

ARTICLES

THE REGULATION OF STRUCTURED DEBTS: WHY? WHAT? AND HOW?

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ABSTRACT

This Article contributes to the legal theoretical foundation of the regulation of structured notes. We shall first anatomize the most typical kind of structured note, the collateralized debt obligation (“CDO”). We analyze the similarity between a CDO and a constructed pledged mortgage, point out the embedded fuzzy information behind this structured mortgage, and then identify the implicit externality of this mortgage construction. We argue that CDOs can be treated as properties instead of contracts, and the usual notion of *numerus clausus* does support more severe regulations on such properties. Most existing literature has emphasized the moral hazard problem of investment banks which packaged and sold these structured products. The implications are naturally to increase the capital adequacy ratio, and to impose partial liability on the banks in the event of defaults. What we demonstrate in this paper is the intrinsic externality and information deficiency associated with CDOs. We show that the feature of prioritization associated with the structured debt makes the disclosure of information of CDOs intrinsically difficult. More importantly, the fuzzy information is actually created by the issuer of CDOs, which suggests a rationale for government intervention.

I. INTRODUCTION

It is quite well known that the world in 2008, and the first half of 2009, experienced the onset of the worst economic recession since the 1930s. This recession was brought about by a financial tsunami, the center of which was somewhere on Wall Street, wherein several large investment banks faced a serious financial crisis in the latter half of 2008. Moreover, most people know that the crisis of these investment banks was related to the collapse of widespread structured debt financing. Because structured debt financing has been identified as the number one culprit of the current recession, there have been many suggestions and much discussion concerning the future regulation of structured debt financing.

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This Article contributes to the legal theoretical foundation of such regulations. We shall first anatomize the most typical kind of structured debt, the collateralized debt obligation (“CDO”). We analyze the similarity between a CDO and a *constructed pledged mortgage*, point out the embedded fuzzy information behind this structured mortgage, and then identify the implicit externality of this mortgage construction. We argue that the feature of prioritization associated with the structured debt makes the disclosure of CDO information intrinsically difficult—if not impossible, and the externality of it suggests room for government intervention. Most existing literature has emphasized the moral hazard problem of investment banks which packaged and sold these structured products. The implications are naturally to increase the capital adequacy ratio, and to impose partial liability on the banks in the event of defaults. What we add in this paper is the intrinsic externality and information deficiency associated with CDOs. We argue that CDOs can be treated as properties instead of contracts, and that the usual notion of law supports more severe regulations on such properties.

This paper is arranged as follows. In section I, we briefly review what happened in 2008 and how the financial side and the real estate market mutually influenced each other to cause the global economic crisis. Sections II and III scrutinize the CDO from a legal perspective. We argue that CDO is typically a constructed mortgage based on a pool of assets which, because of its prioritization design, *creates* much more information than the original features of assets in this pool; these missing pieces of information are not only risks to bond-buyers, but also risks to the selling banks. Thus, it is not that the regulatory agency requires the banks to disclose information to bond-buyers, but rather requires them to tell the public exactly what kind of risks are created and embodied in the financial products they are selling. Section IV points out the implicit externality associated with a CDO—the aggregate system risk. Based on the analyses of sections II, III and IV, we are able to propose suggestions in section V for the possible regulation of CDOs in the future. The final section concludes our arguments.

A. WHAT HAPPENED IN 2008?

From the beginning of 2007, some unpleasant news started to surface in the financial market. In February 2007, HSBC wrote down its holdings of bad loans by the amount of \$10.5 billion.¹ Bear Stearns, one of the pioneers in structured finance, in June 2007 announced that it pledged up to \$3.2 billion of loans to bail out one of its hedge funds, the Bear Stearns High-Grade Structured Credit Fund, which collapsed because of its bad bets on subprime mortgages.² Lehman Brothers, at that time the biggest underwriter of U.S. bonds backed by mortgages, closed its subprime lending unit, BNC Mortgage LLC, in August 2007, due to an unexpected

¹ Lee Oliver, *The week Wall Street went into meltdown*, 38 EUROMONEY, September 2007.

² Julie Creswell and Vikas Bajaj, *\$3.2 Billion Move by Bear Stearns to Rescue Fund*, N.Y. TIMES, June 23, 2007, at A1.

loss.³ Merrill Lynch, one of the most successful investment banks in the past decade, reported in October 2007 that it had the biggest quarterly loss in its ninety-three year history after taking \$8.4 billion of write-downs.⁴

Some hoped that the 2007 write-downs had filled the hole and helped the investment banks weather the crisis; however, by the latter half of 2008, the situation became worse. In August 2008, it was estimated that financial institutions around the world lost around \$500 billion.⁵ On September 15, 2008, Lehman Brothers filed for Chapter 11 bankruptcy petition for its losses.⁶ That move triggered the chain reaction. Thereafter, Merrill Lynch announced that it would be sold to Bank of America.⁷ In order to avoid a depression, the U.S. Federal Reserve lowered its interest rate target to a range of 0% to 0.25% in December 2008;⁸ however, market confidence was not restored, such that investment activity was extremely low worldwide. It appeared that the world faced the classical phenomenon of a *liquidity trap* of Keynes.

The above mentioned 2008 events happened in the U.S. were only the tip of the iceberg. In almost all areas of the world, the economic situations were disastrous in 2008. For instance, in the end of September 2008, Iceland's government took control of the country's third-largest bank, Glitnir Bank.⁹ The Bank of England and European Central Bank cut the interest rate sharply in the last quarter of 2008, also due to the economic recession.¹⁰ For many East Asian tigers, their export dropped 30%–50% in December. The exact figures can be found in the respective country-specific statistics.¹¹

In witness of the scenario from 2007 to 2008, we find that a new depression emerged and in fact it had extended all over the world. The starting point of the whole event was the investment bank failure in mortgage related financial products, especially the structured finance products. In the next subsection we shall briefly review the investment bank disaster and explain how it happened.

³ Yalman Onaran, *Lehman Brothers Shuts Down Subprime Unit*, BLOOMBERG, Aug. 22, 2007, http://www.bloomberg.com/apps/news?pid=20601087&sid=a_jFXHzh0PFc&refer=home.

⁴ Bradley Keoun, *Merrill Lynch Reports Loss on \$8.4 Billion Writedown*, BLOOMBERG, Oct. 24, 2007, <http://www.bloomberg.com/apps/news?pid=2067000120601087&sid=afYnoCdmTh4M.&refer=home>.

⁵ Yalman Onaran, *Banks' Subprime Losses Top \$500 Billion on Write-downs*, BLOOMBERG, Aug. 12, 2008, <http://www.bloomberg.com/apps/news?pid=20601087&sid=aSKLfqh2qd9o&refer=worldwide>.

⁶ Yalman Onaran and Christopher Scinta, *Lehman Files Biggest Bankruptcy Case as Suitors Balk*, BLOOMBERG, Sept. 15, 2008, <http://www.bloomberg.com/apps/news?pid=20601087&sid=aSKLfqh2qd9o&refer=worldwide>.

⁷ Matthew Kamitschnig, Carrick Mollenkamp, and Dan Fitzpatrick, *Bank of America Reaches Deal for Merrill*, WALL STREET J., Sept. 14, 2008, at A1.

⁸ Press Release, Board of Governors of the Federal Reserve System (Dec. 16, 2008) (available at <http://www.federalreserve.gov/newsevents/press/monetary/20081125b.htm>).

⁹ *Iceland Nationalises Glitnir Bank*, BBC NEWS, Sept. 29, 2008, <http://news.bbc.co.uk/2/hi/business/7641753.stm>.

¹⁰ Howard Schneider, *Bank of England, European Central Bank Make Aggressive Cuts in Key Interest Rates*, WASH. POST, Dec. 5, 2008, at D06, D05.

¹¹ For instance, Taiwan's export value declined by 41.9% in December of 2009, before dropping an even deeper 44.1% in January of 2009. See Philip Liu, *Taiwan Business: Despite Export Decline, No Currency Depreciation* (2009), Am. Chamber of Com. In Taiwan, <http://www.amcham.com.tw/content/view/2700/422/>.

B. THE RISE AND FALL OF STRUCTURED FINANCE

Households or businesses that take out housing loans from banks often put their houses or buildings in the hands of banks as collaterals. The bank that lends out such mortgaged loans certainly faces the risk of default; if some borrowers cannot pay their loan interest or principal in time, the bank often has to sell the assets to maintain liquidity and incur significant capital losses. It is, in fact, a major risk the bank faces.

Thanks to the innovation of various financial instruments, starting from 1980s, banks were able to create securities to pass some of their mortgage risks to the public through the security market. A typical way is to create various asset-backed notes, of which the terms of payments or fees are related to the default events of some mortgages. If some loan borrowers default, that will trigger the payment terms specified in the asset-backed notes, so that the buyers of such notes may get back only part of their principal. When buyers may lose some of their principals in case of default, the banks' default risks are essentially distributed out and shared by these buyers.

To accomplish the risk-sharing role of such securities, the bank first assembles a pool of assets, which is often called a "special purpose vehicle." If the bank only assigns some fixed proportion of risks associated with all assets in the portfolio to the new, structured notes, then these notes are nothing more than a standard proportional pass-through of the asset risks. The credit rating of these asset-backed notes would simply be given by the weighted average rating of the underlying pool of assets. For instance, if the bank divides a house mortgage into 1000 pieces of the original note, then if the house owner defaults, each note will bear 1/1000 of the capital loss incurred.

However, the investment banks on Wall Street did more than this over the past few decades. They often isolated asset risks into tranches,¹² and then prioritized the notes into various slices, with each corresponding to a tier of risk. For instance, if there is a small proportion of housing defaults, then only the slice that faces the first priority risk will face capital loss. When the default proportion of this asset pool increases, the slices of a higher tier of risk will incur losses. This method magnifies the complexity of the transaction, but is in fact the key to financial innovations. The prototype of this kind of asset-backed notes is called the *collateralized debt obligation*.

The CDOs are often classified according to their risk tranches into three categories. The most risky tranche is the one that first absorbs losses, which is called the junior tranche. The least risky tranche, called the senior tranche, is last to absorb losses. Lastly, there is the middle tier, called the mezzanine. Evidently the general public, who is unable to further distribute risks out, is more willing to accept the senior tranche, because it bears relatively less risks. By mid-2007, there were roughly 37,000 kinds of structured notes issued in the U.S., and many of them were top-rated by

¹² The word *trenche* is French for slice, section or portion.

credit agencies.¹³ According to the rating by Fitch in 2007,¹⁴ 60% of all structured notes were rated AAA, whereas less than 1% of corporate issues were rated AAA. This indicates that these structured notes were deemed “safe” relative to corporate bonds by the public.

The fact that many senior structured notes were well-rated made them popular in the market. By 2001, the value of these asset-pooled notes started to exceed traditional banks. The outstanding structured notes reached 600 trillion by 2007, eleven times that of the world’s GDP, compared to the 2.5 trillion a decade ago.¹⁵ The rating agencies such as Moody’s Corporation also earned much of their profit from structured finance products. By 2006, Moody’s reported 44% of its revenues came from structured notes, and only 32% from the traditional rating business.¹⁶ This seems to suggest that rating agencies and issuers of CDOs are both benefiting from the wide spread of CDOs. Indeed, credit rating agencies are paid by the issuers of securities and thus have a built-in incentive to tailor rating to their clients.

Everything changed in 2008. The new issuance of CDOs suddenly came to a near standstill. By 2008, many banks had high leverage and relied on short-term wholesale of such structured notes to finance their liquidity. Instead of holding loans, banks essentially originated CDOs and distributed the risks out. Put differently, many banks tended to transfer their long-term loans into short-maturity CDOs. The shortage of demand for CDOs in 2008 made banks unable to distribute them, finding themselves holding too much risk and too little liquidity. The credit rating of CDOs also had a huge change in 2008. For instance, it turned out that twenty-seven of thirty asset-backed CDOs underwritten by Merrill Lynch had a rating of AAA in 2007, but were suddenly downgraded to junk in 2008.¹⁷ Even earlier, Moody’s had to downgrade 31% of their CDOs, and many of which were originally AAA-rated.¹⁸ By mid-2008, the structured finance activity was essentially frozen.

C. THE FEED-BACK IMPACT ON REAL ESTATE

The collapse of the asset-backed structured note market and the investment banking business certainly had their real-side impact. Among many other things, we mention one important channel with respect to which the spillover effect is typical. Because a substantial part of the mortgage risk is born by the public buyer of CDOs, banks had less and less

¹³ Saskia Scholtes and Richard Beales, *Top Rating Proving Crucial to Structured Finance Sector*, FIN. TIMES, May 17, 2007, at 41.

¹⁴ *Inside the Ratings: What Credit Rating Mean*, FITCH RATINGS 5 (Aug. 2007), <http://www.fitchratings.com.br/ytmr0608.pdf>.

¹⁵ *When Fortune Frowned*, ECONOMIST, Oct. 11, 2008, at 8; CFA Society of the UK, *IMC OMC Update on the consequences of the financial crisis 2007/8*, (available at http://www.cfauk.org/assets/88/Market_downturn_and_risk.pdf).

¹⁶ Joshua Coval, Jakub Juruk, and Erik Stafford, *The Economics of Structured Finance*, 23.1 J. OF ECON. PERSPECTIVES 3, 4–5 (2009).

¹⁷ Susanne Craig, Randall Smith and Serena Ng, *Merrill Aims to Raise Billions More: Firms Dump Mortgage Assets as Crisis Drags on; Another Big Write-Down*, WALL STREET J., July 29, 2008, at A1.

¹⁸ *Basel Committee on Banking Supervision, Credit Risk Transfer: Developments from 2005 to 2007 12–13* (Mar. 2008), available at <http://www.bis.org/publ/joint21.pdf> (last visited Mar. 25, 2010).

incentive to take particular care in credit checks and monitoring. Mortgages were often granted under very loose background checks, and even the “no income, no job or assets” (“NINJA”) group was able to obtain loans.¹⁹ Two typical examples were Fannie Mae and Freddie Mac: both were United States government-chartered institutions, and were supposed to be safe. But records show that they actually endorsed many subprime loans.²⁰ By mid-2008, they securitized a large proportion of their mortgages and had about 1.5 trillion in outstanding bonds with 168 billion in the form of CDOs.

The expansion of mortgages and loosening of loan checks evidently increased the demand for houses, pushed up their prices, and formed a potential housing price bubble. The growing housing prices, ironically, “rationalized” the loose check of credit, because even if the borrower defaulted, the expected value increase of the house might have been good enough to overcome the capital loss incurred while liquidating the defaulted mortgage. In terms of the proportion of household debt relative to disposable incomes, the ratio was 80% in 1986, 100% in 2000, and 140% in 2007.²¹ Thus, the prevalence of CDOs expanded the mortgage loans, increased the demand of housing, and pushed up a housing price bubble. When investment banks started to sell their house holdings as they faced liquidity pressure, housing prices started to fall. Then, even relatively healthy banks that provided excessive loans faced a liquidity squeeze, and this in turn made the banks liquidate more assets. The message spread, and some of the originally AAA-rated CDOs defaulted and finally led to the sharp drop of CDO prices.

By the end of 2007, the mortgage-backed securities issuance provided by private sectors began to dry out.²² By mid-2008, according to the president of Standard & Poor’s, Deven Sharma, the structured finance activities were essentially shut down, and were expected to remain so for years.²³ When CDOs could not absorb the loan risks any more, the demand for housing loans could not expand. The estate prices fell, and the housing price bubble burst. The messy uncertainty in global finance also caused the credit crunch among banks worldwide, which suppressed the regular investment finance. Moreover, as their asset value depreciated, consumers decreased their consumption due to the wealth effect.²⁴ Banks panicked and dared not make loans which suppressed domestic investment demand. For countries that mostly relied on exports, they found their export orders

¹⁹ Markus K. Brunnermeier, *Deciphering the Liquidity and Credit Crunch 2007–2008*, 23.1 J. OF ECON. PERSPECTIVES 77, 82 (Winter 2009).

²⁰ Kimberly Amadeo, Fannie Mae, Freddie Mac and the Subprime Mortgage Crisis, http://useconomy.about.com/od/grossdomesticproduct/tp/Subprime_Mortgages_FNMA.htm (last visited Mar. 25, 2010).

²¹ Coval, Juruk, and Stafford, *supra* note 16, at 10.

²² *Home Economics*, ECONOMIST, Aug. 16, 2008, at 66–67.

²³ Joshua D. Coval, Jakub Jurek, and Erik Stafford, *The Economics of Structured Finance* 4-5 (Harvard Business School, Working Paper No. 09-060 2008), available at <http://www.hbs.edu/research/pdf/09-060.pdf>.

²⁴ The International Monetary Fund estimated that the worldwide losses on debt originated in America (primarily related to mortgages) would reach 1.4 trillion. See Craig, Smith, and Ng, *supra* note 17. The wealth effect of consumption is an argument related to Milton Friedman’s permanent income hypothesis, which says that the current consumption is affected by one’s long term estimates of income and wealth, MILTON FRIEDMAN, A THEORY OF THE CONSUMPTION FUNCTION 20–31 (1957).

dropped significantly.²⁵ The recession then appeared and completed the chain of events ending in 2008.

D. TRYING TO REGULATE THE MONSTER

Although finance is supposed to serve a positive function in modern economies, our analysis above shows that modern finance seems to have added to the instability of the world's economies. Our impression is pretty much echoed by the general public.²⁶ Given that the 2008 recession—by all standards the worst one since the 1930s—was at least partly brought along by the financial sector, most people would agree that we somehow should do something about the market of structured financial products. Below we summarize some suggestions we found from the news media and professional journals.

The first suggestion concerns the revision of the regulation on capital adequacy. We shall skip some details, but the essence is the following: Basel II had some regulation on capital adequacy, but that requirement was loosened in 2004 for investment banks.²⁷ In particular, since the asset-pools used to back up CDOs were not necessarily owned by investment banks, they belonged to “off-balance-sheet” vehicles.²⁸ Therefore, it has been argued that the structured notes issued by such investment banks should apply other capital adequacy calculations. By 2004, Wall Street started to use a calculation based on risk-adjusted basis.²⁹ According to Sanford C. Bernstein Co., this made the leverage ratio rise from around twenty-two before 2003 to thirty before the end of 2007.³⁰ Given the mess of investment banks in 2008, it is natural to cry for more regulation on capital adequacy, at least to bring back the old regulations prior to 2004.

The rationale behind regulating capital adequacy is twofold. The first is a moral hazard: a bank with a shallow pocket is more likely to be negligent in risk management, and a higher capital adequacy ratio lessens this concern. The second is a reservoir effect: a bank with a deeper pocket is less likely to face liquidity pressure, therefore less likely to trigger a crash of asset bubbles.

Following this logic, some different regulatory measures have been proposed by different countries. In December of 2008, the Swiss government proposed to restrain growth in bank assets when times are good. Even earlier, Swiss authorities also required that their biggest banks introduce a leverage ratio that does not allow for risk-weighting of assets. These are measures to restrain the expansion of assets. British Financial Authority (“FSA”) required that banks hold significantly more liquid assets. This is to increase the pocket depth of the bank to deal with liquidity threats. Other than improving the adequate capital regulation, there were also proposed changes in regulatory agencies. The U.S. government

²⁵ Liu, *supra* note 11.

²⁶ Coval, Juruk & Stafford, *supra* note 16.

²⁷ Mewling and Puking, *ECONOMIST*, Oct. 25, 2008, at 85–86.

²⁸ *Id.*

²⁹ *Id.*

³⁰ See *When Fortune Frowned*, *supra* note 15.

considered expanding the power of their Securities and Exchange Commission (“SEC”), and also the consolidation of the SEC and the Commodity Future Trading Commission (“CFTC”). There were also some amendments targeted at the rating agencies, such as Standard & Poor’s and Moody’s.³¹

The difficult part of the above mentioned regulation on capital adequacy is the lack of a general theoretical foundation to draw a line. For instance, so far we find that hedge funds, the least regulated part of the financial industry, appear to be relatively stable. Therefore it raises the natural question: which part of finance should be regulated and how much capital adequacy should be required for each kind of financial product?³² Evidently, a simple rule of thumb stating that the ex post disturbed sector needs to be more regulated ex ante simply does not help much. Furthermore, the capital adequacy problem may not capture the whole picture of today’s mess. For instance, transactions such as futures and asset default swaps are created for various risk-sharing reasons. It is difficult to judge whether agencies providing platforms for these transactions should be regulated based on the measure of capital adequacy. In fact, it may be the case that a severe regulation may choke the business of otherwise healthy risk-sharing financial instruments. Conceptually, risk-sharing and risk-spreading are two sides of a coin. We certainly do not want to push for more regulations without a solid theoretical foundation.

In the following sections of this paper we shall go beyond the concern of capital adequacy and propose a theory of regulating structured financial products. To do this, we start by looking into the features, in detail, of a typical structured product, namely the CDO. We argue that a buyer purchasing an asset-backed CDO is actually *lending money to the bank in exchange for a pledge constructed upon a set of mortgages*. Looking at the CDO this way, we see that buying a CDO really has the features of buying a constructed mortgage *property*. Regulating a CDO is therefore regulating the transaction of properties and, as we shall explain, is more acceptable to legal scholars in both common-law and civil-law traditions.

We shall argue that there are two kinds of information problems associated with the constructed prioritized mortgages, such as a CDO. First, there is some intrinsic information about these CDOs which is supposedly disclosed, such as the probabilities of events that are related to the fees and payments of these structured notes. Without such information, buyers of these CDOs are in the dark and the pricing of CDOs is far less than transparent, not to mention accurate. Second, because CDOs tie together a pool of assets, the more prevalent these CDOs are, the more likely a particular asset is related to some unknown assets elsewhere. For instance, suppose some real estate in areas a, b and c is pooled to form a CDO named ϕ , and some estates in areas c, d and e are pooled to form a CDO named

³¹ Huw Jones, *UPDATE 2-EU Backs New Rules on Rating Agencies*, REUTERS NEWS, Apr. 23, 2009, <http://www.reuters.com/article/idUSLN96840920090423>; *Save Yourself*, ECONOMIST, Dec. 13, 2008, at 78–79; *When a Flow Becomes a Flood*, ECONOMIST, Jan. 24, 2009, at 65–66; *Inadequate*, ECONOMIST, Mar. 14, 2009, at 68.

³² See Coval, Juruk & Stafford, *supra* note 16, at 11.

ϕ . Because the estates in area c are included in both ϕ and φ , these two CDOs are related. In particular, if some house owners in area c default, then the returns to both ϕ and φ will be affected. Moreover, if there are thousands of CDOs in the market, then there will be a *system risk* associated with these CDOs. The seller of such products may have the responsibility to explore and disclose such complex information to potential buyers. If we treat CDOs as properties, then banks as producers of such properties should certainly disclose the intrinsic risk of the properties they sell. Later we shall analyze in a systematic way the impact of such information problems and propose solutions from a legal perspective.

II. RATIONALES FOR THE REGULATION OF CDOs

Before a detailed analysis of the regulation of the CDOs, we should first clarify the theoretical foundations of such regulation. From much discussion, we see that the existence of a moral hazard and externalities are two of the main grounds requiring regulation. In this section we only introduce the concept; the more specific context concerning CDOs is left to later sections.

A. MORAL HAZARD

Suppose a contingent event hurts both agents X and Y, and only agent X can take actions to prevent it. If the event does not happen, then both X and Y benefit. Conversely, if it does happen, the associated damage is often shared between X and Y. The problem of moral hazard arises when the preventive action of X is not observable to Y. This is what economists call *hidden actions*.³³ In general, the less damage shared by agent X, the less incentive for X to exert preventive actions to avoid the event. In the case of investment banking, agent X is the investment banker who issues or underwrites those asset-backed notes. In case of defaults of such mortgages, banks with inadequate capital would not bear much of the loss. The regulation proposals are therefore designed to increase the banks' potential loss in case of defaults, thereby lessening the banks' moral hazard problem.

In the discussion of the subprime crisis and the key role of the CDO, the problems in connection with moral hazard are widely recognized. The loan borrowers can walk away; the originating lending bank can sell the loan out to some investment banks; the rating agencies are not responsible for the mess they created, and still get the service fee;³⁴ the investment bankers sell the financial products from packaged loans; and the hedge fund managers only have a very limited obligation of disclosure and enjoy

³³ HAL R. VARIAN, MICROECONOMIC ANALYSIS 444 (3d ed. 1992).

³⁴ See John Patrick Hunt, *Credit Rating Agencies and the "Worldwide Credit Crisis": The Limits of Reputation, the Insufficiency of Reform, and a Proposal for Improvement*, 2009 COLUM. BUS. L. REV. 109, 112-14, 169-80, (2009).

excessive interest.³⁵ In short, the investment bankers who sell CDOs do not seem to bear sufficient risk to be cautious.

Restricting attention to the issue related to investment bankers, there are two methods the government can implement to increase the potential responsibility of a bank. The first is of course to impose capital adequacy. For instance, the government may require the bank to provide a proportion of capital to cover default losses of each tranche of the CDO. By doing this, the banks and most buyers of the senior CDOs are more aligned. The bank therefore would be more cautious as they sell these financial products. The second is to restrict banks from selling CDOs backed by assets that are beyond the control of the bank. This can prevent banks from “facilitating” the realization of the default by buying sufficient CDO swaps. If the assets backed behind a CDO sold by a bank are all owned by the bank, then the bank would have a vested interest in not seeing it default.³⁶

B. EXTERNALITIES

“Externality” refers to the scenario where the activity of agent X affects the welfare of agent Y, but X does not receive any compensation or penalty through the market. The classical approach to correct the distortion of externalities was to impose a Pigouvian tax³⁷ or subsidy on the activity of X. Ronald Coase in his famous 1960 article challenged the necessity of imposing governmental regulation in all cases of externalities.³⁸ In particular, when the transaction cost between X and Y is low, they can bargain and come up with an efficient outcome.³⁹ In reality, however, there are cases where transaction costs are very high and negotiations are prohibitive. In the case of selling CDOs, the problem is indeed that buyers do not have sufficient information to exercise the bargaining with banks. In fact, as in the case of the 2008 financial tsunami, buyers do not even realize the externality problem until banks run into trouble and it is too late to bargain with the banks. This implies that some kind of ex ante regulation is necessary.

For our purpose, it is also helpful to identify a special kind of externality: the aggregate externality associated with CDOs. A typical example of aggregate externality is traffic congestion. It is not that any pedestrian or driver is specifically affected by another driver or pedestrian, but that the *overall* traffic is more crowded, when a sufficient number of people move on the road.

The aggregate risk associated with CDOs is just like an externality of congestion. It is not that any particular CDO can be associated with a

³⁵ Lawrence J. Lau, Lessons from the U.S. Sub-Prime Mortgage Loan Crisis 23–24 (2008), <http://www.cuhk.edu.hk/governance/officers/lawrence-j-lau/presentations/english/080524.pdf> (last visited Mar. 24, 2010).

³⁶ Lawrence J. Lau, Keynote Speech at the International Conference on the Impacts of and Lessons Learned from the Global Economic Crisis, (May 16, 2009) (powerpoint of presentation available at <http://192.192.124.23/public/data/20090516-1.pdf>).

³⁷ See R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

³⁸ See *Id.*

³⁹ See, e.g., STEVEN SHAVELL, FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW 18 (2004).

certain percentage of responsibility for the financial crisis, but rather that the overall aggregation is responsible. The difficulty of identifying ex post responsibility is another reason we expect to have more ex ante regulation. Because all CDOs have several back-up assets as their respective pools, when CDOs are prevalent, essentially all housing mortgages are bundled together. It is the same as congestion in the sense that it is difficult to identify the independent risk of any single CDO that stands out from others. We shall come back to this point later.

III. CDO AS CONSTRUCTED MORTGAGES, AND THEIR PROBLEMS

In this section we shall explain how an asset-backed CDO is constructed, and what kind of new information is created and embodied in the CDO by the investment banker. We start with the traditional pass-through securitization and then elaborate gradually to more complicated cases.

A. TRADITIONAL PASS-THROUGH SECURITIZATION OF MORTGAGES

Consider the case that person A buys a house and takes out a loan of \$100 from the bank using his house as collateral. The bank, Z, trying to distribute some of the risk, may use say 40% of the mortgage as a pledge, selling it to individual a, in return for \$40 from a. The deal between the bank and person a is usually written as a note, which says that if A pays the interest and principal regularly, then bank Z pays person a some interest on top of the principal when the expiration date arrives. However, if A defaults by the expiration date, then Z can sell A's mortgaged house, usually getting back only a proportion of \$100, say \$70. In that case, person a will get back $\$70 \times (40\%) = \28 . This is the typical pass-through securitization, and the relationship between A, Z and a is drawn in Figure 1.

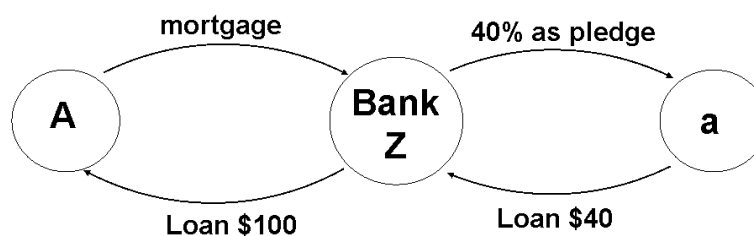


Figure1: The pass-through loan A,Z and a

An alternative way to look at the relation in Figure 1 is to skip the middle stage, and imagine that person A “directly” borrows \$60 from the bank, and \$40 from a. Person A simply divides the estate into a forty–sixty split, and uses two mortgages to finance the \$100. Again, in case of a default where the debt holder sells the mortgage with a return less than

\$100, there should be a sharing rule specifying the payments between Z and **a**. The relation is drawn in Figure 2. In fact, if we treat the bank simply as another individual named **b**, then Figure 2 would depict that **a** and **b** (with “Bank Z” in Figure 2 replaced by “b”) jointly provide the loan to A and jointly hold the mortgage in a forty–sixty split.

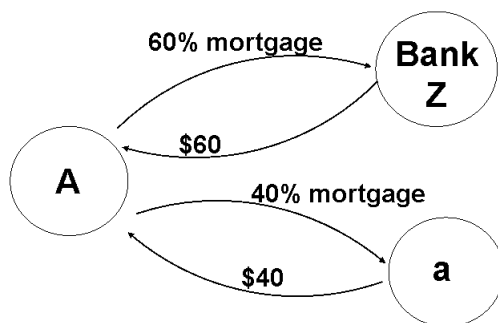


Figure 2: An alternative way to look at the pass-through loan

B. THE GENERALIZED PASS-THROUGH SECURITIZATION

Now the bank may want to expand the distribution of the mortgaged loan to more individuals. This can be done by the securitization of the estate. Specifically, the bank Z can cut the estate mortgage into many small pieces, each written as a security, and sell these notes in the market. This security can be viewed as asset-backed, because there is a mortgage behind it. The notes may have a face value and interest payments. If the mortgage defaults, then the security owners will have to bear the potential loss from estate price depreciation as the bank liquidates it.

In Figure 3, we simplify the figure a bit. Between the bank and each individuals **a, b, c, d . . .**, we only draw one line instead of two—recall that one line originally represented the pledged mortgage and the other line represented the loan. Furthermore, other than A, the bank may also include the estates bought by persons B, C, and D, pool them together and sell these combined mortgages to individuals. For instance, suppose the bank pools together estates owned by A and B, and sells 100% of both mortgages to the public **a, b, c . . .**, then we have a structure like Figure 3. Of course, one can take away the bank tier in the middle, and redraw Figure 3 as a relation between A, B and individual buyers **a, b, c, d**.

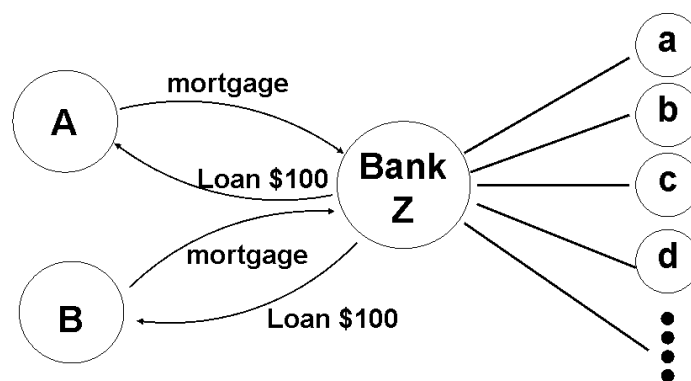


Figure3: The securitization of mortgages

The reason why we would like to interpret the securitization of houses as a mortgage is to make clear the characters behind a structured security. Indeed, given that a mortgage is a typical *property*, it may aid us to think of a fundamental principle behind the property law: information disclosure. When a person buys an asset-backed note issued from a bank, he or she is supposed to know what kinds of property rights are imposed on these mortgages. For instance, in Figure 3, if house A is also set as a mortgage for other loans provided by Y, this may affect the right of each security buyer of bank Z in case that A defaults to Y. Thus, viewing a security backed by some estate as a *contract* between the buyer and the bank, the disclosure of information may be treated as a *moral obligation* of the seller. If some relevant information is not known to the issuer, then there is no way that the issuer can possibly disclose it. The court then may simply treat it as an intrinsic risk faced by the buyers.

Looking at the asset-backed note as a mortgaged *property* permits the view that the disclosure of property information is a *principle*. The law may even require that all mortgages associated with an asset be registered, so that buyers may obtain accurate information from the recording office. When these notes are shown to be undervalued or depreciated due to the claim of other liabilities, it will cause large losses for the note buyers. If anything like this were to happen, the court would not accept the defense that the issuer of such mortgage-backed notes did not know of the other liability conditions of the housing mortgage. We shall come back to this point later.

Suppose the bank disperses all the risks of A and B and does not hold any of the risk in its own hands. Then we can take away the bank tier and redraw the pass-through securitization relation as in Figure 4. All individuals **a**, **b**, **c**, and **d** simply have some shares of both mortgages A and B.

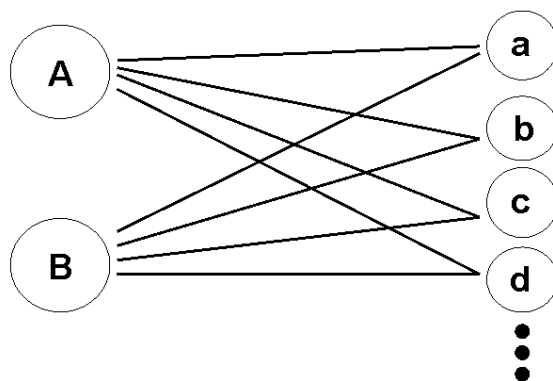


Figure 4: The Direct Relation of Pass-through Securitization

C. STRUCTURED NOTES: POOLING AND PRIORITIZING MORTGAGES

Now we move on to consider the more complicated case in which the bank pools together real estate owned by A and B, and further innovates by issuing a new asset-backed note with some kind of prioritization. Specifically, the bank sells a note to the public with a face value of \$1, to mature in one year with interest payments. If after one year *both* A and B defaults, then buyers can get back 50% of their principal, that is fifty cents. If this event does not happen (neither A nor B defaults, or only one of them defaults), then buyers of this note will get back the full amount of \$1. We call this note a *prioritized note* because the bank fully absorbs the risk if only A or B defaults, and individual buyers of this note only bear the secondary risk, when *both* A and B default.

In terms of financial derivatives, the structured note that bears the smallest risk is called a *senior* CDO. A more complex design for a pool of assets, as we briefly mentioned in section I, can be differentiated into *junior* (which bears the first tier of risk), *mezzanine* (which bears the second tier of risk), and *senior* (which bears the last tier of risk) CDOs.⁴⁰ But for the purpose of our discussion, we do not have to go into that detail.

When CDOs that have a face value of \$1 are sold in the market, they may not be sold at a price of \$1. Depending on the risk, interest, and priority structure, there may be price markups or markdowns. Compared with the conventional pass-through securitization, the key to the CDO is its prioritization. Intuitively, a pass-through securitization is a mechanical division of the original pool of mortgages into smaller pieces, which then distributes the risk of default of each mortgage into the public in a fixed proportional way. However, the prioritized notes, such as the CDO, create more information than the pass-through security. Suppose there are ten

⁴⁰ For instance, if there are ten assets in the pool, the bank may identify that (1) the junior notes will absorb the first 6% of capital loss due to default; (2) the mezzanine notes will bear 6% to 12% of the capital loss due to defaults; and (3) the senior notes will bear the remaining 12% to 100% loss of the capital loss.

assets in the pool, and suppose there are ten default probabilities for each estate owner. Consider a priority event where “two of ten estates jointly default.” The probability of this event can never be inferred by the original ten default probabilities. In this way, the prioritization of default probabilities creates new information. Note that here we emphasize the *new* information *created* by the issuer of this CDO. In contrast, the pass-through security does not create any new information.

Intuitively, if a bank creates a new property, such as a new combined prioritized mortgage that is sold as a pledge in exchange for an individual’s money, then of course this bank would have the responsibility to disclose the default probability of this new prioritized mortgage. The bank simply cannot argue that the uncertainty and risk it creates should be entirely assumed by buyers.

Beyond CDOs, there exist additional forms of structured notes. Banks often pool together a group of CDOs as the generic assets and form something called CDO². For instance, a CDO usually triggers a depreciation of principal when payment is due if certain default events happen; when such events do happen, we say that this *CDO defaults*. Then, one can treat CDO_a, CDO_b, CDO_c, and CDO_d as four assets, and form a new CDO based upon these four CDOs. Specifically, one can create a CDO² specifying that it will trigger the principal depreciation if any two of CDO_a, CDO_b, CDO_c, and CDO_d defaults. Again, one can see that this CDO² also creates some uncertainty not related to the original first-tier CDOs. It is even more difficult for potential buyers to know the subtle property behind a CDO².

D. CRUCIAL UNDISCLOSED INFORMATION IN A CDO

What is the key information associated with the new structured notes? What kind of information do the buyers need to know in order to assess correctly whether they should buy these notes? Consider the simplest scenario wherein there are only two housing mortgages, A and B, in the asset pool used to back up the notes. Suppose the probability that each house owner defaults is respectively p_a and p_b . For the traditional pass-through securities, all the relevant information is embodied in this pair of parameters. But for a prioritized security such as a senior CDO, the new information involved is the probability that *both* owners of A and B default. This probability, denoted p_{ab} , has nothing to do with p_a and p_b , and cannot be inferred from the individual event of either house owner defaulting.

Alternatively, we can view the new information from the two by two table in Figure 5. In this table, D and N denote the events of default and no-default, respectively, and their subscripts indicate the mortgage of the respective default event. In general, the buyers need to know all elements in this matrix in order to assess the value of the structured note. We know that the probability that house owner A defaults (event D_a) is p_a , and thus logically, the event that house owner A does not default (event N_a) is $1 - p_a$. These are listed on the rightmost column of this Table. Similarly, we have p_b and $1 - p_b$ on the bottom row, indicating the probabilities that house

owner B defaults or does not default. Because a house owner either defaults or not, the two elements in each row of this two by two table must add up to the rightmost number, and the two elements in each column must add up to the number on the bottom. Thus, since p_a and p_b are already known, there is only one degree of freedom in this two by two table; once we assign a number p_{ab} , as in Figure 5, then the remaining three numbers are determined. For instance, given that both house owners default is p_{ab} , then the probability for “A-default and B-no-default” is simply $p_a - p_{ab}$. And given the probability of “A-no-default and B-default” is $p_b - p_{ab}$, then the event that neither A nor B defaults must be $1 - p_a - (p_b - p_{ab}) = 1 - p_a - p_b + p_{ab}$.⁴¹

A \ B	D _b	N _b	
D _a	P_{ab}	$P_a - P_{ab}$	P_a
N _a	$P_b - P_{ab}$	$1 + P_{ab} - P_a - P_b$	$1 - P_a$
	P_b	$1 - P_b$	

Figure 5 : The Joint Event Probability of House Defaults

In summary, p_{ab} is a new piece of information other than p_a or p_b . Knowing the event probability of p_a and p_b does not help knowing the probability of the joint event that both A and B default, p_{ab} , which is indeed the critical condition in determining the value of a CDO toward the end of a period.

Put differently, as in Figure 4, in the scenario of pass-through securitization, individuals **a**, **b**, **c**, and **d** face several independent mortgages, and the security they buy is nothing more than a linear combination of assets A and B. However, in the scenario of a CDO, because the risks are prioritized, the structured note essentially creates a new mortgage. Individual buyers **a**, **b**, **c**, and **d** face an *entangled bundle*, and cannot be thoroughly discerned. Borrowing a term from game theory,

⁴¹ An alternative way to understand the joint and several events is to see that the default events A and B are correlated. We know that the probability of event D_a happening is p_a , that the probability of event D_b happening is p_b , and that the probability of both happening is p_{ab} . From probability theory, we know that the variance of D_a is $p_a(1 - p_a)$, and that of D_b is $p_b(1 - p_b)$. The correlation coefficient between D_a and D_b is $(p_{ab} - p_a p_b) / \sqrt{p_a(1 - p_a)p_b(1 - p_b)}$. See SHELDON ROSS, A FIRST COURSE IN PROBABILITY, Chapter VI (2006).

assets A and B jointly form an *information set*, and buyers simply do not know items inside the set, as shown in the dotted ellipse of Figure 6.⁴²

Even if we do show that there is some undisclosed information associated with the created prioritized notes, it does not mean that the law should do something about it. Indeed, in a society with intensive interactions between people and their activities, almost everything may be claimed to have a potential impact on others. We do not tend to ban such activities simply because the probability and extent of such impact is unknown. To argue that issuers of asset-backed CDOs may have to disclose the information of the joint probabilities of various prioritized events, one must raise stronger arguments. In particular, if the joint defaults associated with a prioritized event is an uncertainty (instead of a risk),⁴³ one may wonder how sensitive buyers of such notes are affected by the specification of the probability of this joint event. If the expected return of a CDO is indeed very sensitive to the unspecified (or undisclosed) probability, then the lack of such information evidently makes the pricing of the note inaccurate, hence the law may tend to enforce some disclosure of such a joint probability.

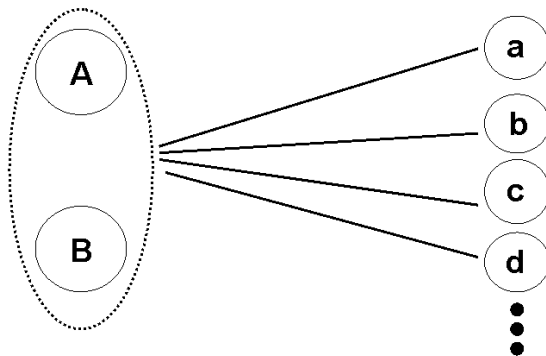


Figure 6: CDO Creates an Information Set Unknown to Buyers

E. THE CRUX OF THE DEFAULT CORRELATION

Suppose there are forty assets in a pool to back up an issued CDO. Then, there are 780 pair-wise correlation coefficients among these assets.⁴⁴ Suppose the original variances of the default events of these forty assets are known. Even after deducting the forty variances of the original assets, we still have 740 new pieces of information. The most practical way to see the importance of these new pieces of information is to check the impact on the

⁴² For instance, when two players are playing rock-paper-scissors, there are three strategies for each player. Each one, however, does not know what strategy the other side will adopt, except that one knows the other side will adopt one of the three strategies. Alternatively, what one sees is an information set containing scissors, rock and paper. For more explanation of the information set see DREW FUDENBERG & JEAN TIROLE, *GAME THEORY* 45–46 (MIT Press 1991).

⁴³ See FRANK H. KNIGHT, *RISK, UNCERTAINTY AND PROFIT* (Univ. of Chicago Press 1971) (on the difference between uncertainty and risk).

⁴⁴ Exhausting all pairs of the 40 assets, we have $C(40, 2) = 40 \times 39 / 2 = 780$.

valuation of this CDO and the derived CDO² by changing these correlations. This can be done by running a computer simulation. When we refer to the *valuation* of a CDO or CDO², we mean their default probabilities, their expected payoffs, and their assigned agency ratings—such as AAA or BBB. Calculating this is not a difficult job, but it has not been done by any rating agencies before.

Recently, Coval, Jurek & Stafford did that simulation.⁴⁵ They considered a pool of forty assets in which each asset has a five year default probability of 5%.⁴⁶ In case of a default, they assumed that 50% of the face value could be recovered.⁴⁷ The created CDOs were divided into three tranches: the junior CDO absorbed the first 6% of loss, the mezzanine absorbed the next 6% to 12% loss, and the senior one absorbed the remaining 12% to 100% loss.⁴⁸ The baseline assumption was that the pairwise default correlation was uniformly 0.20.⁴⁹ In that scenario, the rating of a senior CDO was AAA, and the rating of mezzanine CDO² and senior CDO² were both AAA.⁵⁰ Intuitively, the senior CDO was rated well because the event of simultaneous defaults had a very low probability. But things changed as the correlation of defaults between assets increased.

Consider the gradual increase of default correlation from 0.20 to say 0.40, 0.60, etc. When this correlation increases, the default of any single asset in the pool also implies likely defaults of other assets in the pool. Thus, the originally less risky senior CDO—which is supposedly “safe” unless many assets default simultaneously for an overall loss of more than 12%—actually becomes more risky. In the extreme, if all forty assets in the pool are perfectly correlated, then a default of one item means the default of all forty items. In that case, the junior, mezzanine and senior CDOs all bear the same risk, because no longer do the different classes face a different priority of risk. In short, the *priority* design of different risk tranches relies crucially on the assumption of low correlation coefficients among assets. When this correlation is high, there is simply no way to prioritize risks.

As Coval, Jurek & Stafford show, when the correlation coefficient increases from the baseline 0.20 to 0.40, the senior CDO quickly changes its rating from AAA to A+.⁵¹ When this correlation increases to 0.60, the senior CDO becomes BBB-, moving toward a junk bond. For the CDO², the mezzanine was originally AAA when the correlation was 0.20; but it changes to a rating of C when the correlation is 0.60. Concerning the expected return, the change is also dramatic. For instance, when the correlation changes from 0.20 to 0.60, the expected payoff drop of mezzanine and junior CDO² may be as large as 30% and 85%.

⁴⁵ See Coval, Jurek & Stafford, *supra* note 16, at 8–15.

⁴⁶ See *id.* at 10–11.

⁴⁷ See *id.* at 11.

⁴⁸ See *id.* at 12, n.6.

⁴⁹ See *id.* at 13.

⁵⁰ See *id.* at 14.

⁵¹ See generally *id.*

The sensitivity of a CDO rating and expected payoff with respect to default correlation is now evident. The natural legal question is simple: if investment banks create or endorse such prioritized mortgages embedded with some new and unknown information (such as sensitive default correlations), which influences the expected payoffs and rating of such mortgages, how can there be no legal requirements of disclosing such information? While it is true that if the assets in a pool contain real estate in Seattle and New York City, hardly anyone could predict a default correlation between these two assets. Nevertheless, if this information is crucial to the value of a CDO, the issuers simply cannot use the defense of “hard-to-know” to avoid their responsibility of disclosing such information.⁵² After all, this information is *created* by the investment bank as they pool the assets and prioritize them.

IV. THE SYSTEM RISK ASSOCIATED WITH CDOS

While one may argue that there is actually a very low correlation between mortgaged housing default events in Seattle and New York, we shall explain below why this is untrue. What happened in 2008 provides *prima facie* evidence of high correlation between seemingly uncorrelated assets. This is the idea of the system risk. When there is a system risk, then banks that sell CDOs without disclosing the embedded correlation information become liable.

A. WHAT MOTIVATES THE CREATION OF CDOS?

To see the possible system risk associated with CDOs, perhaps we should go to the most fundamental question: against what background did investment banks in Wall Street *want* to invent the CDOs in the first place? Many media reports described the invention of financial derivatives as ingenious, but here we shall investigate the motivation behind such inventions.

According to official data from the SEC, the subprime mortgages had expanded by a factor of approximately six between 1996 and 2006, from \$96.8 to \$600 billion.⁵³ The amount in 2006 accounted for about 22% of all outstanding mortgages in the U.S.⁵⁴ The key feature of subprime mortgages was that they were provided to those below the credit standards for government-sponsored agencies. Because of the high risk of subprime loans, Wall Street bankers tended to think of ways to disperse such risks among more people. By pooling together assets and prioritizing the risk of defaults, the investment bankers developed a menu of CDOs (junior, mezzanine and senior) that fit the needs of investors with various appetites

⁵² SHAVELL, *supra* note 39, at 222 (showing that in the United States, strict liability is the general practice of product defects). The question is whether the SEC is willing to accept the notion that a CDO is a “product” created by the investment bank.

⁵³ OFFICE OF COMPLIANCE INSPECTIONS & EXAMINATIONS DIV. OF TRADING AND MKTS. & OFFICE OF ECON. ANALYSIS, U.S. SEC. & EXCH. COMM’N, SUMMARY REPORT OF ISSUES IDENTIFIED IN THE COMMISSION STAFF’S EXAMINATIONS OF SELECT CREDIT RATING AGENCIES 33 (Jul. 2008) (on file with author), available at <http://www.sec.gov/news/studies/2008/craexamination070808.pdf>.

⁵⁴ *Id.*

for risk. Usually, the most risky junior CDOs were kept by investment banks themselves, and the public only sought the purchase of senior CDOs with a safe rating. Importantly, as long as some CDOs were bought, the risks were indeed distributed.

Because the risks of subprime mortgages could be dispersed using CDOs, banks were more willing to provide loans to marginally credit worthy people. The typical practice was that banks provided subprime loans to individuals, quickly packing the mortgages together to form a CDO, and then selling these CDOs to the public. Thus, banks in a sense only faced the “pipeline risk.”⁵⁵ In short, CDOs with prioritized risks were indeed created to absorb the higher risk associated with marginal borrowers. Thus, the prevalence of CDOs was synchronized with the expansion of loans to these high risk borrowers. Banks were willing to do that because it created substantial profit with limited risks. It had been observed that the housing loans and mortgages were in general long-term, whereas the CDOs were short-term. Although general finance theory would not suggest a bank conduct this kind of risk pipelining, which transfers long-term loans to short-term notes, it was the practice of many banks in 2008. However, as is often the case, everything happened so gradually that the danger was barely perceptible, until it was too late.⁵⁶

B. THE CDO-INDUCED CREDIT QUALITY DECLINE

How did increased securitization lead to the decline of credit quality? Some solid evidence has been found.⁵⁷ Indeed, when risks are expected to be handed over to CDO buyers anyway, banks do not have to perform exhaustive credit checks or loan monitoring. As noted by Keys et al., in the past decade, many mortgage brokers provided loans with minimal requirements, including no down payments, no-documentation, and even loans to the NINJA group.⁵⁸

Because loans were in general easier to get, housing demand increased. This pushed up housing prices as a result. Because of the rising house prices, banks did not worry about default, for even if default occurred, banks could sell the estates without suffering much capital loss. Because of this expectation, banks were more willing to provide loans to marginally credit worthy people who had higher risks of default. Now it seems that the game of musical chairs had begun, and all that was uncertain was when the music would stop. The melody came to an abrupt end in the latter half of 2008.

⁵⁵ Brunnermeier, *supra* note 19, at 82.

⁵⁶ See *Confessions of a Risk Manager*, THE ECONOMIST, Aug. 9, 2008, at 72.

⁵⁷ Benjamin J. Keys, Tanmoy Mukherjee, Amit Seru & Vikrant Vig, *Did Securitization Lead to Lax Screening? Evidence from Subprime Loans* (EFA 2008 Athens Meetings Paper), available at http://papers.ssm.com/sol3/papers.cfm?abstract_id=1093137.

⁵⁸ *Id.*

C. THE SYSTEM RISK ASSOCIATED WITH CDOs

As we explained in the previous paragraphs, since much of the motivation and design of CDOs was to disperse the risk of loans provided to marginally credit worthy people, it is no wonder that the assets collected in a pool to back up CDOs would have some (low) credit qualities in common. Because people with low credit quality tended to buy houses in certain areas, the assets in the pool were often from similar geographic areas and vintages. Moreover, if person A of the NINJA group defaulted, it was likely that A was laid off due to some economic shock. Intuitively other people who might be affected by such shocks were also likely to be members of the NINJA group. Thus, the event of A's default tended to be correlated with the default of other asset items, say B, C, etc. in the pools.

When default cases started to accumulate, the banks came under liquidity pressure needed to liquidate their mortgages quickly, thereby increasing the housing supply and dragging down the prices of houses and other assets. Furthermore, by 2007, some banks which had generated mortgage-backed securities could not distribute those instruments successfully. Therefore, they ended up holding far too much risk and far too little liquidity. When housing prices started to fall, some investment banks had to write off some of their losses. What is more, CDOs started to default because of individual defaulting loans, which further resulted in the default of the CDO. In fact, many subprime mortgage-backed notes were themselves re-securitized into CDO²s. According to Moody's, as a fraction of total national value of securitization, the share of CDOs that had other structured debt assets as their collateral expanded from 2.6% in 1998, to 55% in 2006.⁵⁹ Thus, by 2008, essentially many assets and banks were pretty much tied together. That is what we call a systematic risk.

Globalization actually made the systematic risk larger. The U.S. investment banks not only sold their CDOs to domestic individuals, they also sold them to foreign banks, which in turn distributed them into hands of citizens all around the world. When the financial tsunami surged, it was no wonder countries and areas such as Iceland, Ireland and Hong Kong all suffered, though thousands of miles away. People simply did not understand why their U.S. AAA rated bonds suddenly became junk.

Here, we see another dimension of the systematic risk. The design of the CDO is supposed to disperse the risk of a pool of assets to buyers, and the buyers at best can assess the risk structure of *this pool of assets* as they evaluate whether they should buy it. However, as various CDO²s are on the market, as we explained, the risks of various CDOs become highly connected. Then, the risk of a particular CDO itself is actually the aggregate risk of the whole economy. According to the standard Capital Asset Pricing Model ("CAPM") theory,⁶⁰ securities of which the returns are

⁵⁹ Coval, Jurek & Stafford, *supra* note 16, at 16. See Jian Hu, *Assessing the Credit Risk of CDOs Backed by Structured Finance Securities: Rating Analysts' Challenges and Solutions*, 13 J. STRUCT. FIN. 43, 43-59 (2007).

⁶⁰ See FISCHER BLACK, MICHAEL C. JENSEN, & MYRON SCHOLES, *THE CAPITAL ASSET PRICING MODEL: SOME EMPIRICAL TESTS* (1972).

correlated with the aggregate market should offer higher returns, whereas securities of which the returns are less correlated with the aggregate market may offer less returns. However, until the bubble burst in 2008, no one actually noticed the correlation between CDOs and the system risks. When the risk was finally realized, of course it was already too late.

V. SHOULD THE CDOs BE REGULATED? AND HOW?

After the financial tsunami began in 2008, a world economic recession followed, and everyone started to blame Wall Street, the Federal Reserve Board (“Fed”), and the U.S. SEC.⁶¹ There was also some blame placed on credit rating agencies such as Moody’s and Fitch’s.⁶² In terms of publicly contemplated possibilities for remedial actions, we previously mentioned one proposal suggesting the raising of capital adequacy of those investment bankers that created off-balance-sheet vehicles, such as a pool of assets to back up the issuing of CDOs.⁶³ Alternately, there were also proposals to amend the accounting rules, somehow believed to be the cause of this financial tsunami merely because banks were forced to express on their financial statements losses not yet realized.⁶⁴

It is of course outrageous to have sold billions of dollars of mis-rated CDOs; but firms do make various mistakes in the market. As long as there are no *systematic* errors, we tend to have *ex post* remedies rather than *ex ante* regulations.⁶⁵ The blame on the Fed and SEC was laid on their inefficiency in seeing the problems, identifying the housing/financial/asset bubbles, raising warnings, and acting in a timely fashion; however, this criticism does not give us much theoretical knowledge about the *ex ante* regulations of the CDO *per se*. In particular, if the asset bubble slowly grew undetected, would there be any reason to request the SEC to regulate the CDOs? Finally, we do not see any point in restricting the accounting accrual basis. Numerous accounting standards were published in the past decade, and we do not see any problems arising from them. In what follows, we propose some other directions to take in possible regulation.

A. CDO AS A “PROPERTY”

The reason we draw Figures 1–4, and 6 is to introduce the idea that an investment banker who sells a CDO is actually selling a created prioritized mortgage, a special kind of property, to individual buyers. Our purpose is to connect the possible regulation of CDOs with the doctrine of *numerus clausus* in property law, a topic well studied in the classic article by Thomas

⁶¹ See *The Securities and Exchange Commission: Growing Insecurities*, THE ECONOMIST, Jan. 17, 2009, at 73.

⁶² See Sam Jones, Gillian Tett, & Paul J. Davies, *Error Gave Top Ratings to Debt Products*, FIN. TIMES, May 20, 2008, at 1 (referring to the acknowledgment by Moody’s of its negligence in inappropriately giving AAA-ratings to some structure financial commodities due to a “bug” in their rating model); Coval, Jurek & Stafford, *supra* note 16, at 20 (providing other evidence of ridiculous rating programs).

⁶³ See discussion in the Introduction.

⁶⁴ See *Flight of the Locusts*, THE ECONOMIST, Apr. 11, 2009, at 63.

⁶⁵ See Charles D. Kolstad, Thomas S. Ulen, & Gary V. Johnson, *Ex Post Liability for Harm vs. Ex Ante Safety Regulation: Substitutes or Complements?*, 80 AM. ECON. REV. 888, 888–901 (1990).

W. Merrill and Henry E. Smith.⁶⁶ In that article, the authors provided numerous references and evidence explaining the prevalence of this *numerus clausus* principle, which says that despite various forms of contracts that can be created and allowed by courts, those forms of properties are usually limited; they can be extended only by legislation.⁶⁷ If someone created a new property such as a “Monday watch,”⁶⁸ then a court would usually neither honor such a new property right nor enforce its transactions. This is the case in countries following either civil law or common law traditions.

Before Merrill and Smith, there had been arguments explaining the *numerus clausus* principle. For instance, Richard Posner suggested that a property right may be limited to avoid the fragmentation of that property right that would act to increase the negotiation costs among many owners of a property.⁶⁹ However, Merrill and Smith provided persuasive arguments for limiting the form of a property right due to information costs.⁷⁰ Because the effects of contracts are restricted to people signing the contracts—whereas the effects of properties are to individuals in general—creating new property right forms would have to consider the *externalities* that may impose on future parties in transactions.

Specifically, suppose someone created a new property right called a “Monday watch,” with the restriction that a specific watch cannot be used on Mondays. This restriction will not only be revealed in its current transaction price, but will also affect future buyers and sellers. Parties to future non-Monday watch transactions will have to make sure that the watch they intend to buy does not have Monday or Tuesday or other holiday restrictions. Thus, if someone created a Monday watch, he also created external search and information costs for future potential buyers and sellers. However, if the types of properties are too narrow, it also has the cost of limiting the fulfillment of individual idiosyncratic purposes. The principle of *numerus clausus*, according to Merrill and Smith, is to create balance between the cost of information and search and the benefit of idiosyncratic demand.⁷¹

In practice, most CDOs are sold by investment banks to buyers, and the transaction is accomplished by a contract between the two sides involved. The terms of such contracts are often very complex and are usually over a 100 pages long. But given the acceptability of various forms of contracts by courts, most people did not tend to think of placing restrictions on the creation of CDOs. Rather, most people tend to suggest regulations on banks

⁶⁶ See Thomas W. Merrill & Henry E. Smith, *Optimal Standardization in the Law of Property: The Numerus Clausus Principle*, 110 YALE L.R., Oct. 2000, at 1.

⁶⁷ See *id.*

⁶⁸ See *id.* at 1, 26–27 (which defines a hypothetical Monday watch as a property form that limits the ownership of the watch to some specific date or dates, say only Monday, or all days other than Monday).

⁶⁹ See RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* 556–60 (5th ed., Aspen Law & Bus. 1998)(1972). See also SHAVELL, *supra* note 39, at 31–32.

⁷⁰ See Merrill & Smith, *supra* note 66.

⁷¹ See *id.*

concerning their capital adequacy, or on rating agencies concerning their capability.

In our previous discussion in Section III, we argued that CDOs are actually mortgage properties created by banks. We hope that this will alter the view of legal literature and facilitate new thinking on possible regulations from the perspective of CDOs as *properties*. Of course, we do not mean to propose regulations solely because CDOs are properties; we tend to point out, as in Merrill and Smith, the possible external costs associated with the invention of CDOs, and then suggest the reasons for regulation.

Our argument for the possible regulation of CDOs, however, is different from those proposed by Merrill and Smith. Merrill and Smith suggested that any creation of new property rights not only affects the pricing of the property currently in transaction, but also increases the search and assessment cost of future transactions, because buyers would have to find out or exclude the possible influence of such new property restrictions.⁷² This is a typical *externality* argument. But for the creation of CDOs, the externalities for government regulation have different interpretations. Let us explain below.

B. CDO AS A NEW DRUG COMPOSED OF OLD CHEMICAL ELEMENTS

As we mentioned in Section III, CDOs go beyond the traditional pass-through securitization of a pool of assets by creating a prioritized mortgage with *new* information not contained in the original pool. This, we believe, is somewhat like creating a new chemical compound and a new drug, and marketing this new drug to people. An investment bank that invents a new CDO is like a pharmaceutical company, and the consultants or agents who sell or endorse these CDOs to buyers are like medical doctors who provide prescription advice. A new CDO may hurt the wealth and income of individual buyers, just like a new chemical compound may harm the health of the patient. Of course we know that losses in human health far outweigh financial losses, but the simile is useful.

A pharmaceutical company cannot claim that because carbon, oxygen, nitrogen and hydrogen are well-known chemical elements, a compound composed of these elements should also be allowed in the market. The U.S. Food and Drug Administration (“FDA”) has strict regulations on all kinds of new drugs because a new compound, despite being composed of “old” elements, creates new risks. The chemical reaction in the human body to different drugs has uncertainties, and even if the impact of an individual chemical element is previously known, a new compound may trigger some unknown chemical reaction in the human body because of temperature, acidity or other variables. This is like the situation of prioritized risks. In a pool of assets composed of forty items, there are essentially 740 new correlation coefficients unspecified. All this information is unrelated to the individual assets in the pool. Compared with the original forty expected

⁷² See *id.*

values and forty variances of these assets that people do know, the information unknown to potential buyers is actually much more. The bank simply cannot say that it does not care about the potential damage that CDOs may have on buyers.⁷³

We propose that the burden of checking information fall on the investment banks rather than the SEC. Investment banks that issue or endorse CDOs should determine the full range of information about the correlations and payoffs embedded in such notes. The SEC can review or check the solidness and assumptions behind the issuers' assessments. In the case of developing new drugs, the FDA does not have to determine the potential danger of the new drugs: the responsibility falls on the manufacturers. The FDA only reviews the results and processes presented by the manufacturers. Likewise, it is *not* the SEC's responsibility to perform the calculation of the correlation coefficients of these thousands of prioritized mortgage bundles for investment banks. Instead, the SEC should only assess whether investment banks have done their job responsibly. Without any effort to explore the correlation between pooled mortgages, the disclosure of information is far less than sufficient. The SEC can ban the transaction of some structured notes if the issuers did not do their jobs satisfactorily.

There is much information associated with the CDO that issuers should disclose but did not disclose in the past. Whether the investment bank provides investment consulting services or advises potential buyers does not matter. The investment consultants in banks are at best like medical doctors who know what the patients want and what kinds of treatments should be avoided, given the specific symptoms. However, even the best physicians can never advise on new drugs that have not gone through pre-clinical research or phase I–II experiments approved by the FDA. Of course, we agree that the problem of health is more serious than that of wealth, but the degree of seriousness does not totally relieve the burden of analysis by issuers of CDOs.

The above discussion does not suggest that all financial products be banned due to vague information. Nevertheless, our analysis does suggest that government agencies such as the SEC have the authority to form a review board to assess whether financial products that contain rather fuzzy information should go to the market or not. Viewed as a contract between buyers and sellers, the CDO should usually be legally recognized by the court. But viewed as a constructed mortgage property, the CDO should have a heightened review by authorities. Because the harm caused by financial commodities is presumably smaller than that caused by new drugs, the regulation does not have to be as strict as the FDA is on new drugs, wherein less than 5% of all INDs survive the review process of

⁷³ For more discussion on the regulations or restrictions on property rights due to the lack of information of individuals see SHAVELL, *supra* note 39, at 77–109.

FDA.⁷⁴ However, an enhanced review process certainly would force investment banks to explore potential harms of new financial products.

The same logic can be applied to the rating agencies. If a rating agency such as Moody's rates a CDO as AAA, it is also responsible to decide how to assess the correlation coefficients of defaults between a pair of assets in the pool. The SEC may not have the authority to regulate the rating agencies, but any CDO stake holders may legitimately question the rating agencies regarding any undisclosed information of correlation coefficients between assets.

C. REGULATING THE SYSTEM EXTERNALITIES OF CDOs

Other than the concerns of information analysis and disclosure, the CDOs have other problems that may need government intervention. Without any regulation, the asset pools that are used to back up CDOs can come from anywhere. Because each bank does not have to check whether the assets they want to include have any particular feature similarities, such as locations, owner profiles, mortgage types, underwriters' backgrounds, as the types of CDOs expand, more and more originally independent risk-sharing CDOs may become too correlated. This connection is actually the source of what we call system risk or aggregate risk in Section IV. Despite the fact that each investment bank unilaterally uses financial engineering to find its optimal way to pool assets, to design priorities, and to issue structured notes for the purpose of risk-sharing, in the end they jointly bind themselves together and face an aggregate risk.

The situation is very much like an ecological externality or traffic congestion. Each household or firm decides optimally whether to emit CO₂ into the air. Given what other households and businesses are doing, one's best strategy is to emit as one wants. Because these decisions are made independently and all households are small, people believe that their individual actions would not affect the overall CO₂ level in the globe. However, when all individuals do the same, we have a global warming problem, and the result is a disaster.

Note that the ecological externality is different from the "Monday watch" externality raised in Merrill and Smith. The externality of excessive new property forms in Merrill and Smith are immediately felt by each individual who is about to do his or her own property transaction; there the externality is experienced by property owners one at a time. In the case of ecological externality, the whole world is tied tightly together because we share the same global environment. Over time, no one actually feels the externality. Since the global temperature is random, a warmer temperature trend may or may not be the trigger of such disasters as a melting ice field or changing landscape. However, the trend of global warming will

⁷⁴ *Success Rates in Biotech Going the Wrong Way*, BIOPORTFOLIO, Jan. 2009, available at <http://www.bioportfolio.com/cgi-bin/sh000001.pl?REFPAGE=http%3a%2f%2fwww%2ebioportfolio%2ecom%2fcgi%2dbin%2facatalog%2f&WD=success%20way%20going%20wrong%20biotech%20rates&PN=Success%2dRates%2din%2dBiotech%2dGoing%2dThe%2dWrong%2dWay%2ehtml%23a1363#a1363>.

definitely trigger a disaster some day. When this happens, then all individuals will be affected simultaneously, unlike the sequential externality pattern as described by Merrill and Smith.⁷⁵

Because the sequential externality is experienced by individuals gradually, the result is the suppression of individual economic incentives and inefficient transactions. This inefficiency accumulates slowly. However, most ecological disasters might not be felt until it is too late. This is exactly the case for CDOs. The market for CDOs and other derivatives went well until the latter half of 2007, when suddenly the bubble burst, affecting everyone disastrously.

The externalities mentioned in Merrill and Smith allowed them to conclude that the form of properties may need to be restricted. The tradeoff is to balance the inefficiency cost caused by inflexible property types with the information cost of searching for possibly undisclosed property conditions. The situation is similar here. Although we suggest the existence of system externality associated with the individual invention of CDOs, we cannot conclude the degree of restriction the law should impose on the creation of CDOs or financial derivatives in general. The key, in our opinion, is the implicit connection derived from the fact that a new financial product has been created.

D. A PRINCIPLE OF REGULATING FINANCIAL DERIVATIVES

Knowing the danger of making an incomprehensive argument, we would like to propose a principle of regulation of CDOs which we call “the two-way spill-over principle.” As is well known, all financial products are designed with a purpose in mind. For instance, futures are often designed to minimize the risk associated with some future uncertainties. Stock options are often designed to overcome the incentive problems of some agents of a firm. These financial derivatives are all connected with some events and may even have some priorities embodied in these events. For instance, the board of directors may grant a stock option to the CEO, specifying the payments and conditions in the option contract. Some conditions of this option may be bundled together, and may even look like a structured note based on these events. But since most of these conditions are only related to the performance of the individual firm itself, or at most the performance of the industry, much spill-over effect is unlikely.⁷⁶

Next we consider the futures of stock indexes. It is true that the stock index is an aggregate risk; but we also tend to allow its free transaction. While a fall of the stock index may influence the price of the index futures, there is hardly any possibility to have an effect *the other way around*—that the buyers of such futures somehow prop up the price of the overall stock index.⁷⁷

⁷⁵ See Merrill & Smith, *supra* note 66.

⁷⁶ In other words, the conditions of payments specified in these derivatives are unlikely to cause fundamental changes in other industries.

⁷⁷ Stock prices of corporations are determined by their fundamentals, which in turn may be affected by the general economic condition, but not by stock index speculations.

The problem with the asset-backed CDO is that it has a spiral *two-way* spill-over effect. The prioritized CDO distributes the risk of mortgages, and this in turn lowers the overall risk of estate mortgages themselves. This lowered risk allows banks to loosen their credit check and risk management, which boosts housing demand, thereby increasing housing prices, and further raising the marginal profit of mortgaged loans. The increased loans lead to more risks to be distributed, and hence a more widespread sale of CDOs. The two-way spill-over effect is formed, because in each step there are strong economic incentives for agents to do things in a certain way.⁷⁸ If we are to restrict the types of mortgage-backed CDOs, this two-way spillover effect may be a guideline of our regulation. The SEC may want to think about demanding the issuers of new CDOs to prove their “safeness” by showing that there is no two-way spillover that can possibly arise. This may also be fruitful avenue of exploration in the future.

VI. CONCLUDING REMARKS

In this Article, we analyze the basic problems of a CDO, the main source of the financial crises in 2008. We argue that a CDO is in fact a constructed mortgage property which harbors some intrinsic problems of moral hazard, externality, newly created information, and aggregate risk. Most of the existing discussion only touches on the moral hazard problem with no discussion of the other problems. Treating CDOs as a property with its intrinsic problems justifies more intensive regulation. Treating the CDO as a mortgage property rather than a contract strengthens the rationale of regulation in both common and civil law traditions.

As far as the regulation principle is concerned, since the bank that issues a structured mortgage with priority *creates* some new information, they should have the burden to inform potential buyers about the likely values of such information. The burden of proof should be laid on the shoulders of CDO issuers to insure that there is no externality or aggregate risk involved. The regulatory agency should review the proof of analysis provided by the issuer and approve or disapprove its issuance. The same principle applies to rating agencies such as Moody’s; if they want to rate a CDO as AAA, they should provide their assessment about the correlation of default between all pairs in the asset pool. Failing to justify that correlation seems to imply a rating assessment without a basis.

There are, however, some avenues for future research where more effort is needed. Some other structured products may have similar problems as CDOs, but the appropriate regulations upon these financial products may be different. The main difference between a CDO and other structured products is that the CDOs are largely backed by mortgages and thus incentivize banks to lend more money and take more risks, while spreading the risk out to the innocent parties. However, if there is a CDO backed by

⁷⁸ On the one hand, the risk-spreading effect of CDOs makes banks loosen their credit checks, thereby propping up the real estate price bubbles. On the other hand, the crash of price bubbles depreciates the value of CDOs, which causes the liquidity constraints of many banks and hence the financial crisis. Both of these causalities can be reasoned and predicted.

credit card loans, we can determine that the issuance of such financial products may, theoretically speaking, also produce incentives for the banks to lend more money. In reality we do not see this loan-backed CDO, perhaps because credit card loans are not as good collaterals as houses. But if we do observe this kind of CDOs, conceptually should there be any regulatory difference between credit-backed CDOs and asset-backed CDOs? It seems to us that there might be some differences between these two CDOs, but this point is not explored here.

