

# Chicago Fed Letter

## Clearing and settlement of exchange traded derivatives

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Derivatives are a class of financial instruments that derive their value from some underlying commodity, security, index, or other asset. Futures and options are common forms of derivatives. This article explains how clearing and settlement systems for exchange traded derivatives work.

Derivatives are traded on organized exchanges or in the over-the-counter market—a decentralized market model where market participants find other market participants to trade with.

**Because** of its role in fostering a sound financial system, the Federal Reserve Bank of Chicago has taken a keen interest in clearing and settlement systems for derivatives products, in particular, the risk-management, banking, and payment systems that support such clearing and settlement systems. The Seventh Federal Reserve District is home to over half a dozen exchanges and four systemically significant clearing organizations, or central counterparties (CCPs).<sup>1</sup> As these markets have grown, their potential systemic implications for the nation's financial system have similarly increased. Previous *Chicago Fed Letter* articles have explained the concepts of clearing and settlement in general,<sup>2</sup> and the settlement of foreign exchange contracts in particular.<sup>3</sup> This *Chicago Fed Letter* expands upon the general clearing theme, discussing specifically how derivatives CCPs' margining<sup>4</sup> and settlement systems work and how they affect payment and settlement systems and foster public confidence in organized markets and the financial system in general.

### Derivatives

Derivatives are financial contracts that are traded on organized exchanges or in the over-the-counter (OTC) market—a decentralized market model where market participants find other market participants to trade with. As is the case with derivatives in general, futures and

options derive their value from the current or expected market value of an underlying commodity, security, index, or financial instrument or from the occurrence or magnitude of an event. For example, a futures or options contract based upon the expected value of a foreign currency versus the dollar would be directly affected by changes in the “spot” (or current) foreign exchange rate between the two currencies, the prevailing and anticipated interest rates of both currencies, and other economic indicators that capture economic growth or relevant international capital flows. Similarly, a futures or options contract based on a commodity like corn would be based on the amount of corn currently in storage; anticipated corn crop yields; and anticipated demand for corn, ethanol, and other corn byproducts.

### Exchanges versus the OTC market

Exchanges provide a forum for attracting interested buyers and sellers. Trade intermediaries solicit clients and assume the financial risk of those clients. Some OTC instruments, notably certain standardized interest rate swaps and credit default swaps,<sup>5</sup> are eligible to be cleared by one or more CCPs, even though the contracts were bilaterally negotiated in the OTC market and not on an exchange. Unlike securities, where settlement occurs in three business days or fewer, derivatives instruments are financial contracts

that are often outstanding for weeks and even years. Derivatives contracts are revalued daily and eventually mature or are liquidated. To address the continuing financial risk throughout the life of derivatives contracts, all derivatives exchanges are associated with one or more CCPs that guarantee financial performance among all clearing members.<sup>6</sup>

### Derivatives CCPs

A derivatives CCP guarantees the financial performance of its clearing members.

Public confidence in organized markets depends in large part upon the smooth functioning of the clearing and settlement systems that support those markets.

At the time that a trade matches,<sup>7</sup> the CCP becomes the buyer to the selling clearing member and the seller to the buying clearing member. In this way, clearing members do not need to make a credit assessment of the other clearing members or their clients. In an electronic trading environment, clearing provides valuable anonymity; buyer and seller (and buying clearing member and selling clearing member) rarely know (or need to know) each other's identity.

In order to guarantee the performance of all clearing members, a derivatives CCP collateralizes, or "margins," the financial performance exposure that the CCP has to each of its clearing members. This is called performance bond collateral, and it is based upon the historical price volatility<sup>8</sup> of the instruments, multiplied by the number of open (unliquidated) positions that a clearing member has with a CCP.<sup>9</sup> By setting the performance bond collateral requirements at levels that anticipate a likely one-day market (price) movement,<sup>10</sup> a CCP should have any potential liquidation risks reasonably well collateralized before the fact.<sup>11</sup>

Should a clearing member fail to satisfy its financial obligations to a CCP, that CCP would declare the clearing member to be in default and would transfer or liquidate its positions, liquidate the relevant performance bond collateral, and apply the proceeds to cover the costs of

liquidation.<sup>12</sup> Should the costs of liquidation exceed the proceeds of the performance bond collateral, any residual loss would be covered by the very substantial financial assets held in reserve.<sup>13</sup>

Clearing members satisfy their performance bond (initial margin) collateral requirements by depositing eligible assets (which are largely composed of cash, U.S. Treasury securities, and equity securities) with the CCP. Similarly, clearing members' clients collateralize the risk

of their positions with their respective clearing members by providing eligible performance bond collateral assets, most of which are simply passed through by the clearing members to the CCP. Performance bond collateral requirements are generally set to cover one day's probable market movement with a 95% to 99% confidence limit. To protect itself from the probable liquidation costs associated with a defaulting clearing member, the CCP must then "refresh" the utility value of the performance bond collateral daily. The CCP does this by removing each day's market risk from the clearing system, thus preventing losses from accumulating above the levels collateralized by the performance bond collateral. Removing this market risk is accomplished by revaluing all open positions to current market prices (thus, they are "marked to market"). Clearing members having a debit balance with the CCP are required to promptly satisfy that deficiency. The process for doing so for futures contracts is somewhat different than the process for options contracts.

### Futures settlements

All futures contracts are revalued at least once per day. The change in value (up or down) of those contracts from the prior valuation price to the current valuation price is known as variation margin, or "settlement variation."<sup>14</sup> Since there are always an equal number of buyers and

sellers for each futures contract, the CCP collects cash variation margin from clearing members having an aggregate debit balance and pays those funds to clearing members having an aggregate credit balance. Clearing members receiving variation margin on behalf of their clients complete the process by crediting that variation margin to the individual accounts of clients whose futures contracts increased in value. It all balances to the penny.

### Options settlements

Options settlements are asymmetric because the risks associated with purchasing or selling (writing) options contracts are asymmetric. First, the option buyer must pay (through his clearing member and the CCP) the option seller the purchase price of the option in cash (option premium pass-through). Once that is accomplished, the option buyer owns an asset (the option) that can change in value like any other asset, and the option seller posts performance bond collateral to support the seller's ability to perform during the life of the option.<sup>15</sup> There are no continuing margining processes that affect the option buyer. Since all of the continuing liability to perform lies with the option seller, the seller must properly collateralize the option contract from the moment it is sold, and the seller must post additional performance bond collateral should the value of the option increase in value over the original trade price. In this manner, both the clearing member representing the option seller and the CCP are holding performance bond collateral from the option seller in an amount that equals or exceeds the current market value of the option. While the CCP makes the initial call for additional performance bond collateral in cash, clearing members quickly substitute securities for that cash, typically on the same day. Thus, an options CCP always holds collateral equal to or greater than the market value of all options that it has issued (cleared).

### Settlement banks

In order to be admitted to a CCP, clearing members must satisfy and maintain minimum financial requirements and establish a settlement banking relationship with one or more settlement banks. Settlement

banks provide specialized commercial banking services to CCPs and to clearing members of those CCPs. As part of every clearing cycle,<sup>16</sup> CCPs transmit the settlement obligations of clearing members to the clearing members' settlement banks. Settlement bankers make the determination to either honor or decline the CCPs' demands for payment, knowing that to decline a demand for payment will almost certainly constitute a default under the rules of most clearing organizations.

Assuming that the settlement bank is prepared to satisfy all of the settlement demands for all of its clearing member clients, it issues its binding commitment to do so, usually both in writing and verbally on a recorded line of the CCP, although the technology varies with the CCP. Some CCPs now have procedures that require their settlement banks not just to make a commitment to pay, but to actually remit the requisite funds to the account of the CCP by a predetermined deadline.

One of the types of settlements that a CCP asks a settlement bank to process<sup>17</sup> is a request for additional performance bond collateral for futures or options. Variation margin (the marked-to-market funds) for futures is collected at least daily from the bank accounts of clearing members having a debit balance with the CCP and remitted to the bank accounts of clearing members having a credit balance.

Thus, on any given day, a settlement bank will likely have both debits and credits to process for its clearing member clients. Invariably, a CCP ends up with either too much or too little money in its accounts at its settlement banks. To balance its accounts, a CCP provides its settlement banks with instructions either to expect covering funds from one or more settlement banks or to transfer excess funds to one or more settlement banks. Once these interbank balancing transfers have been completed, another clearing cycle is complete, and that risk has been removed from the CCP's clearing system. This has an important implication—a CCP can only remove market risk from its clearing system when the national banking system is open.

## Conclusion

Public confidence in organized markets depends in large part upon the smooth functioning of the clearing and settlement systems that support those markets. This so-called financial plumbing includes payment systems (including securities settlement systems and securities depositories) used by clients to settle with their clearing members and by clearing members and CCPs that hold those securities and make and receive payments. The settlement process today is concentrated among fewer and fewer settlement banks.

Clearing and settlement systems work perfectly when all relevant settlement payments are made promptly. If clearing members are not given full or immediate access to funds due from a CCP, then, absent any information to the contrary, clearing members and other market participants might assume that the CCP has failed to completely collect losses from other clearing members, resulting in a loss of public confidence in the settlement process. Indeed, late settlement payments associated with derivatives markets were one of the root causes of near payments gridlock during the 1987 market crash.<sup>18</sup>

Clearing members and especially CCPs must also have the infrastructure and human capital to accurately process a record number of transactions and be prepared to handle a potential default every day that their markets are open. That is an extraordinarily high standard of preparedness, and it comes with a cost that cannot and should not be trivialized or compromised.

Many CCPs are still using outdated communications technologies, such as faxes, telephones, and CCPs' vintage proprietary communications networks. As more and more public attention is focused on our financial markets and the clearing and settlement processes that support those markets, it might be in everyone's best interest to reassess current uses of legacy technology that might pose potential weaknesses to our settlement systems.

The U.S. Department of the Treasury recently proposed that all standardized OTC derivatives contracts should be cleared by one or more CCPs. Bringing even more derivatives instruments into

clearing and settlement systems will concentrate market and operational risk even more than today, making it all the more important that CCPs function flawlessly.

Lastly, much attention has been given to potential regulatory reform proposals for the larger financial services industry. The recent proposal by the Obama administration contains elements that would have an effect on the supervisory "oversight of systemically important payment, clearing, and settlement systems."<sup>19</sup> The administration's proposal would also give the Federal Reserve the "authority to provide systemically important payment, clearing, and settlement systems access to Reserve Bank accounts, financial services, and the discount window."<sup>20</sup> It will be important for us to study the implications of these reforms should they become law.

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<sup>1</sup> The four CCPs are The Clearing Corporation (an operating affiliate of ICE Trust U.S. LLC); the Clearing House Division of the CME Group; ICE Clear U.S.; and The Options Clearing Corporation.

<sup>2</sup> John W. McPartland, 2005, "Clearing and settlement demystified," *Chicago Fed Letter*, Federal Reserve Bank of Chicago, No. 210, January, available at [www.chicagofed.org/publications/fedletter/cfjjanuary2005\\_210.pdf](http://www.chicagofed.org/publications/fedletter/cfjjanuary2005_210.pdf).

<sup>3</sup> John W. McPartland, 2006, "Foreign exchange trading and settlement: Past

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<sup>4</sup> Derivatives market participants typically post collateral with counterparties or CCPs to secure unrealized losses and to anticipate future market movements as explained in detail later in this article.

<sup>5</sup> Interest rate swaps are simply the exchange of one set of cash flows (based on interest rates) for another. Credit default swaps are designed to transfer the credit (default) exposure of fixed-income securities between parties.

<sup>6</sup> A clearing member is usually a trade intermediary that can deal directly with the CCP. Trade intermediaries that are not clearing members must clear their trades through a trade intermediary that is a clearing member.

<sup>7</sup> In an electronic trading environment, trades are guaranteed by the CCP instantly upon trade match because no one would otherwise trade anonymously on such a venue. In a paper-based physical trading floor environment, traders and their qualifying clearing members have an incentive to promptly resolve any unmatched trades (outtrades) because the CCP’s guarantee is not granted until trade match occurs. Where exchanges perform the trade match independent of the CCP, the trades are guaranteed when they are accepted by the CCP for clearing.

<sup>8</sup> A CCP has the same market risk whether the market goes up or down. Performance bond collateral (margin) is required to cover the price volatility that is likely to occur on any one day. Derivatives that

could not reasonably be liquidated in one day would be expected to have higher margin requirements to cover liquidation risk over a longer period.

<sup>9</sup> Performance bond collateral requirements can be based either upon the net of the open long and short positions (by commodity and contract month) or upon the gross number of open positions. Net margining and gross margining both seem to work well, albeit under somewhat different conditions.

<sup>10</sup> Portfolio margining provides performance bond collateral credits for positions that generally reduce the risk of other positions in the same portfolio.

<sup>11</sup> This assumes that the instrument traded by a defaulting clearing member could likely be liquidated by the CCP in one day. While this is often the case for exchange traded derivatives, it is less often the case for cleared OTC derivatives.

<sup>12</sup> In actual practice, this is far more complex, since client positions and client performance bond collateral are treated very differently in insolvency situations from proprietary positions and proprietary performance bond collateral. Unfortunately, the relevant bankruptcy regimes for trade intermediaries vary greatly from country to country.

<sup>13</sup> A CCP generally requires clearing members, based on known formulas, to contribute financial assets to a guarantee fund, which may be drawn upon if the performance bond collateral and any other assets of the defaulting clearing member prove insufficient to cover the liquidation loss.

<sup>14</sup> Variation margin includes funds used to purchase futures options, more commonly known as “option premium pass-through.”

Unlike a demand for a variation margin (which normally would indicate a market loss), an option premium “pay” indicates the clearing member purchased a futures option, which is an asset.

<sup>15</sup> This would include having the financial resources to potentially provide additional performance bond collateral should the value of the option sold increase in value (and go against the option seller’s position) and/or provide the underlying asset upon which the option was written should the option be exercised.

<sup>16</sup> Some clearing organizations have one clearing cycle per day. Others have two.

<sup>17</sup> CCPs accept a reasonably wide spectrum of securities that can serve as performance bond collateral. But CCPs do not know which issues of acceptable performance bond collateral a clearing member may elect to deposit, so the initial “margin call” with the settlement bank is always for cash. Once the settlement bank guarantees that the funds will be forthcoming, the CCP has effectively substituted settlement bank risk for clearing member risk. After the securities are delivered to the CCP, the cash is returned to the clearing member’s account at its settlement bank.

<sup>18</sup> See B. Bernanke, 1990, “Clearing and settlement during the crash,” *Review of Financial Studies*, Vol. 3, No. 1, pp. 133–151.

<sup>19</sup> U.S. Department of the Treasury, 2009, “Financial regulatory reform—A new foundation: Rebuilding financial supervision and regulation,” proposal, Washington, DC, June 17, p. 14.

<sup>20</sup> *Ibid.*