Policy Analysis

CATO INSTITUTE
Center for Monetary and Financial Alternatives

September 29, 2015 | Number 781

In Defense of Derivatives

From Beer to the Financial Crisis

By Bruce Tuckman

EXECUTIVE SUMMARY

The vast majority of large businesses use derivatives to hedge their business risks. Anheuser-Busch, for example, uses exchange-traded wheat futures and over-the-counter aluminum swaps to hedge the risk of higher wheat and aluminum prices eroding profitability.

Derivatives also provide implicit leverage. When Anheuser-Busch buys wheat futures, it gets the economic exposure of owning wheat without actually purchasing wheat—though it does have to post some collateral. But leverage magnifies both returns and losses and can be dangerous if misused. In 1995, Barings Bank was bankrupted by Nick Leeson, whose leveraged bets with Japanese stock market futures lost $1.4 billion.

The losses and failures of the financial crisis of 2007–2009, however, were predominantly the result of excessive nonderivative leverage and investments in nonderivative mortgage products that fell dramatically in value. The only significant exception was AIG, whose failure and bailout were due to losses partly from credit default swaps and partly—and comparably—from nonderivative mortgage products.

AIG is sometimes invoked to claim that derivatives caused or triggered the financial crisis. By the time AIG failed, however, many large financial institutions had already experienced large losses and many others had already failed, including Bear Stearns, Countrywide Financial, Fannie Mae, Freddie Mac, and Lehman Brothers.

Derivatives appeared at other points in the crisis narrative, but were not systemically important. The liquidation of Lehman Brothers' derivatives books and the settlement of credit default swaps triggered by Lehman's default did not disrupt markets. Synthetic mortgage collateralized debt obligations did cause losses throughout the crisis, but those losses were small relative to nonderivative losses and, in some cases, large banks were able to reduce risk by using those derivatives as hedges.

Finally, there are two broad problems with the current approach to regulating derivatives. First, rules that treat derivatives in isolation are unlikely to reduce the overall risk of individual financial firms or the financial system. Second, rules that make derivatives harder to use will reduce derivatives risks; but the reduction will be at the expense of increasing business risks. Policies aimed at holistic risk management, reporting, and supervision would be more successful in reducing systemic risk.

Bruce Tuckman is clinical professor of finance at New York University Stern School of Business.

"*Derivatives* are often described as 'financial weapons of mass destruction' and condemned as a cause of the recent financial crisis. Those epithets are misleading and false."

INTRODUCTION

Derivatives are often described as "financial weapons of mass destruction" and condemned as a cause of the recent financial crisis.[1] The primary purpose of this paper is to demonstrate that those epithets are misleading and false, respectively. The secondary purpose of the paper is to argue that current regulatory initiatives will discourage the use of derivatives but will not appreciably reduce systemic risk.

The importance of derivatives in the economy can be measured by the percentage of firms using them. A survey in 2009 found that 94 percent of Fortune Global 500 companies across 32 countries and a broad range of industries used derivatives.[2] A larger study in 2000–2001 found that 88 percent of almost 7,000 nonfinancial firms with listed stock across 47 countries used derivatives. Of the more than 2,000 nonfinancial firms in the United States in that same study, 94 percent used derivatives.[3]

It is not hard to find examples of businesses that manage their risks with derivatives: an airline hedges against increases in the cost of jet fuel, a manufacturer hedges against changes in foreign exchange rates that would increase production costs, and a pension fund hedges against higher rates of inflation that would increase benefit payments. Derivatives enable those enterprises to run large-scale operations without bearing commensurately large business risks that could threaten their survival.

To explain exactly how businesses use derivatives to manage risk, this paper begins with an extended example of a beer brewery that hedges against possible increases in the prices of wheat and aluminum.

The paper then describes the disasters at Barings Bank in 1995 and Société Générale in 2008 to explain how, when mismanaged, derivatives can be dangerous. The reason is that derivatives have built-in leverage, which magnifies gains and losses.

The lesson to be learned from the spectacular failures of the past is not that derivatives are dangerous, but that leverage turns bad trades into disasters and that leverage is sometimes, but hardly always, sourced through derivatives. The rogue traders at Barings and Société Générale did become infamous because of derivatives. But in the recent financial crisis, losses at Bear Stearns, Fannie Mae, Freddie Mac, and Lehman Brothers were all magnified predominantly by less complex (nonderivative) forms of borrowing.

Having familiarized the reader with the way derivatives work, the paper turns to defining a derivative. An abbreviated definition is as follows:

A *derivative* is a contract between two parties that

- Commits to exchange cash, goods, or securities in the future;
- Requires little or nothing in the way of an up-front payment; and
- Is written in a legal form that allows for swift remedial action in the event of a default—that is, without the approval of a bankruptcy court.

A wheat futures contract is a derivative. Neither party to the contract offers or receives payment at the time of the trade; however, at some time in the future, the buyer of the contract pays the seller for delivery of some amount of wheat at some predetermined price. Furthermore, should one party default, the other party can terminate the contract and seize collateral previously posted to ensure performance.

A *bond* is not a derivative; it is a "cash" product. Investors pay the issuer the market price of a bond up front and subsequent interest and principal payments all flow from the issuer to the investors. If the issuer defaults, the investors pursue their claims through the bankruptcy process.

Of particular interest in the context of the financial crisis is the classification of mortgage-backed securities (MBSs) and collateralized debt obligations (CDOs). Although those products are often included in discussions of the role of derivatives in the crisis, MBSs and CDOs are not themselves derivatives. An MBS is a "securitization" that packages a large portfolio of mortgages into a security that is subsequently sold to investors. Similarly, a CDO is a

securitization that packages a large portfolio of debt obligations—for example, corporate bonds and MBSs—for subsequent sale.

Investors in MBSs and CDOs are often divided into classes or "tranches," with some tranches having precedence over others concerning the bearing of risk. The rules that determine which investors get which cash flows may be complex, but those rules lack the characteristics that define derivatives. The investors as a group pay the full market value of the securities up front and all subsequent payments flow from the underlying mortgages or other debt instruments to the investors.

Defining derivatives in a way that excludes MBSs and CDOs is not controversial in the policy context. The Dodd-Frank Wall Street Reform and Consumer Protection Act, for example, treats derivatives and securitization separately, establishing rules for derivatives in Title VII and rules for securitization in Title IX.

The next part of this paper examines the role of derivatives in 2007–2009, arguing that derivatives played a minor role in the financial crisis of 2007–2009, excepting the failure and bailout of AIG in September 2008. It is untenable, therefore, to claim that derivatives caused or triggered the crisis.

The final section of the paper critiques some of the initiatives in derivatives regulation set in motion by Dodd-Frank. First, mandatory clearing of "over-the-counter" (OTC) derivatives—derivatives traded between private counterparties, instead of traded over an exchange—will probably not reduce systemic risk. Second, margin requirements on uncleared derivatives may reduce risk in derivatives markets, but at the cost of discouraging hedging and increasing other business risks. Third, derivatives reporting requirements will not be particularly useful to regulators in preventing or managing a future crisis.

THE COMMODITY PRICE RISKS OF BREWING BEER

Anheuser-Busch is a global brewer with more than 200 beer brands and annual revenues of more than $40 billion. Because the company purchases raw materials to brew and package beer, its profitability depends crucially on the prices of those raw materials.

Should the price of wheat increase, for example, the cost of brewing beer increases and the company's profits decline. Similarly, should the price of aluminum increase, the cost of packaging beer into cans and metal bottles increases and the company's profits decline. Anheuser-Busch's annual report discusses this "commodity price risk" and warns investors of its "important exposures" to "aluminum, barley, coal, corn grits, corn syrup, corrugated board, fuel oil, glass, hops, labels, malt, natural gas, orange juice, rice, steel and wheat."[4]

If the prices of its raw materials increase, Anheuser-Busch could raise the prices of its beers, but that strategy could easily backfire. The beer industry is very competitive. If Anheuser-Busch suddenly raised the price of a bottle of Beck's, one of its most successful international brands, customers might very well switch to competitors' beers, particularly if competing brands did not increase their prices. Furthermore, a sudden increase of the price of Beck's could upset loyal customers and seriously erode the value of that brand, which Anheuser-Busch has painstakingly built up over time. Finally, beer customers can switch at any time not only to competing beer brands, but also to wine, spirits, hard ciders, and even soft drinks.

Anheuser-Busch writes in its annual report that "competition in its various markets" can prevent it "from increasing prices to recover higher cost."[5] The company also recognizes the broader market for alcoholic beverages, declaring that it is in a fight for "share of throat" against "wine, hard liquor and other alcohol beverages."[6]

Anheuser-Busch could choose to do nothing about its commodity price risk, which would mean enjoying higher profits when commodity prices are low but suffering lower profits or even losses when commodity prices are high. This variability in profits, however, is very unappealing to an established business. The chance at a few seasons of particularly high profits cannot outweigh the risk that a

"Derivatives played a minor role in the financial crisis of 2007–2009, excepting the failure and bailout of AIG in September 2008."

“Losing money in futures when the price of wheat turns out to be low is as much a part of the hedging strategy as making money in futures when the price of wheat turns out to be high.”

few seasons of losses might jeopardize the viability of a successful, ongoing business that took years of investment and expertise to create. For this reason, Anheuser-Busch uses derivatives to hedge its commodity exposures—that is, to ensure that its profits are not overly dependent on whether commodity prices rise or fall.

In its annual report, Anheuser-Busch lists positions in several categories of commodity derivatives. As of December 2013, Anheuser-Busch had agreements covering $1.71 billion of aluminum, $330 million of natural gas and energy, $147 million of sugar, $332 million of corn, $390 million of wheat, and $70 million of rice.[7]

Hedging the Costs of Brewing Beer with Wheat Futures

Say that, as of December 2013, Anheuser-Busch plans to buy 20 million bushels of Soft Red Winter (SRW) wheat in July. The price of SRW wheat in July might turn out to be $5.15 per bushel, that is, $103 million for the 20 million bushels, or the price might turn out to be a much higher $8.00 per bushel, that is, $160 million for the lot. But, as just discussed, Anheuser-Busch wants to avoid having to purchase its raw materials at a very high price, even if that means giving up the chance to purchase them at a very low price. The company chooses, therefore, to hedge the cost of its future purchases of wheat by buying SRW wheat futures contracts with a delivery date in July.

Say that the price of the July wheat futures contracts was $6.40 per bushel in December of the previous year. Anheuser-Busch's purchase of futures for 20 million bushels in December means that it commits to buy 20 million bushels in July at $6.40 per bushel from the sellers of the futures contracts.

Using futures in this way locks in a total cost of $128 million, but creates another problem: Anheuser-Busch wants to buy wheat from its regular suppliers, not from whoever happened to sell futures contracts. It is possible, however, for Anheuser-Busch to lock in a price of $6.40 per bushel *and* purchase wheat from its regular suppliers.

Assume for the moment that the price of SRW wheat in July turns out to be $8.00 per bushel. In that case, Anheuser-Busch's July SRW wheat futures contracts would have increased in value by $1.60 per bushel, from their original purchase price of $6.40 in December to their final price of $8.00 in July. In this scenario, then, Anheuser-Busch would buy 20 million bushels from its regular suppliers at the prevailing market price of $8.00 each, for a total of $160 million, and then sell its futures contracts for 20 million bushels at a profit of $1.60 per bushel, for a total profit of $32 million. The net cost of wheat for Anheuser-Busch in July, therefore, is $160 million minus $32 million, or $128 million, which is exactly $6.40 per bushel, the original price of the July futures contracts.

But now suppose that the price of wheat in July 2014 was not $8.00 but $5.15 per bushel. In July, therefore, Anheuser-Busch bought 20 million bushels from its regular suppliers at $5.15 each, for a total of $103 million and sold its futures contracts for 20 million bushels at a loss of $6.40 minus $5.15, or $1.25 per bushel, for a total loss of $25 million. The effective cost of the wheat, therefore, was $103 million plus $25 million, or $128 million, which is the same $6.40 per bushel as before.

Hence, with futures, Anheuser-Busch achieved an effective cost of $6.40 per bushel whether the July price of wheat turned out to be $5.15 per bushel, $8.00 per bushel, or any other price.

The hedging scenario just described, in which the price of wheat in July turned out to be $5.15 per bushel, shows that losing money in derivatives is often not cause for alarm. Anheuser-Busch did lose $25 million on its futures position, but its hedge worked perfectly! As planned, it successfully locked in a price of $6.40 per bushel. Put another way, losing money in futures when the price of wheat turns out to be low is as much a part of the hedging strategy as making money in futures when the price of wheat turns out to be high.

It's OK to Lose Money on Derivatives: A Detour through Oakland

Ignorance of the truism that successful hedging programs may include derivatives losses can have unfortunate political ramifica-

tions. One such case occurred when the City of Oakland, California, hedged its borrowing costs.[8] In the late 1990s, Oakland borrowed $187 million by selling bonds with a floating rate of interest. This means that when interest rates increased, Oakland paid a higher rate of interest, whereas when interest rates decreased, Oakland paid a lower rate.

At the time of the bond sale, however, Oakland decided that it did not want to take the risk that interest rates would rise dramatically. The city, therefore, made the following deal with Goldman Sachs, through an interest rate swap: "We'll pay you a fixed interest rate of 5.7 percent on $187 million, and you pay us a floating rate." In that way, Oakland locked in an interest rate of 5.7 percent. First, whatever the market floating rate turned out to be, Oakland could use the payments it received from Goldman to pay the interest due on its floating-rate bonds. Second, Oakland would always pay Goldman the agreed-on rate of 5.7 percent.

Fast forward to 2013. Because interest rates had fallen dramatically since the late 1990s, Oakland lost money on the deal with Goldman: Oakland has been paying Goldman a fixed 5.7 percent, while Goldman has been paying Oakland the falling market rate, which is now practically zero. The interest payments due on the floating-rate bonds have also been falling, of course, and now are also practically zero. Hence, the city's hedge worked exactly as planned. Oakland successfully locked in a cost of 5.7 percent.

Many people were angry, however, that Oakland lost and Goldman won on the interest rate swap and wanted Goldman to let Oakland out of the deal. Goldman refused, and in December 2012 the city council went so far as to consider banning Goldman from doing business with the city for five years.

Then councilwoman—and now mayor—Libby Schaaf described the interest rate swap deal as follows: "We gambled. We lost. That happens all the time, and we have to be grown up about it." Schaaf certainly deserves credit for calling for calm. But the derivatives deal should not have been characterized as a "gamble." Oakland decided to lock in a cost of 5.7 percent, and the interest rate swap enabled the city to do exactly that.

Exchange-Traded Derivatives Are Liquid but Have Standardized Terms

Return now to Anheuser-Busch and its hedging with wheat futures. The July SRW wheat futures described earlier can be bought and sold on the Chicago Board of Trade (CBOT), a futures exchange. The fact that derivatives trade on an exchange has both advantages and disadvantages.

The great advantage of exchange-traded derivatives is liquidity. In 2014, on average, about 630 million bushels of wheat were traded on the CBOT every day.[9] This means that even a relatively large purchaser of contracts, such as Anheuser-Busch, can buy the quantity of wheat futures contracts it wants without pushing prices higher or otherwise disturbing the market.

Wheat futures contracts on the CBOT are liquid because the exchange has succeeded in creating a relatively small set of contracts that many firms and individuals are willing to trade. More specifically, many market participants who buy and sell different kinds and grades of wheat all through the year are willing to trade the 10 distinct CBOT wheat contracts per calendar year, that is, SRW wheat for delivery in March, May, July, September, and December and Hard Red Winter (HRW) wheat for delivery in those same five months.

Anheuser-Busch, as depicted in the earlier examples, wants to buy SRW wheat for delivery in July, so it is perfectly content to buy one of the 10 CBOT contracts available. A second company, however, which wants to buy HRW wheat for delivery in October, is not quite so content; there is no October HRW wheat contract.

This company might be willing to buy December HRW wheat contracts, however, reasoning that if its suppliers raise their prices in October, profits from its December contracts will be large enough to compensate. There is some risk, however, that this purchase does not work out. Suppliers' prices in October might rise while December futures prices stay the same or even fall. The risk that supplier prices

"Wheat futures contracts on the Chicago Board of Trade are liquid because the exchange has succeeded in creating a relatively small set of contracts that many firms and individuals are willing to trade."

"The financial engineering and market sophistication required to design and nurture liquid futures contracts should not be taken for granted."

in October do not move one-for-one with the prices of December futures is an example of *basis risk*.

A third company, which needs to buy hard white wheat in October, bears a lot of basis risk when buying December SRW or December HRW wheat futures. Not only might October prices rise while December futures prices fall, but also hard white wheat prices might rise while SRW and HRW wheat futures prices fall. This third company might buy futures contracts anyway, choosing to live with the basis risks. In other words, despite the basis risks, hedging with available futures contracts might be less risky than not hedging at all.

Consider just one more company, however, that needs to buy Black Sea wheat in October. This company may choose not to hedge its Black Sea wheat purchases with either SRW or HRW wheat futures contracts because prices of wheat in the United States do not move sufficiently in tandem with prices of wheat in the Black Sea region. In fact, to attract trades from companies like this one, the CBOT introduced Black Sea wheat futures contracts in 2012.

The financial engineering and market sophistication required to design and nurture liquid futures contracts should not be taken for granted. On one hand, if too many contracts are offered (e.g., too many types of wheat, too many delivery months) then too few market participants would trade any given contract, and few, if any, of the contracts would be liquid. On the other hand, if too few contracts are offered (e.g., only a December SRW contract), then each contract might be liquid but the total amount of wheat traded would be relatively small. Many companies would choose not to take the basis risks between the wheat they need and the wheat available for trading.

Even with expert design, however, many newly introduced futures contracts fail to attract liquidity and are eventually abandoned. Sometimes there are just not enough buyers and sellers willing to trade particular risks in particular markets. Kraft Foods Group, for example, says, "hedging our costs for one of our key commodities, dairy products, is difficult because dairy futures markets are not as developed as many other commodities futures markets."[10]

In short, exchange-traded futures are used to hedge risks when the resulting basis risks are small enough relative to the advantages of liquidity. When basis risks are too large, however, or when the relevant contracts are too illiquid or do not even exist, companies turn to OTC derivatives.

Hedging the Costs of Packaging Beer with OTC Aluminum Swaps

It was mentioned earlier that Anheuser-Busch had a $1.71 billion derivatives position in aluminum. The fact that aluminum is its largest commodity derivatives position reflects the relative importance of packaging costs, which include the costs of purchasing aluminum to make cans and metal bottles. Particularly interesting for the purposes of the present discussion, however, is that Anheuser-Busch hedges the risk of rising aluminum prices not with exchange-traded aluminum futures, but instead with OTC aluminum swaps.[11]

To understand how aluminum swaps work, consider the following example. Anheuser-Busch needs 50 metric tons of aluminum at a particular factory on the first and third Mondays of every month. It plans to purchase aluminum on those days from its suppliers at the then-prevailing market price, which exposes it to the risk of increasing prices.

To hedge this risk, the brewer finds someone, say Goldman Sachs, with whom it makes the following deal: "We'll pay you $1,900 per metric ton for 50 metric tons on the first and third Mondays of every month for the next year. For those same 50 metric tons on those same dates, you pay us the market price prevailing in the region of our suppliers. No aluminum is to be exchanged."

This swap works as a hedge as follows: say that the market price for aluminum on a particular delivery date is $2,000 per metric ton. On that date, therefore, Anheuser-Busch pays its supplier $2,000 per metric ton for 50 metric tons, or $100,000. But that price is exactly what Anheuser-Busch receives from Goldman

under the swap agreement. At the same time, Anheuser-Busch pays Goldman the agreed-upon $1,900 per metric ton on 50 metric tons, or $95,000. Hence, Anheuser-Busch has locked in a price of $1,900 per ton on that delivery date.

Note how Anheuser-Busch eliminates its basis risks in this example by customizing its OTC swap. First, dates in the agreement were set to match the factory's production schedule. Second, the aluminum price in the agreement was tailored to the price prevailing in a particular part of the country. This sort of customization is not available through futures contracts, which, as explained previously, achieve liquidity by standardizing terms.

Craig Reiners of MillerCoors, who faces the same risk management problem as his counterpart at Anheuser-Busch, explicitly explained the advantages of OTC derivatives in eliminating or at least minimizing basis risks: "[we] use OTC swaps to precisely match the timing and prices of our complex manufacturing and distribution process. For example, we exactly match our OTC swaps for aluminum with our actual use of cans over the same time frame."[12]

End Users Need Liquidity Providers, Speculators, and Dealers

Anheuser-Busch is an "end user" of wheat derivatives because it has a business risk exposure to rising wheat prices. But who sells wheat futures to Anheuser-Busch?

The most obvious candidate is another end user, but one with the opposite risk. A wheat farmer, for example, who plans to sell a crop in the future, fears that wheat prices will fall. To hedge against this risk, the farmer would sell wheat futures to lock in a future sale price of wheat. Putting all this together, when the farmer sells wheat futures and Anheuser-Busch buys wheat futures, both reduce their respective business risks.

There is a subtlety, however, in connecting the wheat farmer with Anheuser-Busch. What if Anheuser-Busch wants to buy July wheat, but the wheat farmer wants to sell September wheat? What if Anheuser-Busch wants to buy SRW wheat, but the wheat farmer wants to sell HRW wheat? Finally, what if Anheuser-Busch needs to buy wheat contracts first thing Monday morning, but the wheat farmer wants to sell on Wednesday afternoon?

There are, of course, many end users with various objectives. But it remains the case that buyers' demands do not perfectly match sellers' offers. To compensate for these mismatches, markets that work well rely on liquidity providers and speculators. Those intermediaries provide trade immediacy to end users, taking price and liquidity risks in exchange for fees[13] and possible profit. Liquidity providers aim to earn fees at minimal risk, whereas speculators aim to earn profits at reasonable risk. However, the line between the two types of intermediaries is not particularly bright.

In terms of the mismatches just mentioned, an intermediary might sell July wheat to Anheuser-Busch, buy September wheat from the farmer, and liquidate or unwind these positions with other end users or traders as market conditions permit. Similarly, intermediaries might sell SRW wheat to Anheuser-Busch and buy HRW wheat from the farmer or sell wheat contracts on Monday to Anheuser-Busch and buy them on Wednesday from the wheat farmer.

Quantmetrics is an example of a relatively small firm that acts as a futures liquidity provider and speculator. It was founded in 2003 and describes itself as "a boutique investment manager specializing in niche short-term systematic strategies."[14] One of its products, the QM Directional Strategy, "is a quantitative directional futures strategy, which employs its predictive (anticipating flow) and reactive (liquidity provision) investment strategies to seek to identify and capture market inefficiencies in financial and commodity futures markets. Time horizons range from 5 minutes to 5 days."[15]

Having discussed the other side of Anheuser-Busch's wheat futures trades, attention now turns to the other side of the firm's OTC aluminum swaps. Anheuser-Busch uses its swaps to hedge against increases in the price of aluminum. Who has the opposite problem? That is, who needs to hedge against decreases in the price of aluminum?

"Buyers' demands do not perfectly match sellers' offers. To compensate for mismatches, markets that work well rely on liquidity providers and speculators."

"The flexibility that intermediaries provide, both with respect to pricing dates and with respect to local market price premiums, is very valuable to end users."

Novelis is "the world's leading aluminum rolled products producer" and "the global leader in the recycling of aluminum."[16] It purchases various forms of raw aluminum and produces aluminum sheets and other products for many purposes, including automotive, consumer electronics, architecture, transportation, and foil. Its largest customer market, however, comprises producers of beverage cans. Anheuser-Busch is one of its top three customers and accounts for 8 percent of Novelis' net sales.[17]

The price Novelis charges its customers is the sum of two components. One is the cost of its raw aluminum input, which in turn can be broken down into a general aluminum index price plus any relevant local market premiums. The other component is a conversion premium to produce its rolled product from the raw aluminum input.

An important business risk facing Novelis is what it calls the "metal price lag."[18] Its price for purchasing raw aluminum is set at the time of purchase, while the price of aluminum it passes along to its customers is set later—at the time of the sale of the finished product. If the price of aluminum were to fall between Novelis' purchase of raw aluminum and its sale of finished product, Novelis would certainly earn less than the conversion premium and may even suffer a loss on the entire transaction.

To mitigate the risk arising from the metal price lag, Novelis uses OTC aluminum derivatives "to ensure we sell metal for the same price at which we purchase metal"[19] or, from another perspective, to ensure that it earns the full conversion premium. As of March 2014, for example, the company had outstanding OTC derivatives commitments to sell 222,000 metric tons of aluminum over the following two years.[20]

An earlier illustration explained how Anheuser-Busch could pay a fixed aluminum price to Goldman Sachs to hedge against increasing aluminum prices. Novelis, by contrast, would contract with Goldman to receive a fixed aluminum price to hedge against falling aluminum prices. What is particularly interesting is that both Anheuser-Busch and Novelis arrange their OTC swaps with third parties, such as Goldman, rather than with each other or other end users. According to Novelis, financial holding companies "act as the hedging counterparty in nearly all of our hedging transactions."[21] The flexibility that intermediaries provide, both with respect to pricing dates and with respect to local market price premiums, is very valuable to end users.

Like liquidity providers and speculators in wheat futures, OTC derivatives intermediaries or dealers bear various basis risks when agreeing to buy and sell aluminum. A dealer might agree to pay one client a local market price for aluminum in February, May, August, and November, while agreeing to receive from another client a broad aluminum price index in January, April, July, and October. Fees and potential profits from bearing these basis risks motivate dealers to facilitate the hedging of Anheuser-Busch, Novelis, and their many other clients.

DERIVATIVES HAVE IMPLICIT LEVERAGE, WHICH PLAYED A ROLE IN SOME INFAMOUS DISASTERS

Anheuser-Busch bought wheat futures in December to lock in a cost of $128 million to be paid the following July. Another way to have locked in a cost would have been simply to purchase the wheat in December and store it until July. But Anheuser-Busch did not want to come up with the cash in December; it wanted to pay when the cash was available—that is, in July. Similarly, Anheuser-Busch did not want to store wheat from December to July; it wanted to take possession of the wheat when it was needed for production—that is, again, in July.

From this perspective, Anheuser-Busch's hedging program depended completely on the implicit leverage of wheat futures. The company effectively purchased $128 million of wheat in December without having to put up that purchase price and without having to take delivery of that wheat until July. Put another way, buying futures gave Anheuser-Busch the economic exposure of owning wheat without actually purchasing wheat. Hence, without

putting up the funds to purchase wheat, the company could profit from increasing wheat prices and offset any increases in the cost of purchasing wheat from suppliers.

The implicit leverage of derivatives worked the same way for Anheuser-Busch's OTC aluminum swap. The company effectively owned aluminum through the swap without having to put up the cash to purchase that aluminum. The ensuing profits from increasing aluminum prices and losses from falling prices, applied to the company's ultimate purchases of aluminum from its suppliers, had the net result of fixing Anheuser-Busch's cost of aluminum over the life of the swap. The implicit leverage that works well in the hedging context makes derivatives dangerous when used for investment or speculation without adequate supporting capital. As will be explained below, it is in this way that derivatives have contributed to a number of spectacular losses and business failures.

One of the most infamous derivatives blowups occurred in 1995, when Nick Leeson of Barings Bank lost $1.4 billion primarily by trading Japanese stock futures. This loss was large enough to bankrupt Barings, which had been in existence since 1762. The ultimate culprits of this disaster were certainly Leeson—who fraudulently hid his trades from bank management—and bank management itself, which failed to supervise its traders and monitor its exposures. It is important, nevertheless, to understand how derivatives trades proved so disastrous.

Leeson's losses centered around Japanese stock futures, but, for ease of discussion, consider the more familiar S&P 500 futures contracts. Say that a buyer, Trader B, buys contracts on $1 million of the S&P 500 index, while a seller, Trader S, sells those contracts. Should the index fall by 5 percent, Trader B would lose 5 percent of $1 million or $50,000, which would have to be paid to the exchange. The exchange, in turn, would pass that $50,000 to Trader S, who would win from having sold contracts that fell in price.

To ensure that traders can make good on their losses, futures exchanges require the posting of margin, or collateral. Assume that the margin required for contracts on $1 million of the S&P 500 index is $200,000, to be posted in the form of cash or highly liquid securities. Then, if a trader loses $50,000 and cannot make good on that loss, the exchange would seize $50,000 of the trader's $200,000 collateral and close out that trader's position.

Explicitly considering the posting of margin, one can easily see the leveraged nature of stock futures. Exposure to $1 million of stock can be acquired with a $200,000 investment, which results in leverage ratio of $1 million ÷ $200,000, or 5. Put another way, with $200,000 of capital posted as margin, a 5 percent or $50,000 gain in the S&P 500 index becomes a $50,000 ÷ $200,000 or 25 percent return on capital. Similarly, of course, a 5 percent loss in the index becomes a 25 percent loss on capital.

This implicit leverage of stock futures explains how Leeson's trading positions could generate such large losses. Another well-known and quite similar derivatives disaster occurred in 2008. Jérôme Kerviel, a trader at Société Générale, lost $7 billion trading European stock futures, which led directly to downgrades of the bank's credit ratings. Like Leeson, Kerviel hid trading positions from his bank by taking advantage of egregious supervisory failures and gaps in controls. Once again, while fraud and bad management were the true culprits, the implicit leverage of derivatives greatly magnified the losses.

Leverage without Derivatives Can Be Just as Dangerous

Although leverage can be achieved through derivatives, it can be achieved in many other ways as well. An investor buying stock on margin, for example, leverages capital in the same way as an investor buying futures contracts. More specifically, an individual investor's broker, or an institutional investor's prime broker, might lend the investor $800,000, which, together with the investor's $200,000 of capital, is sufficient to buy $1 million of stock.[22] This explicitly leveraged return profile is equivalent to the implicitly leveraged return profile of stock futures contracts.

"The implicit leverage that works well in the hedging context makes derivatives dangerous when used for investment or speculation without adequate supporting capital."

"Although the Orange County debacle is often blamed on derivatives, it would be more accurate to say that the magnitude of the loss was due to leverage."

Given that financial markets offer many forms of leverage, some catastrophic losses have not surprisingly resulted from derivative and other sources of leverage. One such example was the 1998 failure of the hedge fund Long Term Capital Management (LTCM). The leverage ratio of the fund was between 25 and 30 before taking into account the implicit leverage of the fund's very large derivatives books. The Federal Reserve decided to intervene, fearing that liquidating and bankrupting such a large fund in a time of general market stress could have system-wide repercussions. The Federal Reserve did not provide financial support, but it pressed for a private workout of LTCM that did, in the end, take control of the fund.

The case of LTCM is of particular interest because the Federal Reserve's decision to intervene is often invoked to demonstrate the systemic danger of derivatives. This reasoning is suspect, however. One, as just mentioned, LTCM was highly leveraged even before accounting for derivatives. Two, a private solution would most likely have emerged without the Federal Reserve's involvement. Three, even without such a solution, there are strong reasons to believe that the consequences of LTCM's failure would not have been unacceptably problematic.[23]

A second example of a failure because of excessive leverage from both nonderivative and derivative sources is the bankruptcy of Orange County, California.[24] Robert Citron, who managed the county's cash management and investment funds in the early 1990s, made levered bets that interest rates would stay the same or fall. First, he borrowed money to purchase bonds issued by the government-sponsored entities (GSEs) Fannie Mae and Freddie Mac. Second, he bought custom-made bonds, called structured notes, which were designed to make relatively large cash payments when interest rates fell and relatively small cash payments when interest rates rose. As will be explained later in the paper, structured notes are best described as bonds with embedded or attached derivatives.

As interest rates fell through the early 1990s, Citron's leveraged portfolios performed exceptionally well. The price of his GSE bonds rose as rates fell, of course,[25] but their performance on a leveraged basis was particularly attractive. Citron's structured notes, specifically designed to pay more as rates fell, also enjoyed high returns.

The outperformance of Citron's investments attracted more and more investment dollars from Orange County municipalities so that, by 1994, he was managing $7.6 billion. At that time Citron was borrowing $12.5 billion, which brought the total size of his portfolio to more than $20 billion, of which $8 billion was invested in structured notes. When interest rates reversed direction and rose in 1994, Citron's leveraged portfolio, unsurprisingly, performed exceptionally poorly. Losses came to $1.7 billion, which was about 8.5 percent on the total portfolio but more than 22 percent on the invested $7.6 billion, and Orange County had to file for bankruptcy.

Although the Orange County debacle is often blamed on derivatives, it would be more accurate to say that the magnitude of the loss was due to leverage—some of which was achieved through securities with a derivatives component. More specifically, $8 billion (or about 40 percent) of the more than $20 billion portfolio had been invested in structured notes to which derivatives were attached.

DERIVATIVES: AN OVERVIEW

This paper has by now described several derivatives in some detail, namely, wheat futures (Anheuser-Busch), aluminum swaps (Anheuser-Busch and Novelis), interest rate swaps (Oakland, California), and stock futures (Barings Bank and Société Générale). With this background, a working definition of derivatives for policy purposes can be readily presented and understood:[26]

1. A derivative is an agreement between two parties to exchange cash, goods, or securities in the future according to some prearranged rules and formulae.

2. Neither of the two parties pays or receives a significant amount of cash at the time of the agreement, excluding any margin posted to ensure performance of obligations under the agreement.
3. The agreement is written in a legal form that qualifies it for a safe harbor from bankruptcy rules. This means, roughly speaking, that should one of the parties become bankrupt or default on its obligations under the agreement, the other party can terminate the agreement and seize posted margin to compensate itself for any losses resulting from the default.

To appreciate how this definition applies to the derivatives already discussed, start with part 1 of the definition:

- When Anheuser-Busch bought wheat futures, it agreed in December to pay $128 million and take delivery of 20 million bushels of a particular classification of wheat the following July.
- When Anheuser-Busch entered into its aluminum swap, it agreed to pay $1,900 per metric ton and receive the prevailing market price per metric ton for 50 metric tons of aluminum on the first and third Monday of every month over the next year.
- When Oakland entered into its interest rate swap, it agreed to pay 5.7 percent per year and receive a prevailing short-term interest rate on $187 million for a prearranged number of years.

Consider now part 2 of the definition. This paper described trading in S&P 500 futures. More specifically, Trader B agreed to buy $1 million of S&P 500 stocks and Trader S agreed to sell $1 million of the stocks at some time in the future. At the time of the agreement, however, Trader B did not pay and Trader S did not receive cash for the stocks. True, they each had to post margin of $200,000, but that money, according to part 2 of the definition, does not count as paying or receiving cash at the time of the agreement. A counterparty that posted $200,000 in margin retains ownership of that $200,000 unless it fails to fulfill its contractual obligations.

Anheuser-Busch would also have to post margin against its purchases of wheat futures. But, once again, that money belongs to Anheuser-Busch so long as it fulfills its obligations. Similarly, Anheuser-Busch, Novelis, and Oakland might have to post margin to ensure performance on their swap agreements, but that money would also be a surety rather than a payment of funds.

Part 2 of the definition says that the parties do not pay or receive a "significant" amount of cash at the time of the agreement. If the fair market rate for the interest rate swap between Oakland and Goldman Sachs were 5.7 percent, then, by definition, the two counterparties would enter into the swap on the $187 million without either party paying the other any cash up front. But sometimes a small amount of cash is paid at the start of a swap.

Consider a different swap counterparty that wanted to pay Goldman 5.9 percent on the $187 million, instead of the market rate of 5.7 percent. In that case, Goldman would pay that counterparty some up-front amount to compensate for the extra 0.20 percent. In fact, in this example, the up-front amount can be calculated to be about $220,000. Nevertheless, despite this up-front payment by Goldman, this swap would still be considered a derivative: an up-front amount of $220,000 is not significant relative to the $187 million governed by the agreement.[27]

As to part 3 of the definition, recall the discussion of S&P 500 futures trading. If a trader loses $50,000 on a position and does not pay that amount to the exchange, the exchange can close that position and use $50,000 of the margin posted by that trader to settle the outstanding obligation. The same treatment applies to the other derivatives described. Should Anheuser-Busch not make good on its obligation to pay $1,900 per metric ton of aluminum on 50 metric tons, Goldman could terminate the swap and apply the posted margin to compensate itself for any resulting economic losses.

"Should one of the parties to an agreement become bankrupt or default on its obligations, the other party can terminate the agreement and seize posted margin."

> "It would be impossible for a leveraged firm to manage its risk in relatively fast-moving markets if it had to wait for a bankruptcy court to decree whether its swap would be honored or not."

The treatment of derivatives in bankruptcy is really quite special. Most creditors of a bankrupt firm are subject to a bankruptcy stay and cannot take any actions against the bankrupt firm or its interests without the approval of a bankruptcy court. A bank that has lent a newspaper company money on the security of its printing press cannot, as soon as bankruptcy is declared, seize the printing press. The rationale for the derivatives safe harbor is to enable financial firms to manage their risks in the midst of market turmoil. It would be impossible for a leveraged firm such as Goldman to manage its aluminum risk in relatively fast-moving markets if it had to wait for a bankruptcy court to decree whether its swap with Anheuser-Busch would be honored or not, and, if not, what fraction of its value would be assigned to Goldman.[28]

Credit Default Swaps

Credit default swaps (CDSs) have not yet been mentioned in this paper, but they are a type of derivative, and their role in the recent financial crisis will be discussed below. Credit default swaps function as insurance against default for bondholders. Say that an investor bought a portfolio of corporate bonds with a principal amount of $100 million and then bought protection in the form of CDSs from Lehman Brothers. More specifically, the investor agreed to pay Lehman an insurance premium of $1 million per year. In return, Lehman promised to make the investor whole for any losses resulting from default experienced by the portfolio. If defaults caused the investor to lose $5 million, Lehman would pay the investor $5 million. If, however, the portfolio had no defaults over the life of the CDSs, Lehman would have earned $1 million per year without ever having to make compensation payments. Notably, an investor does not need to buy the underlying bond to purchase a CDS referencing it. As will be discussed in detail later, the value of CDSs can outstrip a firm's actual liabilities.

Credit default swaps easily fall within the definition of derivatives presented here. The buyer of protection paid Lehman an insurance premium over time in exchange for a contingent payoff in the event of credit losses. Although one party might have made a small payment to the other at the time of the agreement, the amount is not significant relative to the principal amount being insured. Finally, if Lehman declared bankruptcy, its counterparty in the swap could terminate the CDS and use margin posted by Lehman to compensate itself for any resulting economic losses. The fact that CDSs are derivatives is particularly interesting because there are extremely similar economic agreements, written in different legal form, that are classified as insurance.

Some Financial Instruments That Are Not Derivatives

The definition given earlier not only shows that certain agreements are derivatives, but also shows that other financial instruments are not derivatives. Bonds, for example, are cash rather than derivative products. An investor pays $100,000 for a bond from Apple that promises to pay 3.45 percent interest per year for 30 years and then to return the originally invested $100,000. This bond fails part 1 of the derivatives definition because it is not an exchange of future cash payments: all future payments flow from Apple to the investors. The bond also fails part 2 because the investor pays for the bond up front and in full. Finally, the bond fails part 3 as well, because if Apple defaults, investors obtain redress through the relevant bankruptcy process.

MORTGAGE-BACKED SECURITIES. Mortgage-backed securities (MBSs), which will be particularly relevant in the discussion of the financial crisis, are, with few exceptions, not derivatives. Beginning in the 1970s, through a process known as securitization, mortgage loans were made to homeowners, packaged into MBSs, and then sold to investors. To explain the simplest form of MBS, namely a "pass-through," consider a financial company that made 1,000 mortgage loans of $100,000 each for a total loan amount of $100 million. The company then packaged those 1,000 mortgages into a pass through MBS that it sold to investors.

Over time, investors in the pass-through received the homeowners' mortgage payments until all of the mortgages were extinguished. The financial company, however, earned fees both on the mortgage loans and the securitization and recovered the $100 million it had lent through the sale of the MBSs to investors. The company, thus unencumbered, could repeat the process by building another portfolio of mortgage loans.

Pass-through MBSs are not derivatives. They are, in fact, more like bonds. Investors pay up front and in full for the portfolio of mortgages, and future cash payments flow exclusively from the MBS to investors. Furthermore, if any homeowner defaults, investors or their agents must let the appropriate legal process run its course. As stated earlier, the classification of MBSs as securitizations rather than derivatives is not controversial in the policy context, as demonstrated by the fact that Dodd-Frank, for example, deals with securitizations and derivatives under separate titles.

COLLATERALIZED DEBT OBLIGATIONS. A more complex security, which also played an important role in the financial crisis but is not a derivative, is a CDO. A CDO might start with a portfolio of $100 million principal amount of debt securities, commonly corporate bonds or mortgages. The cash flows from this portfolio would then be divided into a number of tranches. For the purposes of discussion, assume a very simple CDO structure with only two tranches, a senior tranche assigned $90 million of principal and a junior tranche assigned the remaining $10 million of principal. The senior tranche receives all principal payments from the underlying portfolio until its assigned $90 million principal amount has been repaid. Only then does the junior tranche begin to receive its principal payments.

Whatever the credit quality of the underlying portfolio of corporate bonds or mortgages, the senior tranche of the CDO will be of higher credit quality than the junior tranche. Say, for example, that losses on the portfolio, because of defaulting corporations or homeowners, turn out to be $5 million. In that case, the senior tranche would still receive its $90 million in principal, as promised, but the junior tranche would receive only $5 million of the $10 million promised. In other words, if the CDO's underlying portfolio experiences a loss rate of 5 percent, then the senior tranche experiences a loss rate of 0 percent, while the junior tranche experiences a loss rate of 50 percent.

Returning to the question of whether CDOs are derivatives, one finds the answer is no. The rules for paying investors are relatively complex, but, in essence, the CDO is still like a bond. Investors pay for the securities up front and in full, subsequent cash flows are all from the CDO to the investors, and any defaults would be resolved according to the relevant bankruptcy procedures.

EMBEDDED DERIVATIVES. The definition of a derivative presented here is clear and workable, but it is not always perfectly satisfying. To see this, return to structured notes, which played a role in the bankruptcy of Orange County. As an example, consider a note that costs $1 million, promises an interest rate equal to 10 percent minus a short-term market rate of interest, and after 10 years promises the return of the original $1 million investment. Assume further, for simplicity, that the market rate never exceeds 10 percent. Then, strictly speaking, this structured note is not a derivative: investors pay up front and in full for the notes, future payments are all from the issuer of the note to the investors, and any default of the issuer would be governed by bankruptcy law. This classification is, by the way, a matter of law: structured notes are not "swaps" under Dodd-Frank.[29]

Although the structured note is not, strictly speaking, a derivative, it is, from an economic perspective, a bond with a derivative attached to it. To see this, consider a portfolio of the following two financial instruments: (1) a bond that costs $1 million, promises an interest rate of 5 percent, and, after 10 years, promises the return of the original $1 million investment and (2) an interest rate swap, which costs nothing today, in which the investor receives 5 percent and pays a short-term market rate of interest on $1 million for the next 10 years. That portfolio

"The classification of mortgage-backed securities as securitizations rather than derivatives is not controversial in the policy context. Dodd-Frank, for example, deals with securitizations and derivatives under separate titles."

"During and immediately after the 2007–2009 financial crisis, derivatives came under intense scrutiny. Looking carefully at the events of 2007–2009, however, it is clear that derivatives played only a minor part in the crisis."

is identical in function to the structured note discussed in the previous paragraph: the bond and interest rate swap *together* have a cost of $1 million, pay 10 percent minus a short-term market rate of interest each year, and return $1 million at the end of the 10 years. But the interest rate swap component, if written up legally as a swap, is a derivative. Hence, structured notes are functionally bonds with embedded derivatives.

It should be noted that there are many common and well-known securities that, while not formally derivatives, do embed derivatives. A callable bond is a bond where the issuer of the bond has an option to buy the bonds back from investors at some fixed schedule of prices. The bond part of a callable bond is not a derivative, but the option part is. Similarly, a convertible bond is a bond in which the purchaser has the option to convert the bond into the issuing company's stock. Once again, the bond part is not a derivative, but the option part is. As a final example, callable preferred stock is a combination of preferred stock, which is not a derivative, and an option of the issuing company to buy back the preferred stock at a fixed price, which is a derivative.

DERIVATIVES AND THE FINANCIAL CRISIS

During and immediately after the 2007–2009 financial crisis, derivatives came under intense scrutiny. Critics claimed they played a key role in causing and amplifying the crisis, and made strident calls for greater regulation. If one looks carefully at the events of 2007–2009, however, one can clearly see that derivatives played only a minor part in the crisis. In fact, the only point at which they had a significant impact came with the failure of AIG—but even then, blame falls more fairly on the firm's misguided business strategy than it does on derivatives themselves.

Derivatives Were Not a Cause or Trigger of the Financial Crisis through Early September 2008

It is remarkable how the false narrative of derivatives' causing or triggering the financial crisis has achieved such broad and unquestioning acceptance. This narrative is easily refuted, however, by following the timeline of the crisis.[30] The purpose here is not to describe the cause of the crisis, but rather to illustrate the fact that it was not derivatives.

In the years before the crisis, lenders were making more and more subprime mortgage loans—that is, mortgage loans to relatively low-credit borrowers. Then, throughout 2007, evidence mounted that those subprime mortgages were defaulting at alarming rates. HSBC announced in March 2007 that a particular subprime portfolio was experiencing much higher delinquencies than anticipated. BNP Paribas announced in August 2007 that it could not even estimate the values of three money market funds with exposures to subprime mortgages. Those revelations and others shook the market's confidence in lower-quality mortgages and, by extension, in the firms whose businesses and inventories were tied up in this asset class. Creditors and investors withdrew funding from such firms, resulting in casualties that included the largest single-family mortgage originator in the United States at the time, Countrywide Financial. Firms originating higher-quality mortgages, such as the United Kingdom's Northern Rock, also began to lose funding.

Throughout the remainder of 2007 and the start of 2008, more and more firms reported mortgage-related losses, including Citibank, Merrill Lynch, UBS, and, of course, Bear Stearns. With secured and unsecured borrowings resulting in a leverage ratio of more than 30[31] and with the value of its mortgage-related assets plummeting, Bear lost the confidence of the market. Its independent existence ended in March 2008 when, with financial assistance from the Federal Reserve, it was acquired by JPMorgan Chase.

Whether Bear's stockholders received too much or too little from the transaction can be debated, but its creditors and counterparties, who suffered no losses, were certainly bailed out by the Federal Reserve–facilitated acquisition. Federal Reserve Chairman Ben Bernanke and Federal Reserve Bank of New York Presi-

dent Timothy Geithner defended their actions in saving Bear from bankruptcy by saying that a "disorderly failure" would have "unpredictable but likely severe consequences for market functioning and the broader economy."[32]

Although the consequences of liquidating Bear's derivatives books were among the specific fears motivating Bernanke and Geithner to save Bear, they had a number of other fears as well, including a run on firms with exposures to Bear, a run on firms with business models similar to Bear's,[33] and the freezing of the "repo" market, which provides crucial short-term financing to financial firms.[34] (In a *repurchase agreement*, or "repo," securities are sold to a buyer with the provision that they will be repurchased in the future, typically at a higher price.) As will be discussed later, fears of liquidating a broker-dealer's derivatives books were overblown, which can be understood both from a conceptual perspective and from the subsequent Lehman Brothers experience.

Return now to the timeline of the crisis. In the wake of the failure of Bear Stearns, the Federal Reserve initiated extraordinary liquidity facilities to lend money to investment banks and to nonbank subsidiaries of bank holding companies. These facilities were extraordinary because the Federal Reserve traditionally made such loans only to banks that were members of the Federal Reserve System.

The Federal Reserve's liquidity facilities calmed markets for a while, but mortgage-related losses continued to plague the financial industry. Mortgage insurers MBIA and Ambac lost their AAA ratings in June 2008; IndyMac, one of the largest mortgage originators in the country, failed in July; and Fannie Mae and Freddie Mac failed in early September.

Fannie Mae and Freddie Mac were the two giant, privately owned but government-sponsored entities that had been created to facilitate home ownership. With short- and long-term debt creating effective leverage ratios of between 50 and 100,[35] losses from mortgage-related assets and guarantees proved fatal. They were rescued and taken into conservatorship by the U.S. Treasury.

As of this point in the story, in early September 2008, the spectacular failures of the financial crisis, along with government support of privately owned firms, were caused by a combination of high leverage and falling prices of mortgage loans, MBSs, and mortgage-backed CDOs. Because those mortgage-related securities are not derivatives, as explained in the previous section, one cannot say that derivatives caused or triggered the crisis as of early September 2008. Some have argued that synthetic mortgage-backed CDOs, which are derivatives, played an important role in fueling the crisis.[36] But in fact, the limited role played by such derivatives will be discussed in a separate section later in the paper.

The Liquidation of Lehman Brothers' Derivatives Books Did Not Aggravate the Financial Crisis

As was the case for other firms caught up in the crisis, Lehman Brothers' financial condition deteriorated from a combination of too much borrowing and excessive exposures to real estate–related assets. Derivatives, therefore, do not enter the crisis narrative as a cause of Lehman's failure. They do enter the narrative, however, in two other ways. First, Lehman's bankruptcy triggered the liquidation of its large derivatives books. Second, firms that had written insurance on Lehman's debt in the form of CDSs had to make good on their promises. Lehman, like all major financial firms, had a great many derivatives agreements in place with many different counterparties. When the firm filed for bankruptcy protection, early in the morning on September 15, 2008, its counterparties could no longer rely on Lehman's fulfilling its derivatives commitments and had to act accordingly.

To understand the actions taken by Lehman's counterparties at the time of the bankruptcy and why those actions might have disrupted markets, consider the following example. Say that years before the bankruptcy, Deutsche Bank and Lehman had entered into an interest rate swap in which Lehman paid Deutsche 5.25 percent on $100 million and Deutsche paid Lehman a short-term floating rate on that same $100 million.

"The spectacular failures of the financial crisis were caused by a combination of high leverage and falling prices of mortgage loans, mortgage-backed securities, and mortgage-backed collateralized debt obligations."

"The prospect of liquidating Lehman's massive derivatives books should not have been as frightening as it appeared to some at the time."

As of September 2008, the swap between Lehman and Deutsche had another 10 years to run, but the swap rate had fallen to 4.25 percent. Clearly the swap had a positive value to Deutsche and a negative value to Lehman: Deutsche had locked in 5.25 percent for the next 10 years, whereas the market rate was only 4.25 percent. In fact, roughly speaking, the value of this agreement to Deutsche was $8 million (and -$8 million to Lehman).

When Lehman declared bankruptcy, Deutsche could no longer rely on Lehman's promise to pay 5.25 percent on the $100 million. It had protected itself, however, like many derivatives counterparties, by holding margin to ensure performance. Assume for simplicity that Deutsche had exactly $8 million of Lehman's cash in margin against this interest rate swap. Deutsche held the swap with Lehman for a reason (e.g., as a hedge against some other positions). In response to Lehman's bankruptcy, therefore, it would have terminated the swap and tried to enter into the same swap with a different, financially healthy counterparty.

More specifically, Deutsche might have approached Morgan Stanley and said, "We want you to pay us 5.25 percent on $100 million for 10 years in exchange for our paying you a floating rate. Because the market rate today is only 4.25 percent, meaning this swap would be worth $8 million to us, we'll pay you that $8 million up front." If Morgan Stanley had agreed, Deutsche would have used Lehman's $8 million in cash to enter into the new swap with Morgan Stanley. (Recall that Deutsche would have been allowed to cancel its swap with Lehman and seize the $8 million of collateral because of the derivatives safe harbor discussed earlier.)

Now consider the systemic risks that might arise from the failure of a firm with a large book of derivatives. Deutsche can easily replace one swap it had with Lehman with one new swap with Morgan Stanley. But at the time of Lehman's default, its U.S. estate was a counterparty to more than 900,000 OTC derivatives contracts governed by more than 6,000 legal agreements.[37]

What happens to markets when all affected counterparties try to replace all of their swaps with Lehman at the same time? In terms of the simple example, if a lot of counterparties like Deutsche tried to replace their swaps at once, would they all be able to find new swap counterparties? Would the rush for the exits mean that they would each have to pay $9 million or $10 million to replace their swaps, rather than $8 million?

The prospect of liquidating Lehman's massive derivatives books should not have been as frightening as it appeared to some at the time.[38] First, Lehman's derivatives books were concentrated in relatively liquid derivatives markets, namely, interest rate swaps and CDSs on corporate bonds. Second, Lehman's derivatives books were relatively balanced because, in those markets, Lehman acted mostly as a derivatives dealer—that is, facilitating transactions for its clients rather than speculating on market movements.

With respect to interest rate swaps, Lehman's having been a dealer meant that nearly as many of its counterparties were paying a fixed rate to Lehman as were receiving a fixed rate from Lehman. Hence, after Lehman defaulted, everyone in the market was not looking to pay a fixed rate or receive a fixed rate. Instead, the demand to pay and to receive fixed rates was about the same, and the counterparties, in effect, had to find each other and pair off.

As it turned out, because Lehman's OTC derivatives book were relatively liquid and balanced, the derivatives' liquidation did not disrupt the financial system. True, prices were very volatile in the days after Lehman's default, though a lot of that can be attributed to the news—the day after Lehman's bankruptcy—of AIG's failure and of the beginning of a run on prime money market funds. But it would be a vast exaggeration to say that markets for interest rate swaps and CDSs on corporate bonds broke down. Furthermore, no derivatives counterparty failed because of having lost or having to replace its derivatives contracts with Lehman. In fact, in subsequent regulatory filings, only two of Lehman's major derivatives counterparties even mentioned losses from the termination and replacement of derivatives contracts.[39]

The market's success in liquidating Lehman's derivatives books is perfectly consistent with significant individual gains and losses. Some counterparties might have lost money, and some might have made money. Lehman's estate probably lost money relative to what would have happened in a hypothetical, more orderly liquidation. And market participants without any exposure to Lehman might have lost or gained in the ensuing market volatility. All these outcomes, however, are zero sum: what one market participant lost, another gained.

Contemporary criticism of derivatives is directed primarily at OTC markets, but the liquidation of Lehman's exchange-traded derivatives is also instructive.[40] Following the bankruptcy, the Chicago Mercantile Exchange (CME) took control of its positions with Lehman and, through an auction, divided these positions among members of the exchange. Barclays, for example, agreed to take over Lehman's energy positions, which were valued as a liability of $372.4 million, in exchange for receiving $707.4 million of Lehman's collateral.[41] All in all, with $2.3 billion of available Lehman collateral, the CME was able to induce members to take over all of Lehman's positions.[42]

This account demonstrates that the CME's liquidation of Lehman's exchange-traded derivatives was also insignificant in the evolution of the crisis. Once again, however, this conclusion is consistent with gains being experienced by some participants and losses by others. For example, if Barclays ultimately managed to unload the energy positions it took over for less than the $707.4 million it received in collateral, then it made money from that transaction; if that unloading proved more expensive than $707.4 million, then it lost money.

Settlement of CDSs Written on Lehman Did Not Aggravate the Financial Crisis

The liquidations of Lehman's derivatives were the first way in which derivatives entered the crisis narrative as a consequence of Lehman's bankruptcy. The second way was the settlement of CDS contracts written on Lehman. Recall that a CDS on a corporate bond is very much like insurance, and then consider a firm that had sold $1 million of protection on Lehman bonds. After Lehman filed for bankruptcy, its bonds declined in value such that every $100 in principal was worth only $8.625, which meant that holders of Lehman bonds suffered a principal loss of $91.375 per $100 principal amount. Consequently, the firm that had sold $1 million of CDS protection on Lehman owed $1 million times 91.375 percent, or $913,750.

At the time of Lehman's bankruptcy there were $400 billion of outstanding CDSs referencing Lehman. If sellers and purchasers of protection on Lehman were completely separate, so that $400 billion of insurance was effectively in force, then the group of protection sellers would have had to pay $400 billion times 91.375 percent, or $365.5 billion to the group of protection buyers. That is a very big number, which was a source of significant fear at the time.[43] What if some systemically important protection sellers were forced into bankruptcy because they could not make good on their CDS obligations?

Those fears led to a common criticism of CDSs. Lehman had only $150 billion of debt outstanding. So how could there be $400 billion of CDS protection outstanding? There must have been a huge amount of speculation on Lehman's bankruptcy—that is, many entities must have bought insurance on Lehman's bonds even though they did not own any of those bonds.[44]

Fears and criticisms concerning the settlement of CDSs on Lehman, however, suffered from a fallacy. Credit default swap positions are very often offsetting. A dealer would have bought protection on Lehman from one client and sold protection to another client. An asset manager might have first bought but then subsequently sold protection. In other words, very few market participants make very large, one-sided bets on the credit quality of a single firm.

The uncertainty was resolved on October 21, 2008. Protection sellers owed a total of only $6 billion to $8 billion to protection buyers.[45] The amount of offsetting trades was very large. The settlement of CDSs written on Lehman had no systemic consequences.

"The market's success in liquidating Lehman's derivatives books is perfectly consistent with significant individual gains and losses."

"AIG has become an anti-derivatives poster child for those who assign the blame for its failure and bailout on its derivatives positions."

Derivatives Played a Significant But Not Exclusive Role in the Failure and Bailout of AIG

Derivatives did play a significant role in the collapse of AIG.[46] AIG had written $527 billion of CDS protection on corporate loans, prime residential mortgages, corporate debt, and mortgage-based CDOs. Most of the $527 billion of CDS protection sold by AIG caused no problems through the financial crisis. This was not true, however, for the $78 billion of CDS protection sold on the mortgage-based CDOs.

The CDOs in question held subprime or other low-quality mortgages. The tranches on which AIG wrote CDS protection, however, were mostly AAA-rated securities. As explained in a previous section, if enough of the principal amount of a CDO was assigned to junior tranches, which bear losses first, then the most senior tranches would, in theory, be protected from losses and be worthy of the highest credit ratings.

As the crisis played out, however, mortgage defaults were high enough to inflict losses on these AAA tranches. Furthermore, prices of mortgages and MBS fell from 2007 through 2008 not only because default rates had increased, but also because markets feared further increases in default rates and because lenders became increasingly unwilling to fund purchases of MBSs. The precipitous fall in the market prices of MBSs and, by implication, their associated CDOs was a huge problem for AIG. Falling CDO prices increased the market's valuation of AIG's insurance liabilities to make investors whole. These higher liability valuations, by definition, saddled AIG with significant (though unrealized) losses on its CDS portfolio.

The more pressing problem, however, was that, as MBS prices fell, AIG's CDS counterparties demanded additional margin to ensure AIG's performance on its obligations. From June to mid-September 2008, the amount of collateral AIG posted against its CDSs on CDOs increased from $13.2 billion to $22.4 billion. Calls for additional margin did not stop there, and AIG, facing losses and cash drains from other businesses as well, was in imminent danger of failing.[47] The Federal Reserve and the U.S. Treasury rescued the company on September 16, 2008, with an initial $85 billion credit facility plus subsequent loans and infusions of $97.3 billion, for a total of $182.3 billion.[48] AIG has become an antiderivatives poster child for those who assign the blame for its failure and bailout on its derivatives positions. That reasoning is an oversimplification of the full story, however, in which blame does not land solely on derivatives.

First, although CDSs on CDOs significantly contributed to the failure of AIG, those swaps were not the only contributor. The company lost money across the board: of its $99 billion loss in 2008, only $29 billion was from CDS positions. Furthermore, AIG's securities lending business rivaled the destructiveness of its CDS book.[49] Not only did that business lose a comparable $21 billion in 2008, but it also drained a comparable amount of desperately needed cash.[50]

Second, of the $182.3 billion in bailout funds provided by the government, only $51.7 billion, or about 28 percent,[51] was used to manage and eventually liquidate AIG's derivatives positions: $22.4 billion in direct payments to AIG's derivatives counterparties;[52] a $24.3 billion loan by the Federal Reserve to Maiden Lane III, which was the vehicle established to hold and eventually liquidate the CDOs on which AIG had written insurance;[53] and a $5 billion equity contribution by AIG to Maiden Lane III.[54]

Third, AIG's largest derivatives counterparties were not so exposed to an AIG default that their viability required a bailout. According to one set of calculations, the exposures of large financial institutions to a default on AIG's CDS obligations were hardly apocalyptic, varying from 1.3 percent of equity (Rabobank) to 7.6 percent (Société Générale).[55]

Fourth, although anxiety about AIG's derivatives counterparties was definitely a consideration in the decision to rescue AIG,[56] despite the relatively unthreatening exposures presented in the previous paragraph, the Federal Reserve and the U.S. Treasury took into account many other factors—unrelated to derivatives—in their decision to bail out the company:

1. There were many nonderivative, direct exposures to AIG, including bank lines, securities lending arrangements,[57] money market fund investments,[58] holdings of AIG debt,[59] life insurance and annuity products, and surety bonds for construction projects.[60] Interestingly, the significant financial difficulties facing AIG's life insurance subsidiaries, because of the company's securities lending losses, were not well understood at the time of the bailout.[61]
2. There were several potential indirect or spillover effects from an AIG bankruptcy, such as frightened customers rushing to cash out insurance polices,[62] a loss of confidence in insurance companies as an industry,[63] and nervous creditors refusing to lend money to corporations in the commercial paper market.[64]
3. There was a more expansive fear that the collapse of AIG, with its "size, name, franchise and market presence, [would] raise questions about potential worldwide contagion."[65]

Synthetic CDOs Did Not Cause or Trigger the Financial Crisis

Almost all of the financial institutions that failed during the crisis suffered crippling losses from their (nonderivative) mortgage and real estate investments. AIG was the notable exception, of course; a lot, but far from all, of its losses came from derivatives positions. Even putting AIG aside, however, it has been argued that synthetic CDOs, which package CDSs on mortgages, played a major role in the crisis.[66] This section explains synthetic CDOs and argues that they did not cause or trigger the financial crisis.

The CDO described earlier, which is called a "cash CDO," divided the default risk of a portfolio of mortgages across tranches. More specifically, starting with a cash position of $100 million of mortgages, the $10 million junior tranche was assigned all losses on the underlying mortgages up to $10 million. Any further losses were assigned to the remaining $90 million senior tranche.

A synthetic CDO, by contrast, started with a "short" side trading firm or bank that bought CDS protection on $100 million of a "reference" portfolio of mortgages or CDO tranches. These purchasers of protection paid regular insurance premiums in exchange for payments when the reference portfolio experienced losses. If losses on the reference portfolio were $10 million, for example, the buyers of protection received $10 million.

The "long" side of the synthetic CDO consisted of insurers, investors, or financial firms that sold protection on the same $100 million reference portfolio. The sellers of protection were divided into tranches that were "funded" or "unfunded." In a $5 million junior funded tranche, for example, an investor paid $5 million for a note that paid interest but deducted from returned principal the first losses on the reference portfolio. In that case, a $10 million loss on the reference portfolio wiped out the junior tranche investor.

In a senior unfunded tranche, an insurer sold CDS protection on the reference portfolio. In exchange for receiving premium payments, this seller of protection made payments only if the junior tranche had been wiped out. For example, if the losses on the reference portfolio were less than the $5 million junior tranche, the senior unfunded tranche paid nothing. If the losses on the reference portfolio were much larger, however, say $15 million, then this senior tranche paid $10 million.

To summarize, the buyers of protection in a synthetic CDO were called the short side because they profited when the reference portfolio of securities experienced losses. The sellers of protection, funded or unfunded, were called the long side because they paid money when the reference portfolio experienced losses. The CDO was called synthetic because the reference portfolio was not part of the deal; its loss experience mattered to the synthetic CDO only as a means to calculate payments due from the long side to the short side.

Synthetic CDOs were beneficial in that they allowed banks and others to buy protection on their holdings of mortgage products.

"Almost all of the financial institutions that failed during the crisis suffered crippling losses from their (nonderivative) mortgage and real estate investments."

"Although side bets through synthetic collateralized debt obligations did result in losses, these losses did not have adverse systemic consequences."

This benefit might have been destabilizing, however, if systemically important institutions had failed because they had sold too much protection. It is therefore necessary to examine the role of synthetic CDOs through the crisis.

As of April 2008, the outstanding principal of synthetic CDOs was about $160 billion, which was 1.5 percent of the size of the entire residential mortgage market and 2.5 percent of the non-GSE market—that is, the purely private and riskier market.[67] Those numbers understate the significance of synthetic CDOs, however, because the derivatives were riskier than many other mortgage-related securities. According to one set of estimates at the time, synthetic CDOs constituted from 8 percent to 15 percent of the total risk of outstanding residential mortgage securities.[68]

The fraction of risk resulting from synthetic CDOs is hardly overwhelming. Moreover, it would be incorrect to conclude that this risk added to systemic risk without knowing who held how much of the risks on the short side and who held how much on the long side.

Exact figures are not available, but large banks and broker-dealers appear to have held a lot of the short-side risk of synthetic CDOs to hedge their long CDO positions.[69] To the extent that large financial institutions did hedge in this way, while long-side investors were smaller and more diffuse, synthetic CDOs spread risk away from systemically important financial institutions and made the system safer. AIG, of course, was not part of this virtuous circle: it was a large financial institution that purchased and held too much concentrated mortgage exposure in the form of CDS protection it had sold to banks and broker-dealers.

Another portion of the risk of synthetic CDOs was in pure side bets between short-side investors, such as hedge funds, and long-side investors, such as small foreign banks. Although long-side investors ultimately lost money on these side bets, those losses did not have system-wide consequences.

What then are the two main arguments for synthetic CDOs contributing to the financial crisis? The first argument is that, by facilitating bets on mortgages without the need to buy or sell those mortgages, synthetic CDOs expanded the population of investors and traders who could bet on the housing market. As a result, when prices fell dramatically, there were more losses to be distributed across the system.[70] This argument, taking the outstanding amount of mortgages as given, assumes that the risk of synthetic CDOs was completely additive and systemic. As described earlier, however, hedging with synthetic CDOs actually reduced risk at large financial institutions. Furthermore, although side bets through synthetic CDOs did result in losses—one of the two counterparties in a derivatives trade always loses—these losses did not have adverse systemic consequences.

Readers of this paper will realize that this first argument against synthetic CDOs makes a mistake that is common in discussions about derivatives markets. Because businesses use derivatives for a reason, derivative positions often combine with other positions to produce desirable risk profiles. Wheat futures and interest rate swaps may look risky in isolation, but they reduce risk in the broader business context. Counterparties who had sold CDS protection on Lehman Brothers were not so dangerously exposed to a default as was feared from fixating on the total amount of Lehman CDSs outstanding. Similarly, some of the outstanding risk from synthetic CDOs hedged the existing mortgage risk of large financial institutions.

The second argument is that synthetic CDOs contributed to the crisis by facilitating the hedging of credit risk, thus encouraging market participants to increase mortgage underwriting and investment, particularly those participants of lower credit quality. As a result, outstanding mortgage debt was greater and riskier than it would have been otherwise.[71] From a narrow perspective, this argument has to be right. One reason derivatives exist is so that businesses can hedge risks and, as a consequence, can increase the size of their operations with relative safety. Anheuser-Busch can produce as much beer as it does because it uses derivatives to control the risks of increasing input costs. Similarly, mortgage market partici-

pants almost certainly did produce and absorb some quantity of additional mortgages because mortgage risk could be hedged.[72]

One of the key problems in the financial crisis, however, was not simply that institutions decided to take on too many financial risks related to mortgages, but rather that the risks of the mortgage market were widely underestimated or ignored. In other words, for many reasons beyond the scope of this paper, many investors were willing to buy too many mortgage-related assets at prices that were too high. Not surprisingly, derivatives counterparties were among those too eager to take long-side mortgage risk, whether by buying funded tranches or writing CDS protection. According to the statistics presented earlier, however, mortgage risk at the time of the financial crisis resided predominantly in the cash markets and to a much lesser extent in derivatives markets.

To summarize, it is narrowly correct to say that hedging with synthetic CDOs increased the size and risk of the mortgage market. Because the size of the synthetic CDO market was small relative to the cash market, however, and because the same excesses of mortgage investing drove both the cash and derivatives markets, it is not sensible to lay much of the blame for the financial crisis on synthetic CDOs.

Following this line of reasoning, by the way, one can argue that short-side synthetic CDO speculators, as opposed to hedgers, actually *dampened* growth in the mortgage market. By definition, speculative shorts were not hedging and, therefore, did not add to the demand for mortgage product. Furthermore, their short positions allowed some long-side investors to purchase mortgage exposure synthetically. Therefore, by satisfying this portion of long-side demand, speculative shorts replaced underwriters and financial institutions that would have otherwise been making new mortgage loans.[73]

Finally, some short-side participants in synthetic CDOs are alleged to have known a lot more than the long-side about the poor credit quality of certain referenced mortgages.[74] However, whatever the merits of these allegations, and whatever their legal and ethical implications, they are not directly relevant to the question of whether synthetic CDOs triggered or caused the financial crisis.

OTC DERIVATIVES AND THE DODD-FRANK ACT OF 2010

This paper argues that the destabilizing losses during the financial crisis of 2007–2009 resulted predominantly from a combination of excessive debt and oversized investments in nonderivative mortgage products. Furthermore, the crisis was very much underway when—the day after Lehman Brothers' bankruptcy—AIG failed and was rescued on account of losses from both its CDS and (nonderivative) securities lending businesses.

A very different narrative of the crisis, however, motivated Title VII of the Dodd-Frank Act, which made sweeping changes to the laws governing OTC derivatives. For example, House Financial Services Committee Chairman Barney Frank described an early version of Title VII to fellow House Democrats as follows:

> Our legislation brings tough new restrictions for the first time to the opaque, unregulated [OTC derivatives] market. . . . Dealers and large market participants will face robust new regulation and never again will an organization such as AIG be able to amass a large, unsecured position in swaps that can threaten the stability of the financial system.[75]

The overarching view of Title VII is that exchange-traded derivatives are more transparent and safer than OTC derivatives. The main provisions of the law, therefore, are designed to make OTC derivatives more like exchange-traded derivatives. In particular, Dodd-Frank mandates that OTC derivatives be cleared whenever possible, that regulators set margin rules for uncleared OTC derivatives, and that all OTC derivatives trades be reported to data warehouses. The following sections of the paper describe those provisions of Dodd-Frank and argue that, although they are likely to dis-

"It is not sensible to lay much of the blame for the financial crisis on synthetic collateralized debt obligations."

> "In the context of derivatives regulation, clearing means that a central counterparty interposes itself between the two parties of a derivatives trade."

courage the use of OTC derivatives, they are unlikely to reduce systemic risk appreciably.

A Description of Clearing and Its Advantages

As a prelude to a discussion of whether the Dodd-Frank mandate to clear OTC derivatives will, as intended, reduce systemic risk, this section describes clearing and its advantages. In the context of derivatives regulation, clearing means that a central counterparty (CCP) interposes itself between the two parties of a derivatives trade. A trade without the interposition of a CCP is called a bilateral or uncleared trade.

As described earlier, the City of Oakland agreed to pay 5.7 percent to (and receive floating payments from) Goldman Sachs through a bilateral interest rate swap. Oakland and Goldman negotiated the margin rules for the trade, and if one party were to default on its obligations under the swap, the other party would bear any resulting losses.

By contrast, if this interest rate swap had been cleared, say by the Chicago Mercantile Exchange (CME), then the trade would, in fact, have been executed as two separate agreements. In the first agreement, Oakland would have agreed to pay 5.7 percent to the CME. In the second agreement, the CME would have agreed to pay 5.7 percent to Goldman. The margin rates and collateral rules for both agreements would be those established by the CME for its swaps clearing business. As a consequence of clearing this swap, the CME and its member firms, as the CCP, would be exposed to any losses resulting from an Oakland or Goldman default. Or, from the perspective of the parties to the swap, clearing means that Oakland and Goldman are not directly exposed to the default of the other.[76]

All exchange-traded futures are cleared. This means, for example, that when Anheuser-Busch buys wheat futures, as discussed earlier, it faces the futures exchange as a counterparty. There are three advantages to clearing derivatives trades. First, clearing outsources aspects of risk management to a CCP. Rather than every buyer and seller of futures contracts verifying the creditworthiness of its derivatives counterparties, pricing the contracts every day and computing appropriate margin levels to ensure performance, the CCP performs those functions for everyone.

Outsourcing risk management to a CCP is most valuable to smaller market participants for whom the applicable fixed costs might be prohibitively expensive. This outsourcing is also valuable for relatively simple and liquid derivatives, where there is wide agreement on pricing and margin levels. Goldman might be very willing to outsource some of its risk management of wheat futures positions while refusing to outsource any of the risk management of its CDSs on mortgage CDOs.

The second business reason to clear derivatives is netting. Say that Goldman had portfolios of interest rate swaps with many clients. At the end of each business day, depending on the individual portfolios and the changes in market prices, Goldman would owe additional margin to some of its counterparties and would be owed additional margin from others. If the swaps were uncleared, Goldman would send margin to or receive margin from every single one of its counterparties. If the swaps were cleared, however, Goldman, along with every other counterparty, would make one net payment to, or receive one net payment from, the CCP. This significant reduction in the number of payments reduces operational complexity and settlement risk.

The third business advantage of clearing is automatic compression, although this advantage is applicable only for standardized products. Following up on an example from earlier in the paper, say that Quantmetrics sold 100 July SRW wheat futures contracts to Anheuser-Busch on Monday morning. The following Wednesday, Quantmetrics bought 100 of the same contract from a farmer. If the wheat contracts were not cleared, then, until July, there would be 200 outstanding commitments to buy (100 from Anheuser-Busch and 100 from Quantmetrics) and 200 outstanding commitments to sell (100 from Quantmetrics and 100 from the farmer). Because the contracts

are cleared, however, the CCP cancels the 100 contracts Quantmetrics sold to the CCP on Monday against the 100 contracts it bought from the CCP on Wednesday. As a result of this compression, there are only 100 remaining commitments to buy (from Anheuser-Busch) and 100 remaining commitments to sell (from the farmer). With only the Anheuser-Busch–to–CCP and farmer-to-CCP contracts outstanding, there is less settlement activity in July. Furthermore, a Quantmetrics default becomes completely irrelevant, with neither the CCP nor any of the surviving counterparties suffering any disruption or even inconvenience.

Mandatory Clearing Will Not Significantly Reduce Systemic Risk

Dodd-Frank mandates the clearing of OTC derivatives whenever possible primarily to reduce systemic risk.[77] Proponents of this approach argue that CCPs reduce systemic risk by requiring that adequate margin be collected against derivatives exposures, by minimizing the interconnectedness of financial firms,[78] and by establishing procedures to liquidate the positions of a failing derivatives counterparty.

Before addressing those three arguments, it is important to note that only the most liquid OTC derivatives can and will be cleared under Dodd-Frank. A CCP will agree to clear a particular derivatives security only if it can both confidently price the security and calculate a margin requirement that safeguards itself and its members. Similarly, as discussed in the previous section, an OTC derivatives counterparty will outsource its pricing and margin decisions to a CCP only if it feels that the CCP can perform these functions well. That only liquid derivatives will be cleared is more unspoken than controversial. Dodd-Frank explicitly forbids CCPs from imperiling their financial soundness through clearing. Furthermore, only the most liquid OTC derivatives are currently being cleared, namely, interest rate swaps and CDSs on government and corporate bonds.

Turn now to the first argument in support of mandatory clearing. Will the mandatory clearing of liquid derivatives reduce systemic risk by having CCPs replace individual firms in setting margin requirements? Probably not, for the following reasons:

- For liquid products, methodologies to calculate appropriate margin levels are relatively simple and standard. There is no reason to believe that CCPs have any more or less relevant expertise than any large financial firm. CCPs may very well have more margin expertise, even for liquid products, than smaller and less sophisticated financial firms, but these firms are typically not of any systemic concern.
- One might argue that CCPs are more likely to maintain appropriate margin levels than individual firms that might compete with each other by excessively lowering margin requirements. However, competition among CCPs for clearing business might very well lead to a similar erosion of margin protection.
- When firms have positions with each other in both liquid and illiquid derivatives, clearing the liquid derivatives alone can actually increase risk.[79] To understand why this is true, say that Goldman and Anheuser-Busch have agreed to a portfolio of interest rate swaps, which are relatively liquid, and aluminum swaps, which are relatively illiquid. By the principle of diversification, the margin calls on the portfolio of all the swaps considered together would be less volatile than the sum of the margin calls on the interest rate swaps and on the aluminum swaps considered separately. Hence, risk would be lower for both Goldman and Anheuser-Busch if they faced each other on all the swaps than if they faced each other only on the interest rate swaps and faced the CCP on the aluminum swaps. Under mandatory clearing, however, only the latter, riskier alternative is permitted.

The fact that clearing can increase risk under some circumstances is not an argument against clearing, but an argument against *mandatory* clearing. Left to decide

> "It is important to note that only the most liquid over-the-counter derivatives can and will be cleared under Dodd-Frank."

"Is the system safer if investment banks bear less risk when trading derivatives with end users while commercial banks bear more risk when making loans to those same end users?"

for themselves, counterparties could minimize risk by choosing exactly which subset of their trades to clear.

Incorporating the discussion of the previous section, a dealer or other market participant would decide when it is more valuable to reduce operational risk by netting positions in a limited number of products through a CCP and when it is more valuable to reduce counterparty risk by netting across both liquid and illiquid products outside a CPP.

- Some counterparties, mostly nonfinancial corporations, find it very costly to divert cash from operations to margin.[80] Derivatives dealers charged these clients an insurance premium, called a credit value adjustment, instead of collecting margin. Managed correctly, the pool of these premiums across a dealers' clients compensated for the relatively infrequent losses from events of default.

  Forcing these counterparties to post margin will increase their risks as business entities: they will either hedge less or shift to exchange-traded contracts and bear the associated basis risks. But it is far from obvious that these increases in business risk are offset by reductions in derivatives-specific risk. More concretely, is the system safer if investment banks bear less risk when trading derivatives with end users while commercial banks bear more risk when making loans to those same end users?
- Traditionally, many OTC derivatives fixed margin over the life of the contracts. A hedge fund might have to post $5 million of margin against possible losses through the maturity of a particular interest rate swap. Fixed margin agreements throughout the system provided some stability in a crisis; it was not possible for many counterparties to panic and decide simultaneously to increase margin requirements and set off a scramble for cash.

  If swaps are cleared, however, CCPs can change margin for all cleared derivatives at any time, which could further destabilize a system in crisis.[81] Regulators are well aware of this problem, but it is hard to imagine their refusing to let CCPs protect themselves in a crisis by widespread increases in margin requirements.

The second argument in support of mandatory clearing is that it reduces systemic risk by reducing the interconnectedness of financial firms. Sometimes this argument is expressed more starkly by claiming that CCPs eliminate counterparty risk. In either phrasing, however, the argument is flawed.

To understand the flaw in this argument, consider, for simplicity, a financial system with 11 firms of equal size. Each firm trades $100 million of derivatives, divided equally so as to trade $10 million with each of the other firms. If there is no CCP and one firm defaults, each surviving firm has an exposure equal to the $10 million it traded with the defaulting firm. Now change the system so that the 11 firms get together as equal partners in a CCP. If one firm fails, the CCP's exposure is the defaulting firm's $100 million of derivatives. Splitting that exposure equally across the 10 surviving CCP partners leaves each with a $10 million exposure, exactly as in the case of no CCP. In short, CCPs mutualize but do not reduce systemic risk.

In the more realistic case of firms of different sizes, so long as firms distribute their businesses in proportion to the market shares of their counterparties, the mere interposition of a CCP does not reduce or redistribute risk. If, on the other hand, firms in bilateral derivatives markets would not distribute business proportionately because, for example, they have very different beliefs about each others' credit quality, then they would most likely not agree to be joint members of a CCP.

Given that the default of a large financial institution inflicts comparable losses on the surviving firms whether they trade derivatives bilaterally or through a CCP, the government has as much of a rationale to bail out firms through a CCP as it had to bail out those firms directly. The likelihood of a bailout is most probably greater, how-

ever, because the failure of a CCP under mandatory clearing would severely disrupt, if not halt, derivatives trading. It is no wonder, then, that the larger CCPs have already been designated "systemically important financial market utilities."[82]

One argument to support the notion that CCPs reduce systemic risk is that they put capital into their businesses, which protects surviving firms from the default of another firm. But it might well be that firms trading in a system without a CCP and without this extra capital would hold (or be required to hold) more capital themselves. The relevant issue here with respect to systemic stability is the total amount of capital. Once again, the mere existence of a CCP does not reduce systemic risk.

The third argument in support of mandatory clearing is that a CCP's internal auction to liquidate the positions of a defaulting member poses less systemic risk than every counterparty liquidating on its own in an OTC market. Indeed, as recounted earlier, the CME's liquidation of Lehman's exchange-traded derivatives was managed very well with respect to limiting systemic risk. But, as also recounted earlier, the free-for-all liquidation of Lehman's OTC derivatives had no systemic consequences either. The empirical conclusion, therefore, is that, for liquid products—which are the only ones that will be cleared—neither liquidation mechanism adds much to systemic risk.

From a theoretical perspective, CCP liquidations have the advantage of being organized. Market liquidations, however, have the advantage of broader participation because they are not limited to clearing members. This advantage can be significant because some firms that are not clearing members—perhaps hedge funds and asset management firms—are sophisticated enough to take over large derivatives positions and might, in some situations, have stronger balance sheets than the clearing members.

As an aside, both CCP and market liquidations, as currently conducted, could be improved. CCP liquidating auctions could be opened up to a broader set of participants, and market liquidations could be organized into broad-based auctions.

Liquidations could also be made less disruptive by auctioning off portfolios of claims and securities that are currently liquidated separately. Say, for example, that a defaulting firm has a portfolio of Treasury bonds, which had been posted as collateral against its short-term borrowing, and has a portfolio of Treasury futures contracts that hedged the interest rate risk of those Treasury bonds. Because the overall portfolio is hedged and, therefore, not very volatile in value, selling it as a single portfolio would be relatively easy. Current practice, however, is for the lenders who hold the Treasury bonds as collateral to sell them independently of the CCP that auctions off the futures positions.

Regulatory Margin on Uncleared Derivatives Is Likely to Replace Derivatives Risk with Business Risk

As pointed out in the previous section, mandatory clearing will apply only to the most liquid of derivatives. Dodd-Frank and supporting regulation, therefore, require regulators to set margin rules for uncleared OTC derivatives. First, the current regulatory regime implicitly distrusts financial firms to set margin. Second, margin rules for uncleared derivatives are deemed necessary to prevent market participants from restructuring derivatives contracts solely to circumvent mandatory clearing requirements and CCP-determined margin.

Regulators face a truly daunting task in setting margin rules or in approving firms' internal margin methodologies for the enormously broad range of uncleared, relatively illiquid derivatives contracts. First, regulatory bodies simply lack the necessary scale and expertise. Second, the consequences of relatively small errors are severe. Setting margin too low for a particular product will encourage too much leverage in that product, whereas setting margin too high will discourage beneficial hedging activity. For those reasons, the implementation of this part of Dodd-Frank is still in progress.

The real question, however, is why one would expect regulators to do better than the marketplace in the very difficult problem of balancing

"Regulators face a truly daunting task in setting margin rules or in approving firms' internal margin methodologies for the enormously broad range of uncleared, relatively illiquid derivatives contracts."

"Problems with opacity arise more from the way firms disclose information and the way regulators use information than from the attributes of particular securities or markets."

the risks of leverage and the benefits of hedging. In the spirit of the time, the answer is very possibly that regulators will not really attempt a balance. Instead, they will set margin for uncleared derivatives at discouragingly high rates. This approach assumes, without evidence either way, that the resulting fall in derivatives risk is more important for systemic stability than the resulting increase in other business risks.

Many end users expressed their concerns, however, that increasing margin requirements would increase business risk. The following excerpt from a comment letter on proposed regulations was written by a group of captive finance companies—that is, companies that exist to finance their parent companies. (Ford Motor Credit Company, for example, lends money to purchasers of Ford cars.)

> It is vitally important that regulators do not impose margin requirements on manufacturers or on the risk-reducing transactions engaged in by captive finance companies in support of their parent manufacturers. Margin is not required in our hedging transactions today. If this were to change, there would be unavoidable finance cost increases, which would be negatively felt throughout the economy. Any disincentive to hedge legitimate business risks would serve to push risk and volatility back into the manufacturing sector.[83]

It is true that regulators are likely to exempt some set of end users from margin requirements. As discussed earlier, however, intermediaries are crucial to well-functioning derivatives markets, and they are highly likely to pass their increased costs through to end users. For this reason, any end-user exemption is unlikely to insulate end users from the increased costs of derivatives regulations.

Derivatives Reporting Requirements Are Not Likely to Help Regulators in Preventing or Managing Future Crises

The last of the three derivatives-related initiatives of Dodd-Frank discussed in this paper is the requirement to report all derivatives positions. This requirement stems, in part, from the characterization of OTC derivatives markets as "opaque." This characterization makes most sense when comparing OTC with exchange-traded derivatives. The details of an aluminum swap between Anheuser-Busch and Goldman had normally been known only to those two companies. By contrast, the purchasers and sellers of exchange-traded wheat futures and the terms of those contracts were compiled by the relevant exchange and were readily available to regulators.

From a broader perspective, however, characterizing OTC derivatives as opaque is misleading. First, firms are subject to accounting rules that mandate various disclosures on their positions and transactions. Whether current accounting rules sufficiently inform investors and creditors about OTC derivatives is a useful but separate question.[84] Second, financial firms are already subject to regulations that cover derivatives trades. The SEC had regulatory authority over Lehman Brothers and its derivatives books, for example, because that firm became a "consolidated supervised entity" in 2005.[85] Third, many other financial transactions are just as opaque as OTC derivatives agreements in the sense that details are not collected and stored in a dedicated repository. These other transactions include, for example, bank loans, financial guarantees, letters and lines of credit, private equity investments, and insurance policies.

These reasons all suggest that problems with opacity arise more from the way firms disclose information and the way regulators use information than from the attributes of particular securities or markets. To take one concrete example, MF Global had accumulated more than $11 billion in short-term European government bonds before it was forced in summer 2011 to reveal that position to investors and to hold capital against it.[86] European government bonds—like many derivatives and like U.S. government bonds—trade over the counter, but no one concluded from the MF Global episode that European government bond mar-

kets are opaque. Many did conclude, however, that there were problems with the pertinent accounting regime, and the relevant provisions were subsequently changed. To summarize the discussion to this point, OTC derivatives markets are opaque relative to exchange-traded derivatives, but they are not particularly opaque relative to many other financial transactions and agreements—from government bond trading to financial guarantees.

Much more important than trade-by-trade transparency to external parties, however, is that holistic risk be managed and disclosed appropriately. Regulators were understandably (though perhaps belatedly) appalled during the crisis to discover that firms could not adequately manage their counterparty risks. For example,

> A report by bank supervisors [in] October [2009] pointed to poor risk "aggregation": many large banks simply do not have the systems to present an up-to-date picture of their firm-wide links to borrowers and trading partners. Two-thirds of the banks surveyed said they were only "partially" able (in other words, unable) to aggregate their credit risks. The Federal Reserve, leading stress tests on American banks last spring, was shocked to find that some of them needed days to calculate their exposure to derivatives counterparties."[87]

The major failure of risk systems at the time was that many firms simply did not prepare for the possibility that the largest and most-highly rated of them would fail. This meant, for example, that most large banks and broker-dealers were capable of calculating their aggregated exposures to hedge funds but not to other large dealers, banks, or AAA-rated bond insurers. This was a terrible oversight, which must be, and is in the process of being, corrected. To this end, in fact, authorities are working with the financial industry to develop a standardized set of legal entity identifiers. This unglamorous but extremely important project should very much improve counterparty risk management over time.

The discussion now turns to the recent legal and regulatory response to the perceived opacity of OTC derivatives markets, namely, to require that OTC derivatives trades be reported to swap data repositories (SDRs). Apart from nontrivial cost and privacy concerns, it is hard to argue that authorities should not have access to derivatives trade data. In practice, however, SDRs are not likely to be useful to authorities.

First, ensuring the accuracy of such a large reporting data set would be practically impossible. The harsh reality of the financial world is that data are accurate only when they determine cash flows or when they are actively used by market participants themselves to trade or to manage risk.

Second, a list of derivatives trades is not likely to be very informative about the overall risks of an individual firm or of the financial system. It would be useless to analyze Goldman's OTC aluminum swaps without taking into account its exchange-traded aluminum futures and its physical aluminum inventories and commitments. Similarly, it would be a waste of time to scrutinize a bank's derivatives exposure to a client without understanding the bank's book of loans to that client. It is for this reason, perhaps, that regulators during the crisis do not seem to have made much use of the Trade Information Warehouse, which had collected details of CDS transactions from many financial institutions since 2006.[88]

Third, during a crisis, it is enormously important to know the real-time values and locations of collateral posted against derivatives obligations. Such real-time data are not contemplated as part of SDRs.

CONCLUSION

Derivatives are enormously useful in managing business risks. They can be dangerous when misused because of their embedded leverage, but no more so than other forms of leverage. Throughout the financial crisis of 2007–2009, losses and failures were predominantly due to a combination of nonderivative

"The major failure of risk systems was that many firms simply did not prepare for the possibility that the largest and most-highly rated of them would fail."

> "Financial institutions must properly manage and disclose their holistic risks. It is not particularly useful to consider derivatives trades, positions, and markets in isolation."

leverage and falling valuations of nonderivative mortgage inventory. AIG was the sole exception, with comparable losses from both derivative and nonderivative businesses.

The conclusion to be drawn from the nature of derivatives and the history of the crisis is that financial institutions must properly manage and disclose their holistic risks. It is not particularly useful to consider derivatives trades, positions, and markets in isolation.

From this perspective, several current regulatory initiatives are ill considered. Mandatory clearing may forcibly break apart bilateral portfolios that had previously been a diversified combination of liquid products (that must now be cleared) and illiquid products (that cannot be cleared). Punitive margin requirements on uncleared derivatives may very well reduce derivatives volumes and risks, but they may do so at the expense of increasing nonderivative business risks. Finally, required databases of derivatives trades and positions are unlikely to be useful in crisis prevention and management because they focus on a one-dimensional slice of firm and system-wide risks.

Although discussed only in passing in this paper, a number of possible reforms would reduce systemic risk without impairing the business uses of derivatives:

- Joint work by authorities and the industry to create common entity identifiers will improve both firms' and regulators' abilities to manage holistic counterparty risk.
- There should be a protocol to coordinate the liquidations of a failing firm's most liquid derivatives and nonderivative claims.
- Higher priority should be put on compressing OTC derivatives positions. Simply put, if A receives some index from B, and B receives that same index from C, then removing B from the loop can reduce both counterparty and operational risks in the system without significantly changing economic exposures.
- Accounting norms should be improved so as to provide better holistic risk reporting that incorporates derivatives exposures.
- The safe harbor for derivatives should be narrowed so providers of illiquid leverage are not subsidized by their ability to circumvent the bankruptcy system.[89]

Policies that recognize the usefulness of derivatives and of holistic risk management and supervision will encourage businesses to use derivatives appropriately and, at the same time, reduce systemic risk.

NOTES

The author would like to thank Viral Acharya, Larry Bernstein, Mark Calabria, Helen Edersheim, Kathy Edersheim, Stephen Figlewski, Chiente Hsu, Thaya Knight, Diana Newman, Stephen Ryan, David Sayles, Alan Shaffran, Roy Smith, Ashutosh Tripathi, Katherine Waldock, and Lawrence White for helpful comments and suggestions. All opinions and errors are, of course, the sole responsibility of the author. The author also wishes to note that he was an employee of Lehman Brothers from 2002 to 2008, of Barclays from 2008 to 2010, and is currently on a risk management committee of a major derivatives clearing house.

1. Warren Buffett described derivatives as "financial weapons of mass destruction" in Berkshire Hathaway Inc., *2002 Annual Report* (Omaha, NE: Berkshire Hathaway Inc., 2002), p. 15, http://www.berkshirehathaway.com/2002ar/2002ar.pdf.

2. International Swaps and Derivatives Association Inc., "Over 94 Percent of the World's Largest Companies Use Derivatives to Help Manage Their Risks," news release, April 23, 2009, http://www.isda.org/press/press042309der.pdf.

3. Söhnke Bartram, "Corporate Hedging and Speculation with Derivatives," working paper, Warwick Business School, Department of Finance, Coventry, U.K., 2015.

4. Anheuser-Busch InBev, *2013 Annual Report* (Belgium: Anheuser-Busch InBev), p. 133, http://www.ab-inbev.com/content/dam/universaltemplate/abinbev/pdf/about/dream-people-culture/

ABI_AR13_EN_Full.pdf.

5. Ibid., p. 63.

6. Ibid., p. 4.

7. Ibid., p. 134.

8. All of the facts presented about Oakland, California, can be found in Kevin Roose, "How Do You Run Goldman Sachs Out of Town?," *New York*, April 11, 2013, http://nymag.com/daily/intelligencer/2013/04/how-do-you-run-goldman-sachs-out-of-town.html.

9. Chicago Board of Trade, "CBOT Exchange ADV Report—Monthly," December 2014, http://www.cmegroup.com/market-data/volume-open-interest. Note that each wheat contract is for 5,000 bushels, whereas each mini wheat contract is for 1,000 bushels.

10. Kraft Foods Group Inc., *2013 Annual Report* (Northfield, IL: Kraft Foods Group Inc., 2013), p. 11, http://files.shareholder.com/downloads/ABEA-3QV6OO/486803031x0x813507/A268CB03-19B3-406C-BD8D-B716C27BB6C4/kraft2013filing10K.pdf.

11. Anheuser-Busch InBev, *2013 Annual Report,* p. 134.

12. Craig Reiners, director of risk management, MillerCoors LLC, "Assessing the Regulatory, Economic and Market Implications of the Dodd-Frank Derivatives Title," Testimony before the House Committee on Financial Services, 112th Cong., 1st sess., February 15, 2011, http://www.financialservices.house.gov/uploadedfiles/112-5.pdf.

13. Most of these fees would normally be in the form of a bid-ask spread—that is, buying at the lower bid price and selling at the higher ask price.

14. For more information, see "About Us," Quantmetrics, http://www.quantmetrics.com/about-us.

15. For more information, see "Quantmetrics Capital Management, LLP: QM Directional (10V) Strategy *QEP*," Altegris Clearing Solutions, http://www.managedfutures.com/program_performance.aspx?fundtype=&productId=86117.

16. Novelis Inc., annual report to the United States Securities and Exchange Commission for the fiscal year ended March 31, 2013, p. 4, http://app.quotemedia.com/data/downloadFiling?webmasterId=101533&ref=8927370&type=HTML&symbol=0001304280&companyName=+&formType=10-K&dateFiled=2013-05-15. The general descriptions of Novelis's business practices are taken from this report.

17. Ibid., pp. 4–13.

18. Ibid., p. 16.

19. Ibid., p. 33.

20. Ibid., p. 111.

21. Nick Madden, "Re: Docket No. 1479 and RIN 7100 AE-10: Complementary Activities, Merchant Banking Activities, and Other Activities of Financial Holding Companies related to Physical Commodities, Advance Notice of Proposed Rulemaking," Letter to Mr. Robert deV. Frierson, secretary, Board of Governors of the Federal Reserve System, April 14, 2014, http://www.federalreserve.gov/SECRS/2014/May/20140515/R-1479/R-1479_041514_123328_629592169057_1.pdf.

22. A broker-dealer in the United States is limited by "Reg T" to lend, at most, 50 percent of the value of a stock portfolio. Many professional investors in the United States have been able to get around this restriction, however, by locating their accounts abroad.

23. See, for example, Kevin Dowd, "Too Big to Fail? Long-Term Capital Management and the Federal Reserve," Cato Institute Briefing Paper no. 52, September 23, 1999.

24. The details presented in the text can be found in Carol Loomis, "The Culprits of Orange

County," *Fortune*, November 21, 2012, http://fortune.com/2012/11/21/the-culprits-of-orange-county.

25. The price of any bond that promises a fixed rate of interest will increase as the general level of interest rates falls. A bond that pays 5 percent interest is worth more when the prevailing or otherwise available rate of interest is 4 percent than when the prevailing rate of interest is 6 percent.

26. For a more technical presentation, see Bruce Tuckman, "Embedded Financing: The Unsung Virtue of Derivatives," *Journal of Derivatives* 21, no. 1 (Fall 2013): pp. 73–82.

27. More precisely, this interest rate swap effectively exchanges a $187 million 5.5 percent bond for a $187 million floating-rate bond. The $220,000 up-front payment is small relative to what either party would pay or receive for those fixed and floating-rate bonds. For further explanation, see Tuckman, "Embedded Financing," pp. 73–82.

28. For more details on the derivatives safe harbor, see Bruce Tuckman, "Amending Safe Harbors to Reduce Systemic Risk in OTC Derivatives Markets," policy paper, Center for Financial Stability, New York, 2010.

29. See, for example, Lloyd Harmetz, James Schwartz, and Bradley Berman, "Structured Notes, Their Hedges, and Dodd-Frank," *Morrison & Foerster News Bulletin* 4, no. 13 (2013): pp. 7–8.

30. See, for example, Viral Acharya and Matthew Richardson, eds., *Restoring Financial Stability* (New York: John Wiley & Sons Inc., 2009).

31. Bear's gross leverage ratio was about 30, whereas its net leverage ratio was about 15. Net leverage removes the safest assets from the leverage calculation. For a more detailed discussion of the distinction, see Viral Acharya and Bruce Tuckman, "Unintended Consequences of LOLR Facilities: The Case of Illiquid Leverage," *IMF Economic Review* 62, no. 4 (November 2014): 606–55.

32. Ben Bernanke, "Developments in the Financial Markets," Testimony before the Senate Committee on Banking, Housing, and Urban Affairs, 110th Cong., 2nd sess., April 3, 2008, http://www.federalreserve.gov/newsevents/testimony/bernanke20080403a.htm; and Timothy Geithner, "Actions by the New York Fed in Response to Liquidity Pressures in Financial Markets," Testimony before the Senate Committee on Banking, Housing, and Urban Affairs, 110th Cong., 2nd sess., April 3, 2008, http://www.newyorkfed.org/newsevents/speeches/2008/gei080403.html.

33. Ibid.

34. Financial Crisis Inquiry Commission, *The Financial Crisis Inquiry Report* (Washington: Government Printing Office, 2011), pp. 290–91, http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf.

35. These leverage ratios are effective in that they incorporate exposures to the off-balance sheet guarantees. Viral Acharya et al., *Guaranteed to Fail* (Princeton: Princeton University Press, 2011), p. 26.

36. See, for example, Financial Crisis Inquiry Commission, Financial Crisis Inquiry Report, pp. 142–46, 155.

37. Kimberly Summe, "Misconceptions about Lehman Brothers' Bankruptcy and the Role Derivatives Played," *Stanford Law Review Online* 66, no. 16 (2011): 18.

38. Bill Gross, head of PIMCO, for example, said the following to reporters: "It appears that Lehman will file for bankruptcy and the risk of an immediate tsunami is related to the unwind of derivative and swap-related positions worldwide in the dealer, hedge fund, and buy-side universe." See, Andrew Ross Sorkin, *Too Big to Fail* (New York: Penguin Group, 2009), p. 360.

39. Lehman's derivatives counterparties did claim extremely large damages from the liqui-

dation of their derivatives trades with Lehman, but those damages were likely exaggerated. See Tuckman, "Amending Safe Harbors," p. 15; see also Kimberly Summe, "An Examination of Lehman Brothers' Derivatives Portfolio Postbankruptcy—Would Dodd-Frank Have Made a Difference?" in *Bankruptcy Not Bailout*, ed. Kenneth Scott and John Taylor (Stanford: Hoover Institution Press, 2012), chapter 4.

40. For completeness, note that at the time of the bankruptcy, Lehman Brothers also had a significant amount of OTC derivatives that were cleared at LCH.Clearnet. Those positions were also liquidated without incident and without requiring funds beyond what Lehman had posted as collateral. See LCH.Clearnet, "$9 Trillion Lehman OTC Interest Rate Swap Default Successfully Resolved," press release, October 8, 2008, http://secure-area.lchclearnet.com/Images/2008-10-08percent20SwapClearpercent20default_tcm6-46506.pdf.

41. Emily Chasan and Ann Saphir, "Firms Reaped Windfalls in Lehman Auction: Examiner," *Reuters*, April 14, 2010, http://www.reuters.com/article/2010/04/15/us-lehman-examiner-idUSTRE63D57U20100415.

42. Terrence A. Duffy, executive chairman and president, CME Group Inc., Written Testimony before the Financial Institutions and Consumer Credit Subcommittee and the Insurance, Housing, and Community Opportunity Subcommittee, 112th Cong., 2nd sess., November 29, 2012, http://financialservices.house.gov/uploadedfiles/hhrg-112-ba15-ba04-wstate-tduffy-20121129.pdf.

43. See, for example, Ambrose Evans-Pritchard, "Fears of Lehman's CDS Derivatives Haunt Markets," *Telegraph* (London), October 16, 2008, http://www.telegraph.co.uk/finance/comment/ambroseevans_pritchard/3211647/Fears-of-Lehmans-CDS-derivatives-haunt-markets.html; Heather Landy, "Lehman Credit-Default Swap Payout Could Climb as High as $365 Billion," *Washington Post*, October 11, 2008, http://www.washingtonpost.com/wp-dyn/content/article/2008/10/10/AR2008101003050.html.

44. See, for example, Evans-Pritchard, "Fears of Lehman's CDS Derivatives."

45. See International Swaps and Derivatives Association, "ISDA CEO Notes Success of Lehman Settlement, Addresses CDS Misperceptions," news release, October 21, 2008, http://www.isda.org/press/press102108.html.

46. Data on AIG's experience are taken from Robert McDonald and Anna Paulson, "AIG in Hindsight," *Journal of Economic Perspectives* 29, no. 2 (Spring 2015).

47. There is a relatively wide misconception that AIG was rated AAA/Aaa before its failure (see, for example, Federal Open Market Committee, "Transcript of the Meeting of the Federal Open Market Committee," September 16, 2008, p. 62) and, therefore, did not have to post collateral before mid-September 2008. That information is not correct. AIG lost its triple-A ratings in 2005, and the collateral terms of its CDS varied across contracts. See McDonald and Paulson, "AIG in Hindsight," pp. 92–93.

48. For details on the government bailout, see U.S. Department of Treasury, "Investment in AIG," December 11, 2013, http://www.treasury.gov/initiatives/financial-stability/TARP-Programs/aig/Pages/status.aspx.

49. Securities lending businesses work as follows. A portfolio manager (e.g., an AIG life insurance subsidiary) lends some of its securities (e.g., corporate bonds) to various market participants, taking cash as collateral. The portfolio manager earns a fee from lending the securities and earns income from investing the cash collateral. Because the securities borrower can return the securities at any time and demand the return of cash posted as collateral, portfolio managers traditionally invest cash collateral in short-term, safe, and liquid securities. AIG, however, invested about 65 percent of its cash collateral in long-term and illiquid real estate–related assets.

See McDonald and Paulson, "AIG in Hindsight," p. 85. As these assets fell in value through 2008, AIG had trouble returning cash collateral owed to securities borrowers.

50. McDonald and Paulson, "AIG in Hindsight," pp. 83–84, 86–87.

51. The percentage of all government support attributable to derivatives would rise to only 35 percent, even after attributing to derivatives the entire $12.5 billion of "maturing debt and other" (a broad category of AIG financial products' liabilities that was satisfied with government funds according to AIG, "AIG Discloses Counterparties to CDS, GIA and Securities Lending Transactions," March 15, 2009, http://www.bloomberg.com/apps/news?pid=newsarchive&sid=aw3JLaVb3kBs).

52. AIG, "AIG Discloses Counterparties," p. 1, attachment A.

53. For details on the Maiden Lane facilities, see "Maiden Lane Transactions," Federal Reserve Bank of New York, http://www.newyorkfed.org/markets/maidenlane.html.

54. AIG, "AIG Discloses Counterparties," attachment A.

55. McDonald and Paulson, "AIG in Hindsight," p. 45, table 4.

56. See, for example, Financial Crisis Inquiry Commission, *Financial Crisis Inquiry Report*, p. 348; Federal Open Market Committee, "Transcript of the Meeting," p. 62–63; Matthew Karnitschnig et al., "U.S. to Take Over AIG in $85 Billion Bailout," *Wall Street Journal*, September 16, 2008, http://www.wsj.com/articles/SB122156561931242905; and Sorkin, *Too Big to Fail*, pp. 391–92, 395.

57. See, for example, Financial Crisis Inquiry Commission, *Financial Crisis Inquiry Report*, p. 347.

58. See, for example, Federal Open Market Committee, "Transcript of the Meeting," p. 5; Karnitschnig et al., "U.S. to Take Over AIG."

59. See, for example, Sorkin, *Too Big to Fail*, p. 396; see also Karnitschnig et al., "U.S. to Take Over AIG."

60. See, for example, Sorkin, *Too Big to Fail,* p. 401.

61. The financial difficulties of AIG's life insurance subsidiaries at the time of the bailout are documented in McDonald and Paulson, "AIG in Hindsight," and in Hester Peirce, "Securities Lending and the Untold Story in the Collapse of AIG," working paper no. 14-12, Mercatus Center, George Mason University, 2014. The lack of awareness of these problems at the time can be seen by their not appearing in the historical account of, for example, Sorkin, *Too Big to Fail*. It can also be seen by contemporary reports that these subsidiaries were safe—for example, Karnitschnig et al., "U.S. to Take Over AIG."

62. See, for example, Sorkin, *Too Big to Fail*, p. 395.

63. See, for example, Federal Open Market Committee, "Transcript of the Meeting," p. 62.

64. See, for example, Financial Crisis Inquiry Commission, *Financial Crisis Inquiry Report*, p. 348.

65. Ibid., p. 349. See also Karnitschnig et al., "U.S. to Take Over AIG."

66. See, for example, Financial Crisis Inquiry Commission, *Financial Crisis Inquiry Report*, pp. xxiv–xxv, 142–46.

67. Akhil Mago, Rahul Sabarwal, and Madhuri Iyer, "Residential Credit Losses—Going into Extra Innings," Fixed Income Research, Lehman Brothers, April 11, 2008, p. 4, figure 3.

68. Ibid., p. 3, figure 2. The 8 percent figure comprises the estimated mark-to-market losses from synthetics as a fraction of the estimated mark-to-market losses from all residential mortgages. That figure might be most relevant to allocating sources of financial stress. The 15 percent figure

is computed from the optimistic or conservative estimated cash-flow losses, which might be most relevant to allocating sources of insolvency. Note that the text relies on Mago, Sabarwal, and Iyer's research only for the ratio of synthetic risk to total risk and not for the estimates of absolute risk.

69. See, for example, the discussion in Financial Crisis Inquiry Commission, *Financial Crisis Inquiry Report*, 143–45; and Bethany McLean and Joe Nocera, *All the Devils Are Here* (New York: Penguin Group, 2010), pp. 271–82, which explains how Goldman Sachs retained short positions in synthetic CDO deals to hedge its long positions. For another mention of synthetics as hedges, see Citigroup Inc., *2008 Annual Report* (New York: Citigroup Inc., 2009), pp. 184–85, http://www.citigroup.com/citi/fin/data/ar08c_en.pdf. For a more general statement, see, for example, Felix Salmon, "Understanding Synthetics," *Upstart Business Journal*, November 28, 2008, http://upstart.bizjournals.com/views/blogs/market-movers/2008/11/28/understanding-synthetics.html?page=all; and Felix Salmon, "What's a Super-Senior Tranche?" *Upstart Business Journal,* December 1, 2008, http://upstart.bizjournals.com/views/blogs/market-movers/2008/12/01/whats-a-super-senior-tranche.html?page=all.

70. See, for example, Financial Crisis Inquiry Commission, *Financial Crisis Inquiry Report*, pp. xxiv, 8, 145, 146; McLean and Nocera, *All the Devils*, p. 283.

71. See McLean and Nocera, *All the Devils*, p. 283–84; and Eric Arentsen et al., "Subprime Mortgage Defaults and Credit Default Swaps," *Journal of Finance* 70, no.2, (April 2015).

72. See, for example, Salmon, "Super-Senior Tranche," and Felix Salmon, "The Silver Lining to Synthetic CDOs," *Reuters*, April 11, 2010, http://blogs.reuters.com/felix-salmon/2010/04/11/the-silver-lining-to-synthetic-cdos.

73. Salmon, "The Silver Lining."

74. See, for example, McLean and Nocera, *All the Devils*, pp. 276–82.

75. Quoted in Charles Abbott and Kevin Drawbaugh, "U.S. Seeks Crackdown on Loosely Regulated Derivates," *Reuters*, May 14, 2009, http://www.reuters.com/article/2009/05/14/us-financial-derivatives-idUSTRE54C76J20090514.

76. Goldman Sachs, as a major dealer of interest rate swaps, is most likely to be a member of any CCP for interest rate swaps. Therefore, should Oakland default to a CCP, Goldman would conceivably lose money in its role as a member of that CCP. Furthermore, if Oakland used Goldman as its clearing firm, Goldman would typically be directly responsible for Oakland's swap obligations.

77. Another motivation, not directly relevant to this paper, is to make the OTC derivatives market more competitive.

78. See, for example, Gary Gensler, "Clearinghouses Are the Answer: Complex Derivatives Should be Regulated Like Commodity Futures," *Wall Street Journal*, April 21, 2010, http://online.wsj.com/article/SB10001424052748704671904575194463642611160.html.

79. For a fuller discussion, see Darrell Duffie and Haoxiang Zhu, "Does a Central Clearing Counterparty Reduce Counterparty Risk?" *Review of Asset Pricing Studies* 1, no. 1 (2011), http://raps.oxfordjournals.org/content/1/1/74.short.

80. In a comment letter to regulators (for example, in David Kacynski et al., "Re: Margin Requirements for Uncleared Swaps for Swap Dealers and Major Swap Participants," letter addressed to David Stawick et al., Commodity Futures Trading Commission, September 14, 2012, https://www.fdic.gov/regulations/laws/federal/2011/11c09ad79.PDF), a group of captive finance companies wrote that margin requirements "would significantly increase end-user costs . . . and liquidity requirements as well as divert capital that otherwise would be reinvested in business and job creation. Additionally, margin requirements could necessitate new and costly incremental funding requirements on end-users, who unlike swap dealers and major swap participants, do not have expedient

and low-cost access to liquidity sources like the discount window or consumer deposits."

81. For a fuller discussion, see Tuckman, "Embedded Financing," pp. 73–82.

82. U.S. Department of the Treasury, "Financial Stability Oversight Council Makes First Designations in Effort to Protect against Future Financial Crises," press release, July 18, 2012, http://www.treasury.gov/press-center/press-releases/Pages/tg1645.aspx.

83. Cave, M. et al., "Re: Margin and Capital Requirements for Covered Swap Entities . . . Margin Requirements for Uncleared Swaps for Swap Dealers and Major Swap Participants," letter addressed to David Stawick et al., Commodity Futures Trading Commission, June 23, 2011. The letter is signed by representatives from Boeing Capital Corporation, Caterpillar Financial Services Corporation, Daimler North America Corp., John Deere Financial, Ford Credit, American Honda Finance Corporation, Hyundai Capital America, Nissan North America, Toyota Financial Services, and Volvo Financial Services.

84. See, for example, Viral Acharya, "A Transparency Standard for Derivatives," in *Risk Topography: Systemic Risk and Macro Modeling*, ed. Markus Brunnermeier and Arvind Krishnamurthy (Chicago: University of Chicago Press, 2014).

85. Kimberly Summe, "Misconceptions About Lehman Brothers' Bankruptcy," p. 17.

86. For details on the collapse of MF Global, see, for example, Scott Skyrm, *The Money Noose* (New York: Brick Tower Press, 2013).

87. *The Economist*, "Number-Crunchers Crunched," February 11, 2010, http://www.economist.com/node/15474075.

88. See, for example, Summe, "Misconceptions About Lehman Brothers' Bankruptcy," p. 18. For current information about this data warehouse, see "Trade Information Warehouse Reports," DTCC, December 5, 2012, http://www.dtcc.com/repository-otc-data.aspx.

89. For details, see Tuckman, "Amending Safe Harbors."

RECENT STUDIES IN THE CATO INSTITUTE POLICY ANALYSIS SERIES

780. **Patent Rights and Imported Goods** by Daniel R. Pearson (September 15, 2015)

779. **The Work versus Welfare Trade-Off: Europe** by Michael Tanner and Charles Hughes (August 24, 2015)

778. **Islam and the Spread of Individual Freedoms: The Case of Morocco** by Ahmed Benchemsi (August 20, 2015)

777 **Why the Federal Government Fails** by Chris Edwards (July 27, 2015)

776. **Capitalism's Assault on the Indian Caste System: How Economic Liberalization Spawned Low-caste Dalit Millionaires** by Swaminathan S. Anklesaria Aiyar (July 21, 2015)

775. **Checking E-Verify: The Costs and Consequences of a National Worker Screening Mandate** by Alex Nowrasteh and Jim Harper (July 7, 2015)

774. **Designer Drugs: A New, Futile Front in the War on Illegal Drugs** by Ted Galen Carpenter (May 27, 2015)

773. **The Pros and Cons of a Guaranteed National Income** by Michael Tanner (May 12, 2015)

772. **Rails and Reauthorization: The Inequity of Federal Transit Funding** by Randal O'Toole and Michelangelo Landgrave (April 21, 2015)

771. **Beyond Regulation: A Cooperative Approach to High-Frequency Trading and Financial Market Monitoring** by Holly A. Bell (April 8, 2015)

770. **Friends Like These: Why Petrostates Make Bad Allies** by Emma M. Ashford (March 31, 2015)

769. **Expanding Trade in Medical Care through Telemedicine** by Simon Lester (March 24, 2015)

768. **Toward Free Trade in Sugar** by Daniel R. Pearson (February 11, 2015)

767. **Is Ridesharing Safe?** by Matthew Feeney (January 27, 2015)

766. **The Illusion of Chaos: Why Ungoverned Spaces Aren't Ungoverned, and Why That Matters** by Jennifer Keister (December 9, 2014)

765. **An Innovative Approach to Land Registration in the Developing World: Using Technology to Bypass the Bureaucracy** by Peter F. Schaefer and Clayton Schaefer (December 3, 2014)

764. **The Federal Emergency Management Agency: Floods, Failures, and Federalism** by Chris Edwards (November 18, 2014)

763. **Will Nonmarket Economy Methodology Go Quietly into the Night? U.S. Antidumping Policy toward China after 2016** by K. William Watson (October 28, 2014)

762. **SSDI Reform: Promoting Gainful Employment while Preserving Economic Security** by Jagadeesh Gokhale (October 22, 2014)

761. **The War on Poverty Turns 50: Are We Winning Yet?** by Michael Tanner and Charles Hughes (October 20, 2014)

760. **The Evidence on Universal Preschool: Are Benefits Worth the Cost?** by David J. Armor (October 15, 2014)

759. **Public Attitudes toward Federalism: The Public's Preference for Renewed Federalism** by John Samples and Emily Ekins (September 23, 2014)

758. **Policy Implications of Autonomous Vehicles** by Randal O'Toole (September 18, 2014)

757. **Opening the Skies: Put Free Trade in Airline Services on the Transatlantic Trade Agenda** by Kenneth Button (September 15, 2014)

756. **The Export-Import Bank and Its Victims: Which Industries and States Bear the Brunt?** by Daniel Ikenson (September 10, 2014)

755. **Responsible Counterterrorism Policy** by John Mueller and Mark G. Stewart (September 10, 2014)

754. **Math Gone Mad: Regulatory Risk Modeling by the Federal Reserve** by Kevin Dowd (September 3, 2014)

753. **The Dead Hand of Socialism: State Ownership in the Arab World** by Dalibor Rohac (August 25, 2014)

752. **Rapid Bus: A Low-Cost, High-Capacity Transit System for Major Urban Areas** by Randal O'Toole (July 30, 2014)

751. **Libertarianism and Federalism** by Ilya Somin (June 30, 2014)

CATO INSTITUTE

Published by the Cato Institute, Policy Analysis is a regular series evaluating government policies and offering proposals for reform. Nothing in Policy Analysis should be construed as necessarily reflecting the views of the Cato Institute or as an attempt to aid or hinder the passage of any bill before Congress. Contact the Cato Institute for reprint permission. All policy studies can be viewed online at www.cato.org. Additional printed copies of Cato Institute Policy Analysis are $6.00 each ($3.00 each for five or more). To order, please email catostore@cato.org.