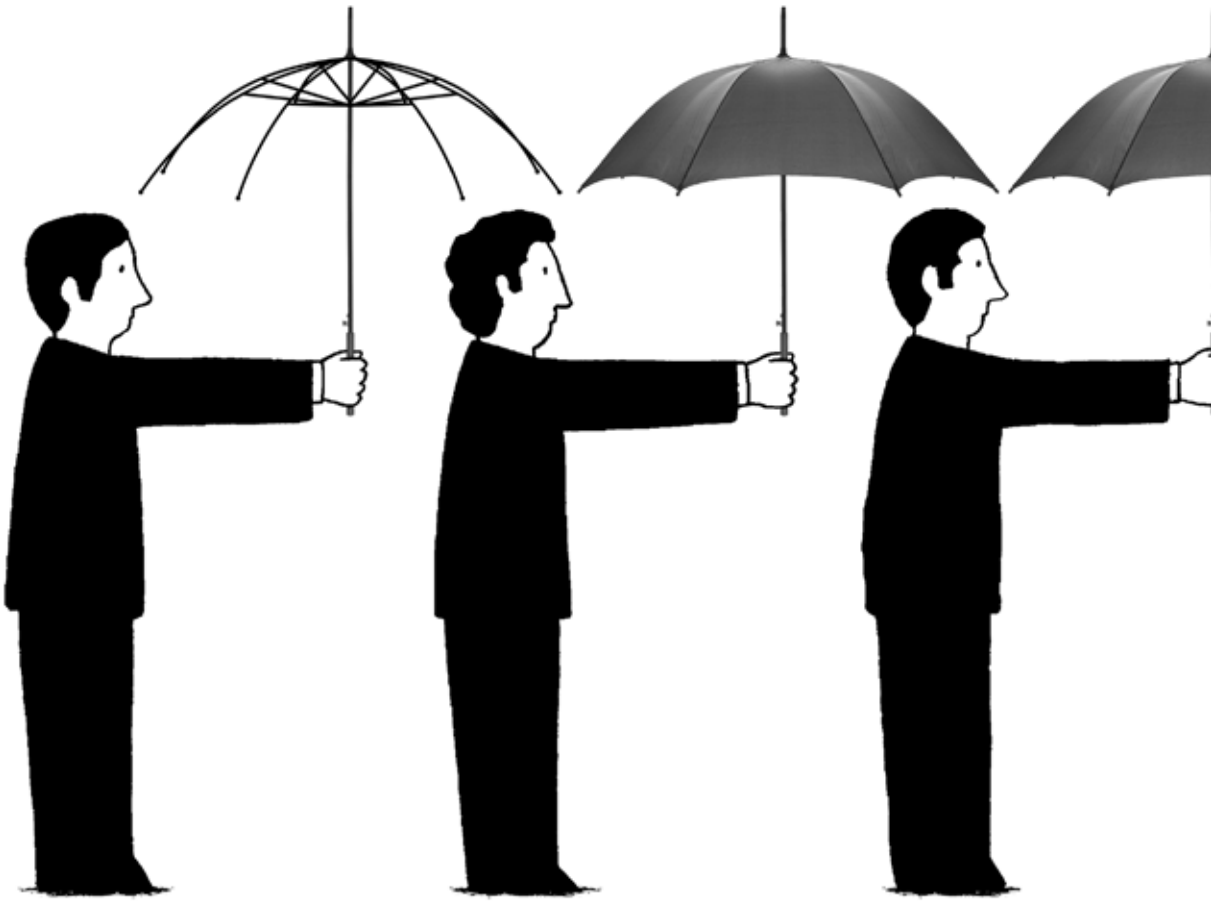
Financial Derivatives

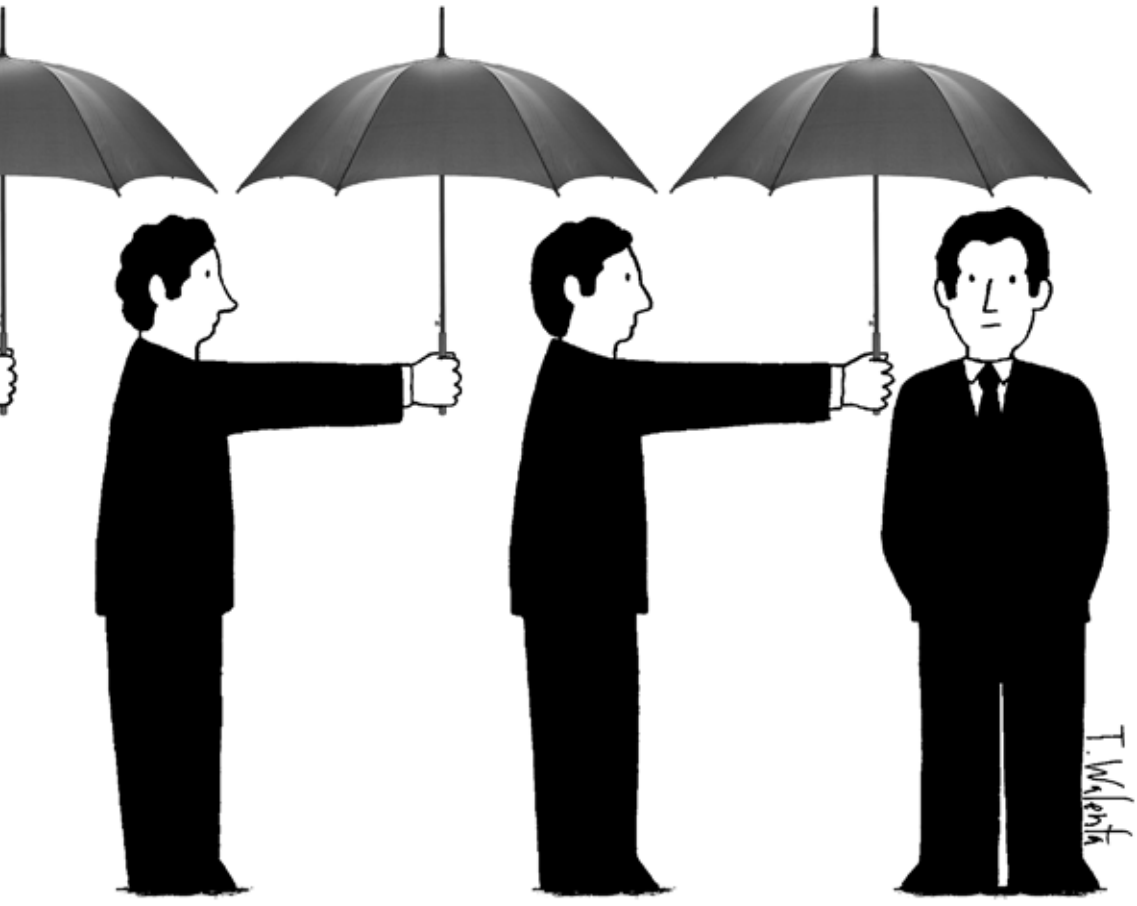
Lessons From the Subprime Crisis

By René M. Stulz



The subprime mess has triggered the most destructive financial crisis since the stock market crash of 1929. It's not surprising, then, that the hunt is on for culprits. And for many, there's no reason to look beyond financial derivatives in general, and credit derivatives in particular. If only Wall Street (and Washington) had listened, they say, when Warren Buffett labeled those derivatives "financial weapons of mass destruction."

I think the case for pinning the blame on these poorly understood financial tools is based on a misunderstanding. There would never have



been a subprime crisis if the housing bubble had not burst. Consequently, for derivatives to be the proximate cause of the crisis, they would have to have influenced the path of housing prices.

To the contrary: I would argue that a well-developed market for housing-price derivatives might have tempered the boom-bust cycle by allowing big market players to signal their growing concerns about escalating prices, and by giving homeowners a means of hedging against the loss of wealth when the housing market headed south. There is, in fact, a market for housing-price derivatives – specifically, for futures contracts on housing price indexes. But this market was small and illiquid, and there is no reason to believe that it had much impact on events.

As Gary Gorton discusses elsewhere in this issue (see page 36), there were also derivatives linked to the performance of subprime-mortgage-backed securities. For simplicity, I'll call them subprime derivatives. The ABX index derivatives that were introduced at the tail end of the housing boom, enabled investors to speculate (or hedge against) subprime risks, and in the process made the crash in the value of subprime mortgage-backed securities more visible. However, to make a crash visible, there has to be a crash – and again, it seems foolish to blame the messenger for the message.

All that said, I won't deny that derivatives played a role – both positive and negative – in the way the crisis unfolded. By the same token, I won't deny that some sort of regulation of derivatives makes sense in light of this. But I worry that the failure to view the impact of derivatives in proper perspective could lead to regulation that does more harm than good.

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THE EXPONENTIAL GROWTH OF DERIVATIVES

Financial derivatives, for those of you who joined this party late, are simply financial contracts in which the promised payoffs are derived from the value of something else – in finance-speak, the "underlying." (Note that securitized debt is not a derivative because the holder of securitized debt has an ownership claim to some of the cash flow from the assets that are securitized.) The underlying is often an asset price (perhaps a stock price) or rate (maybe the interest rate on Treasury bills), but it does not have to be. It could be many other things – for example, a weather variable (like heating degree-days in Chicago, or rainfall in Ghana).

The most familiar derivatives are forward contracts and options. With a forward contract, a party commits to buy (or sell) a financial asset at a specified price at a future date. This "forward price" is set so that the contract/bet has no value when it is entered into – that is, the possible loss equals the possible gain.

With a call option, the holder has the right (but not the obligation) to buy the specified asset for a specified price at (or any time before, in some cases) a specified date. For example, one might purchase an option to buy 100 shares of, say, Bank of America stock at $15 in three months. Such a right has value, since in three months BofA could sell for $25 – in which case the holder of the option would be ahead by $10 a share. And since options confer a right that is valuable, they are bought for a premium.

The largest derivatives market is for swaps. With a swap, two parties exchange the rights to cash flows from different assets. For instance, one party could agree to swap the interest on a fixed-rate bond for the interest on

a floating-rate bond of the same maturity. One may be hedging against a rise in interest rates while the other is speculating against just that prospect.

The principal amount of the bonds is not part of the exchange. Indeed, the parties don't even have to own the underlying securities. That's why the principal is called the "notional amount" of the swap.

company, we do not think of the amount that it insures, but the premiums it receives (and the likely payouts). For derivatives, the premiums correspond to the fair value of the derivatives contracts. Measured this way, the derivatives markets are dramatically smaller – a mere $20 trillion in June 2008. But this number is also growing rapidly: it has almost doubled in the last year.

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It is common to measure the size of derivatives markets by the notional amount outstanding. Measured this way, the derivatives markets are humongous. According to the Bank for International Settlements, the size of the over-the-counter derivatives markets – that is, the derivatives created outside organized exchanges – was $683 trillion in June. Derivatives are also traded on exchanges, but the notional amount of these derivatives is much smaller – roughly $83 trillion at the end of June.

Over the last three decades, outstanding derivatives have increased 300-fold. Yes, 300-fold. When Warren Buffet raised concerns about derivatives in early 2003, the size of the market was $169 trillion – a quarter of its size today.

A good way to put these numbers in perspective is to think of insurance contracts. The maximum amount (often called the policy limit) that could be paid out is the insurance equivalent of the notional amount of a derivative. When we evaluate an insurance

CREDIT-DEFAULT SWAPS

Ten years ago, the market for now-infamous credit-default swaps (CDSs) hardly existed. CDSs trade solely over the counter. The best way to understand a CDS is to think of it as an insurance contract against the risk that a firm will default. If, for example, you own GE bonds and are worried that GE will default, you could insure your holdings with a CDS. As with an insurance contract, you would pay regular premiums to maintain the contract. If GE does not default, you're out-of-pocket the premiums. However, if GE does fail to pay, the CDS gives you the right to exchange the questionable GE bonds for the principal amount, or to be reimbursed for the difference between the face value of the bond and its (lower) market value. Note, by the way, that a CDS on GE bonds does not insure you against market risk – that is, a loss in value caused by changes in market interest rates.

There is nothing particularly exotic about CDSs; they are as easy to understand and to price as life- or casualty-insurance contracts

are. However, with a few exceptions, insurance contracts are not freely traded – the insurance company can't sell your car insurance policy to a hedge fund manager. In contrast, the market for CDSs is highly liquid for many "names" (jargon for the issuer of the debt being insured). This makes it possible for investors to use CDSs to speculate (either way) on the credit of a specific corporation. By the same token, corporations and financial institutions can use CDSs to hedge credit risks. For instance, a bank that lent money to GE could protect itself by purchasing a CDS on the loan from a third party.

Often, the notional amount of CDSs written on a name is much higher than the corporation's outstanding debt. However, such an outcome is not unique to the CDS market – the notional amount of exchange-traded futures contracts on the S&P 500 index is much larger than the capitalization of all the stocks in the S&P 500.

In principle, CDSs make financial markets more efficient by allowing credit risk to reside with the investors most willing to bear it and by introducing 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 these investors can offload the risk when circumstances dictate. Typically, bonds don't trade much, making it hard to assess the credit risk of many companies from the market price of their debt securities. In contrast, trading in CDSs on many names is brisk enough to make it practical to assess credit risk by tracking CDS premiums.

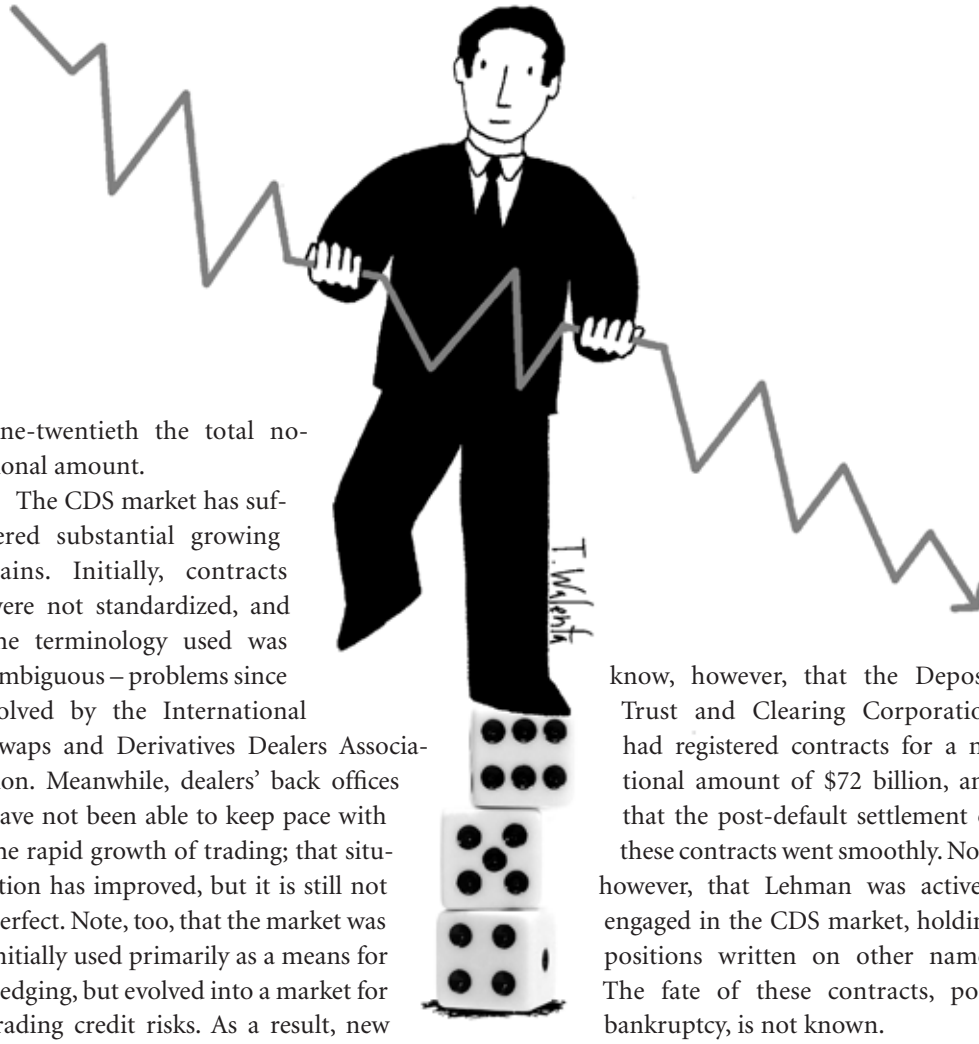
There are several reasons for the high volume of trading in CDSs. First, with a CDS, you don't need deep pockets to take a position. Second, CDSs can be used as insurance for all types of debt issued by a firm, rather than specific bond issues or loans. So the same CDS can be used for hedging by investors who hold different bond issues – or, for that matter, by companies that own receivables from names or by banks that have made loans to them. Banks can thus lend more to accommodate corporations with ongoing relationships, and then hedge themselves against the resulting risk in the CDS market. They can also use information from the CDS market to price loans.

While the value of CDSs as a means for hedging by banks is pretty clear, they have not been used much for this purpose. In my own research with Bernadette Minton of Ohio State and Rohan Williamson of Georgetown Business School, we found that, in 2005, only 23 large United States banks used credit derivatives, and that they used CDSs to hedge an average of just 2 percent of their loans.

The Bank for International Settlements has only published statistics on the CDS market since the end of 2004, when the total notional amount was $6 trillion. By mid-2008, the market had grown to $57 trillion. The private International Swaps and Derivatives Dealers Association also surveys the CDS market; its figure for mid-2008 is slightly lower, and shows a decrease from the end of 2007.

The Deposit Trust and Clearing Corporation, a firm that manages a variety of housekeeping chores for the securities industry, runs a CDS registry. The market, as measured by voluntary registrations with the DTCC, is much smaller – $34 trillion. Most likely, the actual figure is somewhere in between.

As with all derivatives, there is a dramatic difference between the total notional amount outstanding and the market value of the contracts outstanding. The Bank for International Settlements survey puts this latter figure at $3 trillion in June 2008, just



TOMASZ WALENTA (ALL)

one-twentieth the total notional amount.

The CDS market has suffered substantial growing pains. Initially, contracts were not standardized, and the terminology used was ambiguous – problems since solved by the International Swaps and Derivatives Dealers Association. Meanwhile, dealers' back offices have not been able to keep pace with the rapid growth of trading; that situation has improved, but it is still not perfect. Note, too, that the market was initially used primarily as a means for hedging, but evolved into a market for trading credit risks. As a result, new methods for settlements had to be used when defaults took place; with more contracts outstanding than the bonds they insure, settlements of contracts couldn't turn solely on the delivery of the bonds.

I would argue that, despite its short history, the CDS market worked remarkably well during these traumatic times. The market for CDSs written on many corporations remained liquid. Further, the private sector rose to the challenge of operating in the midst of crisis.

Take the case of the Lehman Brothers default. The notional amount of CDSs written on Lehman as a name is not known. We do know, however, that the Deposit Trust and Clearing Corporation had registered contracts for a notional amount of $72 billion, and that the post-default settlement of these contracts went smoothly. Note, however, that Lehman was actively engaged in the CDS market, holding positions written on other names. The fate of these contracts, post-bankruptcy, is not known.

COUNTERPARTY RISKS AND CREDIT-DEFAULT SWAPS

One party to a derivatives contract is generally in the position of a debtor. For instance, with a call option, the writer of the option has to deliver the stock if asked to do so by the option holder. An option may confer the right to purchase a stock for a price that is much lower than the market value of the stock, but that option is, of course, worthless if the option writer can't honor its obligation. The risk that the other party in a derivatives contract will not live up to its obligations is called counterparty risk. And with CDSs, this

risk can be very large.

Consider a hypothetical investor who had bought protection on $50 million of Lehman debt. After the default, this investor was owed a net amount of roughly $45 million, so instead of being owed Lehman's debt by Lehman, the writer of protection became the debtor for $45 million.

Concerns about counterparty risk are no different from the concerns that a buyer of life or casualty insurance would have about the credit of the insurance company. Insurers typically cope with the question by maintaining very conservative balance sheets that merit high credit ratings from the ratings agencies. Similarly, purchasers of credit protection only want to buy credit protection from highly rated sellers.

Often, the purchasers of protection go a step further and require a CDS seller to put up collateral for the full value of the contract. Purchasers of protection may also put in place triggers so that the protection seller has to put up more collateral if its credit worsens. As a result, relatively little extra cash is typically needed for settlement in the event of a default. However, contractual demands for more collateral triggered by ratings downgrades can have a devastating effect on the liquidity of an institution that has written large amounts of protection.

The much-publicized liquidity problem of AIG was largely the result of such margin calls. The AIG situation is unusual, however, because it was mostly a protection writer. Financial institutions more typically are both protection writers and protection buyers.

Counterparty risk is a very serious problem if there is no collateral agreement. In such cases, the buyer of protection may end up with only what it can collect as a creditor

in a counterparty's bankruptcy proceeding. According to a survey by the International Swaps and Derivatives Dealers Association, 63 percent of derivatives contracts were backed by collateral in 2007, up from 30 percent in 2003. And having a collateral agreement is still not enough if the margin is too small.

Counterparty risk is further reduced through netting agreements. If two firms have entered into many derivatives contracts as counterparties, such an agreement will net out the exposures if one firm defaults. Net exposure is often a small fraction of the gross exposure.

SUBPRIME DERIVATIVES

The CDSs we have focused on so far were single-name credit-default swaps. Such CDS contracts effectively provide insurance for debt issued by a single firm. There is also a large market for CDSs based on the value of indexes, which are calculated from the value of credit-default swaps written on multiple names. "Bespoke" (i.e., custom-tailored) CDSs may be linked to a specific basket of names reflecting the insurance needs of the buyer and seller. When the Bank for International Settlements started keeping track of CDS contracts, single-name contracts constituted 80 percent of the market; at the end of June 2008, this figure was down to 58 percent.

What interests people most these days, of course, are CDS contracts on subprime liabilities. Subprime mortgages carry significant default risk. However, as with other mortgages, subprime mortgages are generally securitized. Mortgages are placed in a pool and various securities are issued against that pool. The most highly rated securities backed by a pool are the ones that have the first claim to cash flows of the mortgages. So when mortgages default, the lowest rated securities suffer first. But as default losses mount, the highly rated securities backed by the mortgage pool may suffer losses as well.

Consider a debt security issued against a pool of mortgages. This debt would promise a coupon (that is, a regular interest payment) generally set at a premium above a widely reported market interest rate like the London Interbank Offered Rate (the LIBOR). If a financial institution holding such a debt wants to insure timely payment, it can purchase protection through a CDS.

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However, there is a complication. Debtholders receive cash flows from the pool of mortgages. These cash flows can fall because of defaults on the mortgages that are securitized. With corporate debt, default leads to restructuring or bankruptcy. With securitized mortgage debt, default on the underlying mortgages leads to a reduction in debt payments – not to bankruptcy. Because of this, CDSs written on securitized debt work differently from those written on corporate debt.

Suppose (1) that an investor holds a mortgage-backed, top-rated (AAA) tranche with a principal amount of $100 million, (2) that the value of the other (subordinated) tranches of the securitization have been wiped out by mortgage defaults, (3) that during the past month $1 million of mortgages default so

that the principal balance falls from $100 million to $99 million, and (d) that the investor's tranche is insured with a CDS. When those latest mortgage defaults occur, the investor would be paid $1 million by the writer of the CDS. But that's not the end of it: the CDS – and the resulting liability to the writer – would still exist after that payment if and when other mortgages backing the tranche defaulted.

In 2008, financial institutions faced counterparty risks in derivatives that they had never factored into their calculations, and these plainly aggravated problems with origins in the fall of housing prices.

CDSs were used widely to insure subprime debt in various guises, including what's called collateralized debt obligations. With a CDO, debt issues or loans are placed in a pool and securities are issued against the pool. But the complexity of CDOs makes them difficult to price, which means that credit-default swaps on CDOs are hard to price as well. Further muddying the waters, CDSs were also used to create "synthetic" CDOs in which the risk profile of a regular CDO was mimicked without collateralization by actual loans or mortgages. This allowed the total value of CDOs in existence to far exceed the value of mortgages and other loans made in the economy.

In 2006, derivatives based on indexes of CDSs on subprime securitizations were introduced. These so-called ABX indexes were created every six months for different credit tranches of securitizations, with each based on an average of CDSs for same-seniority securitization tranches. For instance, the AAA index for 2007-1 would be based on an average of individual CDSs on the largest AAA-rated securitization tranches issued in the second half of 2006. In 2007, these indexes fell sharply, reflecting a loss in value of subprime securities. By that time, housing had already stopped appreciating.

The ABX indexes made it possible for investors to take positions – long or short – on the subprime market without owning subprime mortgages or securities collateralized by subprime mortgages. CDOs could be written with payoffs depending solely on the ABX indexes. As a result, it was possible for investors to bear more subprime risk than the risk in outstanding mortgages.

It is not really possible to gauge either the extent of such synthetic exposure to the subprime market or where the risk resides. However, we do have a sense of the size of the notional amounts of subprime CDSs that are registered with the Deposit Trust and Clearing Corporation. Since October 2008, the corporation has been estimating the notional amount of contracts written on various names. And, surprisingly, less than 1 percent of the CDS registered with it as of early November were subprime CDS contracts – a notional amount of just $330 billion. It is possible, of course, that the size of the subprime CDS market was much larger before the financial crisis and that many contracts have been subsequently settled.

The price discovery provided by the ABX indexes is useful, since it helps financial institutions and investors assess the value of subprime securities. But it is not clear how accurate that price-discovery mechanism was.

Some observers argue that the ABX indexes overreacted to the troubles of the subprime market.

With the ABX indexes, financial institutions could hedge subprime risk. However, for ABX indexes to be good hedge instruments for subprime-related securities, the returns on the specific ABX index have to be highly correlated with the returns of the security being hedged. And since there was so much variation in securities that included subprime mortgages as collateral, the ABX indexes often failed this test.

WHAT WENT WRONG, AND HOW TO FIX IT

With a derivative, one party to the contract's gain is the other party's loss. Consequently, derivatives losses neither create nor destroy wealth – they redistribute it. In many instances, this redistribution has no impact beyond the parties involved in the derivatives contract. Indeed, every day millions of people enter into contracts of one sort or another in which one party stands to make money at the expense of the other. And as a general rule, the more trading/contracting opportunities that exist, the better the economy functions.

With financial intermediaries, however, such wealth redistribution can have external consequences, because these institutions routinely operate with a lot of leverage. Suppose that an institution has equity capital of $50 million, equal to 5 percent of its $1 billion assets. If it loses just $25 million in, say, a derivatives contract with another firm, it has lost fully half its capital. Now, at first glance, the total quantity of wealth hasn't changed – our institution's $25 million loss is exactly matched by the counterparty's $25 million gain. But to restore its leverage to preloss figures, the financial institution must either raise $25 million in equity capital or sell $500 million in assets. And if the financial institution in question is a bank, its resulting reluctance to make new loans or to renew old ones can lead to a credit crunch that does destroy wealth.

Consider, too, that highly leveraged financial institutions typically rely on short-term debt to sustain their capital, and are thus at the mercy of lenders. Their capacity to roll over this debt can vanish at the slightest hint that they will be unable to repay. Thus even an unfounded rumor of derivatives losses may be enough to drive a financial institution to collapse. But the fact that the institution has invested in derivatives is not the root of the problem – the degree of leverage and the short-term nature of the institution's debts is.

In general, financial institutions have managed the risks of derivatives well. Indeed, they have long used derivatives to manage risks associated with other investments. However, in 2008, they faced counterparty risks in derivatives that they had never factored into their calculations, and these plainly aggravated problems with origins in the fall of housing prices.

To understand what happened, consider a hypothetical financial institution with, say, $20 billion in equity capital and $200 billion in gross notional amount of CDSs outstanding. Suppose, further, that it has sold $50 billion in protection and bought $50 billion in protection on a single name.

Now imagine that this name defaults on all its debts and that there is no recovery, so that our financial institution ends up owing the $50 billion on the CDSs it had sold. That should be no problem, since the institution exactly offset this potential $50 billion liability by purchasing $50 billion in protection.

But there's a catch. The parties our financial institution owes aren't the same as the parties who owe it. And if the parties that

have insured our institution against loss can't pay up, it's in big trouble. Indeed, if it can't collect at least $30 billion from them, its capital will be wiped out in the process of paying off its $50 billion in liabilities. So our financial institution, which thought it was bearing no net risk, was in fact betting the firm's existence on the credit of its counterparties.

With hindsight, one can see why the way the over-the-counter derivatives market works made huge buildups of counterparty risk likely.

That blithe position wasn't as unreasonable as it appears in retrospect. After all, disaster required the simultaneous default of the name and of the CDS writers. What's more, most CDSs are backed by some collateral. And to get our financial institution in trouble, the losses associated with the name's default would first have to burn through the collateral to expose it to "gap risk" – the difference between the value of the collateral and the liability.

It is fair to say that until last year financial institutions considered the probability of one of the largest derivatives dealers collapsing to be sufficiently small to be ignored. With hindsight, however, one can see why the way the over-the-counter derivatives market works made huge buildups of counterparty risk likely.

Suppose that a big manufacturing company wants to take a position in a derivative to hedge a risk – say the risk that interest rates will rise. It will enter into a swap contract, and most likely the counterparty will be a financial institution. The financial institution will typically not want to bear all the risk of the contract and will therefore seek to acquire an offsetting contract.

The interest-rate-swap market is very liquid, so the financial institution should have no trouble finding a counterparty willing to take the risk. But that counterparty will probably seek to make yet another offsetting swap. As a result, a swap with a nonfinancial firm can lead to swaps among financial firms with many times the notional amount of the original contract. And what goes for swaps goes for all derivatives – including CDSs.

One way to eliminate counterparty risk is to create a well-capitalized clearinghouse that stands between the derivatives counterparties. Organized futures and options markets – the hundreds of markets ranging from the Chicago Board Options Exchange to the Tokyo International Financial Futures Exchange – work that way. The clearinghouse is the counterparty to each side in every contract. Thus if an investor defaults on a futures contract obligation, there are no consequences for other investors who took positions on the other side of the contract as long as the clearinghouse is solvent. The clearinghouse makes sure that it can honor its obligations by requiring collateral from all its counterparties.

There has been much discussion about making the use of clearinghouses mandatory for all derivatives, or even forcing derivatives to trade on exchanges. A clearinghouse would almost eliminate counterparty risk as long as it were well run and well capitalized. This approach would also introduce substantial discipline to the market, since the clearinghouse would have to confirm the details of trades with both sides before being able to assume the role of counterparty to both – though dealers that register their derivatives with the

Deposit Trust and Clearing Corporation already face that discipline.

A clearinghouse for some types of CDSs is in the works. For a clearinghouse mechanism to work, however, it has to require collateral – which means that it would have to mark-to-market all contracts (that is, recalculate their value on a regular basis) and to devise margining systems. And while such an approach would work for the most active CDS contracts, like contracts on indexes, it could prove very expensive to implement for some kinds of derivatives. Mandating the use of a clearinghouse mechanism for all derivatives would thus reduce the variety of derivatives available in the markets.

For new types of derivatives to be introduced, the clearinghouse would have to agree to change its systems to add these derivatives. To protect itself, the clearinghouse might impose extremely high margin requirements on derivatives it finds hard to understand, like new derivatives or derivatives whose pricing requires a substantial investment that the clearinghouse cannot amortize across many contracts.

For a financial product to trade on an exchange, there has to be liquidity. And there is no way that there would be enough liquidity to support exchange trading for most derivatives. Getting rid of derivatives that didn't make the liquidity grade might seem a good thing. But think of it this way: most loans and many bonds do not trade on exchanges. It is thus unclear why derivatives should be treated differently.

Still, there is much that could and should be done to limit the systemic risks aggravated by the use of derivatives.

• Regulators should push the derivatives markets toward greater use of well-run clearinghouses by treating derivatives protected in this way as free of counterparty risk for purposes of computing the minimum capital requirements of financial institutions.

• Regulators should demand greater transparency on the counterparty exposures of systemically important financial institutions – the big banks and securities dealers whose failure would put other institutions at risk. In fact, these institutions should be required to measure of firm-wide counterparty risk in

real time and to share the information with regulators.

• By the same token, financial institutions should be required to disclose their largest counterparty risk exposures in public filings. With CDSs, financial institutions should provide estimates of the worst gap risk to which they would be exposed in the event of the failure of a counterparty.

• Finally, systematically important financial institutions should be required to run "stress tests" – computer simulations of changes in the value of their assets and liabilities – to show that they could survive the collapse of their biggest counterparty.

It's been charged that during the crisis, the CDS market was manipulated in ways that endangered financial institutions. Certainly it has, at times, become hugely expensive to insure debt of some financial institutions. For instance, the annualized cost of insuring Morgan Stanley debt during September 2008 at times exceeded $15 for $100 of debt covered. However, this high cost proves nothing: it could have simply reflected the market's best assessment of the fragility of these institutions, as well as the high demand for hedging these risks.

Nor is the fact that traders in CDSs informally exchange a lot of information in itself evidence of manipulation. That's how dealer markets work, and how they help to create liquidity. In any event, there's a built-in deterrent to manipulation: Traders who attempt to misuse the market are at risk of being frozen out of future transactions and exchanges of information.

The chairman of the Securities and Exchange Commission has expressed concerns that investors can take "naked" positions in CDSs – that is, buy protection without owning debts issued by the name – because this might open the door to manipulation of CDS premiums and increase the cost of funding of corporations. But prohibiting naked short positions in CDSs would destroy most of the CDS market.

Derivatives markets are liquid because speculators and dealers are willing to take one side of the transaction. To put it another way, in a market for risk in which only hedging is permitted, little hedging can take place. And market prices cannot reflect all available information if investors who see profit opportunities cannot exploit them. In the long run, economic growth would suffer because of poorer allocation of capital.

LAST WORDS

Derivatives did not create the subprime mess. However, the panic that took place in 2008 was worsened by uncertainty about the risks created by the derivatives positions of some financial institutions. Hence, derivatives activities of systemically important financial institutions have to be regulated more effectively. The counterparty risks incurred by these institutions should be made clear to regulators and to investors. And systemically important financial institutions should be required to demonstrate to regulators that they could survive the collapse of a major derivatives dealer.

That said, the role of derivatives in bringing down Wall Street has been vastly overstated. For the most part, derivatives markets worked well during the subprime crisis, allowing hedgers to shift risks they were not well equipped to bear. I believe that the global economic growth of the last three decades was in part made possible by rapid financial innovation. Regulation that impedes innovation in the name of saving investors from the real and imagined perils of risk-taking would exact a high price.