

Chicago Fed Letter

What is clearing and why is it important?

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In the financial market disruption of 2007–08, the once arcane topic of clearing of financial products took center stage in major policy debates. Generally speaking, clearing has to do with the nuts and bolts of the contractual performance of financial products after they have been traded.

What is clearing? Clearing is a set of institutions, relationships, and processes that are specifically designed to support performance of contracts, which are effectively promises.

This *Chicago Fed Letter* explains the concept of clearing by way of a series of examples. It then illustrates how centralized clearing can help mitigate commitment problems that are inherent in market relationships and, as a result, can improve risk-sharing opportunities for market participants.

Just as one doesn't dwell on how blood flows through the body until one has a heart attack, market participants aren't typically concerned about what happens after trades are executed so long as the markets are operating smoothly. Although there have been times over the past 70 years when post-trade operations have been in the news (such as the so-called Paperwork Crisis of the late 1960s, the failure of Bankhaus Herstatt in 1974, and the 1987 market crash), by and large the financial markets have operated in a relatively stable environment. Economists have not paid much attention to clearing either. This is because many models that economists use to understand the economy assume that financial markets operate without frictions. In a frictionless environment, clearing is simply not necessary.

To gain an appreciation and understanding of clearing using an economic model, we must add some frictions to it. One friction that we emphasize in this article is the *lack of commitment*, which is the possibility that people may break their

promises and fail to perform their contractual obligations. This friction, it turns out, provides an ingredient that is useful for helping us to understand what clearing is and why it is important.

Benchmark model

The benchmark model in economics is the so-called Arrow–Debreu model, named after the Nobel laureate economists who contributed much to its formulation and understanding. The elegance and simplicity of this model owe a lot to the absence of frictions in the model environment. In this model, all people in the economy at the beginning of time are not only fully aware of all possible future contingencies, but also can write and commit to contracts for delivery and acceptance of all possible goods over all possible contingencies at any possible date. Contracts are mediated by markets, implying that there exists a price for every possible good for each possible contingency over each possible date. People in the model choose to buy and sell goods to maximize their own happiness. The only constraint people face is their budget constraint—the value of what they buy cannot exceed the value of what they sell. A critical assumption in the model is that people commit at the beginning of time to deliver or accept goods in the future. For example, a person might promise to deliver five pounds of corn at a given time

if it does not rain before that time. If the contracted time arrives and there has been no rain, the person must deliver the corn.

Since people can commit and the market at the beginning of time is “complete,” all decisions regarding how much to buy and sell are only made at the beginning of time. As time moves on, people simply make or accept delivery of goods as promised based on the contingencies that actually occur. There is

Clearing financial contracts: A series of examples

Here, we describe a very simple example involving a trade between a farmer and a baker that illustrates what clearing is and why it is important. The farmer plants seeds today that will produce wheat tomorrow, and the baker will need wheat tomorrow to bake bread. Suppose that the price per bushel of wheat tomorrow can take on one of three values, say, \$5, \$10, or \$15, that

Almost anything that happens after an initial contract is executed, i.e., after the buyer and seller agree to the contract terms, and before final settlement occurs should be viewed as clearing.

no need to have markets open up in any future period. If they did, it would simply be an admission that at the beginning of time, people bought and sold goods in a way that did not maximize their happiness. Since all people can commit, and trades covering all possible contingencies are executed at the beginning of time, there is no need for things like money, or banks, or clearing. All deals are struck at the beginning of time and performance is, depending on one’s view, either guaranteed or assumed. So if we want to talk about and understand the notion of clearing, we have to introduce some explicit frictions into the benchmark model. We introduce two. The first is a search friction. Anyone who has ever purchased a house or found a reliable auto mechanic knows that it takes time and effort to purchase certain types of goods and services. This implies that it is not feasible to contract for all goods at the beginning of time and that, as a result, markets will open up over time. The second friction, which is central to the story, is the lack of commitment—people may break their promises to deliver or accept delivery of the goods in some contingencies. When there is a lack of commitment, then things like money, banks, and other institutions are needed to help alleviate the commitment problem. The institution we focus on here is clearing.

are all equally likely. The farmer and baker are risk averse, which means that they would prefer to agree today to exchange one bushel of wheat tomorrow for tomorrow’s expected price of \$10, as opposed to going to the market tomorrow and buying or selling at the spot price of \$5, \$10, or \$15.

The farmer and baker may be able to get their mutually preferred outcomes if they enter into a forward contract. That is, the farmer promises to deliver one bushel of wheat in exchange for \$10, and the baker promises to deliver \$10 in exchange for one bushel of wheat. 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 will only occur when tomorrow’s price of wheat is \$10. For example, if the price of wheat turns out to be \$5, then the baker will not accept delivery of the wheat from the farmer and, instead, will purchase wheat on the spot market. This strategy gives the baker an extra \$5, compared with the performance of the contract. Similarly, the farmer can get a net benefit of \$5 per bushel if he reneges on the contract 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 if another counterparty fails 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 contract. But this is not the end of the story.

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 to the contract holding the other’s collateral. To see this, suppose that the price of wheat 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 (while the baker keeps the farmer’s collateral). Here, one holding of collateral simply offsets the other one and does not guarantee performance. So, 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 reneges 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 reneges when the price of wheat is \$15, then the third party returns the baker’s own collateral and the farmer’s collateral to the baker. From the baker’s point of view, he has paid \$10 for the wheat and, hence, has no incentive to default on the contract. So, 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.

In order for a 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. In the last example, when the price of wheat is \$15, the farmer can always 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 that because of the baker's nonperformance, he had no choice but to sell his wheat on the market and that he should not lose 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 reneged. This implies that the third party mechanism alone, as described earlier, 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 obligations are made to the third party. The third party then "redelivers" the wheat and money according to the original contract. This process, called novation, effectively replaces the initial contract between the baker and farmer with two other contracts: one between the third party and the baker and another between the third party and the farmer. The third party becomes a *central counterparty* to the original parties of the contract. Notice that novation circumvents the verifiability problem: Since the farmer and baker make deliveries to the central counterparty, the central counterparty—which also holds all the collateral—is able to determine perfectly whether each party has performed its obligations. The central counterparty is now able to transfer the collateral to the appropriate party in the event of nonperformance.

In summary, the notion of clearing is directly related to contractual performance. When people can commit, as

in the benchmark Arrow–Debreu model, the notion of clearing does not arise because commitment implies contractual performance. If, however, people cannot commit, then, as the previous examples illustrate, contractual performance may be impaired. One can think of clearing, therefore, as a set of institutional arrangements that are designed to enhance contractual performance. Our examples, although simple, provide significant insights into clearing. The big insights are that central counterparties, which novate the contracts of buyers and sellers, may emerge and require the buyers and sellers to provide collateral (also called margin), so that they (the central counterparties) can effectively guarantee performance. In practice, central clearing of contracts also is concerned with risk management and other operations performed by the central counterparty. Although our examples are too simple to illustrate risk management, they will be helpful for discussing it.

The clearing arrangement we have described is just one possible solution to the underlying commitment problem. Although we make no claims as to its optimality, we think it is a reasonable solution to a situation in which the bilateral contracts are standardized and the buying and selling parties are small and anonymous. The clearing arrangements between large financial institutions might look quite different because these parties have recourse to other commitment devices, such as their immense financial wealth and reputation.

Central clearing in general

A big operation in any central counterparty is risk management. In all of our examples, the central counterparty faces no risk. The central counterparty holds \$10—\$5 each from the farmer and baker. In the event that the farmer or baker defaults, the maximum amount that the central counterparty needs to guarantee performance is \$5. But in the real world, prices of commodities or assets do not move in small, finite, discrete amounts over a specific time interval. Typically, short-term price movements are not very large in relative terms, but

one can't rule out enormous price movements over a period of a few hours. Suppose there is a large price movement and, as a result, some parties default on their contracts with the central counterparty. Can the central counterparty guarantee performance? The central counterparty could guarantee performance if it required enormous amounts of collateral. But collateral is costly: Parties have more productive uses for their resources and do not want them tied up as collateral. If a central counterparty demanded sufficiently huge margins—so as to cover any conceivable price movement—people would simply stop using forward contracts (tied to future prices), since they are too costly, and would instead transact on spot markets (immediate transactions at current prices).

Alternatively, the central counterparty could rely on other resources to supplement the parties' collateral. For example, a central counterparty could obtain insurance against the possibility of default. A more common approach, however, is loss mutualization. In the event that the margins of defaulting agents are insufficient to guarantee performance, the central counterparty may draw on resources in a guaranty fund to which all participants in the clearing arrangement contribute.

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In such arrangements, the loss is shared or *mutualized* among the non-defaulting participants.

Conclusion

Now, we are able to answer the questions we posed at the outset of this article. What is clearing? Clearing is a set of institutions, relationships, and processes that are specifically designed to support performance of contracts, which are effectively promises. By way of a series of simple examples, we have been able to identify some important aspects of

clearing, such as the existence of a central counterparty, novation, margin requirements, and loss mutualization. In fact, almost anything that happens after an initial contract is executed, i.e., after the buyer and seller agree to the contract terms, and before final settlement occurs should be viewed as clearing. So trade confirmation, trade matching, and information warehousing—i.e., checking to make sure party A entered into a contract; verifying that party B is, in fact, on the other side of the contract; and compiling in an accessible manner the set

of all the trades that have taken place—are also part of clearing. It is important to emphasize that these clearing institutions and processes arise only because people cannot commit. Clearing is a substitute for commitment, although not a perfect one.

Why is clearing important? In the absence of clearing, contractual performance of many financial products would be severely impaired and, as a result, society would have to resort to less efficient means of exchange.