sold 6 percent and bought 17 percent (British Bankers Association 2006).

13. Bank for International Settlements (2008, p. 18).

14. Bank for International Settlements (2008, p. 17).

that in synthetic transactions the nonsecuritized AAA-rated portion exceeds 80 percent of the par value of the transaction. Casual talks with bankers indicate that a large part of this nonsecuritized risk is not insured through senior credit default swaps and hence is borne by the originator. That view is somewhat inconsistent with the results reported in Bank for International Settlements (2008) and in Gorton (2008) for Lehman Brothers,¹⁵ which argue that monoline insurers have taken on a considerable share of senior risk. The rationale behind bankers' reluctance to insure the senior risk is probably that the default probability of AAA-rated tranches is so small that buying insurance appears too costly. Also, the low risk weight attached by Basel 2 to AAA tranches does not motivate originating banks to transfer that risk. We therefore conclude that the theoretical prediction that the most senior tranches are held by remote investors is presumably wrong as well.

In summary, it appears that originators sell a large part of the FLP to other banks and to a lesser extent to insurance companies and hedge funds. Furthermore, a significant fraction of the AAA tranches apparently is retained in the banking sector. Both observations obviously run counter to basic assumptions in the securitization model.¹⁶ The proportion of default risk in securitizations retained by the originating banks is not publicly known. We conclude that the observed risk transfer is quite different from what theory (and the common pre-crisis understanding) predicts. That is why we label the risk transfer story a myth.

Multi-Tier Agency Relationships

So far we have assumed that a financial institution organizes all securitization-related activities in house. However, in reality the industry has outsourced many parts of the financial engineering process in order to reduce production costs and to benefit from the specialized skills and innovations of industry suppliers. Banks also started outsourcing various parts of the production process, as is apparent in subprime lending in the U.S. market. Two-tier agency relationships were thus replaced by multi-tier agency relationships. Ashcroft and Schuermann (2007) discusses in much detail the various parties involved in the securitization of subprime loans. The authors also analyze the various agency problems that arise from the division of banking activities and discuss mechanisms to mitigate those problems.

15. Gorton (2008, graph, p. 43).

16. That even clever engineering cannot bypass basic laws of financial gravity is one of the insights gained from the securitization crisis. In commenting on the lessons of the credit turmoil, Joseph Ackerman, CEO of Deutsche Bank, recently said, "We have now learned that what does not work in theory eventually will not work in practice either." See *Euro Finance Week* (Frankfurt), November 17, 2008 (authors' translation).

The parties involved in managing the subprime business form a value chain of highly specialized parties, each having its own interests and its own managers. While the benefits of specialization are indisputable, the agency costs of the value chain are difficult to estimate. The important question is whether a coordination mechanism can be designed for the involved parties to ensure sufficient quality of the overall product. Part of that mechanism is the incentive system.

First, consider the value chain in mortgage lending. In the subprime business, only the originators of mortgage-backed loans and the mortgage brokers cooperating with them are involved in the beginning. Once the loans are contracted, originators are no longer involved, subject to the rule that, within a short time period after contracting, they may have to repurchase loans that were not properly contracted and loans that the debtor fails to pay. Hence originators and mortgage brokers tend to have a short-term perspective. Their rewards depend for the most part on the volume of loans that they contract, not on the long-term performance of the loans. That is reasonable, given that they have little or no influence on the future handling of the loans by other parties.

Thus, loan originators and mortgage brokers demand protection against poor performance by the agents that will be involved at later stages. That in turn implies that hidden long-term characteristics of the loans that are due to the unobservable behavior of the loan originators and mortgage brokers themselves may not matter at all for their reward. Originators and brokers therefore are interested primarily in increasing loan volume, reinforcing adverse quality characteristics.

Another party involved is the warehouse lender that initially funds the loans. It may have some influence on the choice and the activities of the loan originator but not on the choice and the activities of the servicer. Hence, the warehouse lender prefers a reward that is independent of the actions of the servicer.

The servicer of the loans is responsible for collecting interest and principal payments and for making sure that the property on which the mortgage is written is kept in good shape for future action in case of delinquency or default. As pointed out by Ashcroft and Schuermann (2007), the servicer collects servicing fees until default and so has a strong incentive to defer default through restructuring the loan, even though doing so may increase default losses. However, the quality of the servicer may have a strong impact on foreclosure value. Not surprisingly, the loan originator does not want a reward that depends on servicer quality, on which the originator has no influence. Similarly, the servicer has no influence on the choice of loan originator and therefore does not want a reward that depends on the quality of the originator.

The only party involved continuously throughout the securitization process is the arranger, who sets up a special-purpose vehicle (SPV) for securitizing loans

and typically manages the SPV. The arranger therefore is in the best position to coordinate and monitor the activities of all parties involved. The SPV buys the loans and securitizes them. Tranches are sold to investors, who usually have little information on the underlying assets and may rely instead on the ratings of rating agencies and the advice of investment managers. While rating agencies are involved long term in the transaction through monitoring and adjusting ratings, for the most part investment managers are involved only at the start of the SPV, when its loan portfolio is assembled. Later on the portfolio may be adjusted again, depending on the advice of the same or other investment managers. While rating agencies and investment managers do not have a financial stake in the transaction, their reputations are at stake.

As pointed out in Ashcroft and Schuermann (2007), the cooperating parties set up rules to safeguard the quality of the transaction; if the rules are violated, then the negligent party may have to pay damages. However, liability is subject to a time horizon. Also, limited liability and low equity capital may restrict any payments by the negligent party. Moreover, it may be difficult to prove negligent behavior. Thus, the negligent party may escape recourse claims, and default losses that could have been avoided by careful behavior may be imposed on other parties, in particular investors. Of course, investors may anticipate negligence and therefore charge a premium. Still, with so many parties being involved, investors are exposed to a high level of operational risk. Effective coordination of those parties appears to be very difficult.

Can these problems be resolved by an incentive system? Standard theory suggests that, in the absence of asymmetric information and agency problems, all parties should share in the overall risk.¹⁷ The share that a party takes increases with its wealth and its influence on overall risk. This simple rule of risk allocation is no longer optimal if parties have different expectations and if they affect overall risk through different activities not fully observable by the other parties.

If, for example, the loan originator has a strong influence on loan quality through its screening activities, then the originator should bear a relatively high share of the risk. But there are two counterarguments. First, the originator has little control of the other parties involved in the transaction. That should reduce its risk share. Second, the parties are involved in the transaction at different points in time. The loan originator is involved only at the beginning and so has no control over the transaction later on; hence, as argued before, the originator desires

17. More precisely, if all parties have homogeneous expectations and time additive utility functions belonging to the class of functions with hyperbolic absolute risk aversion with the same exponent, then all parties would buy a share in the overall market risk.

protection from agency behavior of the other parties, for example, by reducing its risk share over time. That is even more efficient if the originator's conduct affects the transaction value early during the life of the transaction, when its risk share is relatively high.

If, however, the consequences become visible only in later years, then its risk share should decline at a slower rate, increasing its exposure to agency problems induced by other parties. Similarly, warehouse lenders are involved with their funding activities only for short while. Asset managers may be replaced, reducing their time horizon, too. Hence, constant long-term risk sharing of these parties appears inefficient; moreover, long-term risk sharing would require long-term risk management, which is not the core business of the parties. This explains why the various parties do not have long-term financial stakes in the transaction. To some extent the problems might be mitigated through reputation effects, but we are skeptical of that possibility.

Given these difficulties, one way out could be to give the arranger a very prominent role in setting up the transaction—in choosing and monitoring other parties. An incentive for taking a strong role would be a long-term financial stake bearing a substantial part of the default losses—for example, by retaining a substantial part of the first loss piece. But the empirical evidence shows that arrangers are reluctant to retain substantial parts of this piece. In some cases in recent years, as pointed out before, the arrangers sold the first loss piece completely; hence this incentive mechanism clearly failed in those cases.

This discussion raises a general question: how many parties is it desirable to have in the value chain? There is a trade-off between the cost advantage of outsourcing parts of the production process to specialized parties and the corresponding agency costs. The function relating the cost advantage to the number of specialized parties should increase at a declining rate (declining economies of specialization); the function relating the agency cost to the number of specialized parties also should increase. But we do not know whether it increases at a constant, declining, or increasing rate. If n denotes the number of parties, then the number of bilateral agency relationships, $n(n-1)/2$, increases overproportionally; that might indicate that agency costs also rise disproportionately quickly. So far we lack empirical evidence. The view in Ashcroft and Schuermann (2007) that agency problems can be reasonably resolved at each bilateral stage appears quite optimistic. The authors' argument is based in part on reputation cost. Similarly, Gorton (2008) argues that implicit contracts between originators and other involved parties align interests; presumably, he also refers to the reputation mechanism. We doubt the effectiveness of this mechanism, however, given the observed deterioration of the quality of mortgage-backed loans.

Casual observation suggests that some banks have fully separated different stages in the lending process from each other. For example, one German bank has established an internal pricing scheme according to which loan origination is compensated by a flat fee, while all loan cash flows (that is, return and risk) are transferred to a credit risk unit, which sets loan rates and decides whether a particular loan is sold, securitized, or kept on the books. This system leaves the incentive alignment between the originating and the processing units unresolved.

Two implications emerge. First, it does not make sense to maximize benefits from specialization of parties, ignoring agency costs. A viable model of securitization might have just one party for both arranging and servicing; both activities are long term and therefore can be coordinated by one party without giving rise to conflicts of interest due to different time horizons. If some outsourcing of loan origination is unavoidable, then the arranger-servicer also should participate in origination; that would provide the arranger-servicer with updated information on origination that can also be used for more effective monitoring of other originators.

Second, there should be a trade-off between outsourcing activities in a more extended value chain and the retention of default risk by the transaction coordinator. As more activities are outsourced and more problems arise due to information asymmetries, investors' protection against other parties' negligent behavior should become more effective. Therefore, regarding the first loss piece, the arranger should commit to retaining a larger fraction if the value chain is extended. For the arranger, that would clearly imply trading off the risk and return of outsourcing. If the arranger extends the value chain, it benefits from cost savings; at the same time, it has to take a higher share of default risk.

Apart from the difficulty of maintaining comprehensive incentive alignment all along the value chain, another issue regarding nonintegrated (outsourced) business processes is credibility in the market. Effective coordination of the different parties of a value chain appears to be a requirement for financial stability because otherwise some parties may not worry about risks. Excessive risks thus are imposed on other investors, who, in turn, will retreat from the market once they become aware of that fact, possibly causing a market breakdown.

Compensation and Incentives

Risk transfer and conservation of lending relationships are conflicting objectives. This is true in particular with regard to financial assets, where the terminal value is random and sensitive to moral hazard and adverse selection. While the previous discussion focused on agency conflicts between different legal entities, we now discuss agency conflicts between a bank's managers and shareholders in order to identify possible reasons for excessive risk taking, turning to management com-

compensation as a source of conflict. We focus on the sharing of risks by the manager, shareholders, and third parties and on the term structures of payoffs to those parties to show that certain compensation schemes may give bank managers incentives to pursue a high-risk portfolio strategy. That does not necessarily conflict with maximization of shareholder value, but it may endanger financial stability. Therefore, it is not sufficient to look at managers and shareholders; the default probability of a bank, too, is essential as a proxy for the costs imposed on the financial system.

We present four major findings. First, if the bonus is back end loaded—for example, based on the bank's terminal value—then there is no or only limited conflict of interest between management and shareholders.¹⁸ Yet the probability of bankruptcy may be substantial. Second, if the bonus is front end loaded—for example, based on the present value of expected profits instead of market values or based on a first profit position—shielding the manager against risk, manager and shareholder preferences clearly differ. Third, if the manager is compensated by a package of base salary, annual bonus, and deferred stock or stock options, his or her optimal risk level depends strongly on the structure of the compensation package. Fourth, the manager has a strong incentive for high bank leverage if the bonus is non-negative and the profit for bonus—the internal profit on which the bonus depends—does not include a penalty for high leverage.

It therefore is essential to supplement the bonus system with a malus component in order to discourage the manager from excessive risk taking, even if shareholders also benefit from such risk taking, because it may endanger financial stability. A malus system needs to be carefully designed so that the manager cannot easily change policy to avoid the malus component while retaining strong risk.

Before presenting a numerical example, we mention that there is a large literature on manager compensation and risk taking. On the theoretical side, Ross (2004) demonstrates that conventional wisdom may be misleading. Ross shows that, for example, the conventional wisdom that stock options motivate the manager to increase business risks may be wrong. Nonlinear compensation structures induce conflicting incentive effects¹⁹ on risk taking, so general statements cannot be made easily (see also Lewellen 2006). On the empirical side, Jin (2002) finds that the level of performance-dependent incentives for CEOs tend to move

18. Except for differences in risk aversion, which introduce a departure from optimality.

19. Ross shows that stock options may actually reduce a manager's risk taking. Even though the option protects the manager against downside risk, the option reduces his or her marginal utility in "good" states in which marginal utility is low anyway but does not reduce it in "bad" states in which it is high. Hence, expanding risk so that manager's payoff is reduced (increased) in the bad (good) states may easily reduce his or her expected utility.

inversely to systematic and nonsystematic business risk if the CEOs face hedging constraints. Coles, Daniel, and Naveen (2006) finds that higher sensitivity of CEO wealth to stock volatility (vega) induces the CEO to implement riskier business policies; the authors also find a positive impact of business risk on the vega of CEO compensation. A more detailed analysis of dynamic risk taking of hedge fund managers is provided by Hodder and Jackwerth (2007), which shows in a simulation model that hedge fund managers tend to take very high risks when the fund value is close to the high-water mark.

The public discussion on incentives in bank management begins with the observation that today bonus systems are a strong incentive for bank managers and may induce them to take excessive risks. We take a closer look at these systems and explore what can be done to mitigate the problem of excessive risk taking, starting with a few examples taken from annual reports that show that top management often is compensated by a package of a base salary, a cash bonus based on recent profits, and stock options and stock-like claims subject to a minimum holding period. Table 4-3 displays the value of these components as a percentage of the value of the overall compensation for UBS managers in 2006 and 2007 and for Deutsche Bank managers in 2007. While 2006 was a good year for UBS, 2007 was not, which explains the relative increase in base salary. In all three cases, the base salary is rather small and the cash bonus is quite high.

The third component, stock options, serves to align the long-term interests of managers and stockholders. More critical is the second component, cash bonuses, because they provide short-term incentives for managers that may conflict with shareholder value. Any discussion of incentive systems in the financial sector needs to take organizational factors into consideration. Because a bank is managed by a team of managers, one might want to look into team theories. We do not discuss the team aspect here but instead assume a single bank manager.

A Simple Numerical Example of a Loan Portfolio

Because we are looking into potential causes of the subprime crisis, we illustrate our arguments using a loan portfolio as an example of a manager's choices. This example is a deliberately simple one that completely ignores moral hazard and reputation effects; to pinpoint key elements of a potential incentive system, we look just at the manager's initial choice of portfolio. Given a securitization transaction, the manager can choose between loan portfolios of different quality, all with a maturity of seven years. The best portfolio has an AAA rating, the worst one, a B rating. We are not concerned about tranching the portfolio into an equity piece and rated tranches but assume that the bank retains the default risk itself. In the first scenario, the bank has a given amount of money (equity capital)

Table 4-3. *Managers' Compensation Package, UBS and Deutsche Bank, 2006 and 2007*

Percent of compensation

<i>Firm</i>	<i>Base salary</i>	<i>Cash bonus</i>	<i>Stock and stock options</i>
UBS 2006	6	47	47
UBS 2007	22	50	28
Deutsche Bank 2007	13	52	35

Source: UBS's 2006 and 2007 annual reports and Deutsche Bank's 2007 annual report.

to invest. In the second scenario, a leverage option is included, allowing the manager not only to invest the given amount of money but also to borrow money elsewhere and invest the additional amount into an augmented loan portfolio.

SCENARIO I

In the first scenario, the bank has granted 100 loans, each with a par value of \$1 million, the same initial rating, and seven years to maturity. The risk-free rate is 3.25 percent per year. The credit spreads for the loans are given in table 4-4, together with the cumulative default probabilities over seven years and the annual net risk premiums. The probabilities are taken from S&P's cumulative loss rate table. In case of default, the loss given default is assumed to be 60 percent. The

Table 4-4. *Default Probabilities, Credit Spreads, and Net Annual Risk Premiums for Loans of Different Ratings*

Percent

<i>Rating</i>	<i>Seven-year cumulative default probability</i>	<i>Credit spread</i>	<i>Annual net risk premium</i>
AAA	0.144	0.75	0.238
AA	0.420	0.85	0.314
A	0.887	0.95	0.374
BBB	3.672	1.45	0.635
BB	13.826	3.45	1.765
B	30.999	7.70	4.543

Source: The cumulative default probabilities are those used by S&P for securitizations. The credit spreads are assumed to correspond to credit spreads for securitization tranches. The annual net risk premium is then derived as the credit spread minus annual transaction costs of 50 basis points and the expected annualized loss. For simplicity, that loss equals the cumulative default probability, divided by 7 and multiplied by $(1 - \text{LGD})$, with LGD (loss given default) = .5.

annual net risk premium is defined as the credit spread minus the sum of the annual transaction costs of 50 basis points and the annualized expected default loss.

A loan defaults in year t if its rating changes to D , the default category. Rating transitions are simulated using the S&P transition matrix year by year. The 100 loans are assumed to belong to ten different industries. The correlation coefficient of the annual rating changes of two companies belonging to the same industry is 0.2; if they belong to different industries, it is 0.05.

In the first scenario, the manager decides on loan portfolio quality by selecting the initial rating of the loans. Every year the manager receives a base salary and a bonus, which cannot be negative. The bonus equals the bonus base of the year, multiplied by a given participation rate. The bonus base is defined as the internal profit on which the bonus depends. In this example, the bonus base in year t equals the credit spread earned on the loans that have not defaulted before the beginning of the year minus the loss given default (60 percent) on the loans that default in that year. Thus, the annual transaction cost of 50 basis points is excluded in the bonus base.²⁰ In each year the certainty equivalent of manager compensation is derived by using a power utility function with relative risk aversion. The total income of the manager is then derived as the date 0 present value of the certainty equivalents in years 1 to 7, using the risk-free rate as the discount rate. In this simple setup, the manager does not bear any outside risks and cannot hedge any income risks. In a complete market, the manager can hedge every risk and performance-related compensation packages therefore have no incentive effect.

The shareholders of the bank invest \$100 million initially and receive the terminal portfolio value after seven years, which equals the principal plus interest income (composed of the risk-free rate plus credit spread) on all nondefaulted loans compounded at the risk-free rate to the terminal date, plus the compounded recovery values of all defaulted loans, minus the compounded payments to the manager. For shareholders, the terminal portfolio value is also converted into a certainty equivalent by using a slightly modified power function with a given relative risk aversion. The modification is that shareholders' terminal wealth is composed of the terminal portfolio value plus some given exogenous wealth, for example \$50 million. Therefore the risk premium implied by the certainty equivalent is rather small. Finally the terminal certainty equivalent is discounted to date 0 at the risk-free rate, yielding the shareholder value of the portfolio.²¹

20. The transaction cost could be included, but that would not change the results significantly because the manager is compensated by an increase in base salary.

21. Alternatively, one can use an exogenously given pricing kernel to derive the market value of the portfolio. The results are similar.

Table 4-5. *Manager's Total Income and Shareholder Value for Different Combinations of Base Salary, Profit Participation Rate, and Portfolio Rating^a*

Variable	Total income of manager (in US\$ thousands)				Shareholder value (in US\$ millions)			
	125	35	31	20	125	35	31	20
Participation rate (percent)	1	10	15	20	1	10	15	20
<i>Rating</i>								
AAA	817.1	661.3	851.5	986.4	103.7	103.8	103.6	103.5
AA	821.7	690.6	885.8	1,007.6	104.0	104.1	103.9	103.7
A	825.6	705.3	891.0	964.2	104.1	104.2	103.9	103.7
BBB	804.8	722.4	853.1	799.0	104.0	103.9	103.6	103.3
BB	892.7	796.6	837.2	636.5	103.3	102.7	102.1	101.6
B	979.9	977.0	990.1	719.0	102.3	100.9	99.9	98.9

Source: Authors' calculations.

a. Bold figures show the highest total income and highest shareholder value respectively, given the compensation package, for portfolios of various ratings.

Table 4-5 displays the results. The left panel shows the total income of the manager for different loan qualities, assuming a constant relative risk aversion coefficient $\lambda = 2.5$. The right panel shows the shareholder values, assuming the same $\lambda = 2.5$ for the shareholders. They, however, have additional terminal wealth of \$50 million, which renders them less risk averse. In order to see the impact of the profit participation rate, we consider four different participation rates, 1 percent, 10 percent, 15 percent, and 20 percent. The base salary will be adjusted to the participation rate so that the total income of the manager is roughly constant.

Given a participation rate of 1 percent and a base salary of \$125,000, the manager clearly chooses the poor loan quality B, earning a total income of about \$980,000 due to the high annual profit generated with B loans. The manager benefits strongly from those profits because she earns 1 percent of them when defaults are rare but does not suffer negative payments when many defaults occur because profit participation is truncated at zero (the bonus system). Moreover, because a 1 percent bonus imposes little risk on the manager, she does not suffer from a substantial risk premium. The situation is different for shareholders. Shareholder value is roughly the same for all loan qualities. That appears reasonable because credit spreads are market rates. Given the high risk associated with a B-rated portfolio, shareholder value is slightly lower due to imperfect diversification. Shareholder value is highest for the A portfolio.

Up to a participation rate of 15 percent, the manager still prefers the B portfolio; for a participation rate of 20 percent, she prefers AA loans. A high participation rate imposes much risk on the manager, reducing her certainty equivalent substantially, in particular for low-quality loans.²² Therefore, for any given loan quality, the certainty equivalent of the bonus first increases and then declines with a higher participation rate.

The key implication concerns how the loan quality choice depends on the participation rate. A high participation rate lowers not only shareholder risk, through better loan quality, but also the bankruptcy probability of the bank. If shareholders prefer good loan quality, then they should choose a rather high participation rate.

This finding does not change substantially if shareholders combine a bonus with a small share in the terminal value of the portfolio (TV share), which is equivalent to the extreme form of bonus deferral and similar to stock-based compensation with a long holding period. The reason that the findings are similar is that with no leverage, the probability of bank losses is rather small, so the option feature of the bonus does not really matter. Hence a low (high) participation rate and a small (large) terminal value share have similar effects and induce the manager to choose low- (high-) quality loans. The higher the participation rate and the terminal value share, the better the portfolio quality chosen by the manager.

SCENARIO 2

The story changes fundamentally in the second scenario, in which the manager can also choose the bank's leverage. So far the portfolio had a par value of \$100 million, fully financed by equity capital. Now the manager can borrow \$100 x million from outside and invest in the portfolio \$100 (1 + x) million. Hence (1 + x) can be interpreted as the volume of the bank's portfolio in units of \$100 million, while x is the leverage of the bank—that is, its debt-equity ratio. With leverage, each loan volume is inflated by the factor (1 + x), holding the credit spread con-

22. In disentangling the effects of the participation rate, first consider the call option feature of the bonus. Since the bonus is non-negative, the bonus is a call option on the portfolio payoffs. A call option is more valuable if the underlying risk, represented by vega in most option pricing models, is higher. This effect is also present here. But unlike with option pricing models, in which the pricing kernel is exogenously given, the manager evaluates the risk individually, given her utility function. This means that doubling her income in a given state of nature does not double her utility in that state, because the utility function is strictly concave. In other words, if the participation rate and the underlying risk are high, the endogenous risk premium of the bonus is high as well.

stant (as is typical in buying securitization tranches). For simplicity, the manager is entitled to a base salary plus a bonus but no terminal value share.

We first assume that the interest on bank borrowing charged to the bonus base increases linearly with the borrowed amount—that is, the charged interest rate is constant, independent of the leverage. Then, given the quality of the portfolio and the base salary, the manager will maximize the leverage. The reason is obvious. Leverage implies that the bonus base increases linearly with leverage. Since the bonus can never be negative, the bonus will be multiplied by the factor $(1 + x)$ through leverage. That represents a first-order stochastic dominance improvement of the bonus. Hence, given loan quality, total manager income increases monotonically with leverage. Since the risk premium of the bonus increases disproportionately with leverage²³ and the base salary stays constant, total income increases with leverage at a declining rate. That is visible for poor-quality loans in particular.

The incentive to maximize leverage would be even stronger if leverage did not multiply the par value of each of the 100 loans but multiply instead the number of loans to different obligors in each of the given industries so that the diversification of the loan portfolio improves. That would imply an additional, second-order stochastic dominance improvement, benefiting both the manager and the shareholders. Table 4-6 illustrates the results. The base salary is always \$40,000, and the participation rate is 8 percent. The computations are based on a loan portfolio in which the par value of each loan is multiplied by $(1 + x)$.

Given a low portfolio volume, the manager chooses the B-quality loans. High volumes increase the bonus risk. To mitigate that effect, she chooses a better loan quality. For a volume of 15 (that is, a leverage of 14) or more, she prefers AAA loans. More generally, the higher the volume or leverage, the better the loan quality.

This finding is consistent with highly leveraged vehicles like structured investment vehicles and asset-backed commercial paper conduits, which usually are highly leveraged and for the most part hold AAA assets. As the numbers in table 4-6 indicate, the potential for raising income through leverage is impressive.

For shareholders, the effects of leverage are quite different. Shareholder value increases with leverage over a wide range, given high-quality loans. The additional credit spreads outweigh the additional risk, since default risk is low. The situation is different for low-quality loans. High default losses are fully borne by

23. Given a positive base salary, the manager displays increasing relative risk aversion with respect to the bonus. Her relative risk aversion approaches $\frac{1}{2}$, so that for high leverage levels her total income increases almost proportionally to leverage.

Table 4-6. *Manager Total Income and Shareholder Value for Different Combinations of Volume and Portfolio Rating^a*

Variable	Total income of manager (in US\$ thousands)				Shareholder value (in US\$ millions)			
	1	15	25	35	1	15	25	35
Base salary			40				40	
Participation rate (percent)			8				8	
Volume	1	15	25	35	1	15	25	35
Borrowing rate (percent)	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
<i>Rating</i>								
AAA	605.4	5,235.2	8,345.8	11,306.1	103.9	161.6	202.7	243.8
AA	631.7	4,877.3	7,097.7	8,886.4	104.1	165.6	209.0	252.1
A	648.0	3,965.2	5,237.6	6,159.1	104.2	166.6	209.8	252.1
BBB	682.7	2,368.1	2,604.5	2,708.3	104.0	158.4	183.8	202.6
BB	794.1	1,435.3	1,470.6	1,485.7	102.9	112.7	104.7	100.2
B	994.4	1,555.9	1,579.7	1,579.7	101.3	76.7	69.7	66.5

Source: Authors' calculations.

a. Volume is (1 + leverage) in units of \$100 million. The manager earns a base salary of \$40,000; her profit participation rate is 8 percent. The bank always pays 3.25 percent on its debt. Bold figures show the highest total income and highest shareholder value respectively, given volume, for portfolios of various ratings.

shareholders until equity capital is fully absorbed. Those losses increase with leverage, eating up more of the terminal value. That is evident in table 4-6, in particular for B loans. For a volume of 35, shareholder value drops to \$66.5 million. Since shareholders have limited liability, the bank may go bankrupt. For moderate loan quality, the bankruptcy probability strongly increases with leverage, thereby affecting financial stability.

If the manager participated in the terminal value, as do shareholders, then leverage would have little effect on the manager's choice. As table 4-6 shows, the shareholders also benefit from high leverage, given excellent portfolio quality; therefore, terminal value participation does not discourage the manager from choosing a high leverage.

What do we learn from this simple model? The good news is that although the manager generally prefers high to low leverage, that preference is strongest with a portfolio of good quality. Shareholders also are happy with that policy. This simple model appears to portray quite well what happened in several banks before the subprime crisis. They bought high-quality tranches of RMBSs using high lever-

age. The bad news relates to both biased model parameters and biased choice of leverage. First, model results and bank default probability²⁴ depend heavily on the parameters underlying the simulation. If one assumes a recent history of low default realizations, the temptation is to select simulation parameters that match that history, ignoring the usual long-term swings. That yields misleading model results and renders risk control ineffective.

Second, given a bonus that increases with leverage by first- and/or second-order stochastic dominance, the manager's interest in high leverage is quite strong and that interest is reinforced if the bonus also increases with a super-senior first profit position. High leverage endangers not only bank solvency but also financial stability.

The common argument that risk control driven by shareholder interest implements strict limits to risk taking does not appear to be credible when the parameters used for risk controlling are questioned.²⁵ That doubt is reinforced by the possibility that shareholders might believe that they also benefit from a higher leverage and therefore are not pursuing strict risk control. Shareholder benefit is even stronger if leverage risk is not fully borne by the shareholders themselves but by third parties.

Therefore, we believe that the current crisis was triggered in part by the strong interest of some managers in high leverage. That may explain why the Swiss Federal Banking Commission proposed stricter limits on banks' leverage as a simple cure. However, we believe that a far more promising route to controlling risk taking is to change the reward system for managers. The bonus component should be supplemented by a malus component so that the manager's interest in taking high risks is clearly mitigated. A malus component need not impose an obligation on the manager to pay in adverse situations; instead, the bonus base could be adjusted to discourage excessive risk taking.

A malus component also could be generated by firing the manager in case of losses. One possibility is to fire the manager when default losses exceed a certain trigger; defining the trigger in the manager's employment contract would make the policy credible. What are the implications? If the manager is fired, her income is unlikely to be zero. First, she may get some severance pay; second, she may get some unemployment compensation; and third, since by law the bank is not allowed to mention her bad performance to potential employers, reputation damages may be small, enabling her to find a job again fairly quickly. In addition, the

24. Especially dangerous is a short-term bank funding policy because creditors may feel strongly exposed to the default risk and refuse further lending.

25. The manager may spend much energy in re-engineering model parameters so as to make her leverage policy appear less risky.

manager might expect to be fired in the event of substantial losses even if her employment contract does not state that she will. Therefore, we are skeptical about the effectiveness of a contractual firing trigger.

A different, possibly more effective malus format consists of adjusting the bonus base for the leverage chosen. We assume that the bonus base is derived using an interest rate for bank borrowing that increases with leverage but is otherwise independent of bank policy. That may appear to conflict with the rational expectations of creditors, but it illustrates a phenomenon typical of liquid asset markets. Management may change bank risk very quickly by trading liquid financial assets, without informing creditors accordingly. Therefore, we assume that the borrowing rate charged to the bonus base depends only on leverage. Since credit spreads paid by banks clearly are lower than credit spreads on securitization tranches, we let the borrowing rate increase rather modestly with leverage. Table 4-7 summarizes the results.

The manager maximizes her total income by choosing AA loans and a volume of 15—that is, a leverage of 14. In this example, the malus imposed on the manager by increasing funding costs is effective; hence, market discipline imposed by credit spreads can function like a malus. In addition, shareholders are quite satisfied. The manager's choice also protects creditors well because AA loans have low default risk and thereby protect financial stability. The strength of the effects depends, of course, on the relationship between the imputed borrowing rate and the bank's leverage. The manager's choice would be similar if she also participates in the terminal value, as does a shareholder. In the example, shareholders would prefer A loans with a volume of 20.

The malus effects would be weakened not only by less sensitivity of the borrowing rate to leverage but also by the manager's attempts to undercut the malus. Managers have more decision parameters than just loan quality and leverage. They can effectively design loans to shift hazard rates from early to later years in order to mitigate the adverse effects of loan defaults. One such method is to prolong loans in case of debtor financial distress, so that the loan does not become delinquent and does not default. Another method is illustrated by the many loans granted in the U.S. subprime market that were sweetened with teaser rates. In the first one or two years, debtors are charged low interest rates, followed by strong step up in interest rates. The effect is not only to provide debtors some relief in the first periods, but also to shift the hazard rates of the loans from early to late years. That effect is illustrated in the appendix.

Regarding management incentives, how the annual profit for bonus is determined is again critical. If, as in the teaser rate example, profits are artificially shifted from the late to the early years, then the certainty equivalents of manager

income tend to shift to the early years, too. That fact might render the manager more aggressive. More important, the bonus bases earned in the first years are upward biased because they do not reflect the shift of default risks to later years.

A bonus base scheme should avoid these temporal asymmetries in order to provide undistorted long-term incentives for the manager. More generally, the bonus base should be designed in a forward-looking manner so that expected late-period losses and risks are anticipated on an annualized basis. Otherwise the manager may ride the distorted term structure of bonus bases, rendering malus components ineffective.

The previous examples demonstrate the dangers inherent in various incentive systems. Of course, one might question several assumptions made in these examples. For instance, the manager may be less risk averse, inducing her to take more risks. Or, she might be able to hedge part of the bonus risk, a possibility that might induce her to take even more risk. The qualitative conclusions from these examples appear to be robust even if we change the parameters. Therefore, no further simulation results are presented.

Lessons

What are the lessons to be learned? First, given low leverage, the bonus system with a low participation rate is likely to motivate managers to acquire low-quality financial assets. The reverse is true for a high participation rate. Hence, shareholders can influence the quality of financial assets indirectly through the participation rate.

Second, non-negative bonus payments induce the manager to choose high leverage ratios. Even though high financial leverage usually is associated with high-quality financial assets, the same high leverage increases default risk for shareholders and endangers financial stability. Therefore a bonus-cum-malus system is required, which renders high leverage costly for the manager and should induce managers to have a long-term orientation. Bonus base accounting has to be forward looking, incorporating future expected losses and risks. In addition, the internal control system should make sure that the manager does not undermine the effectiveness of the malus component by making policy adjustments.

The effects of an incentive system depend on the manager's risk attitude and on the investment and financing policies that he or she has available. Moreover, they depend on the bank's internal control system. The effects are therefore difficult to predict for outsiders, which leads to an important conclusion, namely that any outside regulation of bank incentive systems is inappropriate. It might be useful, however, for other market participants interacting with the bank to have

Table 4-7. Manager Total Income and Shareholder Value for Different Combinations of Volume, Leverage, and Portfolio Rating^a

Variable	Total income of manager (in US\$ thousands)					Shareholder value (in US\$ millions)						
Base salary												
Participation rate (percent)				40						40		
Volume	1	2	10	15	20	25	1	2	10	15	20	25
Borrowing rate (percent)	3.25	3.3	3.36	3.44	3.55	3.75	3.25	3.3	3.38	3.48	3.6	3.75
Rating												
AAA	605.4	891.2	2,913	2,925	3,065	2,527	103.9	107.4	135.6	146.9	150.4	135.2
AA	631.7	931.6	3,008	3,284	1,919	1,813	104.1	108.0	138.3	150.9	155.5	141.0
A	648.0	951.1	2,784	3,239	2,834	1,319	104.2	108.2	139.2	151.8	156.3	140.3
BBB	682.7	936.1	1,875	1,661	1,155	1,149	104.0	108.0	136.0	143.1	138.2	113.1
BB	794.1	990.7	1,310	1,280	1,194	1,132	102.9	106.7	112.1	101.0	87.7	70.4
B	994.4	1,203	1,482	1,482	1,411	1,344	101.3	104.4	82.2	71.9	64.6	56.5

Source: Authors' calculations.

a. The manager earns a base salary of \$40,000; her profit participation rate is 8 percent. The manager cannot be fired. The interest rate paid by the bank increases with volume. Bold figures show the highest total income and highest shareholder value respectively, given volume and leverage, for various portfolio ratings.

portfolios of

information on the bank's incentive system. That information might improve their understanding of bank risks.

We add a more speculative remark on performance-based compensation regarding the balance between manager income and financial stability. We suspect that managers whose short-term performance has a significant affect on their compensation worry little about the impact of their policies on financial stability. In contrast, managers whose compensation is based on their long-term performance are more concerned about financial stability because they have relatively more to lose through financial turmoil. That effect is likely to be even stronger for managers with a high base salary and low performance-based compensation; in addition, it would be consistent with the view in Osterloh and Frey (2002) that extrinsic motivation crowds out intrinsic motivation.

In other words, we suspect that performance-based compensation reinforces managers' concerns about their income at the expense of public welfare, resulting in financial instability. If one assumes our view to be correct, the compensation package should have a low bonus component, unless it includes a long-term, forward-looking bonus base. Hence it appears that in designing compensation packages, not only should the manager's and shareholders' interests be aligned but also and equally important, the interests of the manager and the public, as reflected in financial stability.

A final remark on compensation and securitization relates to securitization volume. The huge supply of securitization tranches in previous years allowed the manager to acquire loans of any quality in almost unlimited amounts, at constant credit spreads. A similar possibility does not exist in traditional banking. A bank cannot substantially expand its loan business with its own clientele at constant credit spreads; it would have to lower credit spreads or acquire new customers, which usually also requires lower credit spreads, holding default risk constant. That would limit bank expansion and thus risk taking, in contrast to the securitization business.

Observed Effects of Risk Transfer on Loan Quality and Bank Risk Taking

The discussion of incentive problems illustrates a number of threats to the financial system. What is the available empirical evidence?

First, does risk transfer in securitizations undermine the quality of bank lending? There is ample evidence that the lending standards in the U.S. mortgage-backed security (MBS) market have eroded over the past couple of years.²⁶ The share of subprime loans in overall U.S. MBS lending increased in 2005 and 2006.

26. See, for example, "Fed Shrugged as Subprime Crisis Spread," *New York Times*, December 18, 2007. The article gives an account of many discussions in the Fed regarding mortgage-related lending practices starting in 2000.

It also is likely that the strong increase in U.S. MBS lending would not have been possible without spreading the risks across various parts of the world through securitization, simply because the lending institutions would have run into serious problems with their regulatory capital requirements otherwise. Yet U.S. MBS lending practices cannot simply be generalized to other segments of bank lending. First, in continental Europe, MBS lending has been conservative for the most part over the last few years. Also, credit standards for corporate and private borrowers in Europe have changed somewhat over time, but not significantly.²⁷ Hence it is difficult to argue that the strong increase in European securitization over the period from 2000 to 2006—which, according to HSBC Global Research (2007), amounted to an average annual growth rate of 40.2 percent, with an issuance volume of about \$80 billion in 2000 and about \$725 billion in 2006—was based on deterioration of credit standards. Therefore, even if the deterioration of credit standards in the U.S. MBS market was supported by securitization, there is no simple causal link.

Purnanandam (2008) compares mortgage-related write-offs among banks that differ with respect to their involvement in true sale securitizations. The author finds charge-offs to be significantly higher for firms engaged in securitizations and interprets that finding as evidence favoring the hypothesis of loan quality deterioration, a natural consequence of aggressive mortgage lending.

Data limitations have frustrated attempts to estimate the moral hazard effects of MBS securitizations. Keys and others (2008) takes an indirect approach in comparing default rates of loans that, according to the standardized FICO rating, were eligible for a securitization transaction with Fannie Mae and Freddie Mac.²⁸ After controlling for other possible determining factors, the authors find that loans with a FICO score of above 621 had a default probability that was 20 percent higher (1 percent higher in absolute terms) than FICO-619 loans.²⁹ The authors explain the difference by the higher likelihood of the FICO-621 loans to be securitized, motivating banks to reduce monitoring of the loans. While the evidence is somewhat indirect—because they cannot show directly that lenders are lenient with borrowers whose loans are securitized—their result is the first widely cited evidence of material incentive problems in securitizations.

Second, regarding financial stability, what matters is not only the impact of securitization on loan quality but also the question of whether securitization

27. The European Central Bank regularly publishes reports on credit standards in its monthly reports.

28. The critical rating below which transfer is ruled out is 620. Thus the study compares loans with a FICO score of 621 to a comparison group with a score of 619.

29. The authors argue that the qualities of firms with FICO scores of 619 and 621 are basically indistinguishable.

makes banks more vulnerable through higher risk taking. Does the risk transfer in securitizations reduce or increase the overall risks taken by securitizing banks?

So far, the existing empirical evidence is not very strong, due to the lack of appropriate studies. The enormous growth in securitizations over the last couple of years is one indicator of a rise in overall risk, since not all the risks have been transferred to outside investors. Worldwide securitization growth rates often exceeded 25 percent over the last years. Some of that growth was also due to arbitrage transactions and therefore does not reflect increased lending. But the numbers do not clearly indicate whether originating banks expand their lending activities because of securitization. Cebenoyan and Strahan (2004) does not find a clear relation between a bank's risk and its securitization activities. Minton, Stulz, and Williamson (2005) looks at bank balance sheet data and finds that securitizing banks tend to buy more protection in the credit derivatives market and also to have low capital ratios. The latter finding is consistent with more risk taking. Franke and Krahn (2006) analyzes the stock market betas of securitizing banks and finds that they increase with securitization transactions, in particular, with repeated transactions. This finding is consistent with the interpretation that securitizing banks expand their loan portfolios so that the systematic risk of the portfolios increases. According to credit risk models like the model used by the KMV Corporation, the credit risk of a bank should be correlated with stock price movements of borrowers. Hence the market value of a more granular credit portfolio, which also drives bank market value, should be correlated more with the stock market index, leading to higher betas of bank stocks. This finding therefore supports the view that securitizing banks tend to take more credit risk. A related finding is reported in Haensel and Krahn (2007), suggesting an additional explanation for the rise in systematic risk of banks that securitize their loan book, namely moral hazard. According to that finding, banks with weak balance sheets and poor financial performance are more likely to increase their systematic risk exposure.

To summarize, the process of securitization has led to decomposition of the once-integrated value chain into a string of isolated activities. Those activities should be coordinated in order to avoid moral hazard over the life of the underlying contractual relationship and adverse selection at origination.³⁰ Effective coordination along the value chain appears hard to implement. The available evidence is still weak, but it clearly suggests a deterioration of the quality of U.S.

30. Note that value chain optimization has been a popular project area for bank consultancies like Accenture and Mercer Oliver Wyman, among many others. Given the information technology-driven agenda of these exercises in business process re-engineering, it is at least imaginable that the issue of incentive alignment was largely neglected, leading to the above results.

MBS loans triggered by securitization. The evidence on the effects of securitization on bank risk taking also indicates a positive impact, but more robust tests are needed to establish the relevance of incentive misalignment in securitization transactions to the increase in credit risk.

Ratings and Incentives in Rating Agencies

For remote investors, the quality of structured financial assets is hard to evaluate. When a party is interested in buying protection from others, it is inclined to play down its risks; hence that party's quality assessments typically are not considered credible. In contrast, the quality ratings of the big rating agencies have been regarded with trust by market participants.

As pointed out in the introduction, asset securitization evolved over the 1990s, following the dynamics typical of (financial) innovations (see Ross 1989).³¹ Rating agencies played an important role in that process. Riddiough and Chiang (2003) concludes that rating agencies, through the process of standardization, have played "a unique role" in developing and popularizing the market for securitization transactions among investors. As independent experts, agencies evaluated asset portfolios and assigned subordination levels to the tranches with given ratings. Investors apparently trusted such delegated monitoring, acting as if the risk characteristics of securitization tranches were transparent to them. The expertise of major rating agencies and their ability to separate safe, investment-grade assets from risky, non-investment grade assets allowed complex financial instruments, like securitization tranches or CDO notes to be marketed worldwide.

"Investment grade" has become a well-known quality label, even in colloquial language, indicating that a financial instrument carries a low risk of default. Financial instruments with a top rating (AAA) from one of the big agencies are expected to have a very low ex ante default probability. For example, over the past twenty years, the average AAA-rated bond has experienced a one-year default incidence of less than 0.1 percent.³² For that reason, obtaining an AAA tranche that was as large as possible was a key objective in designing securitization transactions. The flourishing market for AAA tranches relies (or relied) on the credi-

31. As shown in Riddiough and Chiang (2003), a clinical study on the emergence of the structured finance industry, two companies were formative for market development at about the same time (the early 1990s), namely Nomura Securities and Lehman Brothers. The securitization model used by Nomura emphasized a "straightforward" waterfall structure. Due to its simplicity, Nomura became the standard setter for the industry. Lehman, in contrast, was said to focus on complex structured finance products, using lower-quality asset pools. Ironically, at the time of writing, it was apparently Lehman Brother's own book of structured products, involving protection sold, that eventually brought the firm down.

32. These probabilities are taken from a rating table, which draws on the time series of thousands of bond issues over the past decades.

bility of an independent and reliable rating process. Of course, transparency was only borrowed from the rating agencies, as delegated monitors.

Rating agencies have lost much of their credibility in the current crisis. According to Bank for International Settlements (2008), the dramatic downgrading experienced in October and November 2007 was unheard of among corporate bonds,³³ for which rating migration has followed a fairly stable distribution. The massive wave of downgrades for basically all structured finance asset classes in 2008 has therefore called into question the methodologies used by the agencies to rate such structures. Of the possible reasons for the failure of the rating methodologies, the incentive system in rating agencies is an important one. That belief is supported by witnesses' statements during U.S. congressional hearings held on October 22, 2008, in which former and current managers of rating agencies revealed their perceptions of the ratings crisis.³⁴

Before 1970 the rating agencies were paid by investors, who are the recipients and users of ratings. That is in line with standard agency theory: investors demand ratings for their own benefit and therefore should pay to have their interests and those of the rating agencies aligned. After 1970, more and more ratings were solicited by borrowers. That creates a conflict of interest, because borrowers prefer overly optimistic ratings, which can lower their borrowing costs, whereas the rating agencies should produce unbiased ratings, acting on behalf of investors. If borrowers can choose between different agencies, then they can choose the agency that awards the best rating. The standard counterargument claims that rating agencies worry about maintaining their reputation; if they lose that, then neither borrowers nor investors will pay for ratings. The validity of that argument is controversial. It takes a long period of observation to obtain reliable evidence on the quality of ratings or the lack of it. Suppose it takes fifteen years. Most managers in rating agencies will have other responsibilities and positions within the firm or they may have retired by the time any cheating is revealed, so they probably will not have to bear any reputation cost through their income. We therefore are skeptical about the effectiveness of the reputation mechanism. Our skepticism is further reinforced if the management of rating agencies receives large annual bonuses dependent on revenue.

The empirical evidence on compensation and rating activity is mixed. In securitization transactions, agencies were always paid by the arrangers. According to

33. Of the 198 AAA-rated tranches downgraded in this period, the median downgrade was reported to be seven notches, while thirty tranches were downgraded by more than ten notches. Looking at downgrade statistics from 1970 to today, AAA bonds were never downgraded by more than six notches, and even those cases are extremely rare (Bank for International Settlements 2008, p. 22).

34. Fons (2008).

Fons (2008), after 2000 Moody's management focused increasingly on maximizing (short-term) revenues, rather than (long-term) firm value. For structured finance products, agencies handed out client versions of their own rating models, allowing arrangers to game rating standards. According to Raiter (2008), S&P had developed better rating models over the years but never implemented them due to high costs.³⁵ Also, rating agencies did not subject the loan data provided by investment banks to proper due diligence; they relied instead on the assessment information provided with the data. The excuse was that investment bankers usually had hired specialized firms to perform due diligence. We conjecture that the lax standards can best be explained by an incentive system that awards managers bonuses that depend on fee income.

A related question is whether the rating standards applied by the agencies may have deteriorated over time. While Fons and Raiter support that view, the rating agencies deny it. Blume, Lim, and McKinlay (1998) largely confirms the stability of the rating process for corporate bonds; rather than any loosening of rating standards over time, they find a slight tightening. Their findings are consistent with those of theoretical models of the rating industry, which emphasize credibility and reputation with respect to firm monitoring (see, for instance, Millon and Thakor 1985).³⁶ A similar study addressing standards of structured finance ratings is not available.

However, in a study of transactions involving commercial mortgage-backed securities (CMBs), Downing, Stanton, and Wallace (2008) documents that the subordination levels for tranches declined significantly over time. The average subordination level for AAA-rated tranches was about 36 percent in 1996 and declined to less than 15 percent in 2005. Similar declines were reported for AA- and A-rated tranches. The authors argue that some of the decline was driven by the low levels of defaults in recent years, but longer histories show much higher default rates, suggesting a practice of excessively low subordination levels. That, in turn, is consistent with the view that rating standards in the securitization business have been lowered over time. However, the current chairman and CEO of Moody's, Ray McDaniel, argues that his company began warning about subprime

35. Raiter is a former S&P managing director.

36. More recent studies stress the two-way interaction between rating agencies and firms concerning, for example, capital structure and investment decisions. For example, Kisgen (2006), drawing on the theoretical work by Boot, Milbourn, and Schmeits (2006), shows that firms at risk of losing a particular rating notch try to "improve" their capital structure—that is, to issue less debt relative to equity than they would otherwise. The author concludes that firms make some effort to meet standards set by agencies, which shows that rating downgrades are in fact costly for firms.

market quality back in 2003, and accordingly raised the subordination levels by about 30 percent between 2003 and 2006.³⁷

Regarding incentive misalignments, Deven Sharma, the current president of S& P, and McDaniel argue that rating analysts do not get bonuses related to fee income from companies that they rate; therefore, they should have no incentive to lower rating standards.³⁸ That argument is weak, however. If the managers and rating analysts receive bonus payments depending on the overall revenue of the rating agency, then that promotes an atmosphere of joint revenue maximization, and lowering standards can certainly help to achieve that objective. The argument based on long-term reputation costs may again be dismissed, as above.

We therefore believe that the performance-oriented pay of managers and rating analysts in rating agencies promotes deterioration of rating standards. That hazard can be mitigated by internal measures to safeguard rating standards, but it cannot be ruled out entirely. One self-imposed response might be to restrict performance-oriented pay components in favor of higher fixed salaries. In any case, investors are warned not to accept ratings naively as a reliable sign of quality.

The Transparency Failure

Lack of transparency is often mentioned as one of the main drivers of the asset market and of interbank market illiquidity. Transparency has different meanings in this context, one being transparency about the quality of financial assets, the other being transparency of counterparty risks in the interbank market. We start with the transparency of asset quality.

Transparency of Asset Quality

Before the crisis, asset quality was considered transparent because investors trusted the ratings assigned by the rating agencies. Standard discounted cash flow models were applied based on the ratings and the risk premiums observed in neighboring markets. After the avalanche of downgrades at the end of 2007, confidence in ratings was badly disturbed. Hence, the standard valuation model could not be applied because the necessary data were lacking, and asset valuation became nontransparent.

That lack of transparency relating to tranches is reinforced by three factors, which presumably were unknown to most investors. First, tranching results are very susceptible to the distributional assumptions describing the underlying pool

37. McDaniel (2008).

38. Sharma (2008) and McDaniel (2008).

of claims, in particular asset correlations and the moments of the portfolio loss rate distribution.³⁹ Second, AAA tranches and corporate bonds of the same rating quality possess very different sensitivities to macro risk factors, as illustrated in Krahnén and Wilde (2008). Given the same default probability for tranches and bonds—for example, 1 percent for a maturity of ten years—macro factor sensitivity is much stronger for the tranche than for the bond. That is due to the strong diversification in AAA tranches, making them more sensitive than bonds to macro factor deterioration.

Such differences in sensitivities were not widely known, and they certainly were not reported to the outside investor.⁴⁰ Even experts in the industry saw hardly any need to add caveats to the use of well-known bond ratings in assessing the default risk of tranches from a securitization transaction.

Third, a first-order stochastic dominance deterioration of the loss rate distribution raises the expected loss of the first loss piece and of the AAA tranche. That is relevant for our analysis because a key piece of information, typically not reported to outside investors, may have a strong impact on both the actual portfolio loss rate as well as the loss rate expected by the market. That critical piece of information is the originator's retention of the FLP, because of its likely effect on management incentives.⁴¹ As stated above, despite all efforts by analysts and researchers, there exists no overview of first loss piece allocation. Perhaps financial institutions have not yet recognized the signaling potential that a revelation of equity retention could have on the market.⁴²

It is therefore necessary to have information on the retention decision if one wishes to estimate the default risk of an asset portfolio and securitization tranches. Rating agencies may have some knowledge about the whereabouts of equity pieces, but apparently they have not made use of the information. Furthermore, it appears that the retention question typically was not discussed among model builders, as they probably felt it to be irrelevant for their estimations.⁴³ Since

39. See Krahnén and Wilde (2008); Franke and Hein (2008).

40. Gibson (2004) presents a detailed description of the pooling and tranching methodology used by the major agencies.

41. A more complete presentation of this argument will have to lay out the value-enhancing effect of long-term relationships, accompanied by risk underwriting and therefore long-term incentive alignment concerning initial screening, intensive monitoring, and proper bailout incentives (see Brunner and Krahnén 2008).

42. In an ECB conference on financial market statistics in 2006, the need for detailed information on equity piece allocation was discussed and proposals for implementation were presented as a novel idea; see Haensel, Krahnén, and Wilde (2006).

43. Despite many attempts by both authors to address this topic in workshops with practitioners, mostly financial engineers, and in industry gatherings since 2004, the question never elicited a serious response or debate. Another sign of complete negligence vis-à-vis the incentive issue relates to the techni-

models rely on historical loan portfolio data in validating ratings, the models used by the agencies may fail to recognize the importance of first loss piece retention.

The issue of opaqueness of effective risk allocation has been addressed by several studies, for example, Gorton (2008) and Brunnermeier (2009). Their authors point at the complexity of the pooling and tranching methodology and the difficulty of seeing through the many layers of CDOs and conduits and other financial institutions. However, they do not address the retention decision, which we believe to be at the core of the problem.⁴⁴

To summarize, we find transparency about financial assets, securitization tranches in particular, to be very poor, notably following the breakdown of confidence in ratings, which resulted in lack of the data needed for valuing securitization tranches. It therefore is not surprising that the issue of opacity was seriously discussed only after mid-2007, perhaps because many investors had become aware of incentive misalignments by that time.⁴⁵

Transparency of Counterparty Risks

In 2008, several investment banks collapsed almost overnight, even though their Tier 1 and Tier 2 capital ratios were clearly above the levels required by Basel 2. Speculators' short selling of stocks of these banks proved very profitable; subsequently, short selling was restricted in many countries. That raises the question of why the banks apparently could not regain market confidence and survive. Our explanation relies on a lack of transparency concerning counterparty risks. Even though banks publish quarterly accounts, the reports provide only limited insight into a bank's risk position; even fellow banks will find it hard to evaluate the risk exposure of their peers. For example, consider the value-at-risk figures that had been disclosed by banks in the years before the onset of the crisis. Those numbers were said to be in the low three-digit US\$ millions, even for large international banks—

cal manuals published by the rating agencies that explain their modeling techniques. While the manuals do not specify all the details, presumably to avoid duplication of techniques by rivals and customers, we could not find any hint of the sort of retention-related agency problems that we address.

44. Note that opaqueness relating to the location of senior tranches, mentioned in Gorton (2008), will have little if any repercussions on the underlying asset value. Hence senior tranche opaqueness will have less dramatic consequences than junior tranche opaqueness. Interestingly, it is apparently easier to obtain information on the allocation of senior tranches. See the table "Estimated Holdings of AAA CDO Tranches" in Gorton (2008, p. 43), which shows a breakdown of holdings by type of buyer. Similar tables for junior tranches do not exist.

45. In a speech on the subprime lending market given on May 17, 2007, Ben Bernanke concluded: "In sum, some misalignment of incentives, together with a highly competitive lending environment and, perhaps, the fact that industry experience with subprime mortgage lending is relatively short, likely compromised the quality of underwriting" (Bernanke 2007).

small numbers compared with the figures for the subsequent write-downs in 2007 and 2008.

We argue that the nontransparency of the quality of financial assets translates into nontransparency of the balance sheets of the financial intermediaries holding the assets. Consider the models used by banks for determining write-downs of their financial assets. The high level of write-downs shown by many international financial institutions over the 2007–08 period may be due to the fall of secondary market prices. However, it may also be due to bank reporting policy, independent of market price movements. Finally, lack of transparency of bank risk is also a consequence of risk fungibility. Banks can alter their risk position very quickly by using financial assets, financial derivatives in particular. Since most of the time derivatives can be traded with little impact on liquidity, such transactions are especially easy to carry out.

These arguments explain why bank risks are difficult to evaluate from the outside; they also explain why risk reporting of banks is an important topic on the current policy agenda. The obvious implication of the risk evaluation challenge pertains to evaluation of counterparty risk. Another implication is that a bank cannot easily invalidate adverse rumors about its solvency, rendering itself vulnerable to speculative attacks.

Here we see another “private good, public bad” problem. Bank managers consider information about “their” bank risk to be valuable private information and therefore are reluctant to disclose it to the public. At the same time, financial markets cannot work properly without sufficient information on bank risks; hence that information has the character of a public good. By not disclosing the information, managers try to free ride on financial stability—that is, they hope that they can extract all the benefits from trading in financial markets without making the contributions necessary to the proper functioning of the markets.

Liquidity

The preceding arguments relate closely to loss of market liquidity, which has been widely documented.⁴⁶ Liquidity loss is observed in financial asset markets as well in the interbank market. Market microstructure research has emphasized the importance of information on trading and pricing of financial assets. Glosten and Milgrom (1985), among other studies, has argued that transaction costs on asset markets, reflecting liquidity, increase with asymmetry of information among market participants. The stronger the information asymmetries, the higher the

46. See Allen and Carletti (2008) and Brunnermeier (2009) on the enormous loss in liquidity emanating from the CDO market and then spreading to neighboring markets with similar opacity characteristics.

bid-ask spread required by market makers to insure themselves against a bad trade with an informed party.

By a similar argument, the ask price for an asset will be inversely related to the degree of asset opacity. The term “opacity” describes the extent to which a buyer, using available information, is able to assess the “true” cash flow distribution of an asset and thus its riskiness. Caballero and Krishnamurthy (2008) models these opaque situations as Knightian uncertainty, in which probabilities are unknown. Buyers may then follow min-max strategies in these situations, focusing on the extreme scenario. Thus, with high levels of opacity, prices may drop significantly.

Hence, the liquidity (or rather illiquidity) of an asset can be related to the information regime. As argued previously, transparency about securitization tranches is impaired by lack of information on the agency problems in the value chain. Equally, transparency impairment results from a lack of information on FLP retention and on the quality and stability of agency ratings. Apparently, before the onset of the crisis, that lack of information was not felt to be critical by investors. When investors became aware of the transparency failure, asset market liquidity collapsed. Furthermore, the opacity of asset values may translate into opacity of financial intermediaries trading those assets (see also Adrian and Shin 2007). Given this and the lack of reliable reporting of bank risk, the interbank market largely disappeared as well.

We therefore believe that the liquidity loss in secondary markets for notes, bonds, and commercial paper as well as the shutdown of the interbank market is not a natural disaster caused by a sudden decline of U.S. house prices nor is it the consequence of euphoria and fear in asset markets. Rather, it is, at least in part, an implication of externalities imposed on financial market stability by financial intermediaries that used securitization technology without regard to the stability of the quality of underlying assets.

The Future of Securitization

Taking a helicopter view of today’s financial market turmoil, one is inevitably reminded of an old economic tale, the tragedy of the commons. The term originally was coined by Gerrit Hardin in his seminal article in *Science*, in which he recounts the story of the demise of community grazing land open to all residents of a township.⁴⁷ The upshot is, of course, that individuals pursuing their self-interest may exert external effects in the form of overgrazing, ultimately destroying the common resource.

47. Hardin (1968).

The crisis that we are now witnessing has some analogous characteristics. Financial stability may be seen as a commons, undermined by the overleveraging of standard banking activities, the erosion of real estate loan quality, and the design of complex financial instruments. Market liquidity eroded to the point of complete market disruption, and prices fell to levels unimaginable at the time of issue.

Still, looking down from the helicopter, we now realize that misaligned incentives on the micro level—that is, the pursuit of individual happiness on the firm level—can lead to complete opacity on the macro level, eliminating vital market functionalities, namely pricing efficiency, market depth, and liquidity. Of course, deficiencies on the micro level are not universal. A large number of financial intermediaries maintained a prudent policy over the last years. But others, including some large players, did not. That caused the contagion, which first affected those players but then undermined confidence in the financial system on a large scale, with far-reaching effects.

As we have tried to show, this crisis is a “rational crisis.” It is not the result of irrational exuberance of any sort, nor is it the consequence of euphoria and fear, as some observers have argued (see Greenspan 2008). We have identified weaknesses and violations of rules of prudent financial engineering that may be called the root cause of the immense degradation of asset value over the period from the middle of 2007 to the end of 2008. These violations also have contributed to the significant drying up of market liquidity in several of the most popular financial instruments of the last decade, like CDOs, commercial paper, and ABSs in general.

We thus deliver a structural explanation of why the crisis was to be expected, given the incentives of market participants and the inadequacy of the current rules of the game. These structural faults refer mainly to the design of securitization transactions, which in turn determine the subsequent decisionmaking of banks, firms, and households. Consider incentive-compatible engineering. The tranching of asset portfolios, which is the key construction element of these transactions, did not (or not sufficiently) take into consideration the externality that a loan sale exerts on loan quality, both *ex ante* and *ex post*. Since incentive alignment can minimize that externality, one would have expected investors to ask for ample information describing incentive arrangements in these transactions. But nothing of that sort happened; nor did the issuers inform the market or the rating agencies publicly address the question of incentive compatibility.⁴⁸

48. However, industry experts acknowledge that large institutional investors typically have forced originators to retain the first loss before investing in these products.

As a result, the market was flooded with financial instruments whose underlying quality was doomed to deteriorate over time. The degradation of asset quality came as a surprise to most individual and institutional investors, whose trust in agency ratings was badly damaged. Investors responded rationally by shutting down the market.

However, a question remains: why did financial engineers and managers pursue a strategy that created externalities in the first place? We have offered our view, but we acknowledge the existence of other explanations that produce similar predictions. Research may eventually tell the full story. One plausible explanation starts with an individual manager using securitization to maximize his or her wealth. The ensuing transfer of long-term assets from the balance sheet to investors in the market allows reaping almost risk-free profits at the time of issue but weakens long-term incentives.

To see how, consider a set of assets held on the balance sheet, producing a stream of profits over time. The very same set of assets securitized and sold in the market will earn the originator an almost risk-free first profit position. If the originator fully sells the FLP, then he or she is left with a position that is almost equivalent to a gain on sale. Thus, securitization allows for front-end loading of the transaction, although it would have produced more back-end loaded profits if retained on the balance sheet.

If bank management is motivated by some profit-sharing bonus, we predict that bank managers will be interested in asset securitization simply because it may increase their income without imposing any commensurate risk premium—the risk in the form of increased default probabilities is borne for the most part by shareholders and third parties in case of bank insolvency. In other words, the incentive to expand securitizations was reinforced by the fact that the management payoff was cashed out as a bonus well before the externality was felt in the profit-and-loss statements of the bank. In addition, profit sharing through bonuses without an appropriate malus reflecting downside risk may have invited managers to increase bank risks, since managers could appropriate returns privately while the added risks were borne largely by shareholders and third parties.⁴⁹

Who, then, is to blame? We claim that, apart from the lack of a malus component in compensation, internal accounting rules for deriving bonus bases were not designed for the “hybrid” world of modern banking that has emerged over the past ten years. To date, there is no explicit accounting for future losses and risks in profit-and-loss statements. Thus, by marketing information-sensitive assets, financial intermediaries could realize and distribute profits that otherwise would

49. Of course, a malus can be imposed by giving the manager a share in the terminal value at date zero.

accrue only in later years and only under favorable (“normal”) circumstances. The intertemporal transfer of earnings (to the present time) partially explains the enormous interest of investment bankers in these transactions, and it also explains why such transactions simultaneously tended to undermine the real value of the underlying portfolios.⁵⁰

We now turn to the policy options, taking our structural explanation of the crisis as the foundation for policymaking. Since we see negative externalities at work, there is indeed a case for policy intervention. The aim is to internalize to the extent possible the externalities found in the markets.

Securitization 2.0

If we go back a few years, we encounter another financial crisis that has shaped our understanding of equity markets. Around the year 2000, the so-called dot-com bubble, a drastic fall in stock prices of mostly young technology firms, wiped out the wealth of many equity investors. Preceding the crisis was a long and enormous rise in market valuation for high-tech firms, which eventually proved to be unsustainable. Of particular importance in these markets were web-oriented business models. In hindsight, it is clear that many of the firms did not have a sustainable business model.

Only a few years later, the market is embracing a number of successful firms that are built on very similar web-based business models, but these firms are said to cope much better with the difficulties of generating earnings on the otherwise free, open-access Internet. The amended business models often are subsumed under the heading “Web 2.0” to indicate their advanced degree of sophistication (O’Reilly 2007). But in fact, the now-successful enterprises have profited from the dotcom bubble as an important learning experience.

In quite a similar fashion we expect securitization to face a strong future—after it digests the lessons of the current credit crisis. That is why we look for the minimum government intervention required to ensure that those lessons to have an effect in the markets. Our recommendations fall into three broad categories, which we refer to as incentive-related, transparency-related on the micro-level, and transparency-related on the macro-level.

Incentive Alignment and Compensation

As explained, the lack of public information on the status of incentive alignment along the securitization value chain is probably the single most important

50. Ralf Ewert alluded to the Enron and Worldcom cases, which display quite similar features, notably concerning the use of earnings preponement. See Benston and Hartgraves (2002).

reason for the recent investor strike.⁵¹ That insight, however, does not imply that the arrangers should be forced to retain a specified fraction of the issue, as suggested in a recent legislative proposal of the European Parliament. It does not even imply that arrangers ought to retain any part of the issue, provided that investors know that they don't.

The analysis suggests instead that for each issue, the market needs to know precisely what incentives the agents in the value chain have to safeguard loan quality. In particular, it is important to communicate the extent to which the arranger and other agents retain the first loss piece. Regardless of whether an investor is a monitoring specialist like the local commercial bank or a banking amateur like a pension fund, once the investor knows how the first loss piece is allocated, it should be able to understand the risk implications. We claim therefore that public information about incentive alignment, by issuer, will lead the market to sort it out and to establish different prices that reflect incentive alignment or the lack thereof. That implies that differences in incentive alignment become visible in a separating instead of a pooling equilibrium.

Once prices reflect individual qualities, opacity is diminished, as is necessary for liquid asset markets. With transparency regarding the holding of the first loss piece, arrangers will internalize the effects of selling the equity piece, and we predict that substantial first loss piece retention will be the model of choice whenever the underlying assets are highly information sensitive.⁵² In other words, investors will buy tranches only if there is effective retention of the first loss piece.

In practice, retention alone will not be sufficient for "comprehensive incentive alignment," as we have explained. However, that information can be amended by a more comprehensive measure of incentive alignment throughout the securitization value chain that could be produced and continuously monitored by independent information providers. Whether or not auditing firms and rating agencies are independent probably depends on their business model. Ideally, the market reaction to this information would induce the arranger to reshape the value chain so as to mitigate incentive problems. We therefore expect to see some re-intermediation.

Our suggestion emphasizes public information on incentive alignment in order to give it the prominence it deserves, which is mostly lacking in today's ABS markets. We are confident that the industry will quickly develop reasonable standards that allow internalizing incentive alignment in valuation models.

51. The term "investor strike" refers to the refusal of private and institutional investors and banks to buy securitization tranches.

52. "Information-sensitive" in this context refers to underlying assets that are prone to adverse selection and moral hazard.

We argue that front-end loading in securitization transactions is one reason why performance-oriented remuneration generates perverse incentives; here “perverse” means without proper regard to the implications for the longer-term quality of the underlying assets. Compensation systems provide strong incentives for transactions that allow for large gains on sale, for example, through first profit positions.⁵³ Risks imposed on others tend to be ignored. Moreover, the incentives stemming from annual bonuses depend on the accounting of the bonus base, which, in turn, is closely related to accounting method. If the profit in early years does not correctly anticipate losses and risks, then the present value of manager bonuses will be overstated because it includes risk premiums for subsequent years. Accountants need to develop models that take those risks into account properly. If managers do not face downside risk—for example, through a malus—we should not be surprised to find them selecting high rates of bank leverage. A malus needs to be built into the compensation model, shifting profits into the future so that the manager bears more of the risk.

If one looks for remedies against departures from incentive-compatible back-end loaded compensation, there is not much room for the regulator. The only instrument available to encourage incentive harmonization is, once again, transparency. Let investors know what compensation a deal produces and they will learn how to sort out the major incentive problems. Furthermore, once the market differentiates between deals according to the design of their incentives, there will be competitive pressure in the financial industry to install appropriate compensation systems.

Once again, independent information providers are candidates for the task of producing information about compensation-related incentive alignment, regularly updating that information, and communicating it to the market. Rating agencies have demonstrated in the past that even coarse information systems, like bond rating schemes, can fulfill that task quite well. While we see a positive role for the regulator in getting such a reporting system started, we see no role in designing the compensation system.

Rating

While we appreciate the improved access to statistical data, particularly for research purposes, that is not the kind of transparency required to liquefy ABS markets. As argued before, the key providers of information to investors in these

53. In addition, the accounting for retained tranches—in particular, the equity tranche—poses serious problems. These tranches are booked at fair values. Since there is no active market for them, management has discretion to select a value. In effect, management can select, within certain boundaries, the size of the gain to be booked into the income statement. See for example Dechow, Myers, and Shakespeare (2007) and

markets are rating agencies,⁵⁴ which have a strong record of judging default risk of corporate bonds but were not adequately prepared to handle asset-backed securities.

Proposals to regulate the rating industry abound. A major concern is the conflict of interest between investors and rating agencies, which are paid by the bond issuers. We are not in a position to present entirely new proposals. However, we see a major problem in the compensation system of rating agencies, which includes strong performance-related components. Performance cannot be measured easily by the quality of ratings because quality becomes visible only after a long time. Currently performance with respect to compensation is typically measured by the fee income of the agencies, creating a substantial conflict with rating quality. Hence, the compensation of employees of rating agencies should be independent of agency fee income. Compensation that is less dependent on performance might be viewed by investors as a sign of quality.

Is regulation required? We see a positive role for regulation in principle, although one that is perhaps very different in substance from what we have seen in the literature or the political arena. More precisely, we are skeptical about having regulatory bodies regulate any technical detail of the rating method or requiring a rating agency to make its methodology public. Agencies should be free to develop their own methodology, just as they have successfully done in the case of corporate bond ratings.

Regarding transparency of rating agencies, we see three areas on which a regulatory body might publish data. First, regarding the short term, investors should know to what extent rating agencies carry out first-hand due diligence as part of the rating process. The reported lack of any proper due diligence in the case of MBS transactions is a sign of serious incentive misalignment that presumably facilitates the lowering of credit standards. Second, the regulatory body should assess the implications of the incentives used by the rating agencies in developing their compensation systems. Third, regarding the long term, regulatory bodies could publish information on performance. Rating performance refers to the validity of rating assignments—that is, the accuracy with which the announced default probability predicts default. There is a set of common accuracy statistics. In theory, accuracy determines the economic value of agency ratings. Solid rating requires a precise and long-lived database of assigned ratings and observed defaults and an independent body to warehouse and analyze the

Karaoglu (2005). There is some evidence in the empirical accounting literature that earnings management in gains-on-sale transactions is indeed an issue; see, for instance, Dechow and Shakespeare (2006).

54. Because rating information reports broad rating notches only and does not provide continuous updates, it is coarse and slow, but it nevertheless is relevant for remote investors.

data. That also includes the difficult task of reliably estimating default correlations in asset portfolios or, even more complicated, in copula parameters. Otherwise, tranching of portfolios cannot be viable. Today, investors rely on performance statistics disclosed by the agencies themselves, which may be biased due to conflicts of interest.

Reducing Opacity:

Differential Capital Charges and Comprehensive Exposure Survey

While our previous recommendations addressed opacity in incentives and asset quality, the following recommendations address opacity in banks and risk exposure of the banking sector. Bank managers have strong incentives to hide information on financial assets and on the risks of their institutions. That leads to opacity on the macro level and impairs liquidity of asset markets and of the inter-bank market—that is, it generates negative externalities. Capital regulation can be used to encourage financial institutions to increase transparency; one way is through capital charges that are inversely related to transparency. Requiring banks to hold equity against opacity in addition to holding capital against risk-weighted assets would be an innovation in capital regulation. It explicitly addresses incentive problems at the bank level through capital requirements. Note that such a regulatory extension need not imply an increase in overall capital charges. If, for example, an average capital charge of 8 percent is desired, the differential charges may range from 6 percent for very transparent banks to a charge of 10 percent for institutions with low transparency.⁵⁵ Differential charges signal to banks that more transparency pays off, stabilizing financial markets at the same time. We have no recommendations on how to construct an opacity index for banks. That is not an easy job, like improving bank risk reporting.

Another transparency issue that we have not addressed so far refers to sector-specific information, in particular information on the exposure of the banking sector to particular risks. A single bank may be strongly exposed to some (idiosyncratic) risks without endangering financial stability if those risks materialize. If, however, the banking sector is systematically exposed, then such risks may easily destabilize the financial system as a whole. Therefore, sector-specific information can act as an early warning device, encouraging banks to be careful when underwriting those risks.⁵⁶ Central banks and supervisors should be able to map out the allocation and distribution of risk exposures in financial markets. That clearly is not done today,

55. How to determine the incentive alignment score is still an open question; we do not go into any details here.

56. It might also have the opposite effect if bank managers herd—that is, select highly correlated risks.

and some research effort is needed to develop concepts and tools for drawing what one may call an international risk map.

In many ways, that is what the BIS has attempted to do over the past few years. No doubt, BIS reports will become more recognized after this crisis, as they pointed out the weaknesses of the once-celebrated risk-transfer market as early as 2005. Comprehensive risk reporting has to look at the large financial institutions, including entities that so far have managed to avoid the reporting obligations demanded by regulatory bodies, like hedge funds, or institutions domiciled in off-shore financial centers. The comprehensive risk survey that we envisage is a periodic rather than a continuous exercise, with the objective of providing an early warning system for market participants and regulators alike.

The early warning mechanism can be strengthened further by setting up an international credit register that aggregates liabilities on the debtor level. If the scope of such a credit register is defined to encompass financial institutions as well, for the first time supervisors will have a database that allows them to evaluate systemic risk.⁵⁷

Summing up: Proposed Regulatory Measures

Building on our analysis of how misaligned incentives at the bank level can bring down the entire financial market if many banks use such incentives, we propose five regulatory measures whose objective is to restructure the now-defunct asset and interbank markets:

—First, require transparency with respect to tranche allocation in all ABS transactions, especially concerning first loss pieces.

—Second, ensure transparency regarding the use of front- and back-end loaded compensation systems, including a balance between bonus and malus components. A methodology has to be developed to measure transparency, and independent information providers should publish the information when it becomes available.

—Third, make information on the compensation system of rating agencies publicly available. Moreover, validate the information content of agency ratings for corporate bonds and for securitization tranches by credible and independent institutions, such as supervisory bodies and auditors.

—Fourth, impose opacity-related capital charges in addition to risk-related charges in order to regulate banks. Again, the metric for capturing degrees of opacity still has to be developed, but we are confident that it is possible to do so.

57. There also may be indirect measures of systemic risk, like the correlations of bank stock prices with a market index, as suggested in Haensel, Krahen, and Wilde (2006).

—Fifth, aggregate the risk exposures of financial institutions across countries and over time and report them in order to provide a complete picture of the sector exposure (a global risk map).

These five rules for greater transparency and soundness are less severe than many of the ambitious regulatory proposals that are being discussed in the public domain today. Our main reservation regarding these proposals is that often they are not sufficiently backed by theory or empirical research and that dysfunctional proposals are hard to correct. An example is a recent legislative proposal of the European Parliament requiring banks to retain 10 percent flat of every securitized transaction. The German government went even further, demanding 20 percent retention on all asset-backed securitizations. However, forced retention cannot be derived from theory. Conversely, the X percent-retention rule actually invites banks to bypass its intended effects and to game the loss rate distribution. We believe that investors can learn, so that it should be sufficient to force banks to publicly disclose their retention decision.

In concluding we point out that currently there are two camps in the debate. One stresses the hypothesis that the credit crisis that we are witnessing today was caused by an exogenous liquidity or solvency shock, with prices diverging from fundamental values, and employs limits-to-arbitrage arguments to rationalize the enduring fall in prices. In contrast, the second camp claims that the credit crisis is all about incentives—or rather, about misaligned incentives and the ensuing lack of transparency. We clearly belong to the second camp. We advocate transparency in order to stimulate investor reactions, which in turn induce institutions to adopt prudent incentive systems.

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