OTC derivatives—A primer on market infrastructure and regulatory policy

Ivana Ruffini and Robert S. Steigerwald

Introduction and summary

Derivatives have long been important tools for managing risk. In particular, as Culp (2004) explains, "derivatives can be used as a means of engaging in risk transfer, or the shifting of risk to another firm from the firm whose business creates a natural exposure to that risk" (p. xiv). In this article, we discuss some recent developments relating to the regulation of derivatives markets, specifically the Group of Twenty (G-20) mandates, and examine the infrastructure that supports derivatives markets (including both the trade execution and post-trade clearing and settlement processes). Then we identify some of the policy issues raised by the G-20 market structure mandates. To provide a foundation for that discussion, first we explain some key concepts and terms.

Key concepts and terms

What is a derivative? A derivative is a financial contract whose value is based on an underlying market factor, for example, a reference rate or index, commodity, or other asset that is used to manage risk or support a particular profit-maximizing strategy.

How are derivatives traded? Derivatives contracts may be traded over-the-counter (OTC), through swap execution arrangements (developed in response to post-crisis legislation), or in listed markets on exchanges. OTC markets are characterized by the absence of a centralized trading mechanism and dependence on dealers as liquidity providers. By contrast, listed markets typically use a central limit order book to aggregate the trading interests of buyers and sellers. This permits participants in listed markets to trade with each other in an auction environment. OTC and listed markets, however, "do not represent a black-and-white dichotomy," but points along a continuum of trade execution arrangements (Culp, 2009, p. 5). Technological advances have enabled the creation of a variety of electronic platforms for trading standardized OTC products, some of which seem "very close to the central limit order book operated on exchanges."[1]

How are the terms of derivatives contracts determined? Bilaterally negotiated and customized derivatives contracts are hallmarks of OTC derivatives markets. These contracts are negotiated between counterparties (typically, a pair of dealers or a dealer and a client) and are tailored to meet the counterparties' specific needs and risk appetite. Some market participants may not require customized contracts. They may instead trade

Ivana Ruffini is a senior policy specialist and Robert S. Steigerwald is a senior policy advisor in the financial markets group of the Economic Research Department at the Federal Reserve Bank of Chicago. *The authors thank Ed Nosal, Lisa Barrow, Richard Heckinger, Kirstin Wells, and David Marshall for helpful comments and conversations.*

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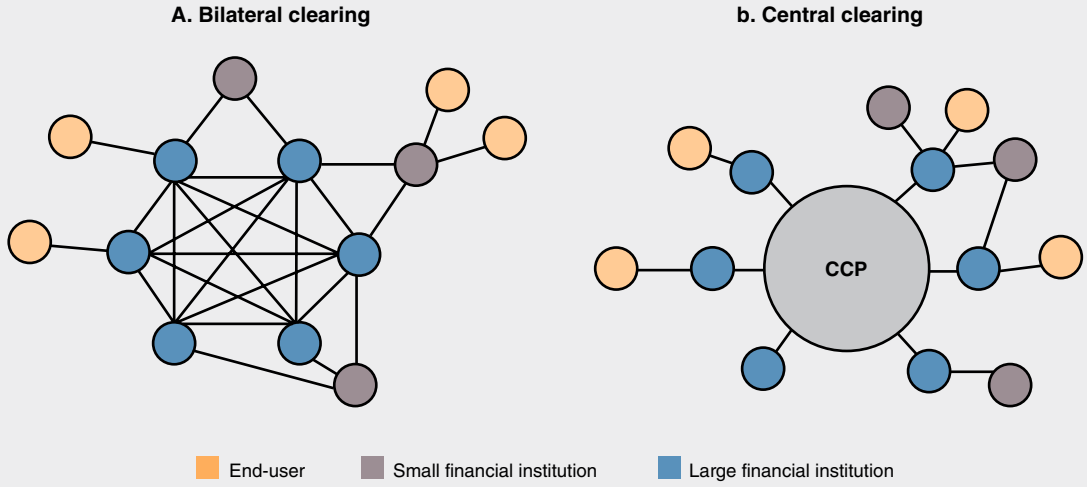
FIGURE 1

Bilateral and centrally cleared networks



Source: Council of Financial Regulators, 2011.

derivatives contracts that have standardized (vanilla) terms. Standardized contracts do not involve negotiation of terms other than price and quantity.

What is clearing and settlement? The term clearing generally refers to a series of operational and risk management processes that occur after a trade is executed and before the contract is settled. Settlement involves the completion of all payments or transfers (for example, of commodities or securities) in accordance with the contract's terms. Settlement discharges the counterparties from their legal obligations under the contract. "Central counterparty clearing" refers to an arrangement by which a central counterparty (or CCP) is substituted as a principal to all cleared trades, becoming the buyer to all sellers and the seller to all buyers (CPSS–IOSCO, 2012, p. 9). As a result of counterparty substitution, the bilateral contract between the original buyer and seller is irrevocably terminated.

Figure 1 provides a stylized depiction of the structure of counterparty relationships in bilateral and centrally cleared markets. The left panel of figure 1 illustrates a network of bilateral counterparty relationships between pairs of market participants. Some participants, in particular, all of the large financial institutions at the core of the market (in blue), have bilateral counterparty relationships with each other. Others, such as smaller financial institutions and end-users (in gray and peach), may trade with only one or two counterparties. There is no central node in this market structure, and counterparty risk is distributed through the network.

In the right panel of figure 1, a clearinghouse has been substituted as the common counterparty to all clearing members (in this illustration, only the large financial institutions are direct clearing members of the CCP). Bilateral contracts between clearing members are terminated and replaced by contracts between each clearing member and the CCP. Bilateral contracts between clearing members and their non-clearing member counterparties (that is, the smaller financial institutions and end-users) remain in effect. In this market structure, counterparty risk is aggregated in a central node, the CCP. As we discuss later in this article, this centralization of risk can be both beneficial and a source of fragility.

The new regulatory environment

The Global Financial Crisis, generally acknowledged as the worst financial meltdown since the Great Depression, crippled housing, credit, and equities markets and highlighted the extent of interconnectedness among market participants, now widely recognized as a source of systemic fragility. In particular, some participants in OTC derivatives markets came under stress and one, AIG, required government intervention.

The heads of state of some of the world's largest economies met in Pittsburgh in September 2009 to discuss ways to strengthen the international financial regulatory system. The Group of Twenty (G-20) summit resulted in agreement on a broad program of regulatory reform, including fundamental changes to the regulation of OTC derivatives markets. In particular, the G-20 reform program provides that, "where appropriate,"

trades involving standardized OTC derivatives must be executed on exchanges or electronic trading platforms and cleared through CCPs.[2] It also imposes higher capital requirements for non-centrally cleared trades and the reporting of all OTC derivatives trades to trade repositories.[3] The G-20 assigned the responsibility to monitor and assess the implementation of these reforms to the Financial Stability Board (FSB).[4]

Later in this article, we consider some of the policy issues raised by the G-20 market structure mandates. In particular, we note that there are divergent opinions concerning the costs and benefits of mandatory exchange trading and central clearing of derivatives. Further analysis is needed before one can conclude that the benefits of centralized trading and clearing of derivatives outweigh the associated costs.

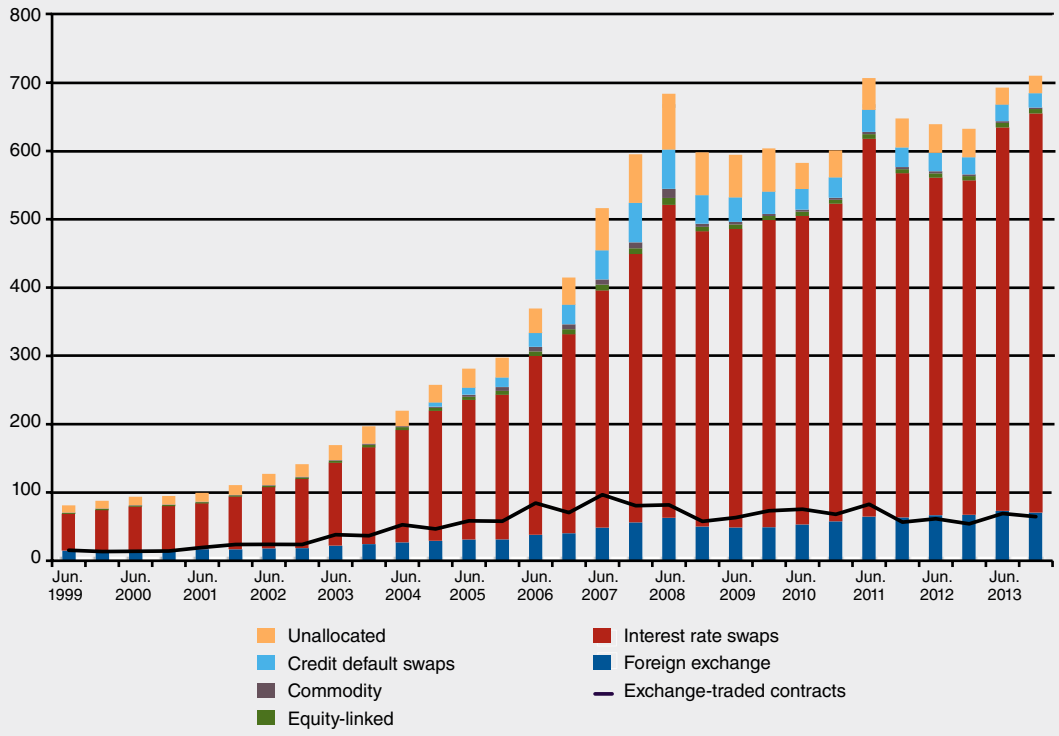
Market infrastructure

OTC derivatives are contracts, and assessing the size of the OTC derivatives market can be challenging because of the variability of contract terms. The industry generally uses the notional amount outstanding to track the size of the OTC market. The term "notional" refers to the principal or face amount used to calculate the payment or settlement obligations defined in the derivative contract. However, the notional (or principal) amount is not typically exchanged between counterparties and, therefore, is not at risk. For example, take a fixed for floating interest rate swap (IRS) on a $1 million notional amount—the only amount that would change hands each period would be the net interest payment calculated on the notional amount. This means that if the fixed rate were 5 percent and the floating rate 4 percent for the period of one year, the amount of money at risk would only be $10,000—the amount that the payor of the fixed rate would have to pay its counterparty (see appendix C). There are exceptions—some types of OTC derivatives, such as credit default swaps (CDS) and some foreign exchange (FX) swaps may, but don't necessarily involve the exchange of full notional amounts.

In December 2013, the average notional amount outstanding of OTC derivatives was $710 trillion, more than eight times the average notional amount outstanding in June of 1999 of about $81 trillion (figure 2). Representing markets in terms of notional amounts has limitations. For example, it may foster misunderstanding about risks associated with particular derivative

FIGURE 2

OTC derivatives market, notional amounts outstanding ($trillions)



Source: Authors' calculations based on data from the Bank for International Settlements.

instruments. For example, in figure 2 interest rate swaps have the largest notional amounts, but this does not mean they carry the most risk. In reality, the risk exposure from a particular type of OTC derivatives contract depends on various factors, such as the concentration of positions and the volatility of the underlying asset. Notional amount is just one of a number of inputs used to calculate risk exposure.

Since the crisis, total average notional amounts have tended to be in a range between roughly $600 and $700 trillion. According to some commentators, this leveling off is mostly a result of an increase in trade (portfolio) compression and a post-trade risk management process that reduces notional amounts though the elimination of redundant positions (positions that offset each other and thus have no economic value) (Kaya, 2013).

Economically redundant positions can occur when market participants change their trading strategies. For example, one of the counterparties to a non-cleared IRS may want to change or eliminate the interest rate exposure from that contract. That can be accomplished either by terminating or renegotiating the terms of the existing contract. However, termination or renegotiation of an existing contract requires the agreement of the other counterparty, which may not be feasible. For example, the other counterparty may want to maintain the original risk exposure, or may be willing to terminate only at a premium over prevailing market rates (Steigerwald, 2014).

It may be simpler and more economical to enter into an offsetting swap with a new counterparty. By entering into a new IRS with matching (but opposite) cash flows, the market participant that has changed its trading strategy can eliminate the economic risk of the original position (PIMCO, 2008). The redundant IRS positions eliminate interest rate risk, but not the credit risk that one of the counterparties may fail to perform its obligation. The Lehman Brothers insolvency in mid-September 2008 brought to light the magnitude of redundant derivatives positions (called "notional overhang") and prompted efforts to reduce it through multilateral terminations of such contracts (Kiff et al., 2009).

The Bank for International Settlements (BIS) calculates the gross market value of the OTC market by aggregating the market values of all outstanding in-the-money contracts before netting. Approximately 4 percent of gross notional value has been considered by the industry to be a good estimate of the gross market value of OTC derivatives. For example, as of June 2012, the average notional value outstanding was $638.9 trillion, while the gross market value amounted to $25.4 trillion, or 3.97 percent of notional value (International Swaps and Derivatives Association [ISDA], 2012).

OTC derivatives markets and infrastructure[5]

Bilateral negotiation of contract terms is one of the defining features of the OTC derivatives market. Recent changes prompted by the G-20 regulatory reforms for derivatives markets are intended to transform the traditional structure of these markets. In this section, we provide a foundation for understanding this transformation by examining the characteristics of different derivatives instruments, the various ways derivatives are used by market participants, and the importance of counterparty credit risk in shaping post-trade clearing and settlement arrangements.

Derivatives instruments

Derivatives are risk transference contracts whose value is based on one or more underlying market factors (Office of the Comptroller of the Currency, n.d.)—such as events (for example, defaults and bankruptcies), reference rates (for example, interest rates and foreign exchange rates), and the prices of assets, (such as commodities, bonds, and equities). Derivatives instruments include forwards, futures, swaps, and options (see the appendices for detailed examples).

Forwards are bilateral contracts that specify the terms of an exchange at a future date (McDonald, 2012). Forwards typically have no upfront costs or fees, making it possible for market participants to enter positions without incurring immediate costs.

Futures are standardized forward contracts that are traded on exchanges and centrally cleared by CCPs (McDonald, 2012). Futures contracts, like forward contracts, call for an exchange at a future date, but the terms of the contract (other than price and quantity) are established as standard terms for all traders by the exchange. We discuss central counterparty clearing and counterparty credit risk in more detail later.

Swaps are derivatives contracts that set out the terms of a series of forward transactions (McDonald, 2012). Typically, a swap transaction involves an exchange of cash flows based on the notional amount at specified intervals (or "reset" dates) during the life of the swap. Some swaps, however, call for an exchange or payment of the full notional amount. Generally, swaps are structured so that at inception, the value of the swap is zero. Swaps may be traded and cleared either bilaterally or through central market infrastructures.

Options[6] are derivatives contracts that give the holder of the contract the right but not the obligation to purchase or sell the underlying interest at a specific date or time interval in accordance with the terms of

the contract (U.S. Securities and Exchange Commission, 2004). The buyer of an option pays a premium for the right to exercise the option (by buying or selling the underlying interest) in the future. The seller of an option receives the premium in return for agreeing to buy or sell the underlying interest to the option holder at the agreed price if the holder exercises the option. Options are traded both in listed markets and over-the-counter.[7]

Market participants

Derivatives can be used by market participants to achieve a desired risk exposure, to speculate in the markets, to reduce transaction costs, or to avoid certain regulatory costs (McDonald, 2012). Market participants can be classified as hedgers, speculators, or a combination of the two.

Hedgers seek to transfer or manage risk exposures. For example, an airline may wish to lock in the price of fuel over a certain time horizon so that it can accurately forecast its cost basis and offer airline tickets for sale months in advance. It may do so by hedging in the energy derivatives market. There are limited opportunities to hedge jet fuel using jet fuel futures. Airlines may hedge with a mix of crude oil, heating oil, and unleaded gasoline futures calibrated to closely correlate with the volatility in the jet fuel prices or use customized swaps. Similarly, banks and other end-users that are exposed to maturity, currency, and interest rate mismatches between assets and liabilities may enter into swap agreements to balance their exposure (Miller, 1998).

Hedgers may be exposed to basis risk if the hedge position does not exactly correspond to the underlying risk exposure. Basis risk is a broad term that describes a risk exposure resulting from an imperfect hedge. This exposure can be exacerbated by differences in the terms of the hedge contract and the underlying risk position, such as differences in expiration, maturity, and other material dates; delivery terms (for example, location, transportation, and storage costs); and changes in yield curves.

Speculators enter into derivatives contracts purely seeking profit. Some speculators benefit from the leverage that is associated with derivatives contracts—as a result, the profit or loss can be large in comparison to the initial cost of entering into a trade. Others may benefit from lower transaction costs or from regulatory or tax arbitrage. For example, taxes on the sale of stock can be deferred when derivatives are used "to achieve the economic sale of stock (receive cash and eliminate the risk of holding the stock) while still maintaining physical possession of the stock" (McDonald, 2012, pp. 2–3). Speculators are important because they contribute to market liquidity. Hedgers benefit from this liquidity. In practice, the line between the hedgers and speculators can be blurred, as some market participants may alternate between taking speculative positions and hedging risk.[8]

Counterparty credit risk

There are many risks associated with derivatives trading. We focus on counterparty credit risk because it plays a key role in shaping post-trade clearing and settlement arrangements for derivatives markets.

Market participants that enter into a derivatives contract are exposed to the risk that the counterparty may default before the contract matures. This exposure is commonly referred to as counterparty credit risk. Counterparties may be required to pledge cash or securities as collateral (sometimes called margin) to mitigate this counterparty credit risk.[9] Assessing potential loss exposure given the possibility of counterparty default (commonly referred to as loss given default) is complicated. For example, the value of an interest rate swap at inception is usually zero for both parties. As the underlying rates, asset prices, and other conditions outlined in the swap agreement change, the swap valuation also changes. The contract becomes "in the money" for the party that is due a payment, and "out of the money" for the party that owes a payment. These periodic payments are calculated on notional amount. A credit loss on an IRS would occur if at the time of counterparty default the swap is in the money for the non-defaulter. Thus, the amount at risk of an in-the-money position is the in-the-money amount, not the notional amount.

Assessing loss given default for a credit default swap (CDS) is even more complex. A CDS buyer seeks protection from losses that may be caused by default of a specified reference credit (for example, a company, a security, or a reference entity in an index[10]). The protection buyer pays periodic premiums to the seller, who in turn agrees to make a payment up to the notional amount to compensate the buyer for losses resulting from specified credit events. Credit events are specified in the CDS contract and can vary from bankruptcy to obligation acceleration (when a bank declares a debt due before maturity).

CDS are settled either by payment of cash differences or delivery of the underlying reference interest. In cash-settled contracts, the reimbursement for the loss is calculated as the difference between the notional and the post-credit-event value of the underlying reference credit. In physically settled contracts, the buyer delivers the actual obligation of the reference entity (for example, a bond or other security) and the seller

pays the face amount of the obligation. Paradoxically, physical delivery can trigger demand for the underlying bonds covered by CDS contracts, causing the price of the bond to increase. In 2009 the International Swaps and Derivatives Association (ISDA) established new settlement procedures for CDS. Under those procedures, a committee of industry experts will decide whether a credit event has occurred and whether or not to conduct an auction to determine the cash settlement price (ISDA, n.d.).

Market infrastructure

Financial markets have evolved in a variety of ways—in particular, developments in computing, data processing, and communications technologies have had a transformative impact. In this section, we briefly describe both the infrastructure for conducting derivatives trades and the post-trade clearing and settlement infrastructure for derivatives markets, noting the effects of recent changes in these structures.

Trade execution

In order to trade, traders first need to communicate (either directly or through a third party) the desired quantity, type of contract, and the price at which they are willing to trade, as well as other material terms and conditions. The second step includes recording the details of the trade—contract terms and counterparty identity. These first two steps are often referred to as trade execution.

Organized exchanges and alternative trading systems are different types of trading venues—they differ in terms of how they perform their functions and regulation (SEC, 1998). As a result of technological developments, changes in regulation, and demutualization, trading has transitioned away from pits and telephones to electronic platforms. Today, the difference between the two types of trading systems hinges on the formality of the structure (with exchanges being more formal) and the degree of regulatory oversight (Kohn, 2004).

An *exchange*, for purposes of this primer, is an organized and regulated marketplace for trading certain listed commodities, securities, or other financial products and contracts. Exchanges create and list contracts with standardized terms, such as expiration dates, minimum price quotation increments, deliverable grade of the underlying, delivery location, and mechanism. Not every financial contract can be traded on an exchange. Typically, to be traded on an exchange, a certain level of demand is necessary to ensure liquidity (although some financial instruments that are standardized and trade in liquid markets, such as the U.S. Treasury market, are not listed on exchanges). Exchanges aim to ensure orderly trading and facilitate price discovery. Examples of stock exchanges include the New York Stock Exchange (NYSE), National Association of Securities Dealers Automated Quotation System (NASDAQ), and Tokyo Stock Exchange. Derivatives exchanges include ICE Futures U.S., ICE Futures Europe, Chicago Board Options Exchange (CBOE), London International Financial Futures and Options Exchange (LIFFE), Chicago Mercantile Exchange (CME), and London Metal Exchange.

Alternative trading systems (ATS) are over-the-counter trade execution venues. Initially, OTC contracts were negotiated over the phone, but in the late 1990s alternative trading systems, or electronic platforms, which functioned like bulletin boards for posting bids and offers, began to emerge. More recently, electronic platforms for trading swaps have been developed in response to legislation implementing the G-20 trade execution mandate. Bloomberg, Tradeweb, ICAP, Tradition, and Tullett Prebon, among others, have developed such swap execution facilities (SEFs).[11]

The implementation of these new swap trading platforms has influenced the fragmentation of global OTC derivatives markets (Giancarlo, 2014). This is reflected in figure 3 (p. 88), which shows changes in dealer trading activity after the implementation of the G-20 trade execution mandate for swaps regulated by the CFTC. This development has important implications for financial stability. As CFTC Commissioner J. Christopher Giancarlo recently noted, "[r]ather than controlling systemic risk, the fragmentation of global swaps markets into regional ones is increasing risk."[12]

Figure 3 illustrates fragmentation in the global swaps market. We see that as of October 2013, following the implementation of the SEF mandate, trading between European and U.S. dealers (the red line) dropped from above 600 billion euros to a 200–300 billion euro range. At the same time, trading between European dealers (the blue line) increased from 1.6 trillion euros to 2.75 trillion in October. This trend continued with the CFTC's made-available-to-trade (MAT) determinations, which expanded the number of derivatives contracts available for trading on SEFs. Throughout this period, we see a general decline in bilateral trading between U.S. dealers (the green line) following the implementation of the SEF trading requirement, the expected consequence of the G-20 trade execution mandate. We also observe geographical fragmentation as evidenced in a decline in trading between European and U.S. dealers (the red line), apparently reflecting the preference of European dealers for trading outside of the SEF regime.[13]

Clearing and settlement

The next step in the value chain of a derivatives transaction is clearing—generally including trade matching and risk management (credit limits, margin collateral requirements, etc.). Bilateral clearing can be accomplished either directly between counterparties or through a clearing agent that matches records and reports back to the traders. Alternatively, trades can be submitted to a central clearinghouse, which becomes the counterparty to both sides of the trade and guarantees performance of the contract. The final step is the settlement of the contract, whereby the parties fully perform their respective obligations.

A specialized form of financial market infrastructure, the central counterparty clearinghouse or CCP, is widely used in modern securities and risk transfer markets. The defining characteristic of central counterparty clearing is counterparty substitution by means of novation or an equivalent legal mechanism (Steigerwald, 2014). As a result of counterparty substitution, the clearinghouse becomes a principal to all trades it accepts for clearing and the clearinghouse undertakes to perform in place of the original counterparties to such trades. The interposition of a clearinghouse as the common counterparty to all trades accepted for clearing tends to simplify and improve transparency of the bilateral "credit chains" that may develop in repeated transactions among market participants (Acharya, 2013).

Examples of central counterparty clearinghouses include CME Clearing, Eurex Clearing A.G., ICE Clear Credit LLC, The Options Clearing Corporation, and LCH.Clearnet LLC.

G-20 policy discussion

In September 2009 the G-20 leaders agreed that all "standardized OTC derivative contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties" (G-20, 2009, p. 9). They also agreed to impose higher capital requirements for non-centrally cleared trades and require trade data to be reported to trade repositories. Although these are important aspects of the G-20 regulatory reforms, we address the trade reporting requirement only incidentally in this article.

Both supporters and opponents of the G-20 mandates generally recognize the benefits of exchange trading and central clearing. Nevertheless, they reach dramatically different conclusions concerning whether these changes will improve transparency in the derivatives markets and mitigate systemic risks, as intended by the G-20. In this part of the primer, we consider some of these policy issues.

BOX 1

Who trades in OTC derivatives and why?

OTC markets meet a need for customized contract terms for hedging purposes. For a hedge to qualify for hedge accounting treatment, it needs to be sufficiently correlated to the underlying interest, which sometimes requires tailoring of contract terms. Other benefits of OTC trading include liquidity in a broader range of instruments than in listed markets and the ability to negotiate the placement of large contracts on mutually favorable terms.

The OTC market includes the end-user (retail) and interdealer (wholesale) segments. Most end-users are hedge funds, corporations, asset managers, and institutional investors, while dealers are large banks. In the retail segment, dealer banks help their clients create effective hedges; while in the interdealer segment banks hedge their own aggregated risk exposure across different lines of business.

Note: The Financial Accounting Standards Board (FASB) has established standards known as Generally Accepted Accounting Principles (GAAP), which include accounting and reporting standards for derivatives.

Transparency and interconnectedness in OTC derivatives markets

One of the main criticisms of OTC derivatives markets is that they are not transparent. For example, as Mengle (2009, p. 1) notes:

> Characterizations [of OTC derivatives markets] such as "murky," "opaque," and "anonymous" appear regularly in the financial press. The apparent implication is that financial markets would be more efficient, and society would be better off, if over-the-counter derivatives moved to a higher level of transparency.

What does transparency mean in this context and why does it matter? To answer that question, we draw on the market microstructure literature,[14] which defines transparency as the quantity and quality of information about trading that is available to market participants and others. Madhavan (2000, p. 224) explains that:

> Non-transparent markets provide little in the way of indicated prices or quotes, while highly transparent markets often provide a great deal of relevant information before (quotes, depths, etc.) and after (actual prices, volumes, etc.) trade occurs.

The degree of transparency in a market depends on many factors, such as the speed with which information is disseminated and the extent to which it is

available to potential traders. One of the most important factors, of course, is the means by which trades are executed.

Auction markets typically use a centralized trading mechanism, such as a central (or consolidated) limit order book, which permits buyers and sellers to trade with each other directly, without intermediation by dealers (Harris, 2003). By comparison, OTC markets are primarily dealer markets. As Duffie (2012) explains, OTC markets do not "use a centralized trading mechanism, such as an auction, specialist, or limit-order book, to aggregate bids and offers and to allocate trades" (Duffie, 2012, p. 1).[15] This has obvious implications for the transparency of OTC markets, because "buyers and sellers negotiate terms privately, often in ignorance of the prices currently available from other potential counterparties and with limited knowledge of trades recently negotiated elsewhere in the market" (Duffie, 2012, p. 1). This, in turn, has obvious implications for market efficiency and price discovery.

This absence of a centralized trading mechanism means that buyers and sellers in OTC markets interact through dealers rather than in an auction environment. It also means that there is no single, central point for aggregating and disseminating information about trades that take place in the market. This may suggest that centralized auction markets are inherently superior to dealer markets. However, some markets do not have sufficient trader participation to operate as continuous auction markets.[16] Consequently, many markets are hybrids that use both centralized and decentralized trade execution mechanisms.

Another important issue that is sometimes treated as an informational problem—and, thus, an issue of transparency—is the ability of market participants to evaluate the creditworthiness of their potential counterparties. Specifically, as Acharya and Bisin (2010, p. 3) explain:

> An important risk that needs to be evaluated at the time of financial contracting is the risk that a counterparty will not fulfill its future obligations. This counterparty risk is difficult to evaluate because the exposure of the counterparty to various risks is generally not public information.

This is, of course, a fundamental problem of financial contracting—namely, the ability of market participants to make credible commitments to carry out their obligations at some time in the future, a problem that arises even in direct, bilateral transactions between a pair of counterparties (Nosal and Steigerwald, 2010). Acharya and Bisin focus on the problem of commitment in situations where traders are indirectly linked in opaque "credit chains." As Acharya (2013, p. 83) explains:

> [S]uppose that counterparty A agrees to pay B. Then, A turns around and sells a similar contract to C. The addition to A's position from the contract with C dilutes the payoff on its contract with B in case that A turns out ex-post to not have adequate funds to repay both B and C. Thus, B's payoff dependency on what else A does represents a negative payoff externality on B due to A's counterparty risk. The key efficiency question is whether B can adequately reflect this risk in charging price or adopting risk controls (e.g., margins

BOX 2

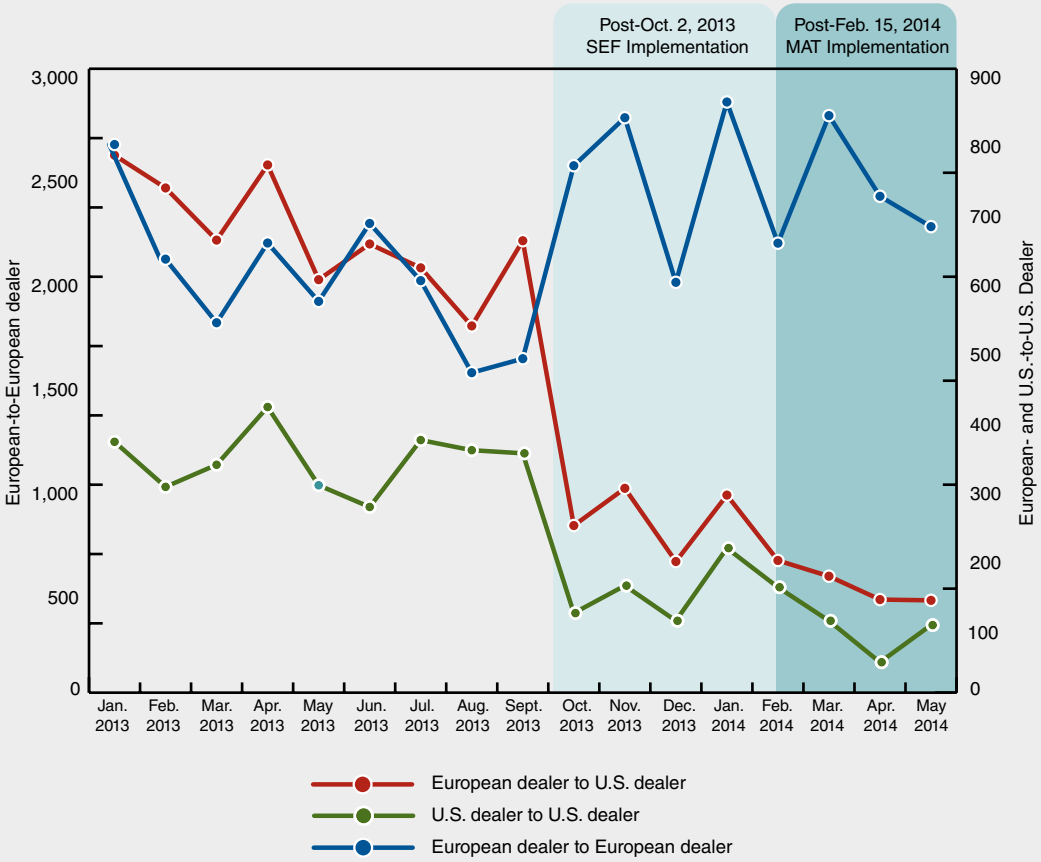
Order-driven versus quote-driven markets

Derivatives trading may take place in "order-driven," "quote-driven," or "hybrid" trading environments. In an order-driven market, the willingness of a market participant to trade a specified amount at a specified or "limit" price is displayed to all other market participants in a central limit order book. Market participants may also submit "market" orders to trade immediately at the current prevailing price. By disseminating information about bids and offers, order-driven markets enhance pre-trade transparency but do not guarantee that limit orders will be executed (Kaniel and Liu, 2006; Macey and O'Hara, 1997). A trade in an order-driven market only takes place when an order to buy can be matched against an order to sell in the central limit order book.

A quote-driven (dealer) market does not use a central limit order book. Instead, dealers in these markets quote the prices at which they are willing to enter into trades with others. These quotes may only be indicative—that is, not binding as an offer to enter into a trade on the quoted terms—and may not be widely disseminated. Thus, pre-trade transparency in dealer markets may be limited. In contrast to order-driven markets, however, the execution of a trade in a quote-driven market is not dependent on the willingness of third parties to buy or sell at limit prices that are widely disseminated. The buyer and seller in a quote-driven market determine whether a trade will take place through direct negotiations. As a result, traders in quote-driven markets are assured of trade execution, assuming they can reach agreement on the terms of a trade.

FIGURE 3

Monthly interdealer cleared euro interest swap activity (notional volume, euros in billions)



Notes: The figure refers to the CFTC's implementation of the new trading requirements from October 2013 through early 2014. SEF indicates swap execution facility, as defined by the Dodd–Frank Act and CFTC rules; MAT indicates made available for trading (as determined by the CFTC).
Source: ISDA (2014).

or overall position limits) on A. Clearly, B's ability to do so depends upon whether B can observe what A does.

The inability of a direct counterparty to fulfill its obligations, as a result of bankruptcy or other circumstances, may disrupt the performance expectations of others in the credit chain. Market participants are thus dependent upon the ability and willingness to perform of a party with whom they did not deal directly and whose creditworthiness they may not be able to evaluate. Acharya and Bisin (2010) call this form of interdependency a "counterparty credit risk externality."

This externality has an obvious informational component—namely, that traders only know and can assess (however imperfectly) the creditworthiness of their direct counterparties. No market participant has a complete view of the credit relationships upon which it is dependent, even if only indirectly. Unlike pre-trade and post-trade transparency, however, this has nothing to do with the availability of information about the prices and cannot be addressed by centralized trade execution. Instead, this externality must be dealt with by enhancing trader commitment in some fashion. This is the classic role of post-trade clearing institutions.

We turn next to the trade execution and central clearing mandates to consider their implications for transparency and interdependency in derivatives markets.

The trade execution mandate

The primary justification for the trade execution mandate is that it "… can potentially increase trade transparency, particularly pre-trade transparency, and ... provide trade transparency more efficiently than OTC markets" (IOSCO, 2011, p. 35). Centralized

auction-style trade execution mechanisms undoubtedly enhance pre-trade and may also facilitate post-trade transparency. But the benefits of centralized trading structures do not come without costs—including, potentially, reduced liquidity, and impaired price discovery (Pirrong, 2010). Decisions about how much and what types of information to make available to traders and how broadly to disseminate that information have different implications for different types of market participant and "... are likely to benefit one group of traders at the expense of others" (Madhavan, 2000, p. 241). For example, traders who have private information tend to favor anonymous trading systems, while others may favor greater pre-trade transparency (Madhavan, 2000). These decisions are critical to the design of trade execution mechanisms. As Lee (1998, p. 98) explains:

> The choice by an exchange of what price and quote information to release is a central element of the wider decision as to what market architecture to adopt. Not only are there substantial differences between the types of data about prices and quotes that trading systems choose to release, there are also differences in the types of information that trading systems are able to deliver.

These differences in pre-trade transparency exist because "... no single market structure is viewed as best by all parties" (Madhavan, 2000, p. 251).

This point is supported by the market microstructure literature, which conceives of the interaction between investors and market markers as a strategic interaction among parties with differences in risk aversion, capital endowments, demand for immediacy, private information, access to other trading alternatives, and so on (for example, Duffie, 2012; Duffie, Gârleanu, and Pedersen, 2005). Pre-trade transparency concerning the prices and quantities at which market participants are willing to enter into trades is important because "... it affects the informativeness of the order flow and hence the process of price discovery" (Madhavan, 2000, p. 241). As Duffie (2012, p. 5) explains, "... dealers have incentives to narrow their bid–ask spreads ... to compete for trading opportunities" in markets that provide for enhanced pre-trade and post-trade transparency. These benefits, however, are not linear:

> If price transparency is too great, ... some dealers may lose the incentive to intermediate, given their fixed costs and the risk of adverse selection by informed customers. Unless the potential demand ... is sufficient to justify exchange trading, a ... *large increase in OTC market transparency could ... potentially reduce trading opportunities for investors*. (Duffie, 2012, p. 5)

In fact, "[a]nonymous exchange-based trading can ... lead to *inefficiently thin markets or even market failure*" (Duffie, 2012, p. 8, emphasis added). The idea that there can be too much transparency, however, is completely absent from the arguments that are typically made in support of the G-20 trade execution mandate.

Moreover, customized derivatives transactions are valuable risk-management tools that facilitate hedging and other trading strategies. This has important implications for risk management because remaining unhedged can be costly. For example, an enterprise that is unable to enter into effective hedging transactions:

> .. may choose to avoid some projects whose uncertain cash flows have a high net present value for their shareholders out of fear that losses resulting from unhedged risks could be misperceived by their shareholders or superiors as a reflection of poor project selection or management. A failure to hedge can also increase the probability of bankruptcy, or at least financial distress, which brings additional costs, such as legal fees or high frictional costs for raising new capital when distressed. (Duffie, Li, and Lubke, 2010, p. 10)

Accordingly, the Squam Lake Group suggests that the benefits of centralized trading "should be weighed against the benefits of innovation and customization that are typical of the OTC market" (French et al., 2010, pp. 70–71).

The G-20 apparently recognizes that the benefits of the trade execution mandate may depend on the circumstances—thus, the mandate is to be implemented only "where appropriate" (FSB, 2010, p. 5). The G-20 Leaders' Statement, however, does not provide any guidance concerning when it is appropriate to require trading on exchange or a similar trade execution platform. According to the FSB, it may be appropriate to mandate exchange trading:

> ... where the market is sufficiently developed to make such trading practicable and where such trading furthers the objectives set forth by the G-20 Leaders and provides benefits incremental to those provided by standardization, central clearing and reporting of transactions to trade repositories. (FSB, 2010, p. 5)

Ultimately, the decision is left to market regulators. This traps regulators in complicated decisions about infrastructure design that are not simply technical in nature—as we noted earlier, they also have different

implications for different types of market users—potentially benefiting one group at the expense of another (Harris, 2003; Madhavan, 2000). As we have noted, there are unavoidable trade-offs among pre-trade transparency, liquidity, and price discovery that must be taken into account in the design of a trade execution mechanism. The G-20 trade execution mandate favors a centralized approach based on the assumption that extensive pre-trade transparency is equally beneficial to all market participants, an assumption that is not supported by the market microstructure literature. Moreover, all market participants, regardless of their preferences concerning pre-trade transparency, will be harmed if the implementation of the mandate impairs liquidity, price discovery, and the ability to use derivatives markets for hedging purposes.

Because the objective of improving market transparency can be accomplished by other, less costly and disruptive means, certain G-20 countries have indicated that they will not implement, or will delay implementation of, the trade execution mandate, and some G-20 countries will not mandate but only encourage central clearing through an incentive-based regulatory framework.[17] According to the FSB, progress in implementing the trade execution mandate remains "slower than in other commitment areas" and "[s]ome authorities have indicated that they are waiting for useful data to be available before adopting requirements to promote increased exchange and electronic platform trading" (FSB, 2013, p. 27).

Central counterparty clearing

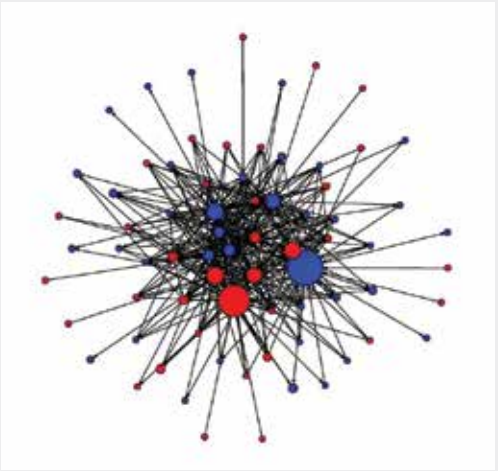
As we noted in our discussion of the "counterparty credit risk externality" identified by Acharya and Bisin, traders in some markets may be dependent upon the ability and willingness to perform of a party with whom they did not deal directly and whose creditworthiness they may not be able to evaluate. Figure 4, for example, employs actual data to represent a point-in-time snapshot of the complex relationships among counterparties in a single credit default swap contract that is traded bilaterally and not centrally cleared.

The counterparty relationships in this illustration are necessarily opaque—only bilateral counterparties stand in direct contractual relationships and no single market participant can have a complete view of all relevant credit and liquidity relationships. In particular, market participants may not know their counterparties' exposures to others, upon which they are indirectly dependent. The lack of such information can result in an "information-related gridlock that we observed in the fall of 2008" (Yellen, 2013, p. 14).

In central clearing arrangements, a central counterparty (CCP) becomes the substituted counterparty

FIGURE 4

Bilateral network



Notes: Red circles represent protection sellers; blue circles represent protection buyers. The size of each circle indicates the relative amount of protection traded.
Source: Yellen (2013).

to all trades accepted for clearing. In effect, the CCP becomes the buyer to every seller and the seller to every buyer and undertakes to perform in place of the original counterparties to such trades. Central counterparty clearing thus transforms opaque bilateral counterparty credit relationships into a "hub and spoke" arrangement. As a result of central clearing, counterparty relationships become simpler and more transparent—each clearing member has a single counterparty, the CCP. Thus, "[h]igher-order, unobservable counterparty credit risk is replaced by first-order, observable counterparty risk with respect to the CCP" (Gai, Haldane, and Kapadia, 2011, p. 468).

Central clearing, however, does not completely eliminate opacity or interdependence. There are several reasons for this. First, the CCP becomes the substituted counterparty only to transactions between clearing members. End-users and non-clearing members typically have no recourse against the CCP if a clearing member intermediary fails to meet its obligations to its customers (Scott, 2010; Jones and Pérignon, 2008; Jordan and Morgan, 1990). Moreover, these customers ordinarily do not know the identities or risk exposures of the clearing member's other customers. Nevertheless, they may be exposed to the risk of "fellow customer" loss (depending on applicable law) if the default of another customer causes the clearing member to default on its obligations. These end-users remain dependent upon potentially complex, inherently opaque credit chains to which they are exposed indirectly through their

common intermediaries. Central clearing internalizes some, but not all, externalities in the assessment of counterparty credit risk.

In addition, CCPs depend on a variety of services provided by financial intermediaries, such as settlement banks, custodians, and liquidity providers. These services and the arrangements among CCPs and their critical service providers are far from simple or transparent. For example, CCPs depend critically on daily (and sometimes intraday) variation settlements—sometimes called variation margin. These payment flows occur through the interbank payment system (or systems) for each currency in which variation settlement obligations are denominated. Not all CCP clearing members, however, have direct access to those systems. Those that do not must use settlement banks to make variation settlement payments on their behalf. Settlement banks intermediate settlement payments and may also provide intraday credit to support the exchange of payments between the CCP and its clearing members. Settlement banks are typically among the largest clearing members of a CCP. The failure of a bank that acts both as a clearing member and a settlement intermediary would pose a significant risk to a CCP.

Central clearing arrangements are designed to mitigate counterparty credit risk. They do so by using a number of important risk management tools—such as netting, collateralization, and membership standards. The use of these risk-management tools also makes CCPs dependent on time-critical flows of liquidity. This means that payments or transfers "must be made at a particular location, in a particular currency (or securities issue), and in a precise time frame measured not in days, but in hours or even minutes" (Marshall and Steigerwald, 2013, p. 30).

An example of the risks posed by CCPs' dependence on time-critical liquidity flows intermediated by settlement banks occurred in October 1987 when global equity markets plunged and clearing members were required to meet large intraday and end-of-day margin calls. Settlement banks became "less willing to advance credit to clearing members" and the Federal Reserve had to take action to ensure adequacy of aggregate liquidity in the financial system (Marshall and Steigerwald, 2013, p. 41). The situation was further complicated by the operational failure of the Federal Reserve's Fedwire funds transfer system on Tuesday, October 20, 1987, as clearing members were attempting to meet their margin calls.

Central counterparty clearing can be effective in managing counterparty credit risk. Does it also mitigate systemic risk? As we have seen, it transforms counterparty relationships by interposing the clearinghouse as the common counterparty to all clearing members. As a result, clearing members (and the end-users on behalf of which they act) become completely dependent on the ability of the CCP to perform its obligations (see Murphy, 2013, and Duffie, Li, and Lubke, 2010). In addition, central clearing concentrates risk in the CCP making it "... a major channel through which ... [financial] shocks are transmitted across domestic and international financial markets" (CPSS–IOSCO, 2012, p. 5).

Masaaki Shirakawa (2012), a former governor of the Bank of Japan, notes that central clearing has "unambiguous advantages" (p. 3). Nevertheless, he also notes that:

> [C]entralized clearing has its own issues. It may increase, if not properly designed, moral hazard among market participants, who will be less concerned with counterparty risk. *Centralized clearing also concentrates risk in the clearing entity itself, which might become "too big to fail."* (Shirakawa, 2012, p. 3, emphasis added)

Whether the benefits of central counterparty clearing dominate or whether they are substantially offset by costs that are both pervasive and irreducible, remains an open question.

It is important to note that although central clearing with counterparty substitution provides the foundation for modern futures and other financial markets, its significance has not been widely appreciated by policymakers or academics. Until recently, moreover, academic interest in the institutional structure of derivatives markets and the nature and significance of central counterparty clearing has been limited.

Conclusion

In this primer, we discussed the trading and clearing infrastructure for derivatives, as well as some important policy changes that are shaping those structures. In the first part of the primer, we provided a foundation for understanding the economic role, selected risks, and significance of derivatives markets. We explained the value chain of a typical derivatives transaction, starting with negotiation of the contract and ending with final settlement, and briefly described the evolution of derivatives markets. We also discussed the impact of the G-20 market structure mandates and related regulatory changes.

In response to the G-20 market structure mandates, some OTC markets are converting to futures markets (Weitzman, 2012). For example, a segment of the energy OTC derivatives market has been "futurized" by the conversion of swap contracts to swap futures contracts (CFTC, 2013). Market participants may find it

possible to use standardized futures markets for hedging. If not, some may decide to exit derivatives markets altogether. It remains to be seen how these developments will unfold. At a minimum, they suggest that the G-20 market structure mandates may result in important but unintended consequences, such as the fragmentation of the global OTC derivatives market (ISDA, 2014).

In the second part of the primer, we focused on the policy rationale for the G-20 trade execution and central clearing mandates. We noted that centralized trade execution and central counterparty clearing have many benefits, but also may involve significant costs. The central question for policymakers is whether the benefits of executing derivatives trades on exchanges, through SEFs or similar trading facilities, and clearing transactions through CCPs outweigh the costs associated with the mandates.

Efforts to provide a comprehensive economic analysis of the G-20 reform program for OTC derivatives have recently begun. For example, the Macroeconomic Assessment Group on Derivatives (MAGD) issued an assessment of the G-20 reforms in August 2013 (BIS, MAGD, 2013). MAGD, which included representatives of member institutions of the FSB working in collaboration with the International Monetary Fund, studied selected aspects of the G-20 reform program for OTC derivatives[18] and concluded that "the economic benefits of [the] reforms are likely to exceed their costs" (BIS, MAGD, 2013, p. 3).[19] However, the MAGD chairman also points out that more work is needed to improve our understanding of the likely macroeconomic impact of regulatory reforms that target the derivatives as well as other types of financial contracts (Cecchetti, 2013, p. 8). The work of MAGD is, on balance, a positive development. We should not, however, underestimate the challenge of fairly assessing the costs and benefits of the G-20 program of regulatory reforms for derivatives markets. We look forward to further studies of the type undertaken by MAGD and eagerly await the results of those studies.

NOTES

[1]See Smyth and Wetherilt (2011, p. 334): Trade execution arrangements are constantly evolving and can be quite complex.

[2]See Group of Twenty (2009, p. 9). We refer in this article to the trade execution and central clearing mandates as "market structure" mandates.

[3]The capital and trade reporting requirements are important. However, a thorough analysis of these requirements is outside the scope of this article.

[4]The Financial Stability Board coordinates the work of national financial authorities and international standard-setting bodies to foster global financial stability through the development and implementation of effective regulatory, supervisory, and other financial policies. More details and a list of institutions represented are available at www.financialstabilityboard.org/about/overview.htm.

[5]This discussion is intended as a description of economic attributes, not legal and regulatory characteristics.

[6]We exclude from our discussion employee stock options, which are a form of contingent compensation, not risk transference (derivative) contracts.

[7]For statistical purposes, the BIS treats any derivatives contract with an embedded option as an OTC option and reports such contracts separately from OTC forwards and swaps.

[8]Market makers are a good example—they aim to have a hedged portfolio, but also provide liquidity to the market through speculation. For further details, see Heckinger et al. (2014).

[9]See, for example, DTCC (2014). We do not consider margining arrangements for derivatives markets in detail in this primer. For additional information, see ISDA–CSC (2010) and Johnson (2007).

[10]When one or more reference entities in a CDS index fails to perform its contractual obligations, the ISDA Credit Derivatives Determinations Committee may declare a credit event—triggering payment to protection buyers. Following a credit event, the CDS index would be revised to replace the defaulting reference entity.

[11]The U.S. Commodity Futures Trading Commission (CFTC, 2013) defines an SEF as a "trading system or platform in which multiple participants have the ability to execute or trade swaps by accepting bids and offers made by multiple participants in the facility or system, through any means of interstate commerce, including any trading facility, that (A) facilitates the execution of swaps between persons; and (B) is not a designated contract market" (pp. 33476–33481).

[12]See Giancarlo (2014), available at www.cftc.gov/PressRoom/SpeechesTestimony/opagiancarlos-1.

[13]ISDA claims that its empirical analysis of cleared derivatives data provides evidence that implementation of the SEF trading requirement in the U.S. has caused fragmentation between U.S. and European markets. See, for example, http://www2.isda.org/functional-areas/research/research-notes/.

[14]The discussion in this section is based primarily on Harris (2003), Hasbrouck (2007), and Duffie (2012).

[15]As Duffie (2012) also notes, however, "[s]ome OTC markets have special intermediaries known as brokers that assist in negotiations between buyers and sellers, conveying the terms of one investor to another, usually without revealing the identities of the counter-parties to each other" (p. 1). Consequently, some OTC markets may not be pure dealer markets. For a discussion of interdealer trading in OTC markets, see Hasbrouck (2007).

[16]For example, Hasbrouck (2007) notes that "[a] dealer may make *continuous trading* possible when the natural customer-supplied liquidity in the book would not suffice" (Hasbrouck, 2007, p. 16, emphasis added).

[17]Most member jurisdictions plan to implement the central clearing commitment through a combination of mandatory clearing requirements and incentives, such as higher capital and margin requirements. Several jurisdictions indicated that, at least initially, they anticipate implementing the commitment to centrally clearing all standardized OTC derivatives through incentives alone (FSB, 2013).

[18]MAGD explains that it examined the following direct costs to market participants as a result of the G-20 reforms:

> (i) the cost of increased collateral required by CCPs and by bilateral margining rules; (ii) the cost of increased regulatory capital required by Basel III; and (iii) other direct costs of reform. The sum of these costs, when compared to the pre-reform costs of trading OTC derivatives, gives an estimate of the extra costs of using OTC derivatives once reforms have been fully implemented. We estimate the change in annual global costs as between €15 billion and €32 billion, with a central estimate of €20 billion (table 10) (BIS, MAGD, 2013, p. 37).

MAGD also notes that its estimates were not intended to be comprehensive.

[19]Addressing only the clearing mandate, Milne (2012, p. 1) argues that the costs of the mandate "are not so large as some commentary has suggested, at least provided that mandatory clearing is applied only to widely traded standardized contracts."

APPENDIX A: EXAMPLE OF A FORWARD CONTRACT

Company USA enters into a contract with Company Italy to purchase 650,000 square feet of 9 cm. thick-honed Italian Carrara Bianco marble slabs for €1 million to be delivered in three months on September 30, XXXX. The terms of the contract stipulate the payment in full (in euros) at the time of delivery. Company USA will need to convert U.S. dollars to euros to meet its settlement obligation.

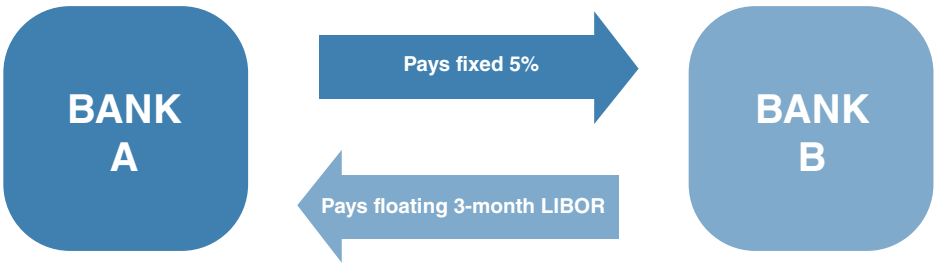
To mitigate the exchange rate risk exposure, Company USA enters into a forward contract to lock in an exchange rate of 1 euro = 1.30 U.S. dollars.

Parties to the forward contract are exposed to the counterparty risk:

a. Company USA enters into a forward contract with a bank. The bank fails. Company Italy delivers the marble and Company USA needs to pay euros to Company Italy. Company USA exchanges U.S. dollars for euros at the prevailing exchange rate. Company USA would incur a loss if the U.S. dollar depreciated against the euro.

b. Company USA enters into a forward contract with a bank. The bank delivers euros as agreed, but Company Italy is bankrupt and fails to deliver the marble. Company USA can "close out" the FX forward or exchange euros back to U.S. dollars at the prevailing exchange rate. Company USA would incur a loss if the U.S. dollar appreciated against the euro.

c. Company USA enters into a forward contract with Company Italy. Company Italy is bankrupt, fails to deliver the marble, and also defaults on the forward currency contract. Company USA has no exchange rate risk exposure (but, of course, may suffer a loss replacing the undelivered marble).



PMT #	Reset date	Payment date	Fixed rate	Fixed payment	3-month LIBOR rate	Floating payment	Net cash flow	
			(percent)	*(dollars)*	*(percent)*	*(dollars)*	*(dollars)*	
1	1/1/XXXX	4/1/XXXX	5.000	125,000.00	4.302	107,550.00	17,450.00	Fixed (Bank A) pays
2	4/1/XXXX	7/1/XXXX	5.000	125,000.00	4.403	110,075.00	14,925.00	Fixed (Bank A) pays
3	7/1/XXXX	10/1/XXXX	5.000	125,000.00	4.745	118,625.00	6,375.00	Fixed (Bank A) pays
4	10/1/XXXX	1/1/XXXX+1	5.000	125,000.00	4.872	121,800.00	3,200.00	Fixed (Bank A) pays
5	1/1/XXXX+1	4/1/XXXX+1	5.000	125,000.00	5.581	139,525.00	(14,525.00)	Floating (Bank B) pays
6	4/1/XXXX+1	7/1/XXXX+1	5.000	125,000.00	5.468	136,700.00	(11,700.00)	Floating (Bank B) pays
7	7/1/XXXX+1	10/1/XXXX+1	5.000	125,000.00	5.460	136,500.00	(11,500.00)	Floating (Bank B) pays
8	10/1/XXXX+1	1/1/XXXX+2	5.000	125,000.00	5.058	126,450.00	(1,450.00)	Floating (Bank B) pays
Total				1,000,000.00		997,225.00	2,775.00	

APPENDIX B: EXAMPLE OF A FUTURES CONTRACT

On September 16, XXXX, Company A, a speculator expecting the price of oil to increase, purchases 100 November XXXX crude oil futures contracts based on a benchmark grade (West Texas Intermediate or WTI) on the IntercontinentalExchange (ICE) at $91.62 per barrel. Let's say that on September 19 the market has moved and the price per barrel is now $94 and Company A decides to capture the profit by selling 100 contracts at the market price. (In the example we do not include any transaction costs, commissions, fees, the cost of margins, or the time value of money.)

Each WTI contract listed on ICE is for 1,000 barrels of crude oil.

Profit = 100 (contracts) * ($94 – $91.62) * 1,000 (barrels) =
= 100* $2.38 * 1,000 = $238,000.

APPENDIX C: EXAMPLE OF A BILATERAL SWAP CONTRACT

Bank A and Bank B enter into a two-year plain vanilla, fixed for floating interest rate swap (IRS) on 1/1/XXXX on a notional amount of $10 million. The fixed rate is set at 5 percent and floating at three-month London Interbank Offered Rate (LIBOR).

In this example, there are eight quarterly payments. Reset date refers to the date on which a new floating rate becomes effective for the period—in this case, the period is three months. Payment date refers to the date when the cash flows are netted and payment received by one counterparty.

Fixed rate refers to the fixed rate outlined in the swap contract. The fixed payment is calculated by multiplying the notional amount by the interest rate divided by the number of periods in one year (in this case = 4, 4 quarters in a year).

Floating rate refers to the prevailing floating rate as specified in the contract (in this case three-month LIBOR rate) as of the reset date (in this example the LIBOR rate is hypothetical). The floating payment is calculated by multiplying the notional amount by the floating interest rate divided by the number of periods in one year. Cash flows are calculated by subtracting the floating payment from the fixed payment amount. The amounts in red denote that the counterparty with a floating obligation pays.

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