

**Banking Reforms for the 21<sup>st</sup> Century: a Perfectly Stable Banking System Based on  
Financial Innovations**

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### **Abstract**

Although bank loans themselves are somewhat illiquid because of private information, most of their cashflows are not. Recent financial innovations allow commercial loans to be liquefied via credit derivatives and actual and synthetic securitizations. The loan originating bank holds the remaining illiquid equity tranche containing the concentrated credit risk, private information rent and the “excess spread” that incentivize the bank to continue to monitor and service the loans. Empirically, we find that the average size of the equity tranche is about 3% for the representative commercial loan portfolios in our sample. The liquefaction of bank loans makes possible a banking system that restricts the guaranteed accounts to be backed by 100% reserves and the non-guaranteed deposits to be backed by liquid securitized loan tranches, while retaining the deposit-lending synergy. Such a system is perfectly safe without deposit insurance and it renders banks bankruptcy-remote without sacrificing a bank’s traditional role as a financial intermediary.

## Introduction

The fractional reserve banking system prevalent in most countries certainly has not been a conspicuous success. Over the past twenty five years, we have witnessed numerous banking crises in industrialized countries as well as developing countries, from Northern Europe to Latin America to Southeast Asia.<sup>1</sup> None of these, however, were as spectacular as those in the world's largest two economies - the US and Japan. The banking crises of the 1980s and early 1990s in the US ultimately cost about \$200 billion to clean up. The direct cost to clean up the Japanese banking crises easily exceeded one trillion dollars. The indirect cost of dragging the Japanese economy down for more than a decade is likely to be many times that. Just as the Japanese economy is finally emerging from the "lost decade," many major US and European banks are facing a fresh financial crisis in 2008 from their investments in risky loans. By the autumn of 2008, the banking systems in the US and Western Europe have essentially collapsed. All major banks in the US and many major banks in UK, Germany, Switzerland, Spain, Belgium, Netherland, Iceland and other parts of Europe are partially or wholly nationalized.

At the root of many of the banking system problems is the common practice for banks to take "riskless" liquid deposits and turn around and invest the money in risky illiquid loans. Bank loans are illiquid in part because banks are generally thought to have private information about the borrower that the market does not have. Banks play an important role in providing private (versus public) sources of funding to borrowers who cannot credibly convey or are not willing to divulge inside information to the public.<sup>2</sup> This, unfortunately, induces a fundamental mismatch of risk and liquidity in banks if riskless liquid bank deposits are backed by risky illiquid bank loans.

Banking authorities have been trying to solve this problem with a convoluted system of deposit insurance, regulations, monitoring, surveillance, capital requirements and bailouts. Despite the heavy intrusions of government into the private investment process in regulating

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<sup>1</sup> See, e.g., Kaminsky and Reinhart [1999] for a list of countries that experienced banking crises in recent years. The 2008 crisis is still on-going.

<sup>2</sup> Banks play a special role as a financial intermediary. See, e.g., Kane and Malkiel [1965], Diamond and Dybvig [1983], Diamond [1984], Santomero [1984], Fama [1985], James [1987], Calomiris and Kahn [1991], Freixas and Rochet [1997], Boot [2000], James and Smith [2000], Diamond and Rajan [2001], Kashyap, Rajan and Stein [2002], Dahiya, Puri and Saunders [2003] and the review paper by Ongena and Smith [2000].

banks, banking crises continue to erupt. The moral hazards posed by deposit insurance and anticipated government bailouts, combined with the high leverage ratios in banking, make such a banking system highly fragile and disaster-prone. Perhaps, it is time to take a fresh look at this old problem!

During the banking crisis years in the 1930s, there was a proposal by Irving Fisher and others to separate a bank's deposit liabilities into two distinct components: the transaction accounts would be backed by 100% reserves and the non-guaranteed savings would be backed by risky loans. In such a system, there is no need for deposit insurance (except for fraud) and there is no need for the government to intrude into the private loan and investment process. While this proposal was favored by some bankers to deal with the banking crises then, many other bankers preferred a system of deposit insurance with government regulations and bailouts (Calomiris [2000]). Fisher's proposal was ultimately defeated in the US Congress as Amendments to H.R. 5357 (see Fisher [1936]).

Critics of Fisher's proposal would argue that the illiquid bank loans that support the non-guaranteed deposits would also make the deposits illiquid. If few depositors were willing to hold illiquid deposits, banks would lose their role as a private source of financing. Such an equilibrium could well be less economically efficient than the fractional reserves system (with deposit insurance and government interventions) that preserves the liquidity of most deposits and preserves the traditional role of banks as financial intermediaries.

The main purpose of this paper is to show that recent financial innovations provide a simple solution to this dilemma. The phenomenal growth of the credit default swap market over the past few years allows highly efficient transfer of credit risks between financial institutions, institutional investors and intermediate market instruments. Furthermore, when credit risks are packaged via actual and synthetic securitizations, the vast majority of the value of a bank loan can be financed with liquid market instruments, and the loan originating and monitoring bank would hold the remaining illiquid residual tranche as incentives. Thus, recent financial engineering can slice out the illiquid portion containing the private information of a bank loan for the loan-originating bank to hold, and securitize the liquid portion of a bank loan for the institutional investors and non-guaranteed depositors.

Empirically, we find that the illiquid portion in representative loan pools is small and the typical level of capital in the banking system is sufficient to support this illiquid portion.

The recent market innovation of using “excess spread” as a dynamic incentive mechanism further helps align the interests of the bankers with the institutional investors and non-guaranteed depositors. Consequently, banks can retain their traditional role in providing private sources of financing and fund the loans with liquid non-guaranteed deposits, all without government interventions and free of deposit insurance. At the general equilibrium level, if it is our national policy for the government to intervene in the relative supply of riskfree to risky investments in the economy to smooth out credit shocks, this can be accomplished with less distortion under a system with 100% reserves than under a system with fractional reserves and deposit insurance.

An important lesson we learn from the 2008 crisis is that exotic financial instruments may become difficult to evaluate under crisis conditions. The 2008 financial and credit crises arise because of excessive risk taking by banks in search of higher profits. When the values of those risky loans fall precipitously, the monetary authorities have to step in to bail the banks out. But the complexity of the financial instruments involved has made the valuation and the bailout more difficult in many cases. Therefore, in this paper, our central idea is based on those plain vanilla financial instruments and avoids the more exotic variety.

A banking reform scheme of this scale invariably has many interesting minor issues that cannot be addressed in a single paper. The main objective of this paper is to set up the overall framework of such a banking system. In section 1, we briefly review the recent banking crises and the history of the 100% reserve idea. Section 2 examines the feasibility of a variant of the 100% reserve idea taking into account of the latest innovations in market technology and credit derivatives. We illustrate how securitization can slice out the liquid portion of a loan’s cashflows and transform them into marketable securities, and save the illiquid economic core to be retained by the originating bank as the “skin in the game.” In section 3, we use the data bases provided to us by Moody’s and Standard and Poor’s to estimate how large is this illiquid portion of representative bank loan pools that has to be supported by bank capital. Section 4 considers the sufficiency of the market in linking liquid bank loan tranches to non-guaranteed deposits and the supply of government securities for the guaranteed deposits. Section 5 discusses the desirability of the resultant banking system over the prevalent fractional reserves banking system. Section 6 concludes the paper.

## 1. The recent banking crises and the 100% reserve plan

Perhaps the best way to appreciate the problems inherent in the current banking system is through the lessons of the recent banking crises in the largest two economies in the world: US and Japan. Both countries run a fractional reserve system supported by deposit insurance laden with moral hazard.

The early 1980s marked the beginning of a new banking era for banks in the world. Financial innovations, deregulations and international competition pushed many US banks away from their once sheltered market (including deposit interest rate ceilings) into risky portfolios. Large banks assumed greater risk to boost profits, but many of them failed. At the same time, the S&Ls were hit hard because of the mismatch in interest rates. The banking crisis period in the US did not end until the mid 1990s when the US economy was several years into its longest expansion period.

The S&L debacle ultimately cost about \$160 billion, of which an estimated \$132 billion was borne by the taxpayers. The cost of FDIC failed-bank resolutions during 1980-94 was \$36.3 billion (the mutual savings bank crisis, Continental Illinois, Texas bank crisis, Northeast bank crisis and others).<sup>3</sup> With the outbreak of the LDC (less-developed-country) loan crisis in 1983, the problem for the big money center banks posed even greater systemic risks for the survival of the US banking system, as “seven or eight of the largest ten banks in the US might have been deemed insolvent (FDIC)” if their loans had to be marked to market without regulatory forbearance. The FDIC review (Footnote 3) pointed out that “the seven-year period (1983-89)...was devoted to...protect the solvency of the US financial system.” Fortunately, unlike the S&Ls, the money center banks were able to take advantage of the healthy world economic growth from 1982-90 to slowly build up their reserves until the late 1980s to absorb the loss (see “The banks’ great escape” in *The Economist* [February 1989]),

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<sup>3</sup> The historical facts for this section are collected mainly from a book published by FDIC called “The banking crises of the 1980s and early 1990s,” Japan’s Financial Supervisory Authority, and financial press like the *Wall Street Journal* and *The Economist*. There were 2978 bank and S&L failures between 1978 and 1999 in the US (source: FDIC). In 1983, it was estimated that it would take FSLIC \$25 billion to close those insolvent S&Ls but FSLIC had only \$6.3 billion. Thus, FSLIC granted forbearance and encouraged those that were insolvent to continue operations and hoped that they would grow out of insolvency. The huge moral hazard problem (with already insolvent institutions) coupled with less than spectacular business environment for the S&Ls doomed such forbearance and cost taxpayers \$132 billions, an average of about \$500 per man, woman and child in America.

but not without the additional help from the World Bank, the government of Japan, the IMF (taxpayers of the member countries) under the Brady plan and the economic recoveries of the less-developed countries themselves.

Just as the banking crisis started to fade in the US in the 90s, the economy of Japan entered into a period of slow growth and the banking crisis in Japan began. Moral hazard in banking was clearly a major factor in the real estate bubble in Japan during the 80s when most banks speculated directly and indirectly (via subsidiaries and other “related” companies) in fueling the real estate price boom. When it burst, the banks were saddled with a bad loan problem so huge that it would impair their ability to finance even normal operations of viable firms. Forbearance was also being practiced in Japan in dealing with its banking crisis with the help of the Japanese Resolution Trust<sup>4</sup> since 1992.

Now, just as Japan is finally growing out of its banking problems, many of the US and European banks are facing new crises in 2008 from excessive speculation on risky loans, in particular subprime mortgages. The final cost of cleaning up the current worldwide systemic banking failure is expected to be multitrillion.

The current convoluted banking system relies on regulators to monitor the banks in regard to the riskiness of their investment and loan portfolios. But, as the FDIC review (see Footnote 3) suggests, it is difficult for bank regulators to restrict banks from those risky investments while they are so profitable, whether they were LDC loans in the 1980s or the subprime mortgages two decades later.

Perhaps all these crises could have been avoided if banks keep “100% reserves” to back “riskless” deposits and package risky loans to back the non-guarantee deposits. The risky loans are subject to direct market discipline because disenchanted investors and depositors can simply pull the plug by not participating if they do not like the overall risk. This is the basis of Fisher (1936)’s plan. Fisher ascribed the original 100% reserve idea (to reform the fractional banking system) to the “Chicago Plan of Banking Reform” that first appeared in a University of Chicago memorandum by Henry Simmons, Aaron Directors, Frank Knight, Lloyd Mints, Henry Schultz and others (see, e.g., Hart [1935], Fisher [1936],

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<sup>4</sup> Kyodo Saiken Kaitori Kiko, or Cooperative Credit Purchasing Company, Ltd., established Aug. 28, 1992.

Simmons [1948] and Mints [1950]).<sup>5</sup> Over the past half century, it has been revised and redefined to address the periodic crises ranging from the banking disasters in the US and Japan to the international financial turmoil that started in the summer of 1997 (see, e.g., Friedman [1960], Tobin [1986], Litan [1987], Miller [1995, 1998a], Chen [2001]). The following is a brief outline of the main ideas on the 100% reserves system.

For a typical 100% reserve bank, its balance sheet would look like the one in Figure 1. In a nutshell, the plan calls for all “insured” transaction accounts to be backed by deposits with the monetary authority (at interest rates reflecting the cost of access to the payment system).<sup>6</sup> In that sense, banks are required to have 100% reserves. This itself will guarantee the safety of the payment system and there would be no need for any deposit insurance except for fraud and it would not be necessary to place any limit on such deposit insurance.<sup>7</sup>

Banks will raise funds to support their loan portfolios by issuing *non-guaranteed securities* at rates reflecting each bank’s risk characteristics. A bank would typically initiate the loan process using its working capital. After the loan portfolio is created, the bank can keep all or part of it on its book and repackage the remainder for the non-guaranteed depositors. Thus the items on the balance sheet below the transaction accounts would resemble those of a typical investment trust or brokerage firm and could be structured in accordance with current market demand.

A concern about this system is that the illiquid nature of private loans would also render non-guaranteed deposits illiquid. If depositors prefer liquid deposits, would such a system destroy the banking system as we now know it? Could our current convoluted banking system, despite its periodic catastrophic collapses, be welfare improving (over a 100% reserve banking system) because illiquid loans can support liquid deposits under the protection of deposit insurance and government bailouts? It is impossible to have a

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<sup>5</sup> The idea behind the 100% reserve banking has a long history and it is discussed in detail in a book by Fisher (1936). A similar idea went way back to Ricardo and The Bank Act of 1844 requiring 100% reserves for all Bank of England notes, putting an end to the era commonly known as the wild cat banking in England. Since then, fractional reserve backing of bank notes was replaced by fractional backing of bank deposits, which aggravated the economic depression and precipitated the general banking failure in the 1930s. In the words of Fisher who had to live through it, the fractional reserve banking system almost wrecked the capitalistic civilization. History repeats itself again in 2008.

<sup>6</sup> See, e.g., Friedman (1960) and Litan (1987) for different variations of the same general concept.

<sup>7</sup> Thus, there is no need for regulations beyond what is normal for other types of financial institutions. Banks may still want to have additional reserves or cash equivalent for their working capital to initiate loans and for the purposes of clearing and carrying out normal banking transactions.

conclusive answer to this question without a large-scale social experiment. Fortunately, with the recent advances in financial engineering, there is a simple but elegant solution that gives us the best of both worlds. The key lies in the recent innovations in the market that allow banks to liquefy consumer, commercial and industrial loans alike into marketable securities.

Figure 2 illustrates the typical structure of a 100% reserve bank after its loans are liquefied. Transaction accounts with access to the payment system are 100% backed by interest bearing deposits with the monetary authority, where the lower interest rates reflect the cost of access to the payment system. Riskfree savings deposits are 100% backed by short term T-bills or their close equivalent. A government deposit insurance, whose cost is borne by account holders, may still be desirable as insurance against fraud. Risky private loans are liquefied into tranches of different risk and liquidity classes and an illiquid residual. These liquid tranches support the non-guaranteed deposits with the risk-reward-liquidity characteristics as determined by the market supply-demand. *The illiquid residual is held by the bank against its capital.* This is to ensure that the loan originating and monitoring bank has enough “skin in the game” to align its interests with the investors of the liquid tranches.<sup>8</sup> With such a suitably revised 100% reserve banking system, a bank can provide perfectly safe transaction accounts with access to the payment system, guaranteed riskfree deposits backed by government papers, private sources of financing and liquid non-guaranteed deposits, all without deposit insurance (except for fraud) and government intrusions into the private loan and investment process. The reality of such a banking system depends on the ability of the market to liquefy most bank loans.

## **2. Feasibility of a 100% reserve banking scheme with liquid non-guaranteed deposits**

There are three key financial innovations in recent years that combine to make most bank loans liquid. The first one is the growth of the bank loan market. The second one is the growth of credit derivatives, in particular credit default swaps (CDS). The third one is the growth of collateralized debt obligations (CDO), which include both collateralized bond obligations (CBO) and collateralized loan obligations (CLO).

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<sup>8</sup> The lack of “skin in the game” for the risky mortgage originators is often blamed as the root of the 2008 financial crisis.

It is well known that these financial innovations are very effective instruments for risk-sharing, but they do not change the risk nature of the underlying asset. In 2008, we discover painfully that the risk of the US subprime loans is spread perhaps too efficiently to any bank in pursuit of higher profits. But, it is worth emphasizing that it is not the financial instruments that create the underlying risks. The financial instruments are there to spread the risk efficiently. In this section, we will look at how properly structured financial innovations (dictated by the market before the easy credit period of 2002-2005) would discourage excessive risk taking and incentivize banks to act in the interests of all parties. By forcing the banks to be a meaningful residual claimant throughout the life of the loans, banks have enough “skin in the game” to be diligent in their loan originating and monitoring roles.<sup>9</sup>

Table 1 shows a breakdown of the aggregate loan portfolio of all the FDIC insured banks in the US at the end of 2007. Of the approximate US\$6.6 trillion in loans, the largest three categories are real estate loans (55%), commercial and industrial loans (21%) and consumer loans (14%). Real estate loans and consumer loans (credit card, auto loans and leases, home equity lines, student loans, etc.) have been securitized and resold in the secondary market since the early 1980s. They are easy to liquefy because their loan process usually follows a standardized procedure with information related to income, wealth, FICO and other credit measures<sup>10</sup> and *very little other private information*. A diversified portfolio of these loans has essentially only credit risk that is a function of the average credit rating, geographic characteristics, economic conditions and interest rates. For large and small banks alike, after they originate these loans, they can *choose* to sell them off easily.

In this study, we focus on the commercial and industrial loans that are considered to be less liquid because they tend to be more chunky and with private information. These corporate loans are also the focus of many theoretical models and empirical research on banking (see review article by Ongena and Smith [2000]). Recent financial innovations, however, allow the market to slice out the most illiquid portion of the loans to be retained by

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<sup>9</sup> We are indebted to many bankers, asset managers and rating agency analysts of structured products for information and insightful comments, in particular Diane Lam (S&P), Marie Lam (Moody's), Powell Thurston (PIMCO), Irene Tsao (Societe Generale), Ram Willner (Banc of America) and Patrick Wright (Deutsche Bank).

<sup>10</sup> Failure to follow this time-honored procedure (since the inception of mortgage-backed securities in the early 1980s) led to the subprime crisis that ultimately brought down the banking systems in US and Europe in 2008. The moral hazard to pursue higher profits with increasingly risky loans during the easy credit period of 2002-2005 highlighted the fatal flaws of our convoluted banking systems.

the loan originating agent bank and liquefy the rest. The contract design leaves sufficient incentives for the agent bank to continue to service and monitor the loans on behalf of the investors. In many aspects, this theory is also well understood in practice<sup>11</sup> and it is similar to the standard corporate finance paradigm of a manager acting on behalf of the shareholders (see, e.g., Gorton and Pennacchi [1995], DeMarzo and Duffie [1999]). The interesting empirical question is what the market actually requires as *incentive mechanisms* that would allow bank loans to be liquefied in practice.

Figure 3 provides a road map of how large and small loans from big and small banks become liquefied in the market. Large loans are often traded in the institutional loan market. Smaller loans can be bundled together for securitization. Big money center banks can off-load most of the value of their loans via many channels. Smaller banks can do it through big banks. We will discuss each of these in turn and then consider them collectively.

#### *A. Growth of the Institutional Loan Market*

Starting in the 1980s, bank loans, which were once thought to be nonmarketable, became marketable (see, e.g., Gorton and Pennacchi [1995]). The average size of these marketable syndicated bank loans is not small, with a typical size of \$200 million to \$1 billion. The liquidity of the loan market has significantly increased recently due to innovations in information technologies that allow efficient sharing of information from comprehensive databases (e.g., Moody's, S&P Leveraged Commentary & Data). By the end of 2007, over 90% of these loans (in the outstanding value) are rated by rating agencies. *These standardized measures of risk contribute to the liquidity of the loan market.* With information so widely available on those loans and their obligors, the institutional investors (based on their own analyses) believe that they do not suffer any informational disadvantages relative to the loan originating financial institutions. They trade these institutional loans in

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<sup>11</sup> It is commonly recognized in the industry that “structural mitigants, balanced equity return profiles and managerial interest-aligning incentives [are] the powerful drivers of CDO performance.” (See, e.g., S&P: “Balancing Debtholder and Equityholder Interests in CDOs, November 2002”)

the same way they trade corporate bonds.<sup>12</sup> This is probably the most significant reason why the institutional loan market is liquid.

### *B. Credit Default Swaps (CDS)*

According to International Swap Dealers Association Inc., outstanding credit default swaps (CDS) reached \$62.2 trillion by the end of 2007 (total wealth of the US was about \$55 trillion). A CDS is simply an agreement between two parties to exchange credit risk on a reference asset (e.g., a bank loan or a corporate bond) or a basket of them. The main idea behind a CDS is that it will allow a bank to sell the credit risk of a loan without actually selling the loan.

For example, a bank wants to transfer the credit risk of a loan on its book to an institutional investor, say, a mutual fund. In this case, the bank buys credit protection from the mutual fund and the mutual fund sells credit protection to the bank. The bank will make periodic swap counterparty payments to the mutual fund (like interest payments). In the event of a credit event related to the reference loan (failure to pay, bankruptcy, restructuring, repudiation/moratorium and obligation acceleration: based on International Swap Dealers Association Inc. [ISDA] credit swap master agreement), with the event independently verified by third parties or public information, the mutual fund will make a credit protection payment to the bank. The credit protection payment is equal to the difference between the notional amount of the defaulted reference obligations and the loan recovery value determined by a “calculation agent” (usually a bank or a group of banks, verified by third parties) at certain time, say 180 days, after the credit event.

In this example, the transaction is similar to the mutual fund “buying” the loan from the bank. The mutual fund will be receiving periodic “interest payments” in the form of swap counterparty payments, but will have to bear the risk of default. The bank transfers the credit risk of the loan to the mutual fund investors and typically receives the “excess spread”

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<sup>12</sup> We thank PIMCO, one of the world’s largest fixed income management companies and bank loan buyers, for providing us with details on the stylized facts of the institutional loan market. Interested readers can also consult “A guide to the loan market (S&P).” When Tyco International Ltd. turned to its banks for a \$1.5 billion loan in 2003, “Morgan Stanley, Bank of America, J.P. Morgan, Citigroup, Goldman Sachs Group and the Credit Suisse First Boston unit of Credit Suisse Group -- each agreed to back \$250 million of the \$1.5 billion credit line. The banks likely won't retain all of their \$250 million pieces; they are in the process of parceling out pieces to other banks and institutional investors (WSJ 1/13/2003).”

(the spread between the interest it receives on the actual loan and the “interest” it pays to the mutual fund) as incentives for monitoring and servicing the loan. In a typical CDS involving a basket of loans (see also synthetic CLO below), there is usually a first loss piece kept by the bank, making the bank the residual claimant, and a reserve account (see Figure 4) funded by the bank to align the bank’s interests with the swap counterparty.<sup>13</sup> *The reserve account is periodically replenished from the excess spread cash flows to keep the bank’s interests continue to be aligned throughout the life of the CDS even after some defaults.*

This type of setup has far-reaching applications in terms of channels for transferring credit risks. As noted by Jones (2000), “...a money-center bank or a securities firm might sell credit protection to regional banks whereby the guarantor promises to cover all losses above a certain amount against a specified pool of loans.” Thus, a CDS is a feasible way for *regional banks*, not large enough to directly liquefy their loan portfolio into the market, to unload their credit risks to *larger banks and securities firms*, who may then bundle many of these CDS into a deal large enough to be of interests to institutional investors in the market. Conversely, smaller banks may sell credit protection to larger banks on syndicated loans in order to get exposure to the risk and reward of the corporate clients of larger banks (*Bank for International Settlements Annual Report*, June 2003). The very low structuring costs fuel the phenomenal growth of the CDS market and make the transfer of a loan’s credit risk extremely liquid. With the prevalence of CDS, it is increasingly unclear how much of the credit risk of the commercial and industrial loans remaining on the bank’s book is still borne by the banks as “banks were net purchasers of credit protection while insurance companies and financial guaranty insurers were important net sellers.”(BIS, 2003)

### *C. Collateralized Debt Obligations (CDO) and Collateralized Loan Obligations (CLO)*

Collateralized Loan Obligations (CLO) and Collateralized Bond Obligations (CBO) are simply securitizations of cash flows from loans and bonds. They are collectively called Collateralized Debt Obligations (CDO). In the simplest case of a CLO, it takes a portfolio of commercial and industrial loans as assets and issues securities with claims against the cash flows. Figure 5 illustrates a typical structure (S&P: Global CBO/CLO Criteria). The

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<sup>13</sup> See related incentive issues discussed by Pennacchi (1988) for bank loan sales.

seller/servicer chooses loans from different banks to form a diversified portfolio and transfer it to the issuer, usually a special-purpose vehicle (SPV), with an asset manager, a trustee and possibly swap agreements to hedge against interest rate and currency risks. The bankruptcy-remote SPV sells asset-backed securities (ABS) backed by most of the cash flows from the loans and retains an equity position with claims against the residual cash flows.

The main idea is similar to that of Mortgage Backed Securities (MBS) which became popular following the financial market liberalization of the late 1970s. At the time, it was obvious that it would be more profitable for banks to originate and service the mortgages rather than funding them because banks do not have any particular advantages in holding something so *standardized, homogeneous and devoid of private information* as residential mortgages. By early the 2000s, the size of MBS alone was roughly the same as the US Treasury market. The CLO market took off around 1996 following the other asset-backed securities (ABS) market. The late start of the CLO market was due in part to the uncertainty of how to structure the securitizations acceptable to the market, knowing that banks may have private information — the same reason why bank loans are considered illiquid in the first place. Over the past several years, the CLO market has endured market tests with exponential growth and the outstanding global volume already exceeded the one trillion benchmark by 2004.

The main reason for the success of the CLO market is that *securitization transforms something heterogeneous and illiquid (loans with private information) into something homogeneous and standardized (e.g., an AAA tranche) so that it is relatively liquid*. Since this is the critical link in liquefying banks' commercial and industrial loan portfolios, we will illustrate with several examples how CLO technologies have evolved over time to deal with incentive issues and provide empirical evidence on the feasibility of liquefying bank loans.

#### *Typical Bank CLO and their incentive alignment mechanisms*

*A Simple Example.* The NationsBank (now part of the Banc of America) Commercial Master Trust<sup>14</sup> provides an example of a simple CLO (Figure 6). In their series 1997-2, NationsBank had an initial loan pool of more than 1000 loans in 50 industries. The internal/external loan

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<sup>14</sup> We thank Greg Duffee for pointing to us this example.

rating distribution was 2.07% AAA, 0.37% AA, 10.35% A, 45.21% BBB and 42.0% BB.<sup>15</sup> The securitization backed by these loans has four tranches due in 2002. Class A is a \$2 billion floating-rate asset-backed certificate with an AAA rating, Class B (subordinated to Class A) is a \$66 million certificate with a rating of A, and Class C (subordinated to Class B) is a \$66 million certificate with a rating of BBB. Class D, with a par value of \$66 million, is the residual “equity” tranche retained by the originating bank, NationsBank, which backs the securitization with an additional 1% reserve. The credit enhancement to bring Class A to an AAA rating, in a loan pool with a weighted average rating of BBB-, was made possible by the subordination of Class B, C and D (representing about 9% of the loans) and the 1% reserve. Since Class A, representing more than 90% of par value the loans, has a rating of *Aaa/AAA/AAA* (Moody’s, S&P, Fitch ratings), there is a market for it among the world’s institutional investors. The credit rating of Class A note is actually higher than the AA rating of NationsBank because of the survivability of the security interest in the notes even if NationsBank becomes insolvent. Class B and C are also of investment grade and there is reasonable liquidity for them. The credit risk of the original loans is concentrated in Class D (to be kept by NationsBank) with a par value that is 3% of the original loan value (with additional support through a 1% reserve).

Through subordination, the CLO creates reasonable liquidity for more than 96% of the loan value of a portfolio dominated by *BBB* and *BB* loans that are presumably laden with private information. As finance theory would predict, when there is substantial asymmetric information between the sellers and buyers of bank loans, it is efficient for the bank that originated the loans to hold the risk-reward for the private information (the residual tranche). In this CLO, financial innovations combined with an independent rating agent, *who also*

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<sup>15</sup> This is also roughly the distribution of ratings in many bank CLO and the distribution of the corporate borrowers at the point of their bank loan originations. Approximately, 80% of bank loans are to companies with ratings *Baa/BBB* or *Ba/BB* (including companies that are not publicly rated, but would have fallen into this category based on banks’ internal ratings; interestingly, the loans to those publicly *unrated* corporate borrowers would have a risk-based capital requirement at the same level of publicly rated *BBB* corporate borrowers in Basel II [April 2003]). This distribution is consistent with the findings of Quantitative Impact Study 3 – Overview of Global Results for Basel II (May 2003) for the performing loan qualities in Group 1 banks (large international banks) and in Group 2 banks (smaller specialized banks). Corporate borrowers with higher ratings would find raising money directly in the financial markets cheaper. Companies with ratings lower than *BB* would find bank financing prohibitively expensive — they are better off raising fund from junk bonds or private capital. We thank Banc of America, PIMCO and CreditSpectrum for providing us the relevant information.

*serves as the monitoring agent,*<sup>16</sup> mitigate the problems associated with private information to the extent that most of the loan value can be sold off to outside investors. This is the typical structure of a CLO: after securitization of the original diversified loan portfolio with an average rating of *BBB-*, “97% of the issued securities could receive an investment-grade rating. The remaining 3% of the pool would be held as equity.” (Fitch research report December 1997, “Bank Collateralized Loan Obligations: An Overview”)

*Synthetic CLO: Offloading Credit Risk without Selling Loans* The transfer of credit risks can be more easily done via credit default swap (CDS) because of the lower structuring costs, especially if the loans are from different legal jurisdictions (to gain more geographic diversification). In Figure 7, the Deutsche Bank’s *Globe-R 2000-1* is a synthetic CLO because Deutsche Bank will keep the loans on its book but use CDS to transfer the credit risks to eventual investors. The super senior tranche of Euro 1.722 billion (86% of the deal) is an “unfunded CDS” in the sense that the super senior tranche is not sold as notes, therefore there is no funding. The Deutsche Bank portfolio contains mostly spot loans whose interest payments can be thought of being decomposed into two components: one supporting the funding and the other supporting the risk (swap counterparty payments on the CDS). In periods when funding is widely available in the market, banks would prefer to sell the credit risk component without selling the funding component.<sup>17</sup>

*Credit Lines and Synthetic CLO with Unfunded CDS* A synthetic CLO structure with an unfunded CDS is often used when the reference portfolio contains credit lines that are undrawn. This is an important financial innovation that takes into account the recent phenomenon that a significant fraction of money center bank loans are in the form of credit lines (see Kashyap, Rajan and Stein. [2002] in the context of deposit-funding synergy). For example, *CitiStar (Citibank) 1999-2* is a \$4 billion synthetic CLO that references 233 senior unsecured facilities in US and Canada in which around 80% was undrawn at offer. *Verdi (IntesaBci) 2002* is a Euro 4 billion synthetic CLO in which 89.5% are undrawn revolving

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<sup>16</sup> A critical failure of the monitoring and risk assessment functions of the rating agencies contributed to the subprime crisis in 2008. As the crisis developed, the rating agencies hastily revised downward the ratings of many mortgage-backed securities based on risky mortgages.

<sup>17</sup> See, e.g., WSJ (December 17, 2003) article entitled “Banks itch to lend, but firms sit tight.” If funding becomes tight later, banks can always sell the funding of the already securitized tranches.

credit facilities (Figure 8). When the credit lines are drawn, the bank would fund them with its working capital or through the interbank market (others' working capital).<sup>18</sup> As the credit line is already securitized with a synthetic CLO, when the credit line is drawn, the structure evolves into a CLO structure where the bank would hold an obligor's spot loan (rather than credit line) whose credit risk has already been transferred through a CDS.

The underlying idea is best illustrated with the help of the CLO of IntesaBci corporate loan portfolio in Figure 8. The credit risk is transferred via a CDS to a counterparty (usually a financial institution with an OECD bank, such as Merrill Lynch, for regulatory capital reasons), who will in turn parcel out the risk to other institutional investors. The commitment fees from the undrawn credit lines are used to cover the swap counterparty payments on the "unfunded" super senior CDS (Euro 3,640 million or 91% of the deal). When the credit lines are drawn on IntesaBci, the structure will gradually evolve into the case of Deutsche Bank with spot loans in Figure 7.

"Excess Spread" as a dynamic incentive alignment mechanism. In many CLO structures, the bank will use "excess spread" in addition to the "first loss" as an incentive alignment mechanism to convince investors that the bank will continue to diligently monitor and service the loans. An example would be the synthetic CLO of Amstel Corporate Loan Offering (ACLO 2000, the SPV) offered by ABN AMRO Bank. In the ACLO structure, AMRO bank will use the "excess spread," [i.e., the difference between the interests that it receives from the original loans and the interest (including swap counterparty payments) it pays to ACLO] to build up a reserve account at an annual rate of 0.5% of the reference portfolio amount, which is available to ACLO when making credit protection payments. For each period (quarter), if the reserve account is exhausted because of credit events, the loss will be allocated to the tranches in reverse order of their priority: Class F first, and then, Class E, and so on until Class A and then the super senior. The excess spread is an important dynamic incentive alignment mechanism that diverts fresh money from the loan-originating

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<sup>18</sup> In our 100% reserve banking, working capital includes cash, deposits with monetary authority, T-bills or their close equivalents. The LIBOR market, the EURIBOR market and the interbank capacity is ultimately determined by the money supply controlled by the monetary authorities (see Fisher [1936] and Friedman [1960] for related issues on monetary policies corresponding to 100% reserve banking).

bank into the reserve account, regardless of what the past default experience was, to keep the loan-originating bank as the residual claimant throughout the life of the CLO.

It is worth emphasizing here the importance of such an incentive alignment mechanism in driving the performance of recent CLO (see Footnote 11). Diamond and Rajan (2001) discuss the implications of the fragility of our banking system (demand deposits) in aligning the interests of the bankers with the depositors in creating liquidity. Here, the excess spread is another practical alternative devised by the market to solve the same problem without the fragility of the banking system. With this mechanism, even if all the lower tranches are in default, the excess spread still puts in fresh money periodically into the reserve to entice the banker to act in the interests of the investors of the surviving tranches.

*Loans to Small and Medium-size Enterprises.* As expected, a large diversified portfolio to small and medium-size enterprises (SME) is easy to securitize. Each securitization may contain thousands, or even tens of thousands, of loans. An example is Geldilux 99-1 offered by HypoVereinsbank. The total loan portfolio is slightly more than EUR 2 billion with 1818 small and medium size corporations and private borrowers. Almost no borrower has a rating from Moody's or S&P.<sup>19</sup> Of the 5 tranches: Class A (94%) is *Aaa/AAA*, Class B (2.6%) is *A/A*, Class C (1%) is *Baa/BBB*, Class D (1.5%) is *Ba/BB* and Class E (0.9%) is the residual tranche without rating. The size of the residual tranche is small because SME loans are like consumer loans in many aspects. This fact is also recognized in the Basel II consultation paper (April 2003) in that SME loans may be separated from other corporate loans, and loans to small businesses can be qualified as retail risk exposure (like consumer loans) warranting a lower risk-based capital requirement. The SME loans originating from smaller banks can be "sold" (via CDS) to larger banks or sold directly into "arbitrage CDO" in the same way smaller banks unload their consumer loans.

*Representativeness of the Loan Portfolio.* There are two competing motivations for banks in selecting which loans to include in the portfolio to be securitized. Banks would want to get

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<sup>19</sup> In rating SME, Moody's would use a binomial simulation based on the bank's internal rating system while S&P would use an actuarial approach based on recent default rates. The ratings from the two agencies are usually consistent.

rid of their worst loans, but, over time if the bank misrepresents the true risk of the underlying loan portfolio, this “lemon problem” will ruin its reputation for future deals and cause its own securitization market to break down. On the other hand, banks would like to securitize their best loans in order to reduce their capital requirements as the best loans would require a smaller residual tranches to be kept, but this would get the regulators really upset because what would remain on the bank’s book would be loans of lower quality.

Banks, regulators and investors are all aware of this selection bias problem. Thus, in many deals, there is voluntary disclosure on the representativeness of the loans. Indeed, in offering prospectuses and rating agency reports, there are always comments on the loan quality with explicit statements attesting to being representative of the loans within certain category (e.g., performing loans originated from normal banking operations). To appease regulators and investors alike, some structures go as far as to state that the loans are selected randomly or that all loans are included within a certain category. Furthermore, rating agencies, being the outside monitors, often insist in their reports that the ratings depend on the quality and consistence of the bank’s internal credit rating and the bank’s continuing effort in monitoring and servicing and extracting recovery values for defaulted loans. Any deterioration of these would lead to a rating downgrade that will impact the bank’s ability for future securitization.

In summary, financial engineering is capable of liquefying almost the entire loan portfolio of a bank. As we will see in the next section, the remaining illiquid portion that must be kept by the banks is relatively small.

### **3. Empirical Estimation of the Size of the Residual Tranche.**

There are more than 20,000 structured finance deals in the data bank of Moody’s and S&P dating back to the early 1980s. Most of these are residential and commercial mortgages and consumer loans because securitizations of commercial loans have been a more recent phenomenon. A sample of recent CLO of commercial loans from North America, Asia and Europe is given in Table 2. This sample is based on a data set of CLO reports from S&P for the purpose of illustrating the typical structures of all the *recent* CLO. These are supplemented by Moody’s and Lehman Brothers reports for the missing data. Our final

sample is based on all the CLO that have *complete* data with respect to structure details, the sponsoring bank, ratings and tranche sizes, especially the residual tranche (or first loss). If there are several offerings based on the same master trust, only the most recent one with complete data is included. There is a sample bias in favor of more observations from European banks because European Banks are still the main source of financing for many corporations in Europe.<sup>20</sup>

All the CLO in Table 2 are from major international banks. Roughly half of these CLO are based on small and medium enterprise loans (SME). With a few exceptions, the size of each deal is at least \$1 billion. The range is from about \$150 million to about \$12 billion (the exact size depends on the exchange rate as different tranches of the same deal may be offered in different currencies to different markets). Most of the deals are in the range of \$1 billion to \$2 billion, which appears to be the typical size of interest to the market. Although we do not have hundreds of independent deals, each data point itself is an extensive empirical and optimization study on its own (no data mining, just billions of dollars at stake). The patterns across data points are remarkably consistent. Perhaps the most telling figures from Table 2 are the average sizes of the investment grade, non-investment grade and the residual tranches (including reserves, if any). Our sample shows that about 96% of the cash flows from the loans can be sold as investment grade. The most illiquid portion pertaining to the residual tranche is only about 3%.

The “3% residual” is a very revealing figure that reflects the size of the “*market determined capital*” required to support the securitizations that sell off the rest of the cash flows. The size of the residual depends on the quality of the underlying loan pool. Most of the reported weighted average ratings (if available from the rating agency report) of the underlying loan pools in Table 2 are about *Baa3/BBB-* and the required equity tranche is about 3% for the liquefaction. If the average loan quality of the pool is *BB-*, a rough estimate (source: PIMCO, Deutsche Bank) of the size for the required equity tranche is between 8 to 12 percent.

We should emphasize that the underlying loans in our sample on Table 2 are all performing loans from large international banks including Citibank, Chase, Banc of America,

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<sup>20</sup> We were told also that American deals become so commonplace that usually only a one-page deal summary with the ratings is in the database.

FleetBoston (now part of Banc of America), HSBC, Sumitomo Bank, Deutsche Bank, ABN AMRO, BNP, IntesaBci and others during a non-crisis period. The loans they securitize are loans from their normal banking operations. Most of these large banks have an *Aa/AA* rating, which is an indirect reflection of the average quality of their loan portfolios. The rating on the bank itself is based on its own unsecured senior debt, with liquid deposits above it in the capital structure. In other words, *the existing capital in these banks, taking into account of the quality of its entire loan portfolio and the liquid deposits above, can support an Aa/AA rating for its unsecured senior debt.*<sup>21</sup> For these banks, it is not surprising to find that the market-determined capital required for supporting the liquefaction of their performing commercial loan portfolios is not much more than 3%.<sup>22</sup> Of course, this number is dependent on the general economic conditions and would likely be higher during periods of economic crisis.

On the other hand, it is interesting to look at cases at the other extreme where the bank is of marginal rating because of the quality of its loan portfolio during a banking crisis. Here, the 3% residual may not be a good estimate of the market-determined capital to support its commercial loans.<sup>23</sup> The CLO of Shinsei Bank provides a meaningful example very different from the banks in Table 2. Shinsei Bank (not one of those mega banks in Japan) used to be Long Term Credit Bank of Japan (LTCB). It was taken over by the Japanese government in 1998 and then re-privatized in 2000. Shinsei Bank's own rating is at the minimum investment grade *Baa3/BBB-* (Moody's/S&P), and it has a series of CLO based on a master trust on its loan book. In order to rate the CLO tranches, the rating agencies had to consider the fact that many "performing" loans in Japan could be doubtful. Furthermore, the recovery value once the loan is defaulted is assumed to be zero (S&P), which is materially

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<sup>21</sup> The weighted average rating of Western European and US banks is between *AA-* and *A+* in 2002 (*Financial Times*, May 21, 2002).

<sup>22</sup> Interestingly enough, if we split our sample into two subsets, one containing only loans to SME (which presumably private information plays a lesser role in a large diversified portfolio as the loan process follows rather standardized procedures) and the other containing loans to larger corporations, the average size of the residual is about the same. The higher average credit quality of the larger companies offsets the higher amount of private information presumably more important in the larger loans.

<sup>23</sup> The average corporate loan quality in banks (excluding SME) is between *BBB* and *BB* (footnote 15). The number of CLO based on defaulted loans, non-performing loans and doubtful performing loans is increasing, but the total number is still small. For example, Ark CLO 2000-1 is based on a portfolio of distressed and defaulted loans from Fleet Boston, Korea Asset Funding 2000-1 is a CLO based on restructured corporate loans and International Credit Recovery – Japan One Ltd is based on non-performing loans. In these cases, summary statistics are less appropriate when the underlying portfolios are so different.

different from the assumptions about other OECD bank loans (S&P recovery assumption: 50-60% for senior secured, 25-50% for senior unsecured and 15-28% for subordinated loans; Moody's experience: 69.5% for senior secured and 52.1% for senior unsecured). Despite the doubtful nature of the performing loans and the extreme assumption of zero recovery value, Shinsei Funding One (03/06/2002; source: Lehman Brothers), has a Class A tranche (75%) rated *Aaa/AAA*, a Class B tranche (10%) rated *Baa/BBB* and the rest (15%) non-investment grade and residual. This example suggests that a rough bound of 15% of the capital is necessary for a solvent but marginal bank to liquefy its commercial loan portfolio.

While it is clear that CLO tranches are more liquid than typical bank loans, they are not as liquid as bonds of a single major corporation. A single name AAA bond is more liquid than an AAA securitized tranche because a single name bond is generally much easier to analyze than a pool of loans. To increase liquidity of those securitized loan tranches, the CLO market must follow the path of MBS in the 1980s to be more standardized and therefore more liquid. One lesson from the current 2008 meltdown is that by mixing too many different types of assets in the same pool (e.g., prime mortgages, subprime mortgages, CDS, equity tranches and subordinated tranches from prior securitizations), it would make the analysis of such a pool extremely difficult. In contrast, a plain vanilla CLO such as the NationsBank example in Figure 6 is easy to analyze and therefore its tranches more liquid.

Going forward, the trend towards securitization is irreversible. To make the end products more liquid, there should be greater transparency, standardization and regulation in the process. (1) CLO should be classified into distinct types, with the loan pool supporting each type originating from more homogeneous, narrowly-limited categories of loans. This would render the CLO easier to analyze and more liquid. (2) As the securitization and CDS markets have grown to the point of posing systemic risks to the financial system, it is appropriate to have a central clearing house and relevant systemic regulations in place in order to build confidence. (3) Finally, as we emphasize repeatedly, loan-originating and monitoring banks must hold the equity tranche for proper incentives.

#### **4. Links to the guaranteed and non-guaranteed deposits**

##### *A. Bank loans financed by small depositors*

In the previous sections, we find that most bank loans can be liquefied. Furthermore, the market that connects bank loans to non-guaranteed deposits has already existed and is rapidly expanding. Nowadays, when a small depositor comes to his favorite bank, he can invest in bank-sponsored, non-guaranteed, non-FDIC insured money market funds, mutual funds specializing in bank loans or Treasury securities, just as easily as he would deposit his money in a FDIC insured account. A casual browse through the offerings of major mutual funds reveals that traditional mutual funds are already playing such a financial intermediary role in bringing bank loans and depositors together in a significant way without deposit insurance. Thus even a regional bank can both retain its information advantage in knowing its borrowers (relationship banking) and have access to the world market of non-guaranteed depositors supporting its loan portfolio.

Of course, there is nothing special about the abilities of mutual funds in securitizing bank loans for the non-guaranteed depositors. Banks can easily play the same role, and even have some natural advantages, in that they can directly offer these types of non-guaranteed deposits. This is especially true now when the distinction between commercial banks, investment banks and brokerages is fast disappearing. Therefore, in a typical 100% reserve bank (Figure 2), deposits in risk class A can be supported by a diversified portfolio of *Aaa/AAA* tranches. Deposits in risk class B can be linked to a bank-sponsored mutual fund. Mutual funds provide the benefit of diversifying across many banks and across many investment types (as in a diversified stock fund) to reduce the risk for non-guaranteed depositors, in addition to their role in monitoring the banks whose loans they invest in. Furthermore, competition among mutual funds keeps them vigilant in regard to their investments. Deposits in risk class C can be caveat emptor with limited liquidity backed by lower rated tranches, emerging market loans, exotic loans, subprime mortgages or even the equity tranche of a CLO. Such depositors would vote with their deposits and diversify across banks just like a typical investor would in stock mutual funds. Indeed, since financial engineering allows banks loans to be liquefied, their risks can be efficiently distributed in forms consistent with the market demand.

*Community Banks* US bank regulators have been suggesting that only the largest ten to twenty banks need to conform to Basel II because their instabilities might induce systemic risk to the economy. The 7,000+ small banks in the US do not pose such a systemic risk, although they are still subject to general economic risks and thus remain a potential liability to tax payers. Thus, it might be politically expedient for the government to continue to support those community banks with guarantees,<sup>24</sup> even though channels for the smaller banks to liquefy their loan portfolios already exist. In this age of banking consolidations, it may be simpler for the smaller banks to (i) understand the local market for loan originations and monitoring and (ii) sell funds and act more like the deposit taking affiliates of larger banks.

Therefore, the necessary markets to linking bank loans with investors, including large institutions and small depositors, have already developed and will continue to develop. The 100% reserve plan would not disrupt the main roles of banking beyond some minor repackaging that has already existed for decades and has been fast expanding in response to regulatory and technological changes. The government role would be greatly reduced under the 100% reserve plan. This is fundamentally different from the government's present role of having to constantly keep a watchful eye on thousands of banks in their lending and investment processes with the attendant deposit insurance moral hazard.

### *B. Sufficient Government Debt for the 100% Reserve*

In the 100% reserve plan, an important ingredient is to back the riskfree deposits with direct government obligations. This would require the government to sell enough obligations to satisfy the demand of the economy. At the end of 2007, the total transaction account (demand deposits, checkable deposits, etc.) in commercial banks was about \$708 billion, the total US government securities held in commercial banks was about \$950 billion (source: FDIC), the total government debt outstanding was about \$7.3 trillion and the contingent liabilities of Social Security were about \$13.6 trillion (source: Federal Reserve and the US

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<sup>24</sup> In the same way as with Small Business Administration, Farm Service Agency, etc. even if they might be a potential burden to the taxpayers.

Treasury). It is not clear if the Treasury needs to float more government debts to support the 100% plan. If indeed it is necessary, there is a question as to where the proceeds should go.

These concerns parallel the concerns of what to do if the government on-budget surpluses would pay off the national debt and the government may have to accumulate private assets. The original 100% reserve plan suggests that the proceeds from issuing government securities be used to finance deficits, reduce taxes, abolish federal taxes, or invest in quasi-government obligations, obligations of states and municipalities, obligations of international organizations and of foreign governments, acceptances and other commercial paper. Any reasonable combination of these would work. Another option would be to privatize Social Security. Using the Chilean model of recognizing the contingent liabilities by issuing Recognition Bonds, the government would issue debt and put the proceeds in a professional managed pension fund (like the California Public Employee retirement Fund) in order to insulate federal investment decisions from political pressures.

The fund would be able to invest in a great variety of financial instruments, *even credit risks in bank loans or CDS*. By doing this, the government would not only create liquidity by issuing liquid debt and investing (like institutional investors) in bank loans, but would also increase the relative supply of riskfree investment to risky investments in the economy.

*Some General Equilibrium considerations when there is a systemic shock.* This brings out an important but rather subtle implication that deposit insurance has had on our economic equilibrium. With deposit insurance, if there is a systemic shock to the economy and there is a flight to riskfree investments, investors may pull their money out of risky investments and deposit them into insured bank accounts (assuming for this argument that FDIC is considered to be riskfree). If banks speculate the proceeds in risky investments, the government is effectively standing ready to invest in the risky investments (without the upside) through deposit insurance with its attendant moral hazard.

In a 100% reserve banking system, if the government does not interfere with the natural market forces in response to a shock, there is no immediate change in the relative supply of risky versus riskfree investments and the economy's risk premium would rise until the market clears. This is the free market equilibrium.

On the other hand, *if it is our national policy* for the government to intervene in the market in response to a shock (e.g., LTCM in 1998 and the collapse of the banking system in 2008), it can commit to do so by standing ready to swap government securities with risky loans (Bank of England 2008), or lend out government securities to banks who put up risky loan portfolios as collateral (US Federal Reserves 2008). In a dire emergency, the government can commit to stand ready to buy or finance the purchase of the loans and loan tranches at *prevailing market prices* (or to sell credit insurance via CDS *at market prices*).<sup>25</sup> Here, the banks do not face any new moral hazard problems as the tranches would already be owned by the depositors in our 100% reserve banking system. The government is merely helping the depositors to rebalance their portfolios from risky investments into riskfree investments in an orderly way, which would incidentally change the relative supply of risky versus riskfree investments and smooth out the shocks in the credit market. Thus, *if it is our national policy* for the government to assume some temporary credit risks in order to absorb unnecessary credit market volatility in a crisis,<sup>26</sup> this can be accomplished with less distortion and in a much less convoluted way than with our current system of deposit insurance.

## **5. The advantages of the 100% reserve plan**

The original intention of the 100% reserve plan was to prevent monetary meltdowns such as those of the 1930s. Interested readers should refer to Fisher (1936) and Friedman (1960) for their analyses on the advantages of the 100% reserve plan in regard to financial system stability, monetary policies, price level determination and interest rates. Here, our intention is limited to comparing the implications to banking between a 100% reserve system and the current fractional banking system with deposit insurance and capital requirements.

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<sup>25</sup> Indeed, by the end of 2008, the US Treasury is empowered by the US Congress to purchase loans and loan tranches from the banks, and finance the purchase by banks of commercial paper that back money market funds.

<sup>26</sup> Central banks and monetary authorities have also routinely added liquidity to the market by open market operations and direct deposits (usually via short notice auctions) into the banking system whenever the credit conditions in the market require (e.g., Federal Reserve 2007-08). This can be much better accomplished with a 100% reserve system, as the central bank and monetary authority do not have to counteract the slack and the positive feedback effect in the fractional reserve system with capital requirements.

1. *Separation of riskfree and risky investments.* In a 100% reserve system, there is no illusion on what is riskfree and what is risky. The transaction accounts are backed by deposits with the Fed and guaranteed riskfree investment accounts are backed by T-bills. Non-guaranteed deposits are backed by risky loans and their liquefied tranches. For the brave souls who deposit in tranches backed by risky loans, they knowingly accept the risks and rewards and vote with their money (just like investors in the stock market). The 100% reserve system is so simple and transparent that the responsibility for risky investments would fall squarely on the shoulders of risk-takers, rather than the government. The payment system is safe with the 100% reserves and it does not have any unintended externalities.
  
2. *Moral Hazard.* At the dawn of federal deposit insurance, Fisher felt that the accompanying moral hazard that it introduced, together with greed, would be the root of future banking crises and it could not be solved by mere government regulations and monitoring. In the last 25 years, the spectacular banking crises in the US, Japan and around the world have confirmed Fisher's conjecture.<sup>27</sup> The FDIC review (see Footnote 3) had a long discussion on why these problems cannot be easily solved by regulations and risk-based capital requirements and insurance.<sup>28</sup> Under the 100% reserve plan, there would be no need for the deposit insurance that creates the moral hazard problems. The incentive problems that would face a 100% reserve bank would be no more than the incentive problems faced by a typical corporation with an agent manager and different liability classes, and much less than the acute moral hazard under deposit insurance, compounded by high leverage ratios, that banks face in the present system.

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<sup>27</sup> In October 2008, many of the industrialized countries in the world raised the limits of their banks deposit insurance to stem bank runs. Ireland, Germany, Iceland, Australia, New Zealand, Austria, Denmark and others moved to guarantee 100% of their bank deposits.

<sup>28</sup> For example, they found several risk characteristics common to the majority of the failed banks, but such characteristics would "flag a much larger number of banks that did not fail." The latter group of banks could well have extracted more profits from the same assumed risks because of superior managerial skills. It is hard to imagine that standard government one-size-fits-all regulations on "risk" based penalties can solve the moral hazard problems when the measurement of risk itself is fraught with errors from the omissions of relevant but non-quantifiable characteristics such as managerial skills in risk management and relationship banking (see also Mingo [2000] and Jones [2000]). It is obvious that government regulations can never hope to match the market balancing of interests through optimal contracting and monitoring in our variant of the 100% reserve banking system.

3. *Market Discipline.* The FDIC report also lamented the difficulty for regulators to persuade the banks to adopt more responsibilities in their investment behavior (e.g., in the Less-Developed-Country loans case) in times when banks and their loan portfolios are doing well. The depositors were largely unconcerned as they were protected by deposit insurance and there was little market discipline. In the 100% reserve banking system, if the banks cannot justify their risk profiles, the non-guaranteed depositors and the institutional investors can vote with their money by staying away from buying those risky tranches. Banks would learn very quickly that they cannot liquefy those risky loans when there is no market demand.
  
4. *Contagious Runs.* When a large bank fails (for example, Continental Illinois in the 80s, Bank of New England in the 90s, Washington Mutual in 2008), there is always a fear of contagious runs on otherwise viable banks. For example, in 1984, Continental Illinois suffered a high-speed electronic bank run and sustained enormous withdrawals of foreign deposits through electronic transfers. The first move of FDIC was to protect both insured and uninsured depositors<sup>29</sup> to contain the damage (at the cost of aggravating the moral hazard problem even further) and prevent possibly other bank runs. In the Less-Developed-Country loans case, the US regulators chose stability over market discipline<sup>30</sup> to prevent the US financial system from a monetary meltdown like those in early 1930s. On September 25, 2008, FDIC seized Washington Mutual, the largest bank failure with \$307 billions in assets after depositors withdrew \$16.7 billions in the previous ten days, and sold it to JP Morgan in the same evening to prevent any bank runs the next day. What has started as a subprime crisis in the US would soon engulf banks as far away as Iceland where the government nationalized all the major Icelandic banks in October 2008, even though the Icelandic banks do not invest in subprime loans. Such catastrophic externalities would never happen to a 100% reserve system.

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<sup>29</sup> Federal Deposit Insurance Corporation Improvement Act of 1991 made it more difficult to protect uninsured depositors in resolving bank failures.

<sup>30</sup> “US bank regulators, given the choice between creating panic in the banking system or going easy...had chosen the latter course. It would appear that the regulators made the right choice.” (L. William Seidman (former chairman of FDIC) in *Full Faith and Credit* (1993))

5. *Capital Requirements, Credit Crunch and Positive Feedback Effect.* Our current system of backing insured deposits with capital requirements produces an unfortunate positive feedback effect that occasionally freezes up credit.<sup>31</sup> This is especially true for the Japanese banking crisis in the 1990s and the world's banking crisis in today. The loan overhang and its impact on the capital requirements in banks have been hampering the banks' traditional role in lubricating the economy. It was a major contributing factor in the Japanese economic stagnation and its destabilizing effect on the East Asian economies that led to the 1997-98 financial crises (see Miller [1998a]). In contrast, under the 100% reserve system, a bank's capital is compartmentalized (as in a submarine) into thousands of units, each supporting the residual tranche of a separate securitization. The bank would not sink even if the capital supporting a particular CLO is driven to zero (in response to major credit events like LDC loans or subprime mortgages). If there are profitable opportunities, banks will continue to lend and securitize. This is because the maximum that a bank could lose would be limited to the residual tranche that it keeps as incentives. Thus, unless there is fraud, banks can continue to function and they are bankruptcy-remote.

### **The role of banks in a 100% reserve system**

Recent banking literature focuses on the special role that banks play as a financial intermediary. Obviously, banks can play their traditional financial intermediary role by bringing together borrowers and investors with less restriction imposed under a 100% reserve system than a fractional reserve system with deposit insurance and government regulations. If banks can capture their private information rent in their relationship banking under the existing system, they can likewise do so after their loans are liquefied into tranches to match any of a variety of market demands and incentive schemes. These are private arrangements arising from optimal contracting and not the incidental by-products of our clumsy banking system.

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<sup>31</sup> The US "credit crunch" of the early 1990s was well reported. See, e.g., *The Economist* "Crunch by Credit," (November 1990), *The Economist* (November 1991), *WSJ* (November 4, 1992), *New York Times* (February 23, 1993). The 2008 credit crunch prompted governments worldwide to guarantee interbank lending and money market funds, inject capital directly into banks and buy up commercial paper and bad loans.

Thus, a bank within the 100% reserve banking system has four roles to play:

1. It provides a perfectly safe payment system including an electronic medium for exchange. The deposits in transaction accounts are matched against deposits with the monetary authority.
2. It accepts *guaranteed* riskfree deposits and invests them in treasury bills or their close equivalents. Such deposits would be guaranteed by government agencies like FDIC and there is no need to place any limit on the size of the accounts. *Banks are not allowed to take government guaranteed riskfree deposits and speculate the proceeds in risky private loans.*
3. It originates and structures private loans and repackages them for large and small non-guaranteed depositors and earns fees in servicing and monitoring them.
4. It holds concentrated risk positions, funded by the shareholders of the bank, to take risk that it cannot credibly sell off and capture the potential reward and the private information rent.

In this 100% reserve system, the cashflows from the bank loan portfolio are decomposed and structured to match the demands of those who have the natural economic rationale for the ownership. The homogeneous liquid senior tranches, in which the banks have no comparative advantages in funding them, are sold to those who ultimately want to own them. The more speculative investors would take the junior tranches. Banks, as the claimants of the residual cashflows in the “excess spread” and the equity tranche, are incentivized and rewarded for their natural financial intermediary role \_\_ relationship banking, private information, monitoring and servicing.

## **6. Conclusions**

Centuries ago, banking started with a 100% reserve concept of depositing gold and other valuables for safekeeping with goldsmiths and transferred through paper evidence called “bank money.” All these began to change when certain goldsmiths decided to start a side business of issuing bank money (loaning out gold) in exchange for loan repayment promises. It led to the collapse of the Bank of Amsterdam two centuries ago, the wild cat banking era in England more than a century ago, the financial meltdown in the 1930s and the

crisis in the 1980s and 1990s in the US, the banking crisis in Japan and the collapse of the banking system in the US and Europe today. The mixing of risky loans and safe storage of value has given depositors the unrealistic expectation that their money is safe with the banks, even though banks turn around and speculate their money in risky loans.

It would seem that a simple cure for this phenomenon would be to separate these two functions of a bank into two different departments, while keeping them within the same bank to preserve synergy. The depositor who does not want to risk his money can put his money in a transaction account backed by 100% reserves or a guaranteed riskfree savings account backed by T-bills. A depositor who wants to take some risk can ask the agent bank to invest on his behalf in risky loans. Instead, the US opted for a clumsy system of deposit insurance, regulations, surveillance, and capital requirements \_\_ with unsuspecting taxpayers standing by as occasional unintended participants. Economists of future generations, looking back on the 20<sup>th</sup> century, will marvel at how we ever came up with such a convoluted system.

The evidence over the past 25 years in the US, Japan and the world clearly shows that the current banking system is not much of a success. Fundamental banking reform is necessary to make our system more robust and stable. Recent financial innovations allow liquefaction of almost all of a bank's loan portfolio. These liquefied tranches can be funded by institutional investors and small non-guaranteed depositors. The bank then holds the residual that contains a concentrated tranche of risk and reward for its private information and its monitoring efforts. Consequently, our variant of the Fisher (1936) 100% reserve narrow banking scheme incentivizes banks to continue their traditional role in originating and monitoring private loans while simultaneously providing a simple and robust solution that eliminates banking crises and makes banks bankruptcy-remote.

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**Table 1 U.S Commercial Bank ( FDIC) Loan Portfolio**

	<b>End of 2006</b>	<b>End of 2007</b>
	<b>(in millions)</b>	<b>(in millions)</b>
<b>Total</b>	5,981,184	6,626,157
<b>Real estate loans</b>	3,432,254	3,674,508
<b>Loans to depository institutions</b>	128,314	136,181
<b>Commercial and industrial loans</b>	1,139,853	1,369,934
<b>Consumer loans</b>	857,879	959,579
<b>Leases</b>	136,878	128,734
<b>Others</b>	286,006	357,221
<b>Notional amount of derivatives</b>	132,168,588	164,767,281
<b>Credit derivatives</b>	9,019,653	14,412,090

**Table 2: Bank Collateralized Loan Obligations (CLO) 1997-2002**

<b>Issue</b>	<b>Tranches with Investment Grade %</b>	<b>Tranches with Non-investment Grade %</b>	<b>Residual %</b>
ACLO 2001 1-2	99.75%	0.00%	0.25%
ALCO 1	95.50%	0.00%	4.50%
Aurora Funding	94.70%	4.30%	1.00%
Brooklands Euro	94.80%	2.20%	3.00%
C*Strategic 1999-1	97.70%	1.30%	1.00%
C*Strategic 1999-2	97.59%	1.41%	1.00%
Cast 1999-1	96.00%	1.00%	3.00%
Cast 2000-2	95.25%	1.55%	3.20%
CDO	95.20%	0.00%	4.80%
CDO 2	97.60%	0.00%	2.40%
CDO 3	97.85%	0.00%	2.15%
Chase	95.00%	0.00%	5.00%
Clover No 2-3	94.52%	1.31%	4.17%
Clover No.4	96.90%	0.00%	3.10%
Cordusio	94.80%	3.00%	2.20%
CORE 1998-1	96.10%	2.18%	1.72%
CORE 1999-1	96.63%	2.12%	1.25%
CORE 1999-2	96.56%	1.97%	1.47%
Credico Funding CBO	97.00%	0.00%	3.00%
CROWN CLO	95.10%	0.90%	4.00%
CYGNUS	97.40%	1.90%	0.70%
Cygnus 2001-1	96.73%	0.73%	2.53%
Eirles Two Ltd	93.50%	2.50%	4.00%
Fleet CLO	96.50%	0.00%	3.50%
Fondo BBVA-1	94.88%	2.44%	2.68%
Fondo BBVA-2 SME	94.67%	1.83%	3.50%
Fondo PYMECAT-1	98.20%	0.00%	1.80%
FTPYME TDA	95.70%	2.40%	1.90%
Geldilux 02-1	97.90%	1.30%	0.80%
Geldilux 99-1	97.64%	1.47%	0.89%
Geldilux 99-2	97.05%	1.75%	1.20%
Globe R 2000-1	94.01%	2.00%	4.00%
Imperial II CDO	94.50%	0.50%	5.00%
London Wall 2002 1-2	96.70%	0.70%	2.60%

Melrose 2001 1-2	92.15%	3.43%	4.42%
NationsBank CLO I & II	96.01%	0.00%	3.99%
Olan II	98.10%	0.00%	1.90%
Park Mountain Capital	95.60%	1.60%	2.80%
Promise A	94.80%	1.10%	4.10%
Promise I	95.75%	1.25%	3.00%
Promise K	94.51%	0.95%	4.53%
Promise Z	93.90%	1.60%	4.50%
Repon 16	98.10%	0.25%	1.65%
Riviera 1 S.A.	94.79%	0.00%	5.21%
Riviera 2 S.A.	95.79%	0.00%	4.21%
Rose No. 2	96.29%	0.00%	3.71%
Scala 3	97.60%	0.00%	2.40%
SMILE 2001	99.01%	0.00%	0.99%
Sundial	95.50%	3.00%	1.50%
Verdi	97.00%	1.00%	2.00%

Summary Statistics	Percentage of Investment Grade	Percentage of Non-investment Grade	Percentage of Residual
Average	96.02%	1.16%	2.82%
Median	96.00%	1.10%	2.80%
Max	99.01%	4.30%	5.21%
Min	92.15%	0.00%	0.70%
Std. Dev.	1.45%	1.09%	1.33%
Total Issues	50		

# Bank

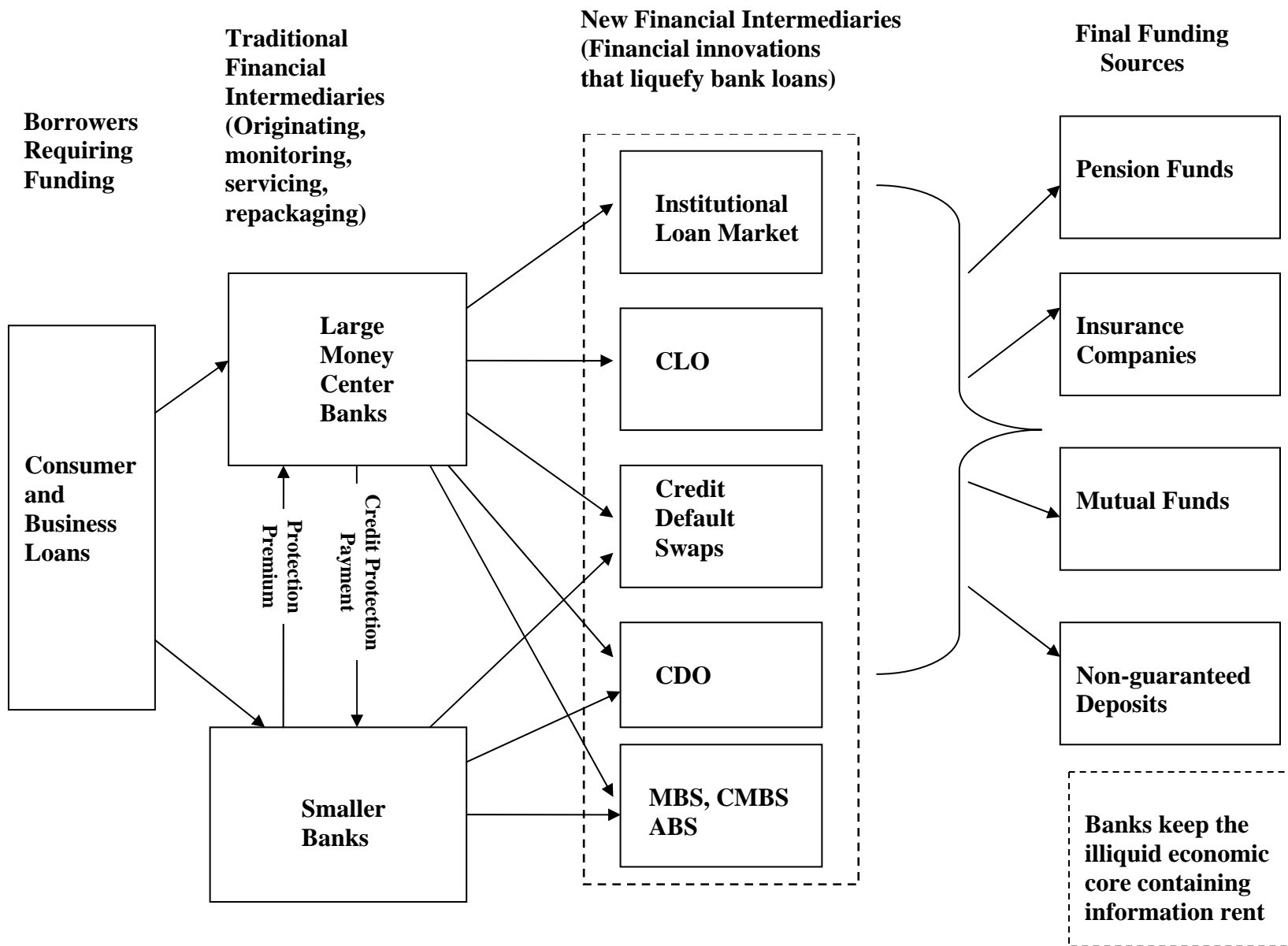
<b>A</b>	<b>L</b>
<b>Deposits with the Fed</b>	<b>Transaction accounts</b> (access to payment system)
<b>Loans</b>	<b>Non-guaranteed deposits</b>
<b>Working capital</b>	
<b>Other loans</b>	<b>Other debt and equity</b>
<b>Other assets</b>	

**Figure 1: Irving Fisher's Proposal**

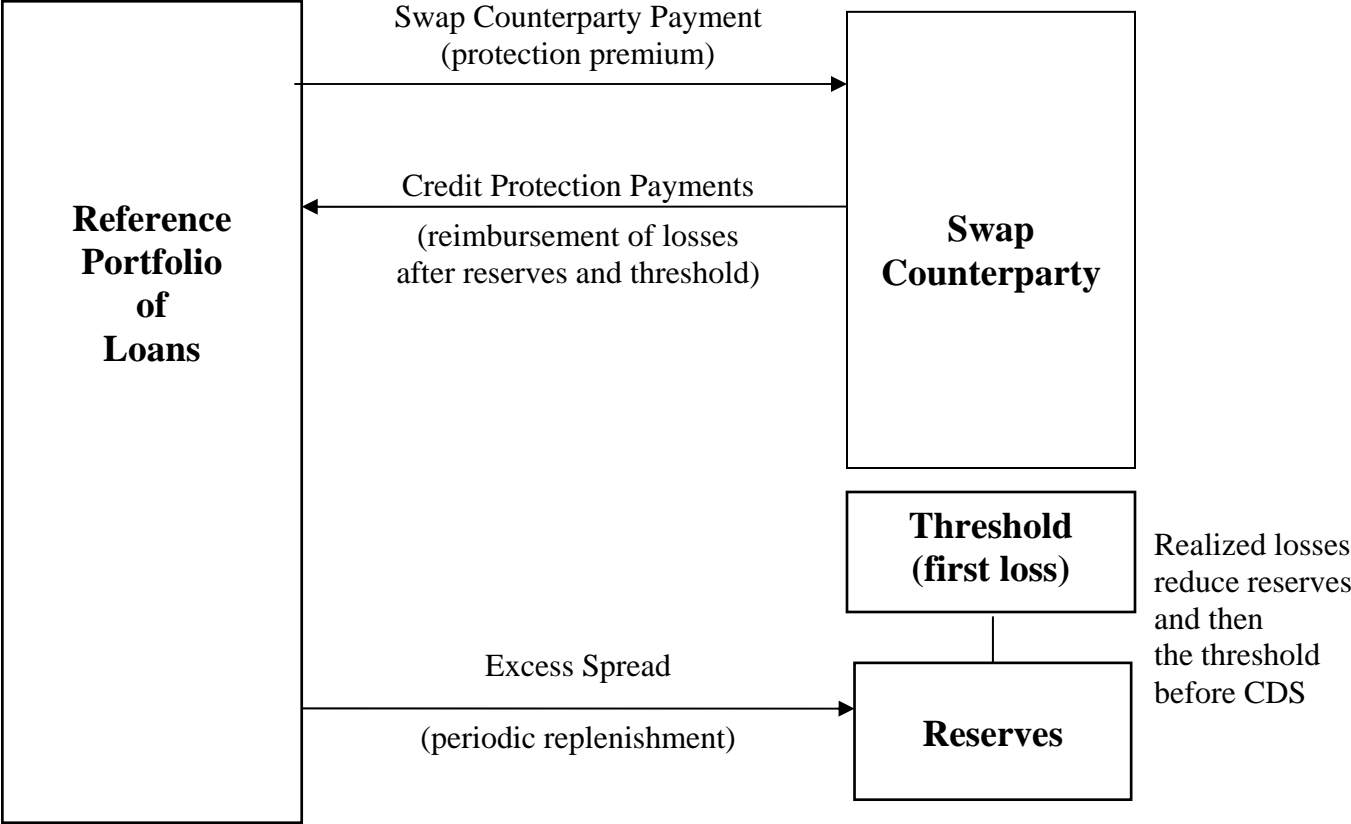
## Bank

<b>A</b>		<b>L</b>	
<b>Safe Assets</b>	<b>Interest bearing deposits with the Fed</b>	<b>Transaction accounts</b> (access to payment system)	<b>Guaranteed Accounts</b>
	<b>T-bills and their close equivalents</b>	<b>Riskfree deposits</b>	
<b>Risky Loans</b>	<b>Tranches of risk class A</b>	<b>Deposits of risk class A</b>	<b>Non-guaranteed Accounts</b>
	<b>Tranches of risk class B</b>	<b>Deposits of risk class B</b>	
	“ “ “ “ “ “ “	“ “ “ “ “ “ “	
	<b>Tranches of risk class K</b>	<b>Deposits of risk class K</b>	
	<b>Working capital</b>	<b>Other debt and equity</b>	
	<b>Illiquid residuals and other loans and tranches</b>		
	<b>Other assets</b>		

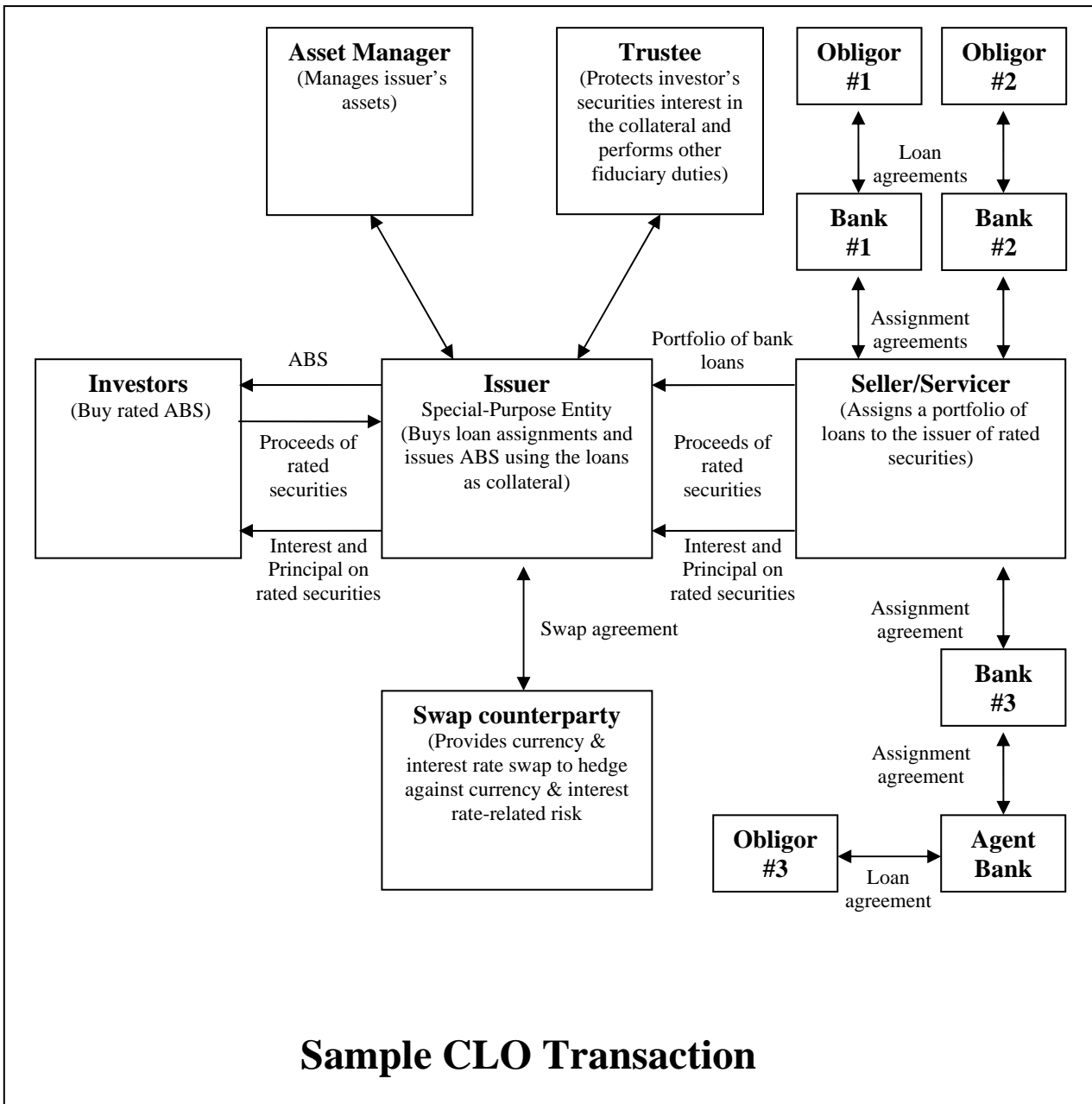
**Figure 2: 100% Reserve Banking without Deposit Insurance**



**Figure 3: Liquefaction of Bank Loans and Final Funding Sources**

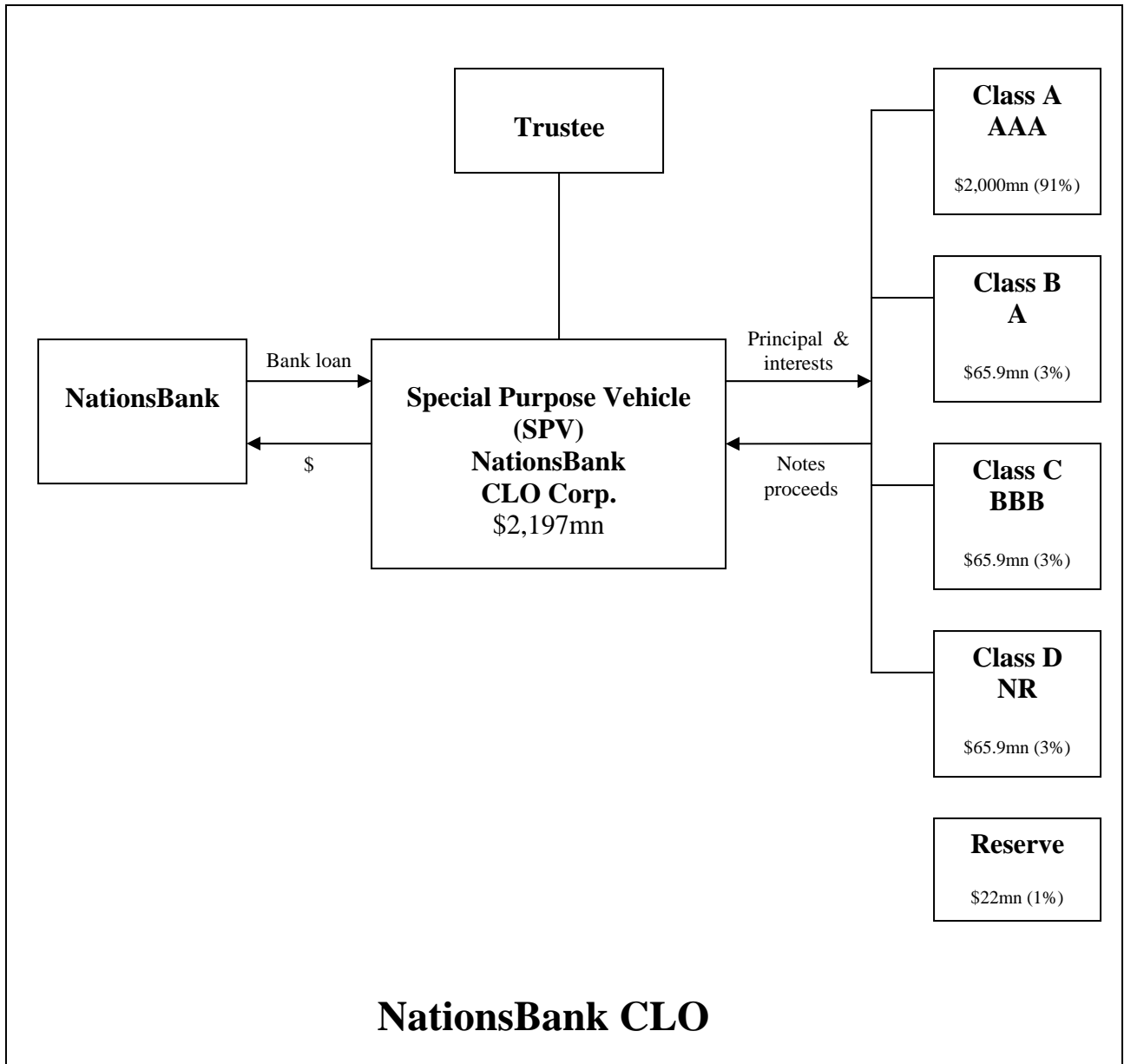


**Figure 4: Credit Default Swap (CDS) on a Portfolio of Loans**



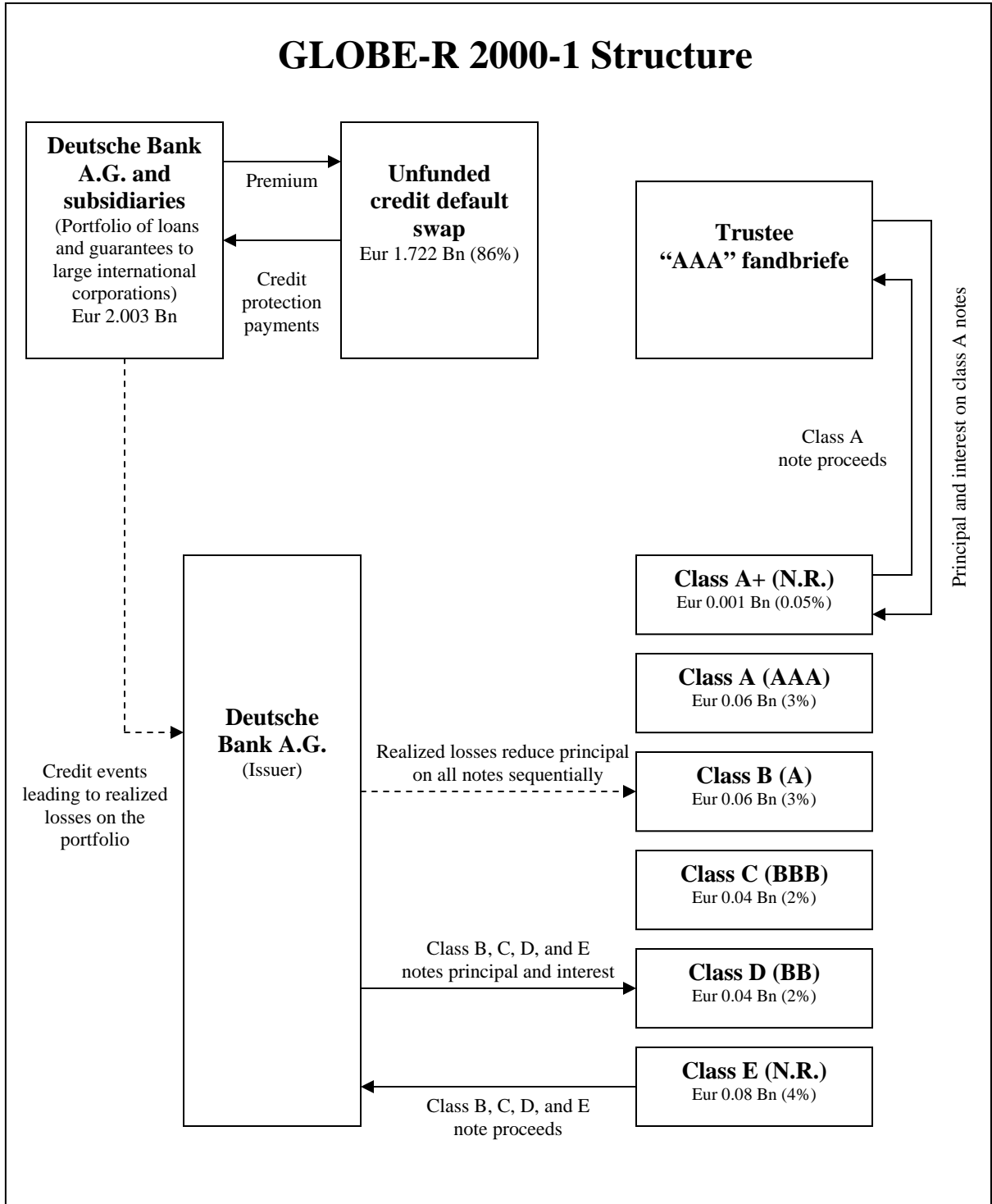
(Source: S&P)

**Figure 5: A Typical Collateralized Loan Obligation**



(Source: Moody's, S&P, Fitch)

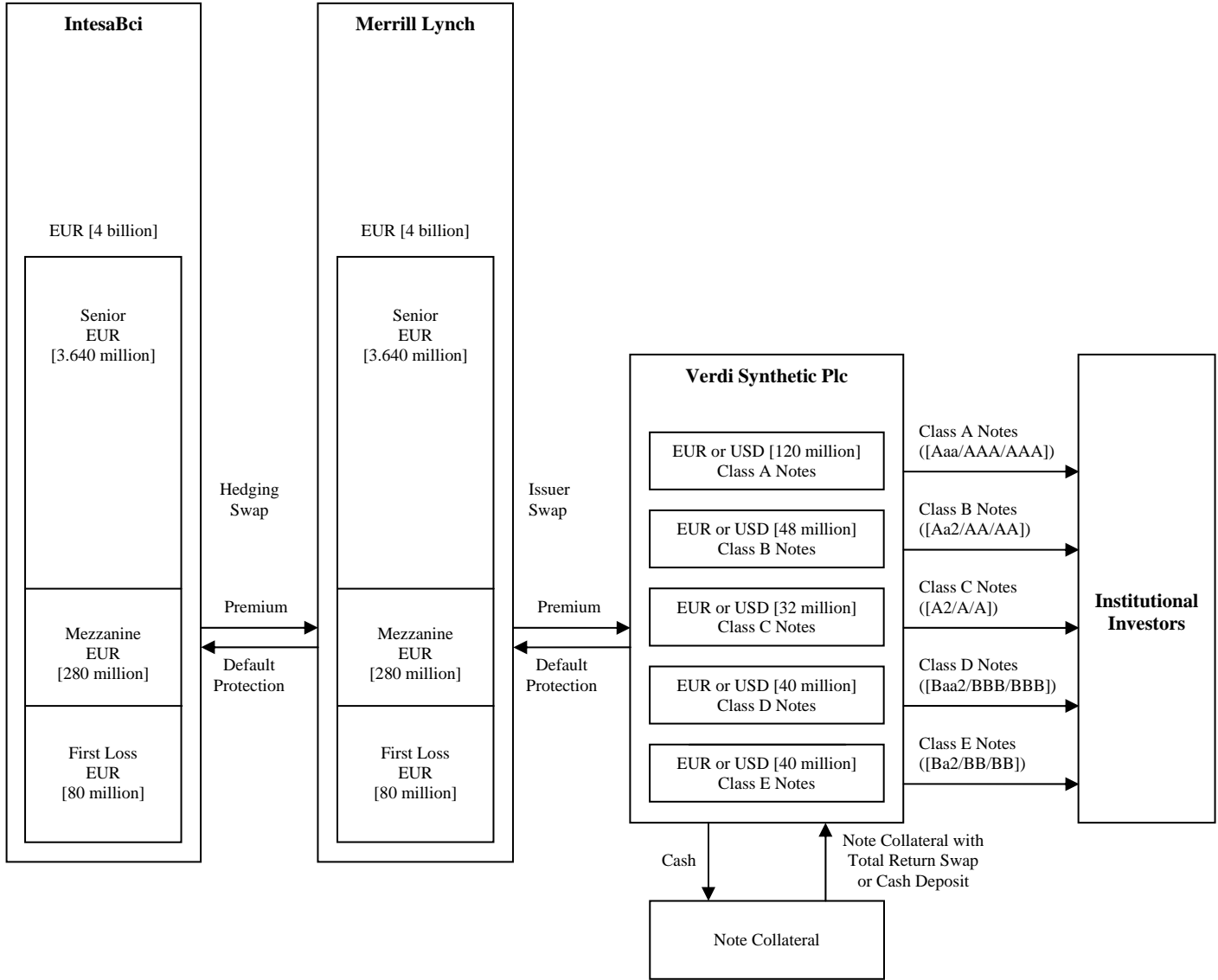
**Figure 6: Example of a Collateralized Loan Obligation (CLO)**



(Source: S&P)

**Figure 7: A Synthetic CLO**

# Transaction Structure



(Source: Merrill Lynch)

**Figure 8: Example of a CLO with Undrawn Credit Facilities**