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Credit Default Swaps and the Credit Crisis

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Credit default swaps are a subject of considerable ambivalence. On one side, they seem like straightforward financial derivatives that serve standard useful functions: making it easier for credit risks to be borne by those who are in the best position to bear them, enabling financial institutions to make loans they would not otherwise be able to make, and revealing useful information about credit risk in their prices. On the other side, in trying to understand the credit crisis, many observers have identified credit default swaps to be a prominent villain. One segment of the "60 Minutes" television show on October 26, 2008, called credit default swaps on subprime mortgages the "bet that blew up Wall Street." Searching the Internet on Google, a search under "worst Wall Street invention" came up with credit default swaps as the first entry. George Soros, the prominent hedge fund manager, and many others want most or all trading in credit default swaps to be banned.

My focus in this paper is on how credit default swaps may have contributed to the credit crisis. I first review the mechanics of credit default swaps in their most straightforward use—providing insurance against the default of individual companies—before turning to how they were used to take positions on subprime mortgages. I examine the size and growth of the credit default swap market. I then turn to arguments as to how credit default swaps may have contributed to the crisis: that financial derivatives in general and credit default swaps in particular enabled an unsustainable credit boom, excessive risk-taking by financial institutions, and even market manipulation. I show how derivatives positions create a web

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of linkages across financial institutions and assess the argument that this web made the financial system significantly less safe and forced taxpayers to bail out financial institutions. I then consider the claim that if credit default swaps were traded on an exchange or through a clearinghouse, rather than over the counter through bilateral contracts between sellers and buyers of protection, it would eliminate much of the risk they might pose to the financial system. I conclude with some thoughts about the difficulties of assessing the social costs and benefits of credit derivatives in the aftermath of the credit crisis.

Credit Default Swaps on Companies

There is nothing particularly exotic about credit default swaps. They are as easy to understand as insurance contracts. The best way to understand a plain vanilla credit default swap is as an insurance contract against the cost of default of a company, which is referred to as the "name" or the "reference entity." Suppose that you hold Ford bonds and are concerned about Ford's default risk. You could insure your bond holdings with a credit default swap. As with a typical insurance contract, you pay premiums over time. If Ford does not default, you lose the premiums. If Ford does default, 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. Your Ford bonds could lose value even if Ford does not default—for instance, if interest rates increase or Ford's credit falls without a default—but you only receive payment from a credit default swap in the case of an actual default (and in the event of a debt restructuring for some contracts).

However, the parallel between insurance contracts and credit default swaps does not hold in two important ways. First, you do not have to hold the bonds to buy a credit default swap on that bond, whereas with an insurance contract, you typically have to have a direct economic exposure to obtain insurance. Because you don't have to hold bonds, the amount you insure with a credit default swap is usually called the notional amount. If you buy a credit default swap on Ford for a notional amount of $100 million, you have insurance on $100 million of principal amount of Ford bonds. Second, insurance contracts (mostly) are not traded; in contrast, credit default swap contracts do trade over the counter—that is, a market where traders in different locations communicate and make deals by phone and through electronic messages. Dealers trade with end users as well as with other dealers.

The Depository Trust & Clearing Corporation (DTCC) keeps a record of outstanding credit default swaps involving major dealers as counterparties.[1] For the

[1] Data on subprime credit default swap positions only became available late in fall 2008 through the DTCC data warehouse. These data are incomplete. The DTCC estimated that less than 1 percent of the credit default swaps registered with it involved the ABX as of early November 2008. It is possible

week ending on May 15, 2009, for example, the DTCC had 5,387 credit default swap 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 credit default swaps 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 billion. It is not unusual for the total notional amount of credit default swaps written on a name to exceed the total amount of debt issued by that name—a point to which I will return.

There are also traded indices based on credit default swaps, which are averages of these contracts on different names. There are indices for corporates for Europe (iTraxx Europe), the United States (CDX North America), as well as other regions. The iTraxx Europe index, for example, represents a basket of 125 credit default swaps. In addition to traded indices, customized indices of credit default swaps are also available.

In principle, credit default swaps should make financial markets more efficient and improve the allocation of capital. 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. Instead, credit risk can reside with the investors who are best equipped to bear it. Separating the cost of funding and the credit risk also introduces greater transparency in the pricing of credit. Taken together, these benefits from credit default swaps should reduce the cost of capital for firms.

For example, the credit default swap market turns out to be a better place to assess a company's credit risk than the market for that company's bonds. An empirical study of how information gets incorporated by Blanco, Brennan, and Marsh (2005) shows that information mostly flows from credit default swap prices to bond prices. After all, abstracting from market frictions, the price of a credit default swap is purely about the expected default loss and thus is not affected by all the contractual provisions of a bond like covenants, coupon, maturity, and so on. Further, liquidity should be less of a factor in the pricing and trading of credit default swaps than of bonds because bonds involve funding. The credit default swap market for a name can therefore often be more liquid than the market for the name's bonds.

Finally, if you believe that a company's risk of default is about to increase, it can be difficult to sell short a company's bonds, or certainly its loans. However, by buying protection, you have the same economic benefit in the event of default as if you had a short position in the bond. If you sell a bond short when it trades at 100 and it trades at 50 after default, you earn 50 abstracting from the costs of selling short. If you buy protection at 100, you receive 50 upon default, but have to pay the cost of protection. Many economists argue that the existence of short-selling makes a market react more

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that the size of the subprime credit default swap 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. For example, AIG contracts involving subprime collateral not indexed to the ABX would not be registered.

quickly to new information (for a model, see Diamond and Verrecchia, 1987). But as we will discuss later, some have argued that the ability to take short positions through the credit default swap market has made this market destabilizing.

The greater efficiency of the credit default swap market in incorporating information benefits the pricing of all securities of a firm. However, the separation of risk bearing and funding made possible by credit default swaps can create problems as well in incentives for monitoring and for working out situations of financial distress.

As an example of a problem with incentives for monitoring, consider a bank that made a large loan to a firm and then buys credit default swap protection against a default of that loan. If the bank has protected itself by buying protection, its incentives to monitor the loan may have become less powerful. Of course, 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, there may be too little monitoring of the firm.

However, in practice, banks have many reasons to monitor their borrowers so that the effect of hedging on their monitoring incentives need not be material. Moreover, the ability of banks to hedge loans that they make also has benefits. For example, banks can keep lending to firms with which they have close relationships, even when they have already lent large amounts, because they can limit their risk exposure to such firms through the use of credit default swaps. As a result, firms can get more credit than they would otherwise receive and on better terms. In the past, the use of credit default swaps by banks has been surprisingly limited. In Minton, Stulz, and Williamson (2009), my coauthors and I show that only 23 U.S. bank holding companies had credit default swaps positions in 2005 and, using a proxy for hedging, that they hedged on average 2 percent of their loans with these instruments. A possible reason why banks' use of credit default swaps to hedge is limited is that, while the credit default swap market is typically quite liquid for large companies, it is usually not liquid for the smaller companies to which banks make a lot of loans.

The availability of credit default swap contracts can change the incentives of investors, too. 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 credit default swap, as Yavorsky (2009) discusses in detail. Some credit default swap contracts treat a restructuring of debt as an event that causes a payout; others do not. An exchange of new bonds for old bonds; for example, will not trigger payment under a credit default swap. An investor in this situation might prefer to drive the firm into bankruptcy, and thus trigger payments under the credit default swap, rather than work out a refinancing plan.

Credit Default Swaps on Subprime Mortgage-Backed Securities

As with other mortgages, subprime mortgages are securitized: that is, the mortgages are placed in a pool (typically set up as a trust) and notes are issued

against that pool. These notes, often called tranches, differ in their priority in receiving payments. The most senior tranche has a first claim on interest payments and mortgage payoffs. The super-senior notes always have a AAA rating. If and when mortgages default, the lowest-rated tranches 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. Ashcraft and Schuermann (2008) offer a more detailed description of the securitization of subprime mortgages and the problems that can arise.

Consider now super-senior AAA-rated debt issued against a pool of mortgages. A financial institution holding that debt, who wishes to insure it, could do so by purchasing protection through a credit default swap. However, a problem arises here. The default of a debt-holder like Ford is a well-defined event, typically leading to bankruptcy or restructuring. But when holding a tranche of subprime securitized debt, a rising level of defaults on the underlying mortgages leads to a reduction in debt payments, but the lower payments do not lead directly to a bankruptcy filing and the debt keeps making payments.

Because of this difference, credit default swaps written on securitized debt work differently from those 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 credit default swap. Moreover, the credit default swap would still exist after that payment and would make payments as further mortgages default until maturity of the contract.

In 2006, the ABX indices on subprime securitizations were introduced, representing a basket of credit default swap contracts on securitized subprime mortgages. An index would be based on an average of credit default swaps for same seniority securitization tranches. For instance, the AAA index for 2007-1 was based on an average of individual credit default swaps on the largest AAA-rated securitization tranches issued in the second half of 2006. In 2007, these indices fell sharply, reflecting a loss in value of subprime securities. These indices introduced greater transparency in the market for subprime debt as their trading facilitated price discovery for that debt. The ABX indices made it possible for investors to take views on the subprime market without owning subprime mortgages directly or indirectly as well as to obtain insurance for subprime exposures. The indices also made it possible for investors to take more exposure to subprime mortgages than there were such mortgages.

Though credit default swaps based on subprime mortgages provided investors with several valuable benefits, including improved price discovery and an ability to hedge the risks of subprime mortgages, many questions have been raised about whether the market for these instruments was efficient. For instance, the Bank of England (2008) argues that the ABX indices overreacted to the troubles of the subprime market. Future academic research will eventually show whether such

overreactions occurred. For now, it's clear that credit default swaps on complicated debt instruments such as securitized subprime mortgages can be hard to price.

In principle, the hedging benefit of credit default swaps should have made it possible for subprime risk to be located with those investors and institutions for which bearing such risk was most efficient. However, there are two problems with this simple view. First, the sellers of these credit default swaps, including some specialty "monoline" insurance companies[2] that had historically mostly insured municipal bonds, as well as the well-known case of AIG, ultimately did not have the ability to bear the risks they took on, so some of the hedging benefit of credit default swaps turned out to be illusory (or would have turned out that way without taxpayer support). Second, because of their built-in leverage, credit default swaps may make it possible for investors to take riskier positions than they could otherwise. To the extent that the most optimistic and least risk-averse investors may be those whose investment opportunities are expanded by the availability of these instruments, these instruments may lead to price distortions where risk is underpriced. Before the credit crisis, the compensation required by investors to bear the risk of high yield debt (so-called "junk bonds") was at historic lows. Future research will hopefully help us understand whether the price of credit risk was ultimately too low and whether credit default swaps played a role in making it too low if it was. If these instruments contributed to a false sense of safety of investors through hedges that were more imperfect than they thought and led to prices that underestimated risk, they may have led to an excessive build-up of subprime exposures. Ultimately, however, such arguments rely not on the properties of credit default swaps, but on market inefficiency brought about by limits of arbitrage—because otherwise arbitrageurs could exploit any mispricing of risks.

The Size of the Credit Default Swap Market

Back in the mid-1990s, one of the first credit default swaps provided protection on Exxon by the European Bank for Reconstruction and Development to JP Morgan (Tett, 2009). It took months to negotiate. By 1998, the total size of the credit default swap market was a relatively small $180 billion (Acharya, Engle, Figlewski, Lynch, and Subrahmanyam, 2009). The credit default swap market has grown enormously since then, although there is no definitive measure of how much.

Based on survey data from the Bank for International Settlements (BIS) at ⟨http://www.bis.org/statistics/derstats.htm⟩, the total notional amount of the credit default swap market was $6 trillion in 2004, $57 trillion by June 2008, and $41 trillion by the end of 2008. Credit-default swap contracts that insure default risk of a single firm are called single-name contracts; in contrast, contracts that provide protection against the default of many firms are called multi-name contracts.

[2] They are so named because they provide only one type of insurance contract, that is they have only one line of business.

In 2004, single-name contracts were 80 percent of the credit default swap market; at the end of June 2008, these single-name contracts were only 58 percent of the market.[3] Based on data from the DTCC, the size of the credit default swap market was $29 trillion on May 22, 2009. It's possible that the survey measure from the BIS inflates the size of the market somewhat by leading to some double counting; it's also likely that because not all contracts are registered with the DTCC, the DTCC underestimates the size of the market to some extent. Of the $29 trillion of credit default swaps registered with the DTCC on May 22, 2009, $15 trillion were single-name swaps.

As with all derivatives, the total notional amount outstanding of credit default swaps and the market value of such contracts differ considerably. In the credit default swap market, for each buyer of protection, there is a corresponding seller of protection. From that perspective, the total market value of outstanding credit default swaps is zero.

Moreover, while the notional value of credit default swaps is established at the time they are created, the market value of the protection bought through credit default swaps varies with market conditions. At inception, a credit default swap's value is zero for the protection buyer because the value of the protection obtained is equal to the present value of the payments the protection buyer will have to make. The value of the credit default swap subsequently falls if default becomes less likely and increases if default becomes more likely. The value of the credit default swap depends on many factors, though. For instance, the protection buyer could make a profit even though the probability of default stays unchanged because the amount expected to be recovered in the event of default falls so that protection becomes more valuable.

Table 1 shows the evolution of the market value of credit default swap contracts from 2004 to the end of 2008. In 2008, the market value of credit default swaps fell when measured using the total notional amount of the contracts, but it almost tripled when measured using the market value of the outstanding swaps. Such an evolution is not surprising because default risks increased for many companies in 2008.

Counterparty Risks and the Financial Crisis

In many ways, the credit default swap market worked remarkably well during much of the credit crisis. Despite huge and unexpected losses in underlying mortgage securities and near chaos in the financial sector at times, the credit default swap market remained fairly liquid for long periods over the last two years. Further, the market handled extremely large defaults efficiently. A good example is how well it processed the default of Lehman.

[3] The International Swaps and Derivatives Dealers Association (ISDA) conducts a survey of the credit default swaps market as well. Its estimate for mid-year in 2008 is slightly lower and shows a decrease from the end of 2007.

Table 1
Credit Default Swaps (CDS) Notional and Market Values Outstanding

	Notional amount outstanding (in billions of dollars)			*Gross market values (in billions of dollars)*		
Period	*Single-name CDS*	*Multi-name CDS*	*All CDS*	*Single-name CDS*	*Multi-name CDS*	*All CDS*
12/31/04	5,117	1,279	6,396	112	22	133
12/31/05	10,432	3,476	13,908	171	71	243
12/31/06	17,879	10,771	28,650	278	192	470
12/31/07	32,246	25,648	57,894	1,143	859	2,002
06/30/08	33,334	23,991	57,325	1,889	1,283	3,172
12/31/08	25,730	16,138	41,868	3,695	1,957	5,652

Source: Bank for International Settlements.

The notional amount of protection bought on Lehman was unclear at the time of the bankruptcy. Estimates for the total notional amount of credit default swaps written on Lehman ranged from $72 billion to $400 billion.[4] The lower-end estimate is firm: 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. The net exchanges of cash for Lehman, despite wild rumors in the markets, were rather small: $5.2 billion were exchanged through the DTCC. Many institutions were both buyers and sellers of protection on Lehman, which contributed to keeping the net positions small. As mentioned before, not all contracts are registered through the DTCC, and surely some additional contracts referencing Lehman existed, but there is no evidence that the additional contracts were especially difficult to settle either or that parties defaulted on these contracts.

If the credit default swap market worked well, why is it considered to have been so dangerous? Credit default swaps were clearly part of the story of how banks and other financial institutions ended up holding mortgage securities on which they made large unexpected losses. 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 (for examples, see Goldman Sachs, 2009). Further, some financial institutions apparently believed that it was advantageous for them to hold super-senior tranches of securitizations on their books if they insured them with credit default swaps. Regulators across countries allowed financial institutions to set aside less capital because these institutions had bought protection through credit default swaps. There was therefore a large demand for

[4] The $72 billion figure is the amount reported by the DTCC for swaps that settled through the DTCC. The $400 billion figure 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"(FT.com, 2008).

insurance of super-senior tranches that was partly met by credit default swaps from AIG. However, the losses on credit default swaps referencing subprime mortgage securitizations came about because of defaults on subprime mortgages and because of disappearing liquidity for such securitizations. The credit default swap market caused neither the mortgage defaults nor the disappearance of liquidity. Though some market participants were surely too optimistic about the prospects of the subprime market, credit default swaps on subprime securitizations cannot be blamed for that excessive optimism. In fact, it is more likely that the ABX indices made it harder for investors to remain excessively optimistic.

Many observers have focused on problems caused by counterparty risk in arguing that derivatives and especially credit default swaps made the credit crisis worse. The argument has two parts. First, derivatives lead to a huge web of exposures across financial institutions. If an institution fails in this web of exposures, it can lead other institutions to fail as they make losses on their exposures. As a result, this web of exposures could lead to a collapse of the financial system and to considerable uncertainty about the solvency of financial institutions in the event of the failure of a major financial institution. Second, credit default swaps heighten this concern because their value jumps, and often by large amounts, when a default occurs. I examine these arguments in turn.

When Lehman failed, it had close to one million derivatives contracts on its books with hundreds of financial firms. Some of these firms expected to receive payments from Lehman on their derivatives. Suddenly, Lehman was no longer in a position to make these payments because it had filed for bankruptcy. One might therefore be concerned that these firms became financially weaker, leading to contagion of Lehman's problems through losses on derivatives contracts because of the failure of a counterparty. However, the typical derivatives transaction uses protections against the risks of a counterparty not meeting its obligations. The biggest protection is generally the use of collateral, and usually the amount of collateral insuring a counterparty's performance on a contract changes with the value of the contract. Consider bank Y that had derivatives positions with Lehman which cost $100 million to bank Y to replace. If bank Y had $110 million of collateral from Lehman when it failed, bank Y could use the collateral and make no loss from Lehman's failure. Alternatively, had it had collateral for $90 million, it would have made a $10 million loss if it had no recovery from the bankruptcy estate. While collateral arrangements were frequent, they were not universal. According to a survey by the International Swaps and Derivatives Association, 63 percent of derivatives contracts were subject to such agreements in 2007, compared to 30 percent in 2003. Consequently, there is still a possibility of contagion through derivatives exposures. However, that possibility is limited by the incentives of counterparties to manage their exposures actively as counterparty risk changes and by the fact that parties not subject to collateral arrangements are often very highly rated counterparties. At the same time, however, a failure of a financial institution can lead to large changes in derivatives prices as well as in derivatives liquidity, so that the collateral amounts

held immediately before the failure may not be sufficient to cover possible losses if other counterparties default.

Another issue with credit default swaps is that because a default is a discrete event, it can lead to large jumps in the value of these contracts. To see this, suppose that the market expects that there is a 20 percent chance a dealer will default and the recovery is expected to be 40 percent. In the event of default, the value of the bonds falls to 40 percent, the recovery value, so that the bondholder loses 60 percent. The credit default swap pays the 60 percent. Ignoring the time value of money and risk premia, the value of a $10 million notional credit default swap for the protection buyer would be $1,200,000 (there is a 20 percent chance of receiving a payout of (1.00 – .40) × $10 million). At default, the value of the credit default swap would be $6 million. The protection seller would lose $4.8 million on the day of default. Such losses could possibly lead to default by some other party that has a large net exposure as a protection seller. For example, on the last working day before Lehman's bankruptcy filing, it cost roughly $700,000 to insure $10 million of Lehman debt for a year, so that a buyer of protection against Lehman on that day would have earned a huge gain since the swap paid off more than $9 million on settlement. With such jumps to default, collateral will not be enough to protect buyers of protection in the event of a counterparty default, which could then lead to additional failures of financial institutions.

Another reason for concerns about the credit default swaps market is the sheer size of gross exposures of dealers. In 2008, the credit default swap contracts outstanding of JPMorgan Chase had a notional amount of almost $8 trillion, and those of Citibank almost $3 trillion. Investment banks did not provide as much information about their derivatives exposures, but the credit default swaps of Bear Stearns may have amounted to a total notional amount of $2.25 trillion (Madigan, 2008). Under normal circumstances, these gross exposures are not much of a problem. The market value of the credit default swaps of JPMorgan Chase, for instance, was estimated to be just $44 billion—and even that amount substantially overstated the exposure of JPMorgan because it ignores netting agreements and that the bank has collateral for a majority of its contracts. In contrast, JPMorgan Chase's shareholder equity at the end of 2008 was $166 billion.

However, even if a dealer's net derivatives receivables are zero, the dealer might still pose significant risks to the financial system. Consider a dealer who has $1 trillion notional of protection bought and $1 trillion notional of protection sold. Thus, this dealer has $2 trillion of gross exposure, but the net amount is $0. Moreover, suppose that all the dealer's contracts have collateral agreements where the collateral changes daily as the market value of the contracts changes (a feature called mark-to-market), so that those who are on track to lose from the trade must post collateral as these losses accumulate. Even in this case, a default of this hypothetical dealer still has the potential to create havoc in the financial markets. If a major dealer defaults, counterparties to the dealer have to replace the credit default swaps. This process 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.

Though Lehman was a big dealer in credit default swaps, these contracts were not the cause of Lehman's failure. Neither were they the direct cause of Bear Stearns's demise. Lehman and Bear Stearns were dealers, and in credit default swaps, their books were largely balanced and collateral arrangements were in place. 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. It is undoubtedly true that without derivatives, their assets and liabilities would have been quite different, but derivatives were not the proximate cause of their collapse.

AIG is a different and more complex story. Exposure to credit default swaps did play a big role in AIG's failure, but it's worth noting that AIG did not behave like a dealer. It did not run a matched book. It did not appear to hedge significantly. What AIG did was provide credit default swaps 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 were derivatives on super-senior tranches with subprime collateral for a notional amount of $55.1 billion. At the time that AIG wrote the credit protection, all the tranches were rated AAA. The probability of a default on an AAA-rated obligation is in principle extremely small, less than 0.1 percent per year. However, with the major downturn in the U.S. housing market, these tranches lost substantial value and the credit default swap liability of AIG became very large. As losses mounted and the company's credit rating dropped, AIG needed to post ever more collateral until it did not have the cash to post the collateral amounts its agreements required. Importantly, AIG could not meet its obligations not because of realized losses on its credit-default swaps (that is, not because of payouts on the contracts because of defaults) but because of collateral arrangements that required posting of collateral because its credit rating was downgraded.

But even in the case of AIG, credit default swaps were not the only or even the primary reason for its problems—nor were its credit default swaps the only or even the primary reason why the firm was bailed out. AIG didn't just write protection on subprime securitizations, it also borrowed heavily to purchase these securities on its own. In fact, AIG made even larger losses on its portfolio of mortgage-related securities than on its credit default swaps. It's true that the danger of an AIG default on its credit default swaps was of concern to many financial institutions, which as noted before had been encouraged by regulators to purchase such protection. But many financial institutions would also have been largely protected by collateral agreements and by purchases of protection on AIG. An additional danger of an AIG default was that AIG would have defaulted on its debt and commercial paper at a time in September 2008 when there already was a run on money markets.

Transparency, Instability, and Manipulation

One of the main arguments for financial derivatives like credit default swaps is that by enabling the trading of specific risks, they help make financial markets more efficient and transparent in price discovery and increase liquidity. However, in the fall of 2008, many executives were complaining that the market for credit default swaps was being manipulated. Of course, it is very difficult to manipulate profitably a highly liquid market through trades, but in the fall of 2008, many financial markets were not always liquid. Thus, the accusation was that few well-placed trades in the name's credit default swaps could give the impression that the name was 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. Financial institutions could be especially vulnerable to such actions, because they are susceptible to runs.

There were extreme movements in credit default swap premiums in the fall of 2008. The peak cost of insuring Morgan Stanley's debt was roughly 1,500 basis points per year (in other words, to insure $100 principal amount of debt, you would have to pay $15 per year). Even firms like Berkshire Hathaway 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 particular derivatives bet that the company had made could turn out to be hugely expensive.

However, despite all the talk of manipulation, the Securities and Exchange Commission has as of yet filed no action. This may mean either that no manipulation occurred or that in an over-the-counter market it is it too difficult to find evidence of manipulation. After all, regulators can only investigate manipulation if they can find who traded what and when.[5] The fact that traders in credit default swaps exchange a lot of information during the day is not evidence of manipulation. Dealer markets work through traders talking to each other! It was clear in 2008 that regulators had an insufficient understanding of dealers' derivatives exposures and that a better understanding would have been beneficial.

It is conceptually important here to separate transparency for market participants from transparency for regulators. 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, to provide liquidity to clients, or to take advantage of its views on the market. In addition, there have been calls for limiting or banning "naked" positions in these securities—that is, situations where an investor buys protection without owning the underlying bonds or securities. Naked positions are controversial because they enable investors effectively to sell debt short. Financial economists generally believe that short-selling

[5] Trade reporting could also help in identifying potential insider trading, as the literature suggests that investors at times can use the credit default swap market to exploit insider information (Acharya and Johnson, 2007).

helps efficiency, but neither the theoretical case for this belief nor the empirical evidence are unambiguous; for example, Khanna and Matthews (2009) show conditions under which manipulation through short-sales can succeed and make the market inefficient. However, prohibiting naked positions in credit default swaps would essentially destroy this market. If the credit default swaps market is reduced to having only hedgers, with speculators banned, hedgers will not find counterparties because the market will have no liquidity. 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 offset their positions to manage their risks. The credit default swap 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 credit protection—which is equivalent to selling short a name's bonds—would help the economy any more than attempts to reduce stock short-sales did during the crisis. Most likely, once the 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.

How Over-the-Counter Markets and Exchange Trading Work

A popular proposal for reforming the market for credit default swaps is to move trading away from the over-the-counter market, and instead use exchange-based trading. Proponents of such a move argue that exchange trading could greatly reduce the problem of counterparty risk, as well as create greater transparency and order in the market. To get a handle on this argument, this section describes in some detail just how an over-the-counter deal for a credit default swap works, and contrasts it with how exchange trading would work. The next section then evaluates the benefits of over-the-counter markets and exchange trading. It turns out that these are not mutually exclusive options, but rather both choices exist in a number of markets. In addition, there is a third choice—greater use of clearinghouses without exchange trading—which has benefits of its own.

To understand the benefits and costs of over-the-counter trading for credit default swaps, let's start with an example of how it works. Suppose that you are a hedge fund manager who wants to purchase a five-year credit default swap on bank X. You call up dealers like Goldman Sachs, Deutsche Bank, and Natixis to obtain quotes. (There are also some fully automated platforms on which you could trade.) Say Natixis offers the best deal. You agree to make regular payments, say quarterly, at an annual rate of 100 basis points on a notional amount of $10 million. Until March 2009, credit default swaps were 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 regular premium payments he expected to receive in the event of a default of bank X. There has been a push by regulators

and by market participants to standardize credit default swap contracts to reduce the operational risks associated with trading these contracts. In particular, since March 2009, credit default swaps originated in North America have a fixed payment of either 100 basis points or 500 basis points per year.[6] 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. Natixis would therefore immediately look for ways to hedge or transfer its exposure. If Natixis doesn't already have some risk exposure that your swap offsets, 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. Natixis might also implement hedges for its whole portfolio of credit default swaps, instead of attempting to match each individual credit default swap with one that is offsetting. Eventually, however, somebody has to bear the risk from the credit default swap you entered.

Continuing this example, suppose that another hedge fund, Contrarian, now wants to sell protection on bank X and agrees to sell protection on bank X to Goldman Sachs. When this happens, in a sense, you, the hedge fund manager, are buying your protection on bank X from Contrarian. However, three intermediaries make this happen—namely Natixis, UBS, and Goldman Sachs—and you never know that Contrarian is the ultimate seller of protection. More specifically, in this example, there are four credit default swaps of $10 million notional each, which is a way in which the over-the-counter market makes the ultimate size of the market appear larger than in some sense it truly is.

Now the trade has to clear, which means that both you and Natixis have to ratify the agreement formally. The trader at Natixis will be off to other trades immediately after talking to you. Back offices now get involved. However, when the back office from Natixis contacts your back office, due to some misunderstanding they may believe they have a contract on $20 million notional instead of $10 million notional. At that time, this disagreement would have to be resolved. The "clearing process" for derivatives consists of all the steps that take place from the trade completion to the settlement. The "settlement" occurs 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. When the market for credit default swaps expanded rapidly in the mid-2000s, a number of banks and dealers skimped on their back offices, and there was a pervasive if usually low level of uncertainty

[6] A number of changes took place in North America for credit default swap contracts in April 2009. These changes are generally described under the name of the "CDS Big Bang" (Markit, 2009). The objective of these changes was to standardize the single-name credit default swap contracts.

as to the status of credit default swaps. The New York Fed worked hard to get the industry to solve these problems and had significant success. That success had limits: after Bear Stearns was acquired by JPMorgan Chase, its new owners discovered a large amount of unconfirmed credit default swaps (Tett, 2009, p. 224).

The run-of-the-mill outcome here is that after you enter the contract, you hold on to the contract until either bank X defaults or the credit default swap matures. But two other possibilities are interesting: 1) you might decide you want to exit the contract or 2) your counterparty, in this case Natixis, might become unable to honor its contract.

If you, the hedge fund manager, wish to exit your credit default swap position, there are at least three ways to proceed: 1) go to Natixis and negotiate terms for termination, which may involve payments depending on how the market has evolved since the agreement was made; 2) enter into a contract to sell protection in a way that exactly offsets your original contract; or 3) enter an agreement with a dealer, with appropriate payments, that this dealer will take on your obligation to Natixis. Such an agreement is called a novation, and Natixis would have to agree to such a change. 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 take on Bear Stearns as a counterparty.[7]

Now look at the case of counterparty risk. If Natixis fails, the swap is terminated. If bank X's credit worsened, you would have gained on your swap (you have a claim on the bankruptcy estate). If bank X's credit improved, on the other hand, 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. 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 an agreement to post collateral as the market value of the swap evolves. If you suffered a loss in excess of the collateral you had in your possession, you would have a claim against the bankruptcy estate of Natixis.

How would your trade in the credit default swap have worked differently had the credit default swap 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 credit default swap position. On the exchange, your trade would have taken place when somebody else would have been willing to take the opposite position. In contrast to the over-the-counter market, your counterparty would not be a dealer, but it would be the clearinghouse of the exchange; in other words, the promise of your credit default swap contract would be honored as long as the clearinghouse has the resources to do so.

[7] See Cohan (2009, pp. 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.

The ability of the clearinghouse of the exchange 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, each contract is marked to market each day, and the gains and losses are settled. Through judicious use of these margin levels, a clearinghouse can make its risk of default low. There would be no chain of contracts if the contracts were 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 need to do so.

Tradeoffs between Over-the-Counter Trading, Exchange Trading, and Clearinghouses

When the first credit default swaps were introduced in the 1990s, or the first interest-rate swap agreement was introduced in the early 1980s, each new deal took much time and effort. Eventually a modest degree of standardization came to exist, even in over-the-counter trading. For example, as interest rate swaps became better known, the industry formed the International Swaps Dealers Association (ISDA), which devised standardized agreements.[8] When parties trade derivatives, they enter a so-called ISDA Master Agreement. The Master Agreement has many options, each with standard forms. However, the Master Agreement still makes it possible to have 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 over-the-counter markets are so flexible? Exchanges create pools of liquidity by standardization—they have few contract types trading. With this standardization, investors and firms give up the opportunity to obtain a contract that exactly fits their needs for the benefit of trading in a liquid contract.

Exchanges offer an efficient solution to matching buyers and sellers 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. On exchanges, the contracts for future delivery of currencies (futures contracts) mature at specific dates, which might not match the dates when the actual payments are expected. However, an over-the-counter dealer could offer a contract that matures on the day that

[8] ISDA eventually renamed itself the International Swaps and Derivatives Association.

the exporter expects to receive the euros and for the exact number of euros the exporter expects to receive. The manufacturing firm can choose to pay extra for a contract that exactly meets its needs or use the exchange.

One benefit of exchange trading is the existence of a clearinghouse that becomes counterparty to all trades. Clearinghouses are also used for some derivatives trades in the over-the-counter market. Indeed, regulators have been pushing hard for the use of clearinghouses as counterparties for credit default swaps both in the United States and in Europe. Ice Trust, part of the Intercontinental Exchange, started clearing credit default swap 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 clearinghouses for over-the-counter derivatives trading could decrease the risks posed by derivatives exposures for the financial system for several reasons. First, a clearinghouse can diversify and manage risks associated with the failure of individual counterparties, so that counterparty risk is reduced. Second, if a dealer uses a single clearinghouse, that clearinghouse can net out all of a dealer's exposures, which also reduces counterparty exposure. Third, a clearinghouse can monitor the exposures of its counterparties and can prevent counterparties from taking additional exposures.

The use of clearinghouses is not a panacea to eliminate systemic risk associated with over-the-counter trading of derivatives (Pirrong, 2009). A dealer who trades hundreds of times a day with another dealer most likely will have a better assessment of the credit of that dealer than would a clearinghouse that interacts with the dealer for only one type of derivative trade. In addition, a clearinghouse is inefficient at dealing with products that are not very liquid—which means most new financial products and customized derivatives. The resources of clearinghouses are limited. For instance, CME Clearing, the largest futures clearinghouse in the United States, can draw on resources of $64 billion to cope with failures, which might not have been enough to deal with the problems of a huge firm like AIG. Finally, if the economy evolves toward multiple clearinghouses and clearinghouses specialized to derivatives types, it is even possible that the netting that takes place through clearinghouses is less than the netting that would take place without clearinghouses (Duffie and Zhu, 2009).

In summary, the over-the-counter 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 over-the-counter market can compete well with exchanges precisely because of this customization. For example, there is a huge over-the-counter forward currency market—a market for the purchase of foreign currencies for future delivery—and at the same time a large parallel currency futures market on exchanges. The forward and futures currency markets have co-existed for more than 30 years.

Conclusion

Economists have generally believed that financial 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 certainly apply to credit default swaps. 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. In the aftermath of the financial crisis, credit default swaps and other financial derivatives have clearly lost any presumption of innocence that they once enjoyed among economists—and they probably never had such a presumption with the general public. But it would be premature and quite misguided to turn 180 degrees from a presumption of innocence to a presumption of guilt. There is a dearth of serious empirical studies on the social benefits and costs of credit default swaps and other derivatives—not just in the last two years, but in the last several decades.

My own sense is that the deep dramatic problems of the financial credit crisis were not caused by credit default swaps, nor by other financial derivatives. Neither Bear Stearns nor Lehman failed because of derivatives. AIG lost money by selling unhedged credit default swaps, but it also lost money in all kinds of other ways, including by borrowing money to buy super-senior AAA-rated tranches of subprime-mortgage-backed securities. The common denominator of the large losses of AIG was that they occurred on subprime exposures and hence were brought about by a dramatic unexpected fall in house prices.

In my view, the financial crisis was primarily driven by two factors. First, investors and financial institutions generally did not expect that real estate prices would fall dramatically. This dramatic fall in real estate prices led to large defaults on subprime mortgages and large falls in value in securitizations of subprime mortgages. The fall in value was especially dramatic for AAA-rated tranches of subprime securitizations even though few of these tranches have suffered from defaults so far (AAA-rated tranches of securitizations of securitizations, called collateralized debt obligations, *have* suffered default losses). The second factor is that many financial institutions were operating with extremely high levels of leverage and held large investments in subprime securitizations, so that significant unexpected losses on these investments could quickly lead market participants to question their solvency, which led to cash hoarding by these institutions, to fire sales of assets to bring about decreases in leverage, and to a contraction in their willingness to lend.

As these events unfolded, financial derivatives like credit default swaps were associated with losses and uncertainty at some institutions, but also enabled other institutions to hedge and hence to reduce the impact of the fall in subprime mortgage and other securities. Rather than blaming derivatives markets such as the credit default swap market for being too large, it might make as much sense to regret that derivatives markets were not larger. For instance, 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 and

averted or minimized the effects of a crash by enabling investors to hedge against drops in house prices.

However, until a significant empirical literature develops on the costs and benefits of credit default swaps and other financial derivatives in the last few decades, it will be difficult for financial economists who view derivatives to be valuable to convince their colleagues—and a large share of the public—that such derivatives have contributed significantly to social welfare and played a positive role in the robust economic growth of the last 30 years.

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