Clearing over-the-counter derivatives

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Introduction and summary

The recent financial crisis highlighted some of the potential problems associated with over-the-counter (OTC) derivatives markets. Prior to the financial crisis of 2008, the over-the-counter market was not required to "clear" transactions. This changed with the signing of the new financial reform legislation, the Dodd–Frank Act, on July 21, 2010. Going forward, most OTC derivatives will be cleared through a particular set of institutional arrangements: a regulated clearinghouse.

The financial crisis exposed some significant cracks in the OTC derivatives markets,[1] as exemplified by the case of insurance company AIG. We now know that AIG sold a gigantic amount of OTC credit default swaps (insurance contracts against defaults), with notional value over $440 billion. Since AIG did not take positions to offset their credit default swap exposure, one might conjecture that this could cause problems for AIG and financial markets.[2] Namely, if the economy were hit by an adverse aggregate shock that either caused a very large number of swap payouts to move against AIG or weakened its balance sheet (or both), then AIG may not have the funds to perform on its OTC obligations. And even if it did have the funds, AIG may choose to default (referred to as a strategic default) on its credit default swap obligations. In either case, AIG's counterparties would not receive the payoffs they were expecting, and this could have a ripple effect on their counterparties and the broader markets.

In fact, during the financial crisis, AIG had to raise money in debt markets in order to make payments on the real-estate-related credit default swaps that moved against it. This new debt issue, along with the large potential future losses that AIG could experience, resulted in AIG's debt being downgraded by the credit-rating agencies. As a result of this downgrade, AIG was required to post billions of dollars of collateral for its existing swap contracts. If the collateral had not been posted, then cross-default clauses in other contracts that AIG had written would have been activated, requiring AIG to settle these contracts immediately. AIG did not have the liquidity on hand to make all these payments, even though its core business activities were in fine shape. Without some help, AIG would have defaulted on its contractual obligations. Hence, the deterioration of the real estate market put significant financial stress on AIG, putting not only AIG at risk, but also AIG's counterparties and their counterparties, and so on. In the end, collateral was posted for AIG's positions thanks to a massive government bailout.[3]

How could this scenario have been avoided? One could argue that clearing AIG's OTC derivatives contracts would have prevented this negative outcome. Intuitively, one can think of clearing as a set of institutional arrangements that are designed to enhance contractual performance. This includes a wide range of procedures that are implemented after a buyer and seller agree to the contract terms and before final settlement occurs. For example, if AIG had been required to clear its credit default swaps, it would have had to set aside collateral when it initially negotiated the contracts. When the swap contracts turned against AIG, it could have used the collateral to satisfy its positions, instead of borrowing, which, in turn, would have prevented the credit downgrade in its debt.

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Clearing would also have led to greater transparency. Even absent posting collateral, if information regarding AIG's credit default swap portfolio was publicly available, it is likely that AIG's credit default swap portfolio would have been much smaller as counterparties would have been reluctant to enter into arrangements with such a highly leveraged entity. These sorts of remedies have, in fact, been mandated in the recent Dodd–Frank Act, which requires the vast majority of OTC derivatives to be cleared through a regulated clearinghouse.

Since clearing is a not a costless activity, two questions naturally arise: 1) Who should be allowed to participate in a clearinghouse as a clearing member?; and 2) Which derivative contracts should be cleared? A recent public policy symposium held at the Federal Reserve Bank of Chicago addressed these questions.[4] In this article, I review the topic of clearing from an economics perspective and provide the reader with a framework to think about clearing issues. The analysis can offer answers to basic but important questions, such as: What is clearing? Why is it important? What is the role of a clearing member? And why is risk management important for clearing? Second, I use this framework to review some of the ideas that were expressed at the symposium regarding who should be allowed to participate in the clearing process and what should be cleared.

I conclude that: 1) although certain criteria must be met for individuals or institutions to participate in the clearing process, one criterion that should *not* be imposed is that participants must possess massive amounts of capital; and 2) derivative contracts negotiated by "end users," corporations that hold the contracts until they expire, should not be treated any differently from contracts that are negotiated by other firms that do not necessarily hold them until expiration.

In the next section, I provide a simple economic environment to think about the clearing concept. The economic environment presented in this section has the benefit of being transparent, but at the cost of being quite simple. In the two following sections, I complicate the environment slightly, in order to discuss the behavior of OTC participants and risk management—important concepts for clearing. I describe how a clearinghouse might be structured. Then, I present and analyze the overarching themes of the symposium. Finally, I analyze the debate about clearinghouse membership and end-user exemptions.

A simple model of clearing

A natural starting point for any economic investigation is the Arrow–Debreu model. In the model, people are fully aware of all possible future contingencies and are able to write contracts, at the beginning of time, for delivery and acceptance of all possible commodities, where a commodity is distinguished by date, location, and state of the world. Contracts are mediated by markets, and there is a market and price for each commodity, that is, markets are "complete." The model determines one of the most important concepts in economics, which is that of relative prices.

Since people are fully aware of all future contingencies and markets are complete, all decisions regarding how much to buy and sell can be made at the beginning of time. Hence, all trading of contracts occurs at one point in time—at the beginning of time—and as time moves on, people simply make or accept delivery of commodities based on their contracts. Spot markets are not needed at future dates since, as the economy moves in time, people do not learn anything that they did not already know at the beginning of time. If spot markets opened up at a future date and trade occurred, that would imply that people made unexplainable mistakes at the beginning of time, that is, they are irrational. So, in the Arrow–Debreu world, all deals are struck at the beginning of time, and people trust one other to perform as specified in the contingent contracts.

The elegance and simplicity of the Arrow–Debreu model owe a lot to the absence of frictions in the environment. For example, people do not have to find one another or bargain over prices and quantities or worry about contractual performance. All of these frictions are assumed away. In fact, the lack of frictions in the Arrow–Debreu model greatly simplifies the nature of social interaction: There is none! People observe equilibrium prices and trade only against their own budget constraint, which means that the value of what they buy cannot exceed the value of what they sell. The model, however, cannot explain a number of important things, such as how goods are exchanged or why the institutions of money, banking, and clearing exist.

If we want to understand these important institutions, we must introduce some explicit frictions into the benchmark model. For example, if we want to have spot markets open up over time, we can introduce a search friction. If it takes time and effort to find and purchase goods and services, then it will not be possible to contract for all purchases and sales of commodities at the beginning of time. If there are informational frictions, then contracts can only depend upon things that are verifiable, and complete state-contingent contracts are not feasible. If there is a commitment friction, then things like money, banks, and other institutions may arise to help alleviate the commitment problem. And finally, we might also want to take into account legal frictions. These frictions may

explain some risk-management practices that would be a puzzle if a lack of commitment was the only friction. Although I use all of the above-mentioned frictions in my analysis, the commitment friction—people cannot commit to undertake future actions—and the information friction play prominent roles. Now, I illustrate the importance of two prominent clearing processes—novation and the posting of collateral.

A farmer plants seeds today that produce wheat tomorrow, and a baker needs wheat tomorrow to bake bread. The price per bushel of wheat tomorrow can take one of two values, say, $5 or $15, that are equally likely. The farmer and baker are risk averse, meaning that they prefer to agree today to exchange one bushel of wheat tomorrow for tomorrow's expected price of $10, as opposed to buying or selling at the spot price tomorrow of $5 or $15.

The farmer and baker may be able to get their mutually preferred outcomes if they enter into a forward contract. A forward contract is a particular kind of derivative contract, where the farmer promises to deliver a commodity, one bushel of wheat, tomorrow in exchange for $10; and the baker promises to deliver $10 tomorrow in exchange for the commodity. If the farmer and baker can commit to these promises, then they can get their preferred outcomes—wheat for $10—and that's the end of the story. But if the farmer and baker cannot commit, then delivery and exchange of wheat for $10 won't happen. To see this, suppose that the price of wheat turns out to be $5 and the baker does not accept delivery from the farmer and, instead, purchases wheat on the spot market, that is, the baker *strategically defaults* on the agreement because the spot price is lower. This strategy gives the baker an extra $5, compared with the strategy of performing his contractual obligation. Similarly, the farmer can get a net benefit of $5 per bushel by strategically defaulting when the price of wheat tomorrow is $15. Although the farmer and baker would *like* to exchange wheat for $10 tomorrow, their lack of commitment prevents this from happening. If the farmer and baker could somehow bind themselves to a $10 per bushel agreement, then they would do so, so long as the cost of binding isn't too great. This is where the notion of clearing comes in.

One way the baker and farmer may be able to bind themselves to the contract is for each of them to provide $5 of collateral upfront. The $5 of collateral is used to cover any losses incurred by a counterparty should the other counterparty fail to perform on the contract. For example, if the price of wheat is $5 and the baker reneges on the contract, then he loses his $5 of collateral, which is given to the farmer. In effect, the baker pays $10 for the wheat. It would seem that with the introduction of collateral, the parties should not have an incentive to renege on their contracts. Maybe.

One tricky issue is who or what is to hold the collateral? Notice that the lack of commitment cannot be overcome by simply having each party hold the other's collateral. To see this, suppose the spot price turns out to be $15. In this situation, the farmer does best for himself by selling his wheat on the spot market and keeping the baker's collateral (and the baker keeps the farmer's collateral). Here, one holding of collateral simply offsets the other one and does not guarantee performance. It appears that a third party is needed to hold the collateral of the baker and farmer.

With the introduction of a third party, things could work as follows. If the baker and farmer perform on their contract, then the third party returns the collateral to each of them. If, however, one party defaults and, as a result, harms the other party, then the third party can use the collateral of the nonperforming party to compensate the other party for his losses. For example, if the farmer defaults when the price of wheat is $15, then the third party gives the baker the farmer's collateral, as well as his own. From the farmer's point of view, he will pay $10 for wheat if he chooses to default, so he now has no incentive to default. It appears that the introduction of a third party that holds the collateral of the farmer and baker implies that they will each perform their contractual obligations. Maybe.

In order for the three-party arrangement to work, it is necessary for the third party to be able to verify which party reneges in the event of contractual nonperformance. Suppose that there is an informational friction. In the last example, where the spot price is $15, the farmer can renege and claim to the third party that he attempted to deliver the wheat to the baker but, for some reason, the baker refused to take delivery. The farmer, then, could argue because of the baker's nonperformance, he had no choice but to sell his wheat on the market and he should not forfeit his collateral. Hence, if the third party cannot perfectly observe or verify the actions of the farmer and baker, then it will be unable to determine which party in fact reneged. This implies that a simple third-party mechanism—one that simply holds collateral—cannot guarantee performance.

One way around this verifiability problem is to have all the transactions related to the contract go through the third party. That is, instead of having the farmer deliver wheat to the baker and the baker deliver $10 to the farmer, all deliveries are made to the third party. The third party then "redelivers" the wheat and money according to the original contract. Under this scheme, the initial contractual obligation between the

baker and farmer is discharged and replaced with two new contracts: one between the third party and the baker and another between the third party and the farmer. This process, called *novation*, makes the third party a *central counterparty*, or CCP, to the original parties of the contract. Notice that novation circumvents the verifiability problem: Since the farmer and baker make deliveries to the CCP, the CCP is able to determine whether each party has performed its obligations. The CCP is now able to transfer the collateral it holds to the appropriate party in the event of nonperformance.

The above example illustrates how novation and collateral can substitute for commitment. Collateral and novation are only two possible ingredients or processes that fall under the rubric of clearing. Things like trade matching and confirmation (that is, checking to make sure party A entered into a contract and that party B is, in fact, on the other side of the contract), information warehousing (that is, compiling in an accessible manner the set of all the trades that have taken place), and risk management are also part of the clearing process.

In the example, the commitment friction is needed for a CCP to emerge; without it counterparties would not strategically default and there would be no need for a CCP. In practice, one might think that even if counterparties cannot commit, concern about their reputations might provide sufficient inducement for performance in the absence of collateral and CCPs. For example, a major financial player will not strategically default on a contract (which is not backed by collateral) for only a small gain today, since that would damage its reputation as a reliable institution in the future. There is a cost associated with being viewed as unreliable: Potential future counterparties will choose not to enter into mutually beneficial contracts with an "unreliable" institution. (These counterparties fear the institution will not perform on its contract.) If a counterparty's concern for its reputation is sufficiently strong, then it will perform on its contracts even though it lacks commitment. If this is always the case, then my claim that a commitment friction is responsible for the emergence of CCPs seems inappropriate. That is, reputation will enforce performance and a CCP is not needed. I now examine this issue.

Commitment and reputation

An implication of the commitment friction, as illustrated in the farmer–baker example, is that if counterparties do not post collateral with the CCP, then one of the counterparties will always strategically default. Yet, in practice, we routinely observe people and organizations honoring contracts that are not backed by collateral. We also observe contractual performance when collateral is posted on a bilateral basis, that is, a third-party CCP does not hold the collateral. Do these observations imply that CCPs and other clearing processes arise for reasons other than a commitment friction? One could argue that counterparties perform on their contracts because they care about their reputations, and concern for one's reputation outweighs the commitment friction. Below, I argue that a commitment friction is still relevant even when parties care about their reputations. Hence, we should take the commitment friction seriously when thinking about clearing.

Here, I modify the farmer–baker example so that I can discuss the notion of reputation. Instead of having a "one-shot" contracting relationship between the farmer and baker, suppose that the farmer and baker repeatedly interact with one another. The repeated nature of the farmer–baker relationship may provide an incentive for them to perform their contractual obligations even when there is a commitment friction and no collateral is posted. Why? Because performance today implies that parties will choose to contract with each other in the future, and this interaction is beneficial to both parties. Or, put another way, a party will only enter into a new contract with a counterparty that has a reputation for performing.

To see this, suppose the farmer and baker agree to exchange wheat for $10. Suppose further that if the farmer fails to deliver wheat when the spot price is $15, then both parties decide that they will never enter into another contractual relationship with each other. The baker believes that if they do, then the farmer will always fail to deliver when the price is $15. With this belief, the baker has no incentive to enter into a contract with the farmer. So, in contrast to the original example, where the interaction between the farmer and baker was a one-shot affair, there is now a cost associated with not performing, which is the inability for the farmer and baker to stabilize the price of wheat at $10 in the future. In deciding whether or not to perform when the price of wheat is $15, the farmer compares the immediate benefit associated with nonperformance, which is $5, with the future benefit associated with performance, which is the ability to sell wheat at $10 in future periods. If the latter exceeds the former, the farmer will perform; otherwise he will strategically default.

One might expect in "normal" times that counterparties will perform their contractual obligations even when no collateral is posted. This is because the benefit associated with future contracting outweighs the short-term gain associated with default. However, in times of "stress," which can be characterized by either large price movements and/or weakened balance sheets, the benefit associated with reneging can look quite attractive.

For example, if there is a huge price movement, a counterparty may find it in its best interest to avoid taking a large loss today, even though it will be unable to enter into a contract in the future. (And this may be the case even when the reneging counterparty has a strong balance sheet and the resources to perform.) Alternatively, if a counterparty has a weak balance sheet, fulfilling a contractual obligation may make the firm insolvent or vulnerable, whereas reneging will allow it to "live" for another day or become stronger. Faced with these choices, the counterparty may choose to strategically default. It is important to emphasize that during stressful times, parties that anticipate receiving positive contractual payments are really counting on their counterparties to perform. Yet, it is precisely at such times that a counterparty is most likely to (strategically) default.[5] If, from a social perspective, it is important to mitigate contractual defaults during times of stress, then we know from the earlier example that performance can be enhanced if collateral is posted with the CCP. Hence, even though parties will perform on their contractual obligations in the absence of posting collateral in most circumstances, a CCP will still emerge and require counterparties to post collateral. The reason is that performance is particularly important to counterparties (and society) during times of stress, but this is a time when their counterparties may not care about their reputations and may strategically default.[6]

The above discussion implies that when there is a commitment friction, a CCP may emerge to enhance performance even though counterparties care about their reputations.

Risk management

In practice, CCPs devote considerable resources to risk management. Unfortunately, the example I introduced earlier is too stylized to illustrate the notion of risk management because the CCP does not face any risk. In the example, the size of the CCP's collateral holdings eliminates the risk that it will fail to perform in the event that one of the counterparties fails to perform. The CCP holds $10: $5 from the farmer and $5 from the baker. In the event that either the farmer or baker defaults, the CCP needs $5 to guarantee performance, which it has. In the real world, however, prices of goods or assets do not move in nice, finite, discrete amounts over a specific time interval. Although short-term price movements are typically not that large in relative terms, one can't rule out enormous price movements over a period of a few hours. One can imagine modifying the example to allow for a continuous distribution of spot prices characterized by low probabilities of large price movements. In that case, the CCP can only guarantee performance if it holds enormous amounts of collateral. But this particular solution to the performance problem may not be an attractive one. Posting collateral is costly for counterparties, as they have more productive uses for their resources. If a CCP demands huge amounts of collateral—so as to guarantee performance for any conceivable price movement—then the farmer and baker may simply stop using forward contracts. In this situation, forward contracts would become extremely costly to use. The farmer and baker may therefore prefer to transact on spot markets and face the (lower cost) price risk. This is where risk management comes in.

The CCP can economize on collateral by "guaranteeing" performance with a high probability (but less than one). So, although there is a possibility that the CCP will default on its obligations, it minimizes this possibility by managing the risk of failure that it faces. A CCP can do this by, for example, requiring adjustments to collateral when it perceives that risk has changed and making provisions for additional resources should its collateral holdings prove to be insufficient to cover a default by one of its counterparties. I will now develop these ideas a bit further.

The amount of collateral that counterparties post can depend on a number of things. It can depend on the volatility of the price of the commodity or assets that underlie the derivative contract.[7] There is a positive relationship between the volatility of the price of the underlying asset and the volatility of the value of the derivative contract. If the underlying asset has low price volatility, then it will require less collateral than an underlying asset with high price volatility. The idea here is that if a counterparty fails, then, on average, a low-price-volatility underlying asset will require a smaller amount of the CCP's resources to ensure contractual performance than a high-price-volatility underlying asset. Also, if the price volatility of the underlying asset changes over time, then so should the amount of collateral that counterparties post with the CCP. For example, if the volatility decreases, the CCP will transfer some of the collateral back to the counterparty; if it increases, then it will require additional collateral from the counterparty.

For longer-lived derivative securities, the value of a particular position will change over time. For example, if the price of the underlying asset, say, wheat, in a forward contract increases over time, then the value of the forward contract for the counterparty who delivers it, the farmer, falls, since he is delivering an asset whose value is much greater than the delivery price. If this counterparty fails to deliver, then the CCP faces a very high performance cost. The CCP can eliminate these "accumulated liabilities" by requiring counterparties

to settle these liabilities on a periodic basis. That is, the CCP marks-to-market its contracts—directly passing resources from counterparties whose contracts have lost value to those whose contracts have gained value.

The amount of collateral required by the CCP can also depend upon the "liquidity" of the contracts it novates. In practice, if a counterparty defaults, the CCP sells the defaulting counterparty's positions. If a position is "liquid," it can be sold quickly and at a low cost. For example, contracts that are exchange traded and cleared, such as futures contracts, are very liquid.[8] The market provides a fairly accurate estimate of the value of a position, and even a very large position can be sold to the market over a relatively short period. On the other hand, specialized OTC derivative contracts are much less liquid because their estimated value is subject to great variation and they are traded on a bilateral basis. Hence, it may be difficult to sell a large position of OTC contracts on short notice at a price that is at or near their estimated value. Since less liquid contracts are more costly to trade than liquid ones, a CCP will require higher collateral for OTC contracts.

The CCP may have access to resources other than collateral to help it facilitate contractual performance in the event of a counterparty failure. The CCP may require all of its members, that is, members that have their contracts novated by the CCP, to contribute to a guarantee fund. Members make this contribution when they join the CCP, before the CCP novates any of their contracts. This fund could be accessed in the event a member defaults and its collateral is insufficient to guarantee performance. (This happens when the value of the defaulting member's portfolio—which includes current payments—plus the value of the member's collateral is negative.) Such an arrangement is sometimes called loss mutualization, because losses are shared or *mutualized* among the nondefaulting or surviving members. If the defaulting member's collateral and the entire guarantee fund are insufficient for the CCP to perform, then the CCP members' agreement may require them to provide additional resources to ensure performance.

Except for the requirement that members provide additional resources in the event of a member default, the risk-management strategies described above are consistent with the commitment and informational frictions. That is, contributions to the guarantee fund, the posting of collateral, and marking-to-market represent various payments that members make and receive that are designed to enhance commitment. Importantly, these payments are made before any default occurs. The requirement to provide additional resources in the event of a member's default is subject to a commitment friction. Since the additional payment to the CCP occurs after a default, members may choose to honor their promises or not. In particular, in times of stress, members may choose not to honor their promises because the benefit associated with being a CCP member in the future is less than the resources they have to sacrifice today. The analysis regarding whether members will contribute extra resources to a CCP after a member defaults is the same as in the farmer–baker example in the previous section, "Commitment and reputation."

To summarize, risk management is an important element of the clearing process because the CCP's performance guarantee is only as good as its risk-management strategy. Risk-management strategies, such as marking-to-market, making contributions to a guarantee fund, and adjusting collateral holdings when perceived risk changes, are consistent with the commitment friction.

The structure of central counterparties

In practice, a CCP has a set of members. Only members can clear contracts with the CCP. That is, a CCP novates only those contacts that are presented by its members. Counterparties that are not members of a CCP—let's call them customers—have their contracts novated by a CCP member. In this arrangement, the CCP guarantees contractual performance for its members, and a CCP member guarantees contractual performance for its customers. Hence, there is a tiered, but separated, relationship between customers, CCP members, and the CCP. There is no direct contractual relationship between the CCP and customers.

If a clearing member defaults on its contractual obligations with the CCP, the CCP guarantees performance of the defaulting member's contracts. That is, the CCP will perform its contractual obligations for all of its nondefaulting or surviving CCP members. As a result, all surviving CCP members will be able to perform their contractual obligations with their customers and the CCP. It must be pointed out, however, that the CCP guarantee does not (typically) extend to customers of a defaulting CCP member. Since customers' contracts are guaranteed by CCP members, they effectively lose any performance guarantee when the entity that guaranteed performance for them—the defaulting member—no longer exists.[9]

Just as in the farmer–baker example, CCP members post collateral with the CCP, and customers post collateral with CCP members. So, the collateral that CCP members post with the CCP can come from their customers or from the members directly for contracts that they entered into on their own account.

A clearing member is responsible for the performance of the contracts that it brings to the CCP. So, if a customer defaults on its contractual obligation to a

CCP member, the member must step in and ensure performance or be in default with the CCP. Effectively, the defaulting customer's contracts become the contracts of the member. The CCP member, however, does not have to hold onto the contracts associated with the defaulting customer as part of its portfolio; the member can always sell them. In either case, the CCP member will receive the collateral that was posted for the defaulting customer's position. If the collateral requirements were appropriately calculated, then they should cover both the payments made by the member and any losses associated with either holding or selling the defaulting customer's position. If, for some reason, the collateral is insufficient to cover the losses, the CCP member must absorb the losses or be in default to the CCP. The member will typically be willing to absorb these losses for the same reason as the farmer is willing to deliver wheat to the baker at $10 when the spot price is $15 in the absence of collateral. The member values the future benefit associated with being a CCP member more than the short-term benefit of walking away from the losses. In times of stress, however, a CCP member may choose to default on its performance obligations.

Debate about central counterparty membership

At the heart of the debate over CCP membership criteria is the liquidity of OTC contracts. The debate can be loosely characterized as follows. One side believes that because OTC contracts are not very liquid, a CCP member must be able to assume the portfolio of a defaulting member. This necessarily implies that members must have significant capital (typically at least $5 billion) available for clearing purposes. The other side believes that the illiquidity of OTC derivatives is overstated; for example, OTC interest rate derivatives and credit default swaps are quite liquid. If a CCP member defaults, then there are methods available to dispose of the portfolio, other than requiring another member to purchase it. And finally, if a requirement for membership is significant financial resources, then membership will be limited to a very small set of financial institutions, which in turn could give these institutions undue market power. I examine these views, starting at the heart of the debate: liquidity.

Contracts are said to be liquid if the value, or "fair price," of the contract can be accurately determined on an ongoing basis and large amounts of contracts can be bought or sold at or near the fair price in a short period.

A CCP adopts risk-management strategies to enhance its performance guarantee. These strategies—such as collateralizing positions, marking-to-market, and disposing of a defaulting member's portfolio—are easier to implement when contracts are liquid. The amount of collateral posted depends, in part, on the volatility of the price of the underlying asset and of the value of the OTC contract. Higher volatility implies that more collateral should be posted, and changes in volatility imply that the amount of collateral posted should also change. When contracts are liquid, good estimates for levels of volatility can be obtained. The CCP can be reasonably assured that the process of periodically marking-to-market members' positions will not leave the CCP with additional liabilities in the event of a member's default when contracts are liquid. Since large positions can be sold quickly at or near the fair price when contracts are liquid, the CCP will be able to efficiently dispose of a defaulting member's portfolio. A final risk-management strategy, contributions to a guarantee fund, provides an additional buffer for the CCP against losses from a member's default. The size of a member's contribution determines the maximum notional value of contracts (or risk) that the member can bring to the CCP.

If all contracts were liquid, there would be no debate associated with CCP membership. Any counterparty that could post the required collateral for its positions and contribute to a guarantee fund would be able to become a member.

Because some contracts are not very liquid, however, any sensible risk-management strategy, *independent of the structure of membership*, will require higher levels of collateral from CCP members.

An important aspect of guaranteeing performance is the CCP's ability to sell a defaulting member's portfolio quickly, at or near the fair price.[10] When contracts are highly liquid, the CCP does this by simply selling the portfolio to the market. What can the CCP do when the contracts are not very liquid and there is no market to sell to? One side of the debate over CCP membership says the solution is to require each CCP member to assume, that is, purchase, part of the defaulting member's portfolio. Since the notional value of a defaulting member's portfolio may be quite large, a CCP member will require substantial capital to assume its share. Hence, this solution would restrict CCP membership to those who possess significant capital that can be used for clearing purposes.

There may be problems associated with this solution. Because of the significant capital requirement for membership, the number of individuals or institutions that can qualify for membership will be small. This implies that the amount of liquidity that can be brought into the clearing process is limited (by the wealth of the small number of clearing members). Perhaps more

importantly, if there is only a small number of clearing members, then they could use the resulting market power to adversely influence the pricing of clearing services and the pricing of the OTC contracts themselves.

If a clearing member defaults, one side of the debate advocates that the CCP auction the defaulting member's portfolio among a small number of institutions, the CCP members. Auctions share many of the desirable properties associated with exchanges or markets, such as price discovery and a place that brings buyers together with a seller. In other words, an auction can provide (some) liquidity for the objects that are being sold. But it is neither clear nor obvious why the auction would operate more efficiently from society's point of view if it is restricted to only "wealthy" bidders. Since a CCP also serves as an information warehouse—collecting and disseminating the prices of cleared contracts—this information could be used by *anyone*, that is, a CCP member or nonmember, who would like to bid on part or all of the defaulting member's portfolio. Opening up the auction to nonmembers would make more liquidity available to the clearing process. (Of course, if a nonmember purchases part of the portfolio, then those contracts would have to be cleared through a CCP member.) There does not appear to be a rationale to limit the sale of a defaulting member's portfolio to only (wealthy) clearing members.

Another problem created by the wealth restriction for membership lies in the pricing of products. There is always a public policy concern regarding the pricing and supply of services when the number of service providers—in our case, CCP members—is small. That is, prices will be too high and quantities will be too low. Perhaps a bigger potential problem is that since CCP members are free to choose their customers, they may choose to clear only those OTC contracts for which they are direct counterparties, thereby limiting competition in the OTC derivative markets.[11] Hence, the wealth restrictions for CCP membership, which are motivated by clearing considerations, can have adverse affects on the pricing of the OTC derivative contracts. Ironically, the wealth restriction could ultimately prevent these contracts from become more liquid.

The wealth restriction for membership seems artificial. As long as an institution can cover the risk that it brings into the CCP, by providing appropriate levels of collateral and making contributions to the guarantee fund, there does not appear to be any reason to exclude it from membership. In an *unrestricted* membership environment, CCP members would compete for customers by appropriately pricing their services. With this structure, there would not be any obstacles to clearing all "clearable" contracts (not just those for which a member is a counterparty) or moving current OTC contracts onto exchanges. Exchange trading would improve both the liquidity of the contracts and the CCP's performance.

In summary, restricting CCP membership limits the amount of liquidity in the clearing process. In addition, membership restrictions can have adverse affects on the provision and pricing of both clearing services and OTC contracts.

End-user exemptions

"Since we weren't part of the problem, we shouldn't have to pay." This statement nicely summarizes the sentiment of many nonfinancial corporate end-users of OTC derivative products regarding that part of the Dodd–Frank legislation that mandates clearing for most OTC derivative contracts.

In most cases, nonfinancial corporations purchase OTC derivative contracts to hedge their business risks. These contracts are attractive because, unlike exchange-traded derivative contracts, they can be tailored to the firm's business needs (for example, in terms of timing of payments). Because these firms are using the contracts for hedging rather than speculative purposes, they usually hold onto them until they expire.

Currently, if a nonfinancial corporation wants to purchase an OTC derivative, such as a swap, it negotiates the terms directly with a dealer. The dealer typically does not require the nonfinancial firm to post collateral. However, the firm does pay a premium over similar products that require the buyer to post collateral. Nonfinancial firms claim that a requirement that all OTC contracts be centrally cleared will raise their cost of hedging, because they will now be required to post collateral. These firms argue that since they use the contracts to hedge their business risks and, by and large, they did not default on their derivative contracts during the financial crisis, they should not have to bear this cost.[12]

I conclude that, even in the best case scenario, the cost of hedging for nonfinancial corporate end-users will increase when their contracts are cleared. In the best-case scenario, the dealer posts collateral and the end-user does not. This is the best-case scenario from an end-user's perspective, because it does not have to post collateral. I now provide the details for this scenario. Suppose that the dealer that negotiates the corporate end-user's swap has a large diversified portfolio of end-users. As well, assume that corporate end-users will never (strategically) default on their swap obligations. That is, whenever end-users make the calculation, the benefit associated with continued access to the swap market exceeds the benefit of defaulting on a swap

payment. Hence, the only time an end-user defaults on a swap payment is when it is insolvent (or bankrupt). If one assumes that the probability of a firm becoming insolvent is independently distributed across firms,[13] then the dealer understands that a certain proportion of its swap contracts will end up in default. The dealer can charge a premium that reflects the proportion of swap contracts that will fail. From the end-user's perspective, this can be interpreted as an insurance premium. A default by an end-user will not create any problems for the broker-dealer since defaults are anticipated and priced. In this ideal world—where end-users never have an incentive to strategically default and (nonstrategic) defaults are uncorrelated—end-users do not have to post any collateral. Note that this result is consistent with my "simple" model of clearing, where collateral was required to guarantee performance because either the farmer or baker would always have an incentive to strategically default.

Prior to the recent financial crisis, the dealer typically would not have been required to post collateral for its positions with the end-user. Most of the time, dealers would contractually perform because it was in their best interests to do so. However, in times of stress, the dealer might default on its swap obligations. As a result, the end-user would not receive any payment—which may be critical during times of stress—and would be one of many creditors seeking remedy from the dealer. Clearly, contractual performance would be enhanced if the OTC contracts were cleared by having dealers post collateral for their positions with corporate end-users.

But posting collateral is not cheap. When dealers post collateral for their swap contracts with corporate end-users (as mandated by the Dodd–Frank legislation), they will pass some proportion—possibly all—of the associated cost to the end-users. Therefore, even if corporate end-users do not post collateral for their positions, their cost of hedging will increase.

Up to this point, I have assumed that corporate end-users don't strategically default and that defaults by nonfinancial firms are uncorrelated. These assumptions are unrealistic. In times of stress, when there are large price movements and/or weakened balance sheets, end-users may find it in their best interests to strategically default on a swap payment, even though they have the resources to pay. If many end-users default, then the insurance premium that dealers charged them will be insufficient to cover the dealers' losses. If, from a social perspective, it is important that dealers do not experience large-scale loses on their swap contracts during times of stress, then end-users' swap positions should be properly cleared through a CCP, which will require them to post collateral.

Although nonfinancial firms, by and large, purchase OTC contracts for the purpose of hedging, it is not at all obvious that these entities do not pose a threat to the stability of the financial system. Nonfinancial corporate end-users represent a relatively large share of the OTC market, 10 percent to 15 percent. If these firms receive a correlated shock that weakens their ability to perform, they may transmit this adverse shock to the balance sheets of the dealers. The potential effects of this shock can be greatly mitigated by requiring them to post collateral for their positions.

Conclusion

In the first part of this article, I sketched out a framework for thinking about clearing. I used the insights from this framework to examine two prominent themes from a recent symposium on clearing. In terms of CCP membership, there is an alternative (unrestricted) CCP structure that is at least as effective as one that requires members to have substantial capital. The alternative structure has the added benefit (which could be huge) of promoting both competition and the provision of liquidity in clearing and in the OTC derivatives markets. In terms of end-user exemptions, the cost of hedging will increase for end-users even if they are not required to post collateral. Since end-users' positions are nontrivial, in the sense that (correlated) defaults by end-users can weaken the ability of their dealers to perform, they should post collateral in order to strengthen dealers' ability to perform.

NOTES

[1]Derivatives are financial contracts whose value is linked to the price of an underlying commodity, asset, rate, index, or the occurrence or magnitude of an event. These contracts are traded both on traditional exchanges and over the counter.

[2]In 2008, the notional value of all AIG's derivative contracts, including credit default swaps, was as high as $2.7 trillion.

[3]See www.freakonomicsmedia.com/2008/09/18/diamond-and-kashyap-on-the-recent-financial-upheavals/ for a helpful Q&A about the financial market disruption in late 2008.

[4]The symposium agenda is available at www.chicagofed.org/webpages/events/2010/public_policy_symposium_on_OTC_derivatives_clearing.cfm.

[5]Some people argue that large companies do not strategically default because the reputational cost is too great. So, if these companies do default, it is because they are either bankrupt or insolvent. But, if a company senses it may become insolvent, it may attempt to counteract this by taking defensive actions such as rescheduling debt and other payments in an attempt to save itself. One can interpret this as strategically defaulting—the company has the resources to pay current bills, but chooses to withhold these payments.

[6]We observe this in the context of sovereign debt. For example, a country has the resources to pay for debt, but chooses not to because the current costs of doing so are too high, say, because the country would have to increase taxes on its citizens when the economy is weak. This is a costly decision—when a country repudiates debt payments, its reputation will take a hit, in the sense that it will be shunned in international debt markets in the foreseeable future.

[7]In the earlier example, the derivative contract is a forward contract and the commodity that underlies the derivative contract is wheat.

[8]A measure of liquidity for exchange-traded contracts is the bid–ask spread. A low bid–ask spread indicates that the contract is liquid; a high bid–ask spread indicates that it is not very liquid.

[9]If the customers' collateral payments are segregated from the member's own collateral and the member defaults on its own positions, then the customers' collateral is protected. In practice, customers of the defaulting member would transfer their accounts to one or more nondefaulting members, who then can "novate" the customer contracts of the defaulting member.

[10]The CCP may be able to avoid receiving a low selling price if additional time is taken to sell the position. There are two possible problems, however. First, there is a chance that the price of the contracts can move against the CCP during a protracted selling period. This implies that the CCP would require additional collateral from its members. Second, the CCP may not have the luxury of time on its side to dispose of the portfolio.

[11]If a clearing member buys or sells a contract from customer A, then I say that customer A is a direct counterparty of the clearing member. If customer A buys or sells a contract from customer B, a clearing member can limit competition by choosing not to novate the contracts.

[12]However, there have been defaults by nonfinancial firms that disrupted the broader markets—for example, Enron.

[13]This assumption is almost certainly false, that is, insolvencies will be correlated. I make this assumption because it provides the best-case scenario for the corporate end-user. Later, I discuss the implications of relaxing this assumption.