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CREDIT DEFAULT SWAPS AND THE CREDIT CRISIS

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ABSTRACT

Many observers have argued that credit default swaps contributed significantly to the credit crisis. Of particular concern to these observers are that credit default swaps trade in the largely unregulated over-the-counter market as bilateral contracts involving counterparty risk and that they facilitate speculation involving negative views of a firm's financial strength. Some observers have suggested that credit default swaps would not have made the crisis worse had they been traded on exchanges. I conclude that credit default swaps did not cause the dramatic events of the credit crisis, that the over-the-counter credit default swaps market worked well during much of the first year of the credit crisis, and that exchange trading has both advantages and costs compared to over-the-counter trading. Though I argue that eliminating over-the-counter trading of credit default swaps could reduce social welfare, I also recognize that much research is needed to understand better and quantify the social gains and costs of derivatives in general and credit default swaps in particular.

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In the banking sector, the credit crisis has brought about a destruction of wealth of a magnitude that has not been seen since the Great Depression. In trying to understand why banks collapsed, why housing prices fell so dramatically, and why the credit markets froze, many observers have identified credit default swaps to be a prominent villain. CBS called credit default swaps on subprime mortgages the “bet that blew up Wall Street”.¹ With Google, a search under “worst Wall Street invention” comes up with credit default swaps first. A hedge fund manager said that they are “the dark matter of the financial universe.”² George Soros, the hedge fund manager, and many others want most or all trading in credit default swaps to be banned. Some have argued that over-the-counter trading of credit default swaps should be eliminated but that exchange trading would be acceptable.

In their simplest form, credit default swaps are a straightforward type of financial derivative. They make a payment to the buyer, generally called the protection buyer, equal to losses on bonds or loans resulting from default (or, in some cases, a debt restructuring) by a company. The seller, usually named the protection seller, receives a periodic fee for agreeing to make these payments. A simple way to understand these contracts is that they are functionally equivalent to default insurance contracts. The insured event is the loss arising from a default; the premium paid is the fee; the policy limit, i.e., the maximum covered loss, is called the notional amount; in contrast to typical insurance policies, credit default swaps have no deductible. Importantly, however, one has to be exposed to a risk to obtain an insurance contract; for instance, to buy insurance on a house, one has to own the house; with credit derivatives, one can buy protection without being exposed to the risk that the protection insures.

Of course, as with all derivatives, credit default swaps take many forms. Default swaps could be purchased to insure portfolios of subprime mortgages and, in securitizations, slices of such portfolios. Default swaps offering protection against defaults on portfolios of subprime mortgages

¹ “The bet that blew up Wall Street,” CBS, 60 minutes, Oct. 26, 2008.

² “The \$55 trillion question,” by Nicholas Varchaver, Fortune Magazine, September 30, 2008.

made it possible for investors to take exposure to subprime mortgages without taking positions in the mortgages themselves. During the boom that preceded the credit crisis, the demand for exposure to subprime mortgages grew so quickly and so intensely that there were not enough subprime mortgages to satisfy that demand. Eventually, investors acquired such exposure synthetically through credit default swaps.

Credit default swaps have both social benefits and social costs. The social benefits are that they make it easier for credit risks to be borne by those who are in the best position to bear them, that they enable financial institutions to make loans they would not otherwise be able to make, and that their trading reveals useful information about credit risk. These arguments for credit derivatives are standard among economists. Among others, Alan Greenspan made them often. For instance, in 2004, while still chairman of the Federal Reserve Board, he stated that credit derivatives and other complex financial instruments contributed “to the development of a far more flexible, efficient, and hence resilient financial system than existed just a quarter-century ago.”³ However, the fact that the credit crisis led him to conclude that the “whole intellectual edifice” which underlies the use of credit derivatives and complex financial instruments “collapsed in the summer of last year” because of risk management mistakes offers strong testimony that the costs associated with credit derivatives have to be taken as seriously as their benefits.⁴

There are fundamentally three reasons why observers argue that credit default swaps contributed to the crisis and are dangerous. The first argument is that derivatives in general and credit default swaps in particular made possible the credit boom that ended in the credit crisis. The second argument is that financial institutions have positions in credit default swaps for trillions of dollars of notional amount and that these positions have created systemic risk. These massive exposures are alleged by many to have necessitated the indirect bailout of Bear Stearns

³ Alan Greenspan, Economic flexibility, speech to HM Treasury enterprise Conference, 2004, London, U.K.

⁴ Testimony of Dr. Alan Greenspan, Committee of Government Oversight and Reform, October 23, 2008.

by the Federal Reserve and to have led to the direct bailout of AIG at a cost to taxpayers of billions of dollars. Further, according to some observers, these exposures led to a crisis of confidence in financial institutions following the collapse of Lehman as market participants were left guessing how much banks might have to pay on credit default swaps. Lastly, observers argue that the lack of transparency of the credit default swap market has made it possible for market participants to manipulate that market, thereby making it appear that some financial institutions were much weaker financially than they actually were and threatening the soundness of the financial system. Such manipulations are often argued to have been partly responsible for the fall of Bear Stearns and Lehman.

Though many have argued that derivatives and especially credit default swaps should be banned, others have claimed that the problems caused by credit default swaps during the credit crisis resulted from the way they trade and from the fact that they were largely free from regulation. A common argument is that these derivatives should not trade over the counter as they do, but instead should trade on exchanges. Others have argued that requiring the trading of credit default swaps to have some features of exchange trading would be sufficient to eliminate much of the risk they might pose to the financial system.

My focus in this paper is mostly on how the way credit default swaps trade contributed to the crisis and poses risks. I first review the mechanics of credit default swaps providing insurance against the default of individual companies before turning to the swaps used to take positions on subprime mortgages. I then examine the growth of the credit default swap market and provide data on the size of the market. I show that how credit default swaps are traded has created risks for the financial system and evaluate how these risks would have been different with exchange trading. Finally, I turn to the claims that these derivatives enabled investors to manipulate the value of financial institutions. I conclude with an assessment of the social costs and benefits of credit derivatives in light of the credit crisis.

1. Credit default swaps

The best way to understand a plain vanilla credit default swap (CDS) is as an insurance contract against the cost of default of a company – the “name” or the “reference entity” in the language of the CDS market. Suppose that you hold Ford bonds and are concerned about Ford’s default risk. You could insure your bond holdings with a CDS. As with a typical insurance contract, you would pay premiums over time. If Ford does not default, you lose the premiums. If Ford defaults, the credit default swap allows you to exchange the Ford bonds you hold, which are now worth little, for the principal amount of the bonds, or alternatively, depending on the details of the contract, for a payment equal to the principal amount of the bonds you hold minus their current value at the time of default. By having taken a position in a CDS on Ford, you protected your investment against a Ford default. Your Ford bond could lose value even if Ford does not default, for instance if interest rates increase or Ford’s credit falls without a default, but in that case you would receive no payment from the Ford CDS.

Despite all the suggestions that CDS are somehow nefarious, there is nothing particularly exotic about them. They are as easy to understand as insurance contracts - they are easier to price than some insurance contracts and harder than others. However, with some exceptions, insurance contracts do not trade. In contrast, CDS contracts trade over-the-counter. The market is a dealers’ market. Dealers trade with end-users as well as with other dealers.

You would not be alone in buying protection on Ford. The Depository Trust & Clearing Corporation (DTCC) keeps a trading information data warehouse that is freely accessible.⁵ For the week ending on May 15, 2009, the DTCC had 5,387 contracts registered with it on Ford Motor Company, 1,583 on Ford Motor Credit Company, and 4,649 on Ford Motor Credit Company LLC. The total notional amount of CDS on Ford Motor Company was for \$36 billion. For comparison, on December 31, 2008, the automotive sector of Ford had total debt of \$25.8

⁵ <http://www.dtcc.com/products/derivserv/data/index.php> .

billion. It is not unusual for the total notional amount of CDS written on a name to exceed the total amount of debt issued by that name.

There is also a large market for CDS indices, which are averages of credit-default swaps on different names. There are indices for corporates for Europe (iTraxx Europe), the U.S. (CDX North America), as well as other regions. To understand how these indices work, let's consider the iTraxx Europe. The index represents a basket of 125 CDS referencing European investment grade credits. New series are introduced on March 20 and September 20 of each year. There also exist individualized (bespoke in the language of the industry) CDS contracts on baskets of names.

Liquidity is generally considered to be a measure of how expensive it is for a market participant to trade quickly (see Grossman and Miller (1997)). In an illiquid market, selling a position quickly is very expensive because the seller has to discount the price to attract buyers. Similarly, the buyer has to offer a substantial markup to attract sellers. In contrast, in a highly liquid market, one can buy or sell quickly without having to pay much for the benefit of immediacy. The CDS market for a name is often more liquid than the market for the name's bonds, which makes the CDS market a better market to assess a company's credit than the market for its bonds. There are at least three reasons for that. First, CDS are ideally suited to express credit views. Since they do not include funding, their price is typically less affected by liquidity considerations than the price of bonds.⁶ Further, firms have all sorts of different bonds whose prices are affected by call provisions, covenants, coupon, maturity, liquidity, and so on; in contrast, CDS are like standardized bonds. Second, CDS on a name can be used for hedging by investors who hold different bond issues – and also by companies that have receivables from that name or banks that made loans to it. This demand for CDS makes the market deeper. Finally, it is generally harder to go short in a company's bonds or loans than it is to buy protection in the CDS market. Many economists would argue that the greater ability to go short means that the market

⁶ See, for instance, Longstaff, Mithal, and Neis (2005).

for CDS reacts more quickly to new information.⁷ An empirical study of how information gets incorporated in bond prices and in CDS prices shows that information mostly flows from CDS prices to bond prices (Blanco, Brennan, and Marsh (2005)). This greater efficiency of the CDS market in incorporating information benefits the pricing of all securities of a firm. As we will discuss later, however, the ability to take short positions through the CDS market has led some to argue that this makes the CDS market destabilizing.

In principle, CDS should make financial markets more efficient and improve the allocation of capital because they make it possible for credit risk to reside with the investors who are best equipped to bear it and introduce greater transparency in the pricing of credit. Historically, the investors who funded companies through debt had to bear the credit risk of these companies. Now, the investors who provide the capital need not be those who bear the credit risk, which can reduce the cost of capital for firms and make it easier for them to raise funds to take advantage of their growth opportunities.

The separation of risk-bearing and funding made possible by credit derivatives has the potential to create problems in that lenders who fund companies but do not bear their risks have less incentive to monitor their loans. Consider a bank that made a large loan to a firm. The market knows that the bank made the loan and believes that the other debt of the firm is safer because it expects the bank to monitor the loan carefully. However, if the bank has protected itself by buying protection, its incentives to monitor the loan may have become less powerful – it would gain nothing from expending resources to discover problems at the firm since if the firm had problems that led it to default on its debt, the bank would receive the full principal amount of the loan, but from the seller of protection instead of from the firm. The seller of protection cannot monitor the firm in the same way as the bank would because it has no contractual relationship with the firm. As a result, the market's assessment of the firm's credit risk is based on the wrong

⁷ See Diamond and Verrecchia (1987) for a model of how the speed with which information is incorporated into prices is affected by obstacles to short sales.

premise, namely that there is a bank monitoring the firm carefully, and, as a result, there may be too little monitoring of the firm. However, in practice, banks have many reasons to monitor their customers. Further, it may be expensive for them to buy protection because counterparties will assume that the bank is better informed than they are and will only trade at prices that protect them against making losses because of this information asymmetry.

The ability of banks to hedge loans that they make also has benefits, however. For example, banks can keep lending to firms with which they have close relationships because they can limit their exposure to such firms through the use of CDS. As a result, firms can get more credit than they would otherwise receive and on better terms. Despite the advantages of CDS for banks, they have used them only to a limited extent to hedge loans. Few banks take positions in CDS and Minton, Stulz, and Williamson (2009) show that the 23 U.S. bank holding companies with CDS positions in 2005 hedged on average 2% of their loans with these instruments. Further, only 2% of the gross CDS positions of these banks were used for hedging – the other positions were held in their dealer business. In addition to the information asymmetry problem already discussed, another reason why banks' use of CDS to hedge is limited is that, while the CDS market is typically quite liquid for large companies, it is usually not liquid for the smaller companies that banks make a lot of loans to. Interestingly, there was a sharp increase in net hedging in 2007.

The availability of CDS contracts can change the incentives of investors. Consider an investor who holds bonds of a company in financial distress. This company may approach the investor to suggest a restructuring of its debt. The attitude of the investor towards the company's proposal will depend on whether the investor hedged his position through a CDS or not.⁸ Suppose the investor hedged his position through a CDS. Some CDS contracts treat a restructuring of debt as a credit event, i.e., an event that causes a payout, while others do not. In addition, however, even if the CDS treats a restructuring of debt as a credit event, not all restructurings qualify – an exchange of new bonds for the old ones would not qualify. If the investor has a CDS contract that

⁸ For a detailed analysis, see Yavorsky (2009).

does not treat a restructuring as a credit event, he would receive nothing from the CDS when he agrees to the firm's debt restructuring but he may make a substantial loss on his bond holdings. That investor might be better off to resist the restructuring and see the firm file for bankruptcy, in which case the CDS would compensate the investor for his loss. An investor who bought protection might even find it optimal to buy enough bonds to block a restructuring.

If CDS are functionally equivalent to insurance contracts, would we be better off if all insurance contracts traded, or is it that CDS should not trade because insurance contracts typically do not? Valuable information about a firm's credit risk can be produced through trading in the CDS market. No such information would be produced with trading on somebody's house insurance policy because the financial reward to anybody who finds that the insurance policy is mispriced would be trivial. However, there is another fundamental difference between traditional insurance and CDS contracts. Insurance companies manage risk through diversification. A large portfolio of house insurance policies has close to no risk. Not so for a large portfolio of CDS contracts because such a portfolio is sensitive to macroeconomic factors that are not diversifiable. Firms are more likely to default in recessions. The ability to trade CDS is therefore a key risk management tool for writers of protection to achieve a level of risk that they can be comfortable with.

2. Subprime derivatives

As is now well-known, subprime mortgages have significant default risk. As with other mortgages, subprime mortgages are securitized, so that the financial institutions originating mortgages do not have to keep them on their books.⁹ Mortgages are placed in a pool and notes are issued against that pool. The notes issued against the pool, often called tranches, differ in their priority in receiving payments from the mortgages. The most senior tranche has a first claim on

⁹ See Ashcraft and Schuermann (2008) for a description of the securitization of subprime mortgages and an analysis of the problems that arise in securitization of these mortgages.

interest payments and mortgage payoffs among the holders of notes. Many of the notes, and generally all of the most senior notes, have a rating from a credit-rating agency. The super-senior notes always have an AAA rating. As mortgages default, the lowest rated securities suffer first from the default losses. As default losses mount, it becomes possible for the highly rated securities to suffer from default losses as well.

Consider now AAA rated debt issued against a pool of mortgages. This debt would promise a coupon, generally set at a premium above a floating rate such as LIBOR. A financial institution could choose to hold that debt. If the financial institution wants to insure that debt, it could do so by purchasing protection through a CDS. However, there is a complication with subprime securitized debt. The debtholders receive cash flows from the pool of mortgages. These cash flows can decline because of defaults on the mortgages that are securitized (or for some other reasons). With corporate debt, default leads to restructuring or bankruptcy. With securitized subprime debt, default on the underlying mortgages leads to a reduction in debt payments and not to bankruptcy. Because of this, CDS written on securitized debt work differently from CDS written on corporate debt. Suppose that an investor holds a AAA tranche with a principal amount of \$100 million and the other tranches of the securitization have been wiped out; further, suppose that during a month \$1 million of mortgages default so that the principal balance falls from \$100 million to \$99 million. At that time, the investor would be paid \$1 million from the CDS. The CDS would still exist after that payment and would make payments as mortgages default until maturity of the contract or, if earlier, until the mortgages in the pool cease to exist.

Lower-rated tranches from subprime securitizations were often repackaged in the form of collateralized debt obligations (CDOs). With a CDO, debt issues or loans are placed in a pool and securities are issued against the pool. One popular type of CDO would put bonds rated BBB in a pool and then issue securities against that pool. Despite the fact that the pool had BBB securities, it would issue perhaps 70% of securities rated AAA. CDS were written to provide protection to

holders of CDOs as well. CDOs are difficult to price, which means that credit-default swaps on CDOs are hard to price as well.

A CDO can be created synthetically. One way to do so is to purchase a portfolio of low risk securities, such as treasuries, sell protection against a reference portfolio of subprime mortgages and other debt, and issue securities against that portfolio. Buying treasuries and selling protection through CDS is approximately equivalent to holding a portfolio of debt. For example, a trust could issue securities to buy \$1 billion of treasuries and write protection on \$1 billion of subprime mortgages. Suppose that the value of the subprime mortgages falls because of defaults, so that the CDS written by the pool has to make a \$100 million payment on the CDS. The trust would sell \$100 million of treasuries to fund that payment. The value of the trust is closely related to the value of an investment of \$1 billion in subprime mortgages. With this approach, CDOs can be created synthetically by issuing securities against a portfolio of treasuries and short CDS positions. With a synthetic CDO, credit losses hurt the investors in the CDO and benefit the writers of the CDS. On net, there is no loss – it is only wealth redistribution.

In 2006, indices of CDS on subprime securitizations were introduced. These indices are called the ABX indices. They represent a basket of CDS contracts on securitized subprime mortgages. When subprime origination was active, ABX indices were created every six months. An index would be based on an average of CDS for same seniority securitization tranches. For instance, the AAA index for 2007-1 was based on an average of individual CDS on the largest AAA-rated securitization tranches issued in the second half of 2006. The index level would behave like a bond price – as the risks of default losses increase, its level would fall. In 2007, these indices fell sharply, reflecting a loss in value of subprime securities.

The ABX indices made it possible for investors to take views on the subprime market without owning subprime mortgages directly or indirectly. Investors could purchase or sell insurance on the ABX indices. As a result, it was possible for investors to take more exposure to subprime mortgages than there were such mortgages. Data on subprime CDS positions only

became available late in the fall of 2008 through the DTCC data warehouse. This data is incomplete. The DTCC estimated that less than 1% of the CDS registered with it were CDS contracts involving the ABX – in other words a notional amount of less than \$330 billion – as of early November. It is possible that the size of the subprime CDS market was much larger because not all contracts are registered with the DTCC, because many contracts may have been unwound by the time the DTCC started reporting contracts, and perhaps because there were many contracts on subprime that did not use the ABX indices.

Subprime CDS provided investors with the ability to go short on subprime securities and to hedge such securities. Both benefits should have been valuable. The price discovery provided by the ABX indices was valuable since it helped financial institutions and investors assess the value of subprime securities.¹⁰ However, it is not clear how good that price discovery was. Many observers argue that at times price movements in the ABX indices overreacted to changes in expected default losses on subprime mortgages – in fact, Stanton and Wallace (2009) provide evidence that for some of these indices at some times the implied probabilities of default on the underlying mortgages were greater than 1.¹¹ The hedging benefit of CDS should have made it possible for subprime risk to be located with those investors and institutions for which bearing such risk was most valuable.

Large providers of protection on subprime risks were various insurance companies. Monoline insurance companies are specialized insurance companies that insure debt. Historically, they mostly insured municipal bonds. As the subprime securitization market grew, monolines became more and more active in providing insurance on the higher rated tranches in subprime securitizations. They acquired extremely large subprime exposures this way. As we will discuss extensively later, AIG also insured much debt with subprime collateral. Unfortunately, some of the hedging benefit turned out to be illusory because parties providing the hedging did not have

¹⁰ See Gorton (2008) for the role of price discovery through the ABX indices in the subprime crisis.

¹¹ See also Bank of England (2008).

the ability to bear the risk ex post and the risk these parties were bearing led some of them to be bailed out.

3. The size of the CDS market

Because CDS are traded over-the-counter and are not regulated, there is no official record of CDS contracts. The Bank for International Settlements (BIS) has statistics on the CDS market only since the end of 2004 based on survey data.¹² By then, the CDS market had been alive for roughly ten years, but its size in the 1990s was trivial – an estimate for 1998 is that at that time the size of the market was \$180 billion.¹³ By 2004, the total notional amount was \$6 trillion. At the end of June 2008, the size of the market, at \$57 trillion, was almost ten times bigger. However, the size of the market fell sharply in the second half of 2008.¹⁴ The BIS reported that the size of the credit default swap market at the end of 2008 was \$41 trillion. When the BIS started keeping track of CDS contracts, single-name contracts were 80% of the market; at the end of June 2008, these single-name contracts were only 58% of the market. Figure 1 shows the evolution of the size of the CDS market.

All major dealers register their plain vanilla credit default swaps with the DTCC warehouse. The size of the market as measured by the CDS registered with the DTCC is much smaller, \$29 trillion on May 22, 2009. With the registry, the DTCC can make sure it counts each CDS contract only once. It is harder to make sure of that with surveys, so it is possible that surveys inflate the size of the market, but since not all contracts are registered with the DTCC, the DTCC underestimates the size of the market to some extent. Of the \$29 trillion of default swaps registered with the DTCC on May 22, 2009, \$15 trillion were single-name swaps.

¹² <http://www.bis.org/statistics/derstats.htm> .

¹³ One of the first CDS was default insurance on Exxon provided by the EBRD to JP Morgan. See Tett (2009). The estimate for 1998 is in Acharya, Engle, Figlewski, Lynch, and Subrahmanyam (2009).

¹⁴ The International Swaps and Derivatives Dealers Association (ISDA) conducts a survey of the CDS market as well and its estimate for mid-year in 2008 is slightly lower and shows a decrease from the end of 2007.

There is no net outstanding supply of credit default swaps. For each buyer of protection, there is a seller of protection. From that perspective, the total market value of the outstanding CDS is zero. However, it is also interesting to consider the market value of the protection bought through CDS. If protection is bought on a firm that has no significant risk of default, the value of the protection will be trivially low even if the protection is bought on a large notional amount. However, if a name's probability of default is close to one and the expected recovery is close to zero, the value of the protection bought is close to the notional amount of the swap. As with all derivatives, there is a dramatic difference between the total notional amount outstanding and the market value of the contracts outstanding for CDS. The BIS survey estimates the market value of the contracts outstanding at \$5.6 trillion at the end of December 2008. Figure 2 shows the evolution of the market value of the contracts from 2004 to the end of 2008. A striking development that took place in 2008 is that the CDS market size fell when measured using the total notional amount of credit swaps, but it increased sharply when measured using the market value of the outstanding swaps. At the end of December 2007, the market value of the swaps was \$2 trillion, so that the size of the market almost tripled using market values. Such an evolution is not surprising because default risks increased for many companies in 2008.

4. CDS, over-the-counter markets, and exchanges

To understand the benefits and costs of over-the-counter (OTC) trading for CDS, it is best to start with a simple example. Suppose that you are a hedge fund manager and are pessimistic about the future of the credit of bank holding company X. A simple way to express your view is to buy protection on bank X through a five-year credit default swap. To enter the swap, you call up dealers to obtain quotes. You might call Goldman Sachs, Deutsche Bank, and Natixis because you typically deal with them. Say Natixis offers the best deal and you take it. You then agree to make regular payments, say quarterly, at an annual rate of 100 basis points on a notional amount of \$10 million. Until April of this year, when you entered the CDS, the CDS was priced so that

the market's assessment of the present value of the payments the buyer of protection expected to make roughly equaled the present value of the payment he expected to receive in the event of a default of bank X. In other words, the terms of the CDS were set so that it had no economic value from the market's perspective at inception – if you sold the contract one second after you entered it, you got nothing for selling it. Since April 2009, CDS contracts initiated in North America have a fixed payment of either 100 basis points or 500 basis points per year.¹⁵ If the net present value of the protection you receive on company X is positive when you pay 100 basis points per year, then you have to make an initial payment to the seller of protection corresponding to that net present value.

Immediately after you enter the swap, Natixis has an exposure to bank X. Should bank X default and the bonds of bank X become worth 40 cents on the dollar, Natixis would have to pay \$6 million. Derivatives dealers are in the business of making markets for derivatives, not of taking exposures to the credit risk of companies. Natixis would therefore immediately look for ways to hedge or transfer its exposure. Most likely, Natixis would buy protection on bank X from some other dealer, say UBS, who might also turn around and buy protection, say from Goldman Sachs. However, eventually, somebody has to bear the risk from the credit default swap you entered. Suppose that another hedge fund, Contrarian, wants to sell protection on bank X and agrees to sell protection on bank X to Goldman Sachs. Contrarian would hold a position that is the opposite of the one you have.

With this example, in a sense you buy protection on bank X from Contrarian. However, three intermediaries make this happen, namely Natixis, UBS, and Goldman Sachs, and you will never know that Contrarian is the ultimate seller of protection. There is a whole chain of credit default swap between you and the end-user who has the opposite position. More specifically, in this example, there are four CDS of \$10 million notional each. The size of the OTC market for

¹⁵ A number of changes took place in North America for CDS contracts in April 2009. These changes are generally described under the name of the “CDS Big Bang” (see Markit (2009)). The objective of these changes was to standardize the single-name CDS contracts.

derivatives is increased by the fact that after an end-user has entered a derivatives position, a search process starts which ends when a party is identified who is willing to hold the opposite position.

So, you made a phone call, or exchanged electronic messages, and agreed to terms to enter a CDS contract with Natixis.¹⁶ Now, the trade has to clear, which means that both you and Natixis have to formally ratify the agreement you made so that everybody involved agrees to the rights and obligations you acquired through your phone call. The trader at Natixis will be off to other trades immediately after talking to you. Back offices now get involved. First, the back office at Natixis captures the trade – it records it. Second, it verifies it with your back office. However, when the back office from Natixis contacts your back office, they might think that they have a contract on \$20 million notional instead of \$10 million notional. At that time, this disagreement would have to be resolved. Third, the trade is confirmed after possible disagreements have been resolved. The clearing process for derivatives consists of all the steps that take place from the trade completion to the settlement. The settlement is when a party receives cash from the counterparty to fulfill the obligation agreed to through the trade.

It should be immediately clear that a disorganized clearing process can create substantial risk. Suppose that for whatever reason confirmation does not take place. It could be that the back office of Natixis was too busy and forgot, or that the trader forgot to inform the back office properly. However, the trade with UBS was cleared properly. In this case, Natixis might have hedged a position that it might not have because the trade was never confirmed. Instead of having no exposure, it would now have a risky CDS contract on its books.

After you enter the contract, its life might be just as you expected when you entered the contract. Perhaps you had decided to hold on to the contract until either bank X defaults or the CDS matures. If bank X defaults, Natixis makes the promised payment. Throughout the life of the contract, you are never concerned about Natixis' ability to honor the promise it made to you.

¹⁶ There are also some fully automated platforms on which you could trade.

What about a less run-of-the mill outcome? Two such outcomes are interesting. First, after some time, you could decide that you don't want to hold the contract to maturity. I call this case the exit case. Second, the financial situation of Natixis could deteriorate so that the market might become concerned about its ability to honor its promises. I call this the counterparty risk case.

Consider first the exit case. There are at least three ways to exit a CDS position. First, you could go to Natixis and negotiate terms under which the CDS agreement would be terminated. If the credit of bank X deteriorated since the inception of the swap, the swap became more valuable to you because it became more likely that Natixis would have to make a payment as a result of a default of bank X. In this case, you would receive a payment from Natixis upon termination. Alternatively, if the credit of bank X improved, you would have to make a payment to Natixis. Second, you could enter a contract to sell protection on bank X for the same notional amount as your contract with Natixis with some other dealer that matures when your CDS matures. In this case, assuming that there is no uncertainty about whether the dealers will honor their promises, the two CDS you have essentially offset each other and you are no longer exposed to the credit risk of bank X. Third, you could go to a dealer and enter an agreement that this dealer will take on your obligation to Natixis. Such an agreement is called a novation.

If you went back to Natixis to reach an agreement to terminate the contract, it would be a bilateral negotiation. Natixis might not offer you favorable terms because if it agreed it would have to find a way to offset the CDS it entered into to offset your swap. Natixis might also feel that it has some market power. It might charge a termination fee. Entering an offsetting swap is simple, but you still have some risk since the new swap counterparty might default and then you will still have your original swap. Novation can eliminate all your risk. However, somebody else has to assume the counterparty risk – and, at times, may require to be paid for that.

With novation, it is important for Natixis to know that the counterparty has changed and to agree to the change. Natixis might be concerned about its exposure to the new dealer and might refuse the novation. A sign that Bear Stearns' situation was desperate was when counterparties to

Bear Stearns wanted to novate their trades and eventually they could not find dealers willing to novate.¹⁷ Again, the role of the back office is crucial here. Suppose that you thought you had novated the contract, but Natixis never agreed. In this case, you would still be the purchaser of protection from Natixis' perspective. However, the situation would be troublesome for the dealer with whom you novated the swap. That dealer might have thought it had a swap buying protection on bank X when it did not.

As we saw, the market for CDS grew very quickly and became enormous. Not surprisingly, this growth was accompanied by growing pains. Traders want to trade and often worry little about whether the back office follows. Back offices are not prestigious. They are hidden. Banks may lag in staffing back offices for new types of derivatives. Not surprisingly, as the market's growth accelerated, back offices often did not follow. For instance, in 2004, according to an ISDA survey, the average time to confirmation for a credit derivative was 25 days.¹⁸ There was uncertainty as to the status of default swaps. A few years back, it might have taken a couple of weeks for Natixis to be informed of the novation, and sometimes these communications fell through the cracks. The New York Fed worked hard to get the industry to solve these problems and had significant success. Nevertheless, after Bear Stearns was acquired by JPMorgan Chase, its new owners discovered a large amount of unconfirmed CDS.¹⁹ However, according to ISDA (2009), at this time, 92% of confirmations for credit derivatives are done electronically. Of these confirmations, more than 60% are done the same day and more than 90% within a day.

Let's now look at the case of counterparty risk. Suppose that you just entered the swap and Natixis files for bankruptcy or is simply closed by regulators. In this case, the swap would have no value because you just entered it. To re-establish your position, you would have to enter the same swap with somebody else. If nothing changed due to the bankruptcy, you would do so on

¹⁷ See Cohan (2009), p. 27-30, for a description of discussions at Goldman Sachs about whether to novate a trade in March 2008 for a hedge fund that had Bear Stearns as a counterparty.

¹⁸ Ledrut and Upper (2007) review some of the evidence on backlogs.

¹⁹ See Tett (2009), p. 224.

terms similar to those that prevailed before the bankruptcy. You would still make a loss that you would want to be compensated for because you would incur transaction costs. However, it could be that the Natixis bankruptcy disrupts markets. In this case, the market might lack liquidity, so that you would have to agree to less favorable terms to re-establish the swap, which would increase the replacement cost for you beyond the cost implied by the bid-ask spread. These replacement costs would be magnified if the position you seek to replace is larger than a standard size position.

What if Natixis fails after some time? In this case, the impact of the failure on your CDS position depends on whether you gained from the swap or lost. If Natixis fails, the swap is terminated. If bank X's credit worsened, you gained on your swap. Your gain is at risk in the event of termination. If bank X's credit improved, most likely you will owe to the bankruptcy estate of Natixis. Irrespective of whether you gained or lost, the precise quantification of the gain or loss can be complicated because termination of the swap leaves you in a different situation from the one you were in before the termination. To be in the same situation as you were in before the termination, you would have to replace the swap which would involve costs that you would want to be compensated for by Natixis.

A well-established solution to address the issue of counterparty risk is a bilateral mark-to-market and collateral agreement. With such an agreement, the counterparty whose position in the swap has negative value has to post collateral based on the market value of the swap. As the market value of the swap falls further, the party has to post more collateral. Consider the case of your swap on bank X. Suppose that the value of the protection you bought is now \$2 million. With a collateral agreement, Natixis might have to post collateral worth \$2 million. With this agreement, you would lose nothing if you could turn around immediately after the failure of Natixis and enter the same swap for \$2 million. However, the failure of Natixis could have made the markets dysfunctional and you might not be able to replace the swap at all for some time or only at a cost much higher than \$2 million. In this case, despite the existence of a collateral

agreement, you could make a large loss because of the failure of Natixis. You would have a claim against the bankruptcy estate of Natixis if you suffered a loss in excess of the collateral you had in your possession. If you had multiple swap positions with Natixis, the positions would be netted against each other if they were made under the same contractual framework (the same master agreement), so that you would owe Natixis the net amount or you would be owed the net amount.

How would your trade in the CDS have worked differently had the CDS traded on an exchange? Derivatives are standardized on exchanges. Consequently, you would have had to choose a contract that is available on an exchange. You would have placed an order with a broker to open a CDS position. On the exchange, your trade would have taken place when somebody else would have been willing to take the opposite position. However, in contrast to the OTC market, your counterparty would not be a dealer, but it would be the clearinghouse of the exchange. The exchange clearinghouse clears all contracts traded on the exchange and serves as the counterparty. The promise of your CDS contract would be honored as long as the clearinghouse has the resources to do so. The ability of the clearinghouse to honor the promises of the contracts it clears depends on its resources, including its capital, and on its risk management. Clearinghouses use margin agreements to reduce their risk. With these agreements, parties to a contract have to put up collateral when they open the contract. This collateral is called the initial margin. Each day, the contract is marked to market and the mark-to-market gains and losses are settled. Through judicious use of margin levels, a clearinghouse can make its risk of default low – if the margin were 100% of the notional amount of a credit default swap there would be no risk of default for the clearinghouse. As long as a day's loss on a contract is less than the margin, the clearinghouse can make up the loss by holding on to the collateral. There would be no chain of contracts if the contracts are traded on exchanges. Trade prices on exchanges are publicly available, so that there is transparency. In addition, regulators could identify the counterparties to trades through the clearinghouse should they have a need to do so.

5. Counterparty risks, the credit-default swap market, and the crisis

Though it is common to hear that CDS contributed significantly to the crisis, it is important to understand that in many ways the CDS market worked remarkably well during the credit crisis. According to participants, much of the market for CDS remained fairly liquid for at least the first year of the credit crisis – i.e, from late July 2007 to late July 2008. Further, the market handled extremely large defaults well organizationally. A good example is how well it processed the default of Lehman. The notional amount of protection bought on Lehman is unclear. Different estimates have been circulating, ranging from \$72 billion to \$400 billion for the total notional amount of CDS written on Lehman.²⁰ However, one estimate is unquestionable: the DTCC had contracts on Lehman for a notional amount of \$72 billion registered in its warehouse. Protection sellers had to pay 91.375 cents on the dollar to settle the contracts. The settlement for these contracts went smoothly. Importantly, the net exchanges of cash for Lehman, despite the wild rumors in the markets, were rather small: \$5.2 billion were exchanged through the DTCC. The net amounts were small because many institutions were both buyers and sellers of protection on Lehman, so that their net position was small. As mentioned before regarding the DTCC, not all contracts are registered through the DTCC, so that additional contracts referencing Lehman existed, but we cannot know the total notional amount of these contracts.

If the CDS market worked well, why is it considered to have been so dangerous? Though financial crises keep occurring, it is not uncommon for the recent financial innovations to be blamed and for legislation to ban them. The crash of one of the first famous bubbles, the South Sea Bubble in 1720, was followed by a ban on joint stock companies in 1720 and by the Barnard Act in 1734 that banned option trading. However, there were problems with CDS exposures

²⁰ The amount of \$72 billion is the amount reported by the DTCC of swaps that settled through the DTCC. The amount of \$400 billion was reported by the Financial Times on October 6, 2008, quoting a Citi analyst stating that “there could be \$400bn of credit derivatives referenced to Lehman.” in “Fed to hold CDS clearance talks,” by Aline van Duyn and Hal Weitzman, FT.com, October 6, 2008.

during the crisis. One problem is that while collateral arrangements were frequent, they were not universal. According to an ISDA survey, 63% of derivatives contracts were subject to such agreements in 2007, compared to 30% in 2003. When a dealer defaults on swaps not covered by collateral agreements, the counterparties can make large losses.

Another major reason for concerns about the CDS market is the size of gross exposures of dealers. In 2008, the CDS contracts outstanding of JP Morgan Chase had a notional amount of almost \$8 trillion, and those of Citi, almost \$3 trillion. Investment banks did not provide as much information about their derivatives exposures, but it was estimated that the CDS of Bear Stearns amounted to a total notional amount of \$2.5 trillion.²¹ Under normal circumstances, these gross exposures are not much of a problem. The estimate of the cost to JP Morgan Chase of replacing the CDS contracts on which it was owed if counterparties were to default, after taking into account bilateral netting and collateral agreements, was just \$44 billion at the end of 2008 according to its 2008 annual report. To put this amount in perspective, JPMorgan Chase's shareholder equity at the end of 2008 was \$166 billion. However, even that amount may overstate the exposure of JP Morgan Chase because it ignores some forms of collateral. The bank does not report the impact of netting for credit derivatives separately. However, this impact is large for its overall derivatives portfolio. As of the fourth quarter of 2008, the bank had derivatives receivables of \$2.7 trillion, but after netting this amount was only \$266 billion.

A dealer's net derivatives receivables could be zero and the dealer might still pose significant risks to the financial system. Consider a dealer who hedges all CDS on its books through matched trades. The dealer has \$1 trillion notional of protection bought and \$1 trillion notional of protection sold. Effectively, the dealer has \$2 trillion of gross exposure. However, the net amount is \$0. For every swap, there is an offsetting swap on the books. Suppose that all the dealer's contracts have mark-to-market and collateral agreements. Does that mean that there is no risk? A

²¹ See "JP Morgan CDS exposure may top \$10trn notional," by Peter Madigan, Risk, April 2008.

default of this hypothetical dealer still has the potential to create havoc in the financial markets for at least five reasons:

- 1) Writers of protection on the dealer will make losses. These losses could potentially be large even with collateral agreements. With an unexpected default, there is a jump to default for the CDS which can lead to a large change in value. To see this, suppose that the market expects that there is a 20% chance a dealer will default and the recovery is expected to be 40%. Ignoring the time value of money, risk premia, and liquidity effects, the value of a \$10 million notional CDS for the protection buyer would be \$800,000. At the default, the value of the CDS would be \$6 million. The protection seller would lose \$5.2 million on the day of default. Such losses could possibly lead to some other dealer default if another dealer has a large net exposure as a protection seller on the defaulting dealer. Such a situation is not dissimilar to the situation for CDS on Lehman the last working day before the bankruptcy filing. On that day, it cost roughly \$700,000 to insure \$10 million of Lehman debt for a year, so that a buyer of protection against Lehman on Friday would have earned a huge gain since the swaps paid off more than \$9 million on settlement.
- 2) Counterparties to the dealer have to replace the CDS they have with the dealer to keep their exposures unchanged. This can take time and can be costly, especially if the dealer's collapse renders the market less liquid or even dysfunctional. As a result, counterparties to the defaulting dealer can be exposed to risks over some period of time, which could lead to further defaults and instability. An especially worrisome situation would be one where a large financial institution collapses immediately after the dealer's default. In that case, financial institutions that had hedged their counterparty risk to that financial institution through the defaulting dealer might be unprotected which could lead to further defaults.

- 3) Collateral is at times re-hypothecated. Re-hypothecation essentially means that the collateral is used as collateral by the dealer to borrow. A CDS counterparty could therefore have its collateral at the dealer, the dealer could have used it to borrow, and consequently the collateral would not be held by the dealer at the time of failure. In such a situation, the counterparty's excess collateral might be difficult to recover, further compounding the uncertainty resulting from the dealer's failure.
- 4) There is limited transparency about the exposures of dealers to derivatives. As a result, it is not possible for counterparties to assess the risk they are exposed to by transacting with dealers following a large shock. It can become optimal for individual counterparties to stop transacting with a dealer when its financial situation is uncertain, which can lead to a run on the dealer and gridlock in the financial system.
- 5) Failure of a financial institution can lead to contagion. With contagion, investors become concerned about the credit risk associated with other financial institutions. This contagion can lead to large changes in the value of credit default swaps. Such contagion can be created by uncertainty about CDS exposures of financial institutions.

In the OTC market, dealers typically have balanced books. There will be a balance of gains and losses resulting from a dealer failure. Collateral will protect the parties who had made gains before the failure. In normal times, we would expect all parties to replace the swaps they had, so that there will be some balance in the markets between parties trying to buy protection and parties trying to sell protection. In an orderly and well-functioning market, we would expect these opposite parties to find each other and make deals to replace the contracts they had with the failed dealer. However, in more turbulent times, this process will not evolve smoothly. To understand this, remember that when a party wants to enter a CDS contract, a dealer typically accommodates that party but with the intention of immediately offsetting the trade so that the dealer has no exposure. When markets function poorly, the dealer cannot have that expectation and may be

extremely reluctant to make a market. As a result, it may be harder and more expensive to find replacement contracts than usual. The dealer's failure could lead to a situation where some counterparties, including other dealers, become unhedged and vulnerable to further shocks. In addition, counterparties could make losses because of changes in the market value of contracts since the last posting of collateral.

With a dealer failure, the losses on CDS from the dealer's counterparties net out in the economy when the dealer has a matched book except for deadweight costs. Consider the simple case where A bought protection on X from the defaulting dealer and B sold protection on X to the defaulting dealer. A has made gains on the contract but is protected with collateral. If the dealer fails, on net, the gain of A is the loss of B except for deadweight losses. Large deadweight losses can arise because of potential difficulties and costs in replacing hedges and because of the costs of dealing with the bankruptcy estate for the two counterparties. For instance, with chaos in the markets, neither A nor B could find replacement swaps quickly and A being unhedged might fail as a result.

Though Lehman was a big CDS dealer, CDS were not the cause of Lehman's failure. Neither were they the direct cause of Bear Stearn's demise. Exposure to CDS played a big role in AIG's failure, but AIG made even larger losses on its portfolio of securities. AIG did not behave like a dealer. It did not run a matched book. It did not appear to hedge. What AIG did was provide credit insurance on AAA tranches in securitizations – on an extremely large scale. As of June 30, 2008, it had written a net amount of \$411 billion notional of credit derivatives on super senior tranches of securitizations. Included among these credit derivatives were derivatives on super-senior tranches of CDOs with subprime collateral for a notional amount of \$55.1 billion. At the time that AIG wrote the credit protection, all the CDO tranches were rated AAA. The probability of a default on an AAA-rated obligation is in principle extremely small, less than 0.1% per year, so that AIG – and the regulator of the subsidiary that wrote the protection, the Office of Thrift Supervision – could reasonably think that there was little risk in selling protection on such

tranches. For instance, Moody's estimated in 2008 that the probability of a default on AAA-rated corporate debt over five years to be 0.09% using data from 1970 to 2007 (Moody's (2008)).²² In almost all possible states of the world, the AAA tranches of CDOs with substantial subprime collateral would not have defaulted. However, they did have a significant probability of default in what appeared to be an exceedingly low probability outcome based on historical data, namely a major downturn in the housing market throughout the U.S. As such a downturn happened, these tranches lost substantial amounts of value. By October 10, 2008, the value of these super-senior tranches was \$36.2 billion and the value of the super-senior tranches still rated AAA was only \$16.4 billion. As a result, the value of the credit default swap liability of AIG became very large when marked to market. The insured assets were held by banks across the world. AIG's agreements required the posting of collateral following a decrease in its credit rating and the collateral requirements were more stringent as its credit rating fell more. As the value of the securities fell, AIG made more losses. By August 2008, AIG had a total amount of unrealized losses on its credit default swaps of \$26.2 billion and had posted collateral worth \$16.5 billion. In addition to its losses on CDS, AIG also made large losses related to subprime and other fixed-income securities involving securitizations. Impairments on AIG's investment portfolio as of September 30, 2008, amounted to \$32 billion, an amount exceeding the mark-to-market losses on its credit default swaps.

On September 15, credit default swaps on AIG were priced so that to insure \$10 million of debt for five years, the buyer of protection had to pay \$2.5 million upfront plus \$500,000 annually. On September 16, after having been downgraded by S&P and Moody's, AIG had to post \$14.5 billion additional collateral. It could not meet these collateral requirements without a bailout. Had it not posted collateral, it would have been in default. A collapse of AIG would not have been a benign event for the markets. However, it is not at all clear that the biggest problem

²² Moody's denotes its top rating by Aaa. AAA is the top rating for Standard and Poor's. I use AAA to denote the top rating throughout.

associated with this collapse would have been the default on the CDS. AIG would also have defaulted on its debt and its commercial paper at a time when there already was a run on money markets. Such an outcome would have been disastrous compared to the impact of default on CDS.

The CDS counterparties of AIG would have made losses, but they also were protected by collateral and some had bought protection on AIG. Most if not all of these counterparties were financial institutions. Financial institutions have to hold capital to meet regulations. They generally view holding regulatory capital to be costly to their shareholders. Because of the way capital requirements are determined, financial institutions generally were able to hold less regulatory capital if they packaged loans in securities and held them on their balance sheet than if they just kept the loans on their balance sheet.²³ Further, some financial institutions apparently believed that it was quite advantageous for them to hold super-senior tranches of securitizations on their books if they insured them with CDS. There was therefore a large demand for insurance of super-senior tranches that was partly met by AIG. Regulators across countries allowed financial institutions to set aside less capital because these institutions had bought protection with AIG. Had AIG collapsed, these financial institutions would have made losses on their hedged holdings of AAA securities to the extent that they were insufficiently protected by collateral and by protection bought against a default from AIG. In addition, these institutions might have found it impossible to replace the insurance provided by AIG and, as a result, would have been less well capitalized. As these institutions became less well capitalized, they might have needed to reduce the loans they made and to raise new capital.

Importantly, however, the starting point for all that demand for insurance of securitized debt was the fact that the securities had an AAA ratings and that financial institutions in some jurisdictions received regulatory capital relief (the extent of which varied across jurisdictions) from holding securitizations tranches with an AAA rating and hedging them with CDS. With

²³ For good examples, see Goldman Sachs (2009).

such a rating, the securities were viewed as having low risk of default. The fair value of the securities fell sharply, but some of that decrease may have had nothing to do with the increase in the risk of default or with actual defaults. Rather, that value may have fallen because the securities became less liquid and investors required a larger risk premium to hold them. However, AIG had to put up collateral regardless of the reason of the decrease in the value of the securities. This was a situation totally different from the situation AIG would have faced in its insurance business: if a hurricane moves away from the coast at the last minute, so that there is no destruction, the insurance company pays nothing. If the value of the securities decreased more than warranted by the increase in the expected default losses, AIG could expect to receive some of the collateral back later as market conditions returned to normal. In the meantime, however, AIG did not have the cash to put up collateral.

6. Are there benefits to OTC trading?

An observer has argued that “Without OTC derivatives, Bear Stearns, Lehman Brothers and American International Group (NYS: AIG) would never have failed.”²⁴ Many espouse such a view. We discussed extensively the case of AIG in the previous section. Both Bear Stearns and Lehman Brothers failed because market participants, rightly or wrongly at the time, believed that there was a high probability that the assets of these institutions were worth less than their liabilities. Derivatives were not the proximate cause of their collapse. However, it is undoubtedly true that without derivatives, their assets and liabilities would have been quite different. From listening to the press and to such observers, it almost seems as if exchange trading could remove the problem of counterparty risk and create transparency and order in the market for derivatives. Why would we not want, then, for all derivatives trading to take place on exchanges? If exchange-trading is so beneficial, why don’t derivatives trade exclusively on exchanges?

²⁴ “Kabuki on the Potomac: Reforming credit default swaps and OTC derivatives,” Chris Whalen, The Institutional Risk analyst,” May 18, 2009.

Derivatives have been around for centuries. However, the most successful derivatives trading today are relatively new. The first interest-rate swap agreement dates of the early 1980s. The first CDS was introduced in 1994. When these derivatives were introduced, there were long negotiations before an agreement was signed. Each new deal took much time and effort. Some derivative types have a high volume of trading – some standardized CDS index contracts are examples of high trading volume derivatives. Other types of derivatives do not trade. They are used to solve specific risk management problems of an end-user. It is easy to innovate over the counter. Anybody who thinks that a new type of derivative might solve a one-time problem for a single firm can introduce that derivative. No approvals are required except for approvals within the firm of the individual who designs the derivative. Innovation on exchanges is much harder. Exchanges are regulated and contracts have to be approved by regulators. It only makes sense to go through the process of introducing a contract when it can be expected to have a volume high enough to justify the expense of getting approvals and setting the exchange up for trading the contract.

The OTC market is perfect for innovation in financial products. This explains why derivatives usually start their life on the OTC market rather than on exchanges. However, there is a substantial amount of standardization in derivatives trading. As interest rate swaps became better known, the industry formed an association, the International Derivatives and Swaps Association (ISDA), which devised standardized agreements. When parties trade derivatives, they enter a so-called ISDA Master Agreement. The Master Agreement is an ISDA document that has many options that the counterparties to derivatives trades select to form the basis of the contractual agreement they enter into when they trade derivatives. Once the parties have agreed on a specific derivatives trade, they use confirmations that are standard ISDA forms. Despite this standardization, however, there is an incredible diversity of derivatives contracts. Because the market is an OTC market, there are infinite variations of amounts and maturities counterparties can choose. They can also choose new forms of derivatives and combine derivatives as they see

fit. In contrast, exchanges do not typically let derivatives traders set the terms of the contracts. Instead, derivatives traders have a choice of contract terms and cannot depart from these terms.

Why are exchanges inflexible while the OTC markets are so flexible? If you want to enter a derivatives contract, you need to find the counterparty that offers you the best deal. Exchanges are places where potential counterparties congregate – sometimes only electronically. As a result, if an exchange is successful with a type of derivative, investors and firms interested in taking positions in that type of derivative will go to the exchange to achieve their goal. It only makes sense to go to the exchange when there is liquidity for the type of derivative you want to trade – namely, when you want to trade, a counterparty is available quickly and there is competition among available counterparties so that you have little impact on prices when you trade. Exchanges create pools of liquidity by standardization – they have few contract types trading. With this standardization, investors and firms give up the opportunity to get a contract that fits exactly their needs for the benefit of trading in a liquid contract.

The OTC market addresses the search process differently.²⁵ Dealers are available to respond to the demand for contracts by investors. Dealers then search for counterparties that will take the risk off their hands. They are organized for that purpose by having traders and sales people devoted to the task of selling and buying derivatives. They provide liquidity to end-users by taking on positions. Exchanges do not take positions. Any derivative's trade on an exchange is between counterparties rather than with the exchange; once a trade has taken place, the exchange steps between the counterparties in its clearing function.

Exchanges offer a very efficient solution when they succeed in drawing large pools of liquidity. However, creating such pools for derivatives can be difficult because there is often a demand for terms that meet specific hedging needs. Consider a manufacturing firm that wants to sell forward its anticipated Euro receipts from exports to Germany. It expects to receive the Euros at some known future date. On exchanges, the contracts mature at specific dates. The closest date

²⁵ See Duffie, Garleanu, and Pedersen (2005).

at which a futures contract matures for Euros might be two weeks away and the contract for that date may not be very liquid. An OTC dealer could offer a contract that matures on the day that the exporter expects to receive the Euros and for the exact number of Euros he expects to receive. The exporter might prefer to pay more for the service from the dealer than what he would have to pay through the exchange for the benefit of having a contract that exactly meets his needs. In this case, the issue is one of maturity, but most hedging demands from end-users can be met at a cost on the OTC market irrespective of how specialized they are.

We saw that a benefit of exchange trading is the existence of a clearing house that becomes counterparty to all trades. There is no reason for the use of clearing houses to be restricted to exchange trading. Clearing houses are used for some derivatives trades in the over-the-counter market. By using a clearing house, the derivatives traders substitute the credit risk of the clearing house for the credit risk of the dealer. Regulators have been pushing for the use of clearing houses as counterparties for CDS contracts both in the U.S. and in Europe. This effort has had some success and it is possible, perhaps even likely, that eventually some types of CDS will have to be cleared. Ice Trust, part of the Intercontinental Exchange, started clearing CDS index contracts in March 2009. By August 2009, the open interest on contracts cleared through Ice Trust was in excess of \$180 billion and Ice Trust had cleared more than \$1 trillion notional amount of contracts.

Use of clearing houses for derivatives trading could decrease the risks posed by derivatives exposures for the financial system. There are three reasons for this. First, a clearing house that acts as counterparty can diversify and manage risks associated with the failure of individual counterparties, so that the failure of an individual counterparty could easily be absorbed as long as the clearing house has enough resources. Second, with a clearing house, all of the dealer's exposures in the contracts cleared through the clearing house are netted. If all derivatives traded through that clearing house, then the exposure of the clearing house to the dealer would only be the net exposure of all of the dealer's derivatives trades to the clearing house. In contrast, the

OTC market only allows netting of contracts with a single counterparty. A clearing house can therefore reduce total counterparty exposure. With multiple clearinghouses and clearinghouses specialized to derivatives types, however, it is possible that the netting that takes place through clearinghouses is less than the netting that would take place without clearinghouses.²⁶ Third, a clearing house can monitor the exposures of its counterparties and prevent counterparties from taking additional exposures.

The use of a clearinghouse is not a magic bullet to eliminate systemic risk associated with OTC trading of derivatives.²⁷ A clearinghouse may be at a disadvantage in monitoring some counterparties compared to dealers. A dealer who trades hundred times a day with another dealer most likely will have a better assessment of the credit of that dealer than a clearinghouse that interacts with the dealer for only one type of derivatives trades would. The stakes for dealers are high because they may have very large intra-day net exposures at times with another dealer. In addition, a clearinghouse is inefficient at dealing with products that are not very liquid. Typically, new financial products start their lifecycle with low liquidity. With such products, the clearinghouse has to build its own models to evaluate the risk. Dealers may be better at building such models because they devise the products and trade them. A clearinghouse may save costs of building models by making such products ineligible to clear, in which case the requirement of using a clearinghouse would make it impossible to use derivatives that may be quite efficient at allocating risk in the economy and would prevent financial innovation.

Importantly, a clearinghouse resolves counterparty risk only to the extent that it has enough resources to draw on to deal with the failure of counterparties. Suppose that a dealer has trades booked through a clearinghouse and the dealer fails. If the net position is small, the clearinghouse will have no problem dealing with the failure. However, the resources of U.S. clearinghouses are limited and they would have been strained by the ongoing problems of AIG. For instance, CME

²⁶ See Duffie and Zhu (2009).

²⁷ See Pirrong (2009) for a more detailed analysis.

Clearing, the largest futures clearing house in the U.S., can draw on resources of \$64 billion to cope with failures. The taxpayer bailout of AIG is a multiple of that amount. The CDS that AIG wrote were highly specialized, so that most likely it would not have been feasible for a clearing house to become a counterparty to such derivatives. As a result, unless there had been a ban on CDS not cleared through a central counterparty, the problems of AIG would not have been avoided by the availability of a clearing house.

In summary, the OTC market is better at enabling innovation, at addressing specific derivatives requirements from end-users, and at finding counterparties when liquidity for a derivative on an exchange would be low. In contrast, exchanges are more efficient when there is a large volume of trading for standardized contracts. The OTC market can compete well with exchanges precisely because of this customization. There is a huge OTC forward currency market – a market for the purchase of foreign currencies for future delivery. There is a large parallel current futures market on exchanges which offers similar contracts. The forward and futures currency markets have lived side-by-side for more than thirty years.

7. Transparency, instability, and manipulation

With OTC trading, the trades are not public. There can be derivatives trades that almost nobody will ever know about. This lack of transparency can create problems. To start with, it means that exposures to derivatives are not well-known. Financial institutions have some disclosures for derivatives. However, as evidenced following the Lehman bankruptcy, these disclosures do not make it possible to assess precisely the vulnerability of a financial institution to a dealer default. Lack of understanding of such vulnerability can lead to runs on institutions and hence to instability. Yet, it would not be in the interests of financial institutions to be too transparent about their derivatives positions. Such transparency could make it difficult for an institution to trade or to take advantage of its views on the market. It was clear in 2008 that regulators had an insufficient understanding of dealers' derivatives exposures and that a better

understanding would have been beneficial. Information available to regulators need not be available to the general public. Consequently, the issue of transparency for regulators is distinct from the issue of transparency to investors.

Lack of transparency for investors means that it is at times difficult for them to know whether they are taken advantage of in a transaction. This concern was important to the SEC for bonds and the SEC mandated the introduction of a system called TRACE where trade prices are reported. Empirical evidence shows that TRACE reduced trading costs for retail investors.²⁸ Retail investors are not important in the OTC derivatives markets. Institutional investors should be able to fend for themselves. If they can't, they should not be dealing in derivatives over the counter. It is therefore not clear that transparency for investors is valuable in the OTC derivatives markets. There is an optimal level of transparency in a market. There is considerable transparency for some types of derivatives and very little for others. End-users would certainly choose lower trading costs if, with lower trading costs, they still had the same choice of derivatives. However, the almost infinite menu of derivatives available to end-users may not be consistent with a market with trade transparency. Less choice in derivatives forces end-user hedgers to bear more risk because they are less likely to be able to take a position in a derivative that exactly matches their needs. The fact that derivatives trade on OTC markets in derivatives that are similar to exchange-traded derivatives is clear evidence that standardization has costs for end-users.

In the fall of 2008, many executives were complaining that the market for CDS was being manipulated so that increases in CDS premiums created panic and drove down stock prices. There were extreme movements in CDS premiums, but in troubled times it can be difficult to assess whether such extreme movements are irrational or reflect actual changes in default probabilities and recovery estimates. At times, the cost of insuring Morgan Stanley's debt was in excess of 1,500 basis points per year (in other words, to insure \$100 principal amount of debt,

²⁸ See, for instance, Goldstein, Hotchkiss, Sirri (2007).

you would have to pay \$15 per year).²⁹ The argument that there was manipulation only made sense to the extent that data on CDS premiums was public and widely followed. However, information reported about CDS premiums does not indicate how deep the market is. It is hard, if not impossible, to successfully manipulate a liquid market through trading. If the market for CDS on a name is not highly liquid at a point in time, however, that market could be manipulated, in that small trades could move prices. Usually, such manipulation might not be profitable because if the market is not liquid it is difficult to establish large positions to take advantage of the manipulation. With CDS, however, the manipulator might be able to benefit by establishing positions in the name's stock and debt. Hence, few well-placed trades in the name's CDS could give the impression that the name is in trouble, which would drive down the name's stock price and debt prices. The manipulator could then benefit by having established short stock and debt positions. It would make sense that financial institutions could be especially vulnerable to such actions because they are susceptible to runs.

So far, despite all the talk of manipulation, the SEC has filed no action on manipulation. This may mean that there is no evidence. But it could also mean that, because of the lack of trade reporting, it is too difficult to find such evidence. Again, however, it is important to separate transparency to regulators from transparency to the public. Regulators can only investigate manipulation if they can find who traded what and when. Trade reporting could also help in identify potential insider trading, as there is evidence in the literature that investors at times can use the CDS market to exploit insider information.³⁰

Exchanges of information, including text messages, among CDS traders have been viewed with suspicion. However, the fact that traders in CDS exchange a lot of information during the day is not evidence of manipulation. Dealer markets work through traders talking to each other.

²⁹ Even firms like Berkshire Hathaway have experienced sharp increases in the cost of protection – from early September to mid-November 2008, the cost of insuring Berkshire Hathaway's debt increased from 140 basis points a year to 415 basis points a year, apparently on rumors that a derivatives bet could turn out to be hugely expensive.

³⁰ See Acharya and Johnson (2007).

That is partly how liquidity is created. Traders who attempt to manipulate the market can be punished by the traders who then refuse to trade with them or exchange information with them.

The chairman of the SEC and others have expressed concerns about naked positions in CDS – i.e., situations where an investor buys protection without owning bonds issued by the name – because they enable investors to effectively sell debt short and, presumably, to push debt prices to levels not justified by fundamentals.³¹ As already discussed, the ability to sell short can make markets more efficient. However, it is also possible that at times the ability to sell short can make markets inefficient, perhaps through the manipulation discussed earlier. Though it is generally believed among financial economists that restrictions to trade in assets and derivatives hurt efficiency, neither the theoretical case for this belief nor the empirical evidence are completely unambiguous.³² For instance, the ability to trade CDS at low cost could make it easier for uninformed investors to move prices influenced by sentiment. In crisis periods, well-informed investors might be constrained in their ability to deploy capital to correct the impact on prices of uninformed investors, so that the ability to take short positions on a firm’s credit through the CDS market might actually be destabilizing.³³ Perhaps this kind of mechanism explains that more than two months after the failure of Lehman a prominent observer could conclude that “now CDS spreads tell us precisely nothing about expected default rates.”³⁴

Prohibiting naked positions in CDS would destroy most of the CDS market. Derivatives markets are liquid because of speculators and because of dealers. If a market is reduced to having only hedgers, the market cannot be liquid and little hedging takes place. Speculators have to be able to trade on either side of a market for there to be trading in that market. Prices cannot be efficient if investors who see profit opportunities cannot exploit them. Dealers have to be able to

³¹ Note that naked positions in CDS have no resemblance to naked short positions in the stock market. Naked short positions in the stock market are illegal and are positions where the short-seller fails to deliver the stock sold short.

³² Khanna and Matthews (2009) show conditions under which manipulation through short-sales can succeed and make the market inefficient.

³³ See Shleifer and Vishny (1997) for an analysis of this issue.

³⁴ Felix Salmon, “In defense of the CDS market,” Portfolio.com, December 9, 2008.

offset their positions to manage their risks. The CDS market would stop being a source of credit information and a means of credit hedging if buyers of protection could only do so if they owned the underlying bond. There is no evidence I know of which suggests that removing naked buying of protection would help the economy any more than attempts to reduce stock short-sales did – most likely, once the scientific evidence is in, we will find out that the attempts to reduce short-sales of stocks hurt the stock market and the economy and worsened the credit crisis.

8. Conclusion

Fundamentally, the dramatic problems of the credit crisis were not caused by derivatives. Neither Bear Stearns nor Lehman failed because of derivatives. AIG could have made the same losses as it made on selling protection on CDOs had it borrowed to buy super-senior tranches of CDOs, believing that such tranches were safe, and in fact it did. Investors and financial institutions generally believed that ex ante AAA tranches of securitization had a very small probability of default. Ex post, it turned out that many AAA tranches unexpectedly lost a lot of value. Because these tranches were held in large amounts by levered institutions, the losses on these tranches led to knock-on losses, reduced confidence in financial institutions, and made it harder for banks to make loans. In all this, derivatives exposures at times increased uncertainty about the financial health of some institutions and led to losses at some institutions, but they also enabled institutions to hedge and hence to reduce the impact of the fall in subprime securities and in other securities. It may well be that more robust derivatives markets in housing would have produced useful information for investors that would have changed the evolution of housing markets before the crash and would have enabled investors to hedge against drops in house prices.

Economists have generally believed that derivatives increase economic welfare by facilitating risk-sharing among investors, by improving price discovery, and by making the allocation of capital more efficient. These arguments apply as well to credit derivatives. However, as we have

seen repeatedly in this paper, there are legitimate reasons to be concerned about potential problems that can be created because of exposures to derivatives and because of the trading of derivatives. A growing number of financial economists are concerned that these problems were not just potential problems and that in fact derivatives did destabilize markets. With their arguments, it is legitimate to ask whether the social benefits of some types of derivatives are large enough to offset their costs. It is fair to say that, at this time, while the theoretical literature can be used by each side to make its case, there is a dearth of serious empirical studies on the social benefits and costs of derivatives that would help in advancing this debate. Without such studies, it will be more difficult for financial economists who view derivatives to be valuable to convince their colleagues – and a large share of the public – that derivatives contribute to social welfare and played a positive role in the extraordinary economic growth of the last thirty years.

References

- Acharya, Viral V., Robert F. Engle, Stephen Figlewski, Anthony W. Lynch, and Marti G. Subrahmanyam, 2009, Centralized clearing for credit derivatives, in Restoring financial stability, Viral V. Acharya and Matthew Richardson, editors, Wiley, New York, New York.
- Acharya, Viral V., and Timothy C. Johnson, 2007, Insider trading in credit derivatives, *Journal of Financial Economics* 77, 110-141.
- Aggarwal, Rajesh, and Guojan Wu, 2006, Stock market manipulations, *Journal of Business* 79, 1915-1953.
- Ashcraft, Adam B., and Till Schuerman, 2008, Understanding the securitization of subprime mortgage credit, unpublished working paper, Federal Reserve Bank of New York, New York, NY.
- Bank of England, 2008, Financial Stability Report, Issue 23.
- Blanco, Roberto, Simon Brennan, and Ian W. Marsh, 2005, An empirical analysis of the dynamic relation between investment-grade bonds and credit default swaps, *Journal of Finance* 60, 2255-2281.
- Cohan, William D., 2009, *House of cards*, Doubleday, New York, NY.
- Diamond, Douglas W. and Robert E. Verrecchia, 1987, Constraints on short-selling and asset price adjustment to private information, *Journal of Financial Economics* 18, 277-312.
- Duffie, Darrell, Nicolae Garleanu, and Lasse Pedersen, 2005, Over-the-counter markets, *Econometrica* 73, 1815-1847.
- Duffie, Darrell, and Haoxiang Zhu, 2009, When does a central clearing counterparty reduce counterparty risk, unpublished working paper, Stanford University, Palo Alto, CA.
- Goldstein, Michael A., Edith S. Hotchkiss, Erik R. Sirri, 2007, Transparency and liquidity: A controlled experiment on corporate bonds, *Review of Financial Studies* 20, 235-273.
- Goldman Sachs, 2009, Effective Regulation – Part I: Avoiding another meltdown, <http://www2.goldmansachs.com/ideas/public-policy/effective-regulation.html>
- Gorton, Gary B., 2008, The subprime panic, unpublished working paper, Yale University, New Haven, CN.
- Grossman, Sanford J., and Merton H. Miller, 1987, Liquidity and market structure, *Journal of Finance* 43, 617-633.
- ISDA, 2009, Operations benchmarking survey, ISDA, New York, NY.
- Khanna, Naveen, and Richmond D. Matthews, 2009, Bear raids and short sale bans: Is government intervention justifiable, unpublished working paper, Michigan State University, East Lansing, MI.

- Longstaff, Francis A., Sanjay Mithal and Eric Neis, 2005, Corporate yield spreads: Default risk or liquidity? New evidence from the credit default swap market, *Journal of Finance* 60, 2213-2253.
- Markit, 2009, The CDS Big Bang: Understanding the changes to the global CDS contract and North American Conventions, available at http://www.markit.com/cds/announcements/resource/cds_big_bang.pdf.
- Moody's, 2008, Corporate one-to-five-year rating transition rates, special comment, Moody's, New York, NY.
- Minton, Bernadette, René M. Stulz, and Rohan Williamson, 2009, How much do banks use credit derivatives to hedge loans?, *Journal of Financial Services Research* 35, 1-31.
- Pirrong, Craig, 2009, The economics of clearing in derivatives markets: Netting, asymmetric information, and the sharing of default risks through a central counterparty, unpublished working paper, University of Houston, Houston, TX.
- Shleifer, Andrei, and Robert W. Vishny, 1997, The limits of arbitrage, *Journal of Finance* 52, 25-55.
- Stanton, Richard, and Nancy Wallace, 2009, The bear's lair: Indexed credit default swaps and the subprime crisis, unpublished working paper, University of California at Berkeley, Berkeley, CA.
- Tett, Gillian, 2009, *Fool's Gold*, Free Press, New York, NY.
- Yavorsky, Alexander, 2009, Analyzing the potential impact of credit default swaps in workout situations, Moody's Investors Services, New York, NY.

Figure 1. Credit default swaps notional amount outstanding, 2004-2008.
The data is obtained from the BIS bi-annual derivatives survey.

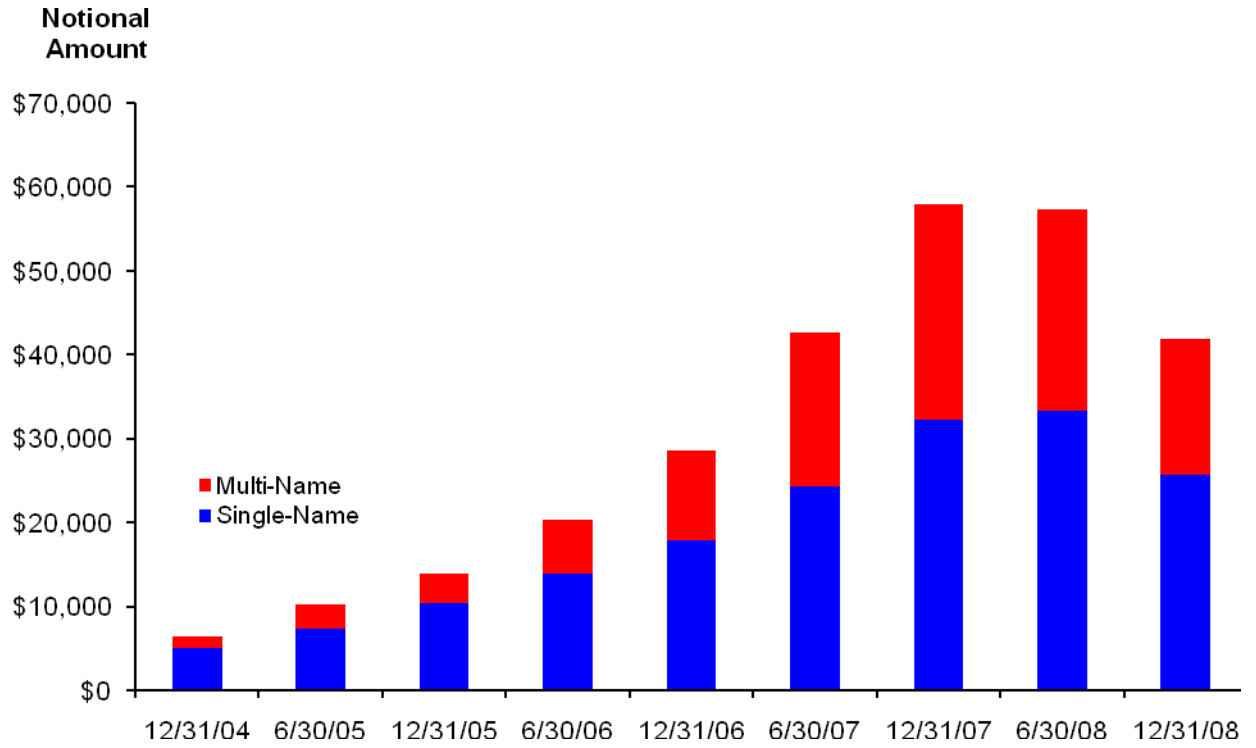


Figure 2. Market value of credit default swaps outstanding, 2004-2008.
The data is obtained form the BIS bi-annual derivatives survey.

