

Chicago Fed Letter

Clearing and settlement demystified

by John McPartland, financial markets advisor

This article explains how clearing and settlement systems support a sound financial system. In particular, the article analyzes the role of CCPs (central counterparties) in managing risk in the securities and derivatives markets and some of the relevant public policy issues.

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Because of its role in fostering a sound financial system, the Federal Reserve Bank of Chicago has a keen interest in clearing and settlement systems for securities and derivatives¹ products and, in particular, the risk management, banking, and payment systems that support such settlements. The Seventh Federal Reserve District is home to five major exchanges and three central counterparties (CCPs) that support much of the activity on those exchanges, routinely processing well over a billion dollars in settlements daily.² These CCPs have substantial and, in some cases, complex clearing linkages to other domestic and international CCPs. CCPs also concentrate risk.

As these markets have grown significantly, their potential impact on the nation's financial system has similarly increased. This *Chicago Fed Letter* explores how the operations of the CCPs' margining and settlement systems affect other CCPs, payment systems, settlement banks, and the financial system in general. We touch upon some of the public policy implications and provide an introduction to the arcane world of clearing and settlement in general, and derivatives clearing and settlement in particular.

How clearing and settlement work

Clearing and settlement usually begin with capturing trade data and ensuring that (if not performed already by an organized market) the specific terms of buyers' and sellers' trade records match correctly (as a mirror image of the

other). Although this sounds simple enough, some of the most complex clearing processes involve the matching of trades. Some clearing organizations receive perfectly matched (paired) trade information from the exchange(s) that they support. In general, the "trade match" function is the gateway to a CCP's clearing system; hence it is often referred to as a clearing system's "front end."

In most countries, clearing of securities and derivatives products involves novation:³ the substitution⁴ of the CCP for the original counterparties with respect to future performance of all remaining obligations (mostly but not exclusively financial). In order to support its guarantee of performance, a CCP employs a prudential risk management system that includes the financial resources to support its trade guarantee.⁵ While clearing arrangements provide many public and private benefits, there are potential public policy implications associated with the concentration of considerable risk within CCPs. Hence, the President's Working Group on Financial Markets determined that CCPs "should be subject to regulatory oversight in order to help ensure that proper risk management procedures are established and implemented and that the clearing system is properly structured."⁶

Securities

The clearing and settlement of securities can be highly automated if the securities are accounted for electronically and if there are few securities depositories

that account for the ownership of such “book-entry” securities. There are significant network externalities associated with clearing: It is efficient for market participants to clear and hold their securities where other market participants clear and hold their securities.

International guidelines prescribe that the transfer of the ownership of a security is conditional on the simultaneous transfer of sufficient funds to pay for the security in full (the concept of Delivery versus Payment or DVP). Once title to the security has been changed, the clearing and settlement process ends and the custody process begins.

Different security types have developed different settlement conventions. Most transactions involving bank certificates of deposit and commercial paper settle “for cash,” i.e., on the same business day. Most U.S. Treasury securities settle “for regular,” i.e., the next business day. Most foreign exchange transactions settle “for spot” or two business days after the trade date (T+2). Most U.S. equity and municipal bond trades settle on a T+3 basis or three business days after the trade is executed.

Risk of settlement default can arise from two sources. The seller either does not have or does not properly deliver the securities on the settlement date, a “short fail.” Alternately, the buyer does not have sufficient funds, a “long fail.” Securities clearing organizations typically (varies by country) have automated procedures and financial resources at hand to temporarily mitigate both long and short fails. They also typically have some risk management policies in place to cover the temporal risk between trade match and settlement.

In an effort to minimize the sheer number of transactions that must be settled, many securities clearing and settlement systems provide for the multilateral netting of settlement obligations. As settlement is often made by trade intermediaries that may have many purchases and sales of the same security, their net delivery obligation is the net difference of purchases and sales, by security/issue. All particulars regarding such settlement obligations should not be in dispute by the close of business the day after the trade date. The funds side of settlement is netted down to a single payment either made to or received from the CCP.

Securities clearing systems in mature markets often reflect a hybrid of public sector and private sector systems. In the U.S., the Federal Reserve’s “book-entry” system settles each U.S. Treasury or agency securities transaction individually, delivering the security to the account of the receiving bank and charging the reserve balance of that bank at veritably the same instant: a real-time, gross settlement (RTGS) system. There are several private sector enterprises that clear government securities by netting all possible transactions and then processing the remaining transactions across their own books, the “on us” transactions. Such settlement services are subject to supervisory oversight and minimum standards. On these systems, only the imbalance between purchases and sales that can not be internalized is sent to the Federal Reserve’s book-entry system to settle. In some countries, the settlement of sovereign debt securities occurs entirely in the private sector.

Derivatives

The clearing and settlement of derivatives transactions are very different from those for securities. Rather than clearing and settling in a few days (the period during which a securities settlement default might occur), derivatives contracts often remain outstanding for several months or years. Unlike securities where the security itself is delivered and promptly paid for in full, derivatives contracts represent the obligation (or the option) to buy or sell a financial instrument at a future date, with buyer and seller assuming (and presenting) significant financial risk to the CCP in the interim. Whereas the CCP’s guarantee lasts only a few days for securities, the CCP revalues exchange-traded derivatives contracts daily and requires market participants to continue to settle with the CCP every day until the derivatives contracts are liquidated, exercised, or mature.

While derivatives clearing systems have the same familiar trade match “front end” and banking and settlement “back end” that securities clearing systems have, derivatives clearing systems have far more complex risk management, margining, and collateral management systems. Significant human and IT resources are devoted to managing the interim risk that a market participant might fail to adequately maintain its long or short position from the time a

trade is matched to the time that it is either liquidated or matures.

Similar to securities clearing systems, derivatives clearing organizations novate trades, substituting the CCP as the counterparty acting as seller to buyer and buyer to seller, creating two new contracts.⁷ Novation also allows the liquidation of derivatives contracts prior to maturity, a concept very different from that of clearing securities transactions. In all clearing systems, the number of buyers (the number of contracts representing contracts to purchase the underlying instrument or index) must always equal the number of sellers. Novation allows market participants to enter and leave the marketplace while keeping the number of buyers (longs) and sellers (shorts) equal at any point in time.

Besides providing risk management, margining, and collateral management practices to organized derivatives markets, the CCPs’ intermediation provides other, more subtle benefits. For example, the substitution of the CCP as the central guarantor of performance allows trading on organized securities and derivatives markets to occur anonymously. Not all organized markets provide anonymity.⁸ Although little empirical research has been done in this area, it is generally believed that market participants utilize organized markets to a greater extent when they can move in and out of those markets with complete anonymity. If one benefit of anonymity is increased market liquidity, this in turn leads to more efficient price discovery and trade execution.

To guarantee performance among clearing participants, derivatives CCPs collateralize market risk and revalue all open positions daily. Derivatives contracts typically involve the right to buy or sell a standardized financial instrument (e.g., 100 shares of General Electric). These contracts change in value as they continue to be traded on the relevant organized market. Either the organized market or the CCP determines a daily settlement price for all derivatives contracts. The CCP calculates the change in value from the most recent settlement price to determine the incremental gain or loss by contract. Market participants with unrealized incremental losses must pay such losses in same-day funds (for futures) or post

additional performance collateral (for options) with the CCP, which remits the funds (or a margin credit) to market participants with unrealized profits on their contracts. These periodic payments, often called *settlement variation* or *variation margin* balance to the penny and prevent unrealized losses from accumulating within the clearing system.⁹

To protect itself from a potential financial loss as the result of liquidating the positions of a defaulting clearing participant,¹⁰ the CCP also requires all clearing participants to deposit performance collateral. The process of revaluing all derivatives contracts to market prices (marking-to-market), collecting incremental unrealized losses, and passing the value of the incremental unrealized profits to firms with a credit balance with the CCP, replenishes the value of the performance collateral that the CCP holds for all positions. Thus, in most cases, CCPs set their performance collateral requirements at levels that would be expected to cover one day's market move.¹¹

Trade intermediaries and settlement banks

On most organized markets, trade intermediaries stand between their clients and the CCP.¹² CCPs determine the daily mark-to-market settlement amount based on all of the clients' positions of a trade intermediary taken as one account, or origin. Virtually no data are available concerning the frequency of client defaults to trade intermediaries because they are usually private events. Not unlike the clearing organization at the center of the settlement process, trade intermediaries must absorb any uncollateralized liquidation loss associated with the liquidation of a defaulting client's positions. This provides an incentive for trade intermediaries to select their clients carefully and to promptly collect performance collateral and settlement.

Settlement banks provide customized commercial banking services to both clearing organizations and the trade intermediaries that are also clearing participants. CCPs notify both clearing participants and their settlement banks of their settlement obligations. Because clearing participants are required to grant CCPs debit authority over their settlement accounts, settlement banks indicate to the CCPs whether all demands

for payment will be honored or not. A clearing member's failure to "make settlement" is tantamount to defaulting to a CCP.

Besides providing credit intermediation between CCPs and their clearing participants, settlement banks may also provide critical commercial payment services, enabling literally thousands of institutional clients to settle their individual obligations with their trade intermediary clearing participants. Derivatives exchanges have rules requiring trade intermediaries to collect performance collateral and settlement variation promptly from their clients. Clearing participants settle with the CCP on behalf of all of their clients in aggregate and, in turn, need to promptly settle with their own clients, typically via interbank transfers.

Once trade intermediaries have settled up with CCPs and with their own clients, the market risk of one business day has been essentially eliminated. Every time that market risk has been flushed from the larger settlement system, the value of the performance collateral of clients held by the trade intermediaries and the performance collateral of clearing participants held by the CCP is effectively replenished for another business day. This process is often highly automated.

Other public policy issues

Because of the critical role that central banks play in fostering financial stability in their economies, central banks have a keen interest in current developments that might upset or otherwise interfere with the orderly settlement of financial transactions. Some of the public policy issues currently being debated include issues relating to CCPs and clearing and settlement best practices. For example, one issue is the potential abuse of pseudo-monopoly powers by CCPs. Clearstream, the second largest international securities clearing organization, based in Europe, was sanctioned in June 2004 for refusing to provide cross-border securities clearing and settlement services and for applying discriminatory prices.¹³ Where there is a one-to-one relationship between exchanges and clearing organizations, holders of open positions have no choice but to return to the market where the initial position was opened to liquidate it through its clearing organization. Where a clearing organization clears economically equivalent

products for multiple exchanges, the exchanges are forced to compete at the product level rather than at the exchange level. Both models appear to perform equally well in providing economies of scale and network externalities. Abuse of monopoly powers, in general, artificially raises costs and decreases efficiency.

Derivatives cross-margining arrangements require intricate cooperation between CCPs. This may be difficult to achieve if CCPs resist providing their services to all qualified enterprises that request them. The Commodity Futures Modernization Act requires the Commodity Futures Trading Commission, which regulates derivatives exchanges and trade intermediaries in the U.S.¹⁴ to "...facilitate the linking or coordination of derivatives clearing organizations..." where the public good is served by doing so.¹⁵

Another one of the issues that arises is that the continued consolidation among CCPs concentrates the aggregate risk among fewer and fewer CCPs. This consolidation among CCPs could raise complex moral hazard issues if some CCPs begin to be perceived by some as "too big to fail." Continued consolidation of CCPs eventually gives rise to the public policy conundrum, "How many CCPs are too many; how few are too few?" To date, little research has focused on this important issue.

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To understand how clearing and settlement systems operate, specifically how the CCPs support today's modern securities and derivatives markets, we need

to consider the intricate inter-relationships that exist between CCPs and payment systems, exchanges, trade intermediaries, settlement banks,

depositories, market participants, and other CCPs. One should not take this financial "plumbing" for granted just because it is often out of view.

¹ Derivatives are a class of financial instruments or contracts that derive their value from some underlying stock, bond, commodity, index or other asset. Futures, swaps, some forwards, options and warrants, and certain mortgage-backed securities are common derivative forms. Derivatives may be exchange traded or privately negotiated.

² The best known exchanges are Archipelago (ArcaEx), the Board of Trade of the City of Chicago, the Chicago Board Options Exchange, the Chicago Mercantile Exchange, and the Chicago Stock Exchange. The Chicago Climate Exchange, Eurex US, the Merchants Exchange, NQLX, OneChicago, and a number of nascent organized markets and lesser-known exchanges are also located in the Chicago area. The CCPs are the Clearing House Division of the Chicago Mercantile Exchange, The Options Clearing Corporation, and The Clearing Corporation.

³ A process through which the original obligation between a buyer and seller is discharged, and is replaced by the substitution of the CCP as seller to buyer and buyer to seller, creating two new contracts.

⁴ In the United Kingdom and some other British Law countries, novation is replaced with the legal concept of *open offer*. Under an open offer regime, the CCP is not automatically substituted as the counterparty.

If proper settlement of the trade is called into question, either of the original counterparties can then demand that the CCP be substituted to complete the settlement of the transaction.

⁵ Readers should not assume that CCPs' guarantees are without limit. While still being prudential, many CCPs' guarantees are finite.

⁶ President's Working Group on Financial Markets, *Over-the-Counter Derivatives Markets and the Commodity Exchange Act*, November, 1999, p.14.

⁷ Committee on Payment and Settlement Systems and Technical Committee of the International Organization of Securities Commissions, *Recommendations for Central Counterparties*, November 2004, Basel, Switzerland.

⁸ For example, the InterContinental Exchange (ICE) provides that the buyer and seller may or may not opt for clearing services. If either or both do not opt for clearing and if there is sufficient unused counterparty exposure available under both counterparty limits to execute the trade, the identities of buyer and seller are revealed, and the bilateral exposures are adjusted accordingly.

⁹ Settlement variation is often referred to as variation margin, particularly in Europe. However, Rule Books usually refer to the

pass-through of accumulated unrealized profits as settlement variation.

¹⁰ The CCP has to absorb a default liquidation loss if the prices at which the CCP liquidates the defaulting clearing participants' positions are less favorable than the settlement prices that were used for the last settlement cycle (which the defaulting clearing participant satisfied). All clearing participants were made whole by the CCP using these prior valuations.

¹¹ Several CCPs set their requirements at levels that would cover more than one day's market move for products where it is reasonable to believe that positions would take more than one day to liquidate.

¹² In a few countries, e.g., Spain, positions are kept at the market participant level.

¹³ The European Commission's investigation revealed that Clearstream had refused to supply Euroclear Bank (its largest competitor) with clearing and settlement services, effectively preventing Euroclear from providing clearing services for German securities to its clients, and from competing with Clearstream in that market.

¹⁴ The U.S. Commodity Futures Trading Commission is also responsible for allowing foreign exchanges to provide their products to market participants in the U.S.

¹⁵ 7 U.S.C. §7a-1(f)(1).