FINANC€ONCEPTS

Transparency in Credit Default Swap Markets

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Abstract

We provide an inventory of existing forms of transparency in CDS markets and discuss methods that may be used to increase transparency as well as their benefits and costs. In particular, we attempt to identify to whom such benefits and costs accrue (broker-dealers, end users, etc). We argue that increased market transparency has a cost, which must be weighed against its benefits in terms of market quality. Central to the discussion is the impact of transparency and market structure on liquidity: this impact may vary depending on trade size and the degree of information asymmetry across market participants. Insights from market microstructure theory and analogies with other OTC markets, in particular the TRACE system in the corporate bond market, suggest that increased transparency primarily benefits uninformed traders, while informed market participants–large dealers, market makers and some large buy–side firms– are likely to bear its costs. These studies also suggest considering different transparency requirements for large trades. Central clearing and increased reporting of CDS trades to data repositories are important steps towards increased transparency in the CDS market.

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1 Introduction

Over-the-counter derivatives markets, and credit default swap markets in particular, were cast into the limelight during the recent financial crisis and have been criticized as being "opaque" and lacking transparency. Given the large notional size of OTC transactions and the role played by credit derivatives during the crisis, this has raised concerns among regulators, who have been calling for increased transparency in OTC markets and, in particular, in credit default swap markets. A common (explicit or implicit) argument is that transparency is necessary for proper functioning and stability of markets, and more transparency leads to more liquidity. An example is provided by the following excerpt from the Council of Securities Regulators of Americas's *Principles of Market Transparency* [8]:

> Transparency is increasingly important for today's securities markets. The fairness and efficiency of securities markets are directly related to their transparency. By providing protections for investors, transparency encourages greater participation in the securities markets, and thereby enhances the liquidity of those markets. This increase in liquidity, in turn, increases market efficiency. Conversely, by reducing the effects of market fragmentation and increasing the pricing efficiency of securities markets, transparency also promotes fairness of the markets. For these reasons, regulators have a responsibility to assess the adequacy of the transparency of the markets operating within their respective jurisdictions.

If one accepts the assertion that "greater transparency necessarily leads to greater efficiency and greater liquidity", then naturally one should call for greater market transparency. Proposals for increasing transparency range from requiring systematic reporting of trades to a central data repository, voluntary or mandatory central clearing of credit default swaps, to full-blown exchange trading of credit default swaps.

Yet the underlying assumption that more transparency necessarily increases liquidity is far from obvious, especially in OTC markets where the incentive for market participants to trade is partly based on their asymmetric information. Also, increasing transparency has a cost and any discussion of efficiency must assess the benefits of increased transparency and weigh them against these costs. A clear analysis of the costs and benefits of such proposals has been lacking so far. When assessing such proposals, one must keep in mind that

- market transparency has different forms and degrees, with different impacts on liquidity
- increasing market transparency has a cost, and
- market transparency is not an objective *per se* but rather a means for ensuring the proper functioning of the market.

In particular, market transparency takes various forms which may benefit different market participants in different ways and, as in any market design problem, a meaningful analysis should specify to whom the costs are incurred and to whom the benefits accrue.

A key issue in assessing whether an increase in market transparency does in fact enhance the proper functioning of markets is to understand the impact of transparency on liquidity. Theoretical studies in market transparency and the impact of increased information on market liquidity indicate that the market transparency may be a double-edged sword when it comes to its impact of liquidity. While a total absence of transparency is certainly not a desirable situation, when the cost of information is taken into account, full market transparency may dissuade informed market participants from making markets and may result in reduced liquidity, which is not a desirable outcome for end-users [18]. These arguments point to a trade-off between market transparency and liquidity: some market transparency may be helpful but requiring too much disclosure dissuades informed participants from making markets and may have the effect of drying up the market.

The goal of this report is to clarify some of the issues underlying such debates, in the context of credit default swap (CDS) markets. General considerations from the market microstructure literature, as well as insights from empirical studies on other OTC markets –such as the TRACE system in the corporate bond market– may apply to CDS markets, but there are many specific features of the CDS market which differentiate them from, say, equity or bond markets and it is necessary to consider how the structure of the CDS market affects the discussion. In particular one needs to keep in mind the differences between index and single name CDS when discussing these issues. As noted in Bessembinder et al. (2006), the impact of market transparency on liquidity and execution quality is important enough to warrant a careful examination of regulatory changes, especially since theoretical and empirical evidence lead to variable results when assessing the impact of transparency on liquidity.

We will limit here the scope of our discussion to standardized CDS contracts which include index and single name credit default swaps on corporate and sovereign reference entities. "Exotic" credit default swaps, such as credit default swaps on asset backed-securities, involve more complex issues which deserve a separate discussion and we will not address them here.

2 Transparency defined

Transparency in the securities markets may be defined as the degree to which information regarding quotes for securities, the prices of transactions, and the volume of those transactions is made available to market participants.

O'Hara defines market transparency as "the ability of market participants to observe the information in the trading process [29, p. 252]. An operational definition of market transparency requires specifying what is meant by "information" –the size and direction of orders, their timing, or nature (for example, a limit or a market order– who gets to see the information (i.e., regulators, market makers/ dealers, all potential traders, public), and the information's timing (i.e., real-time, end-of-day, delayed for a fixed period, monthly).

In particular, when discussing transparency in securities markets it is useful to distinguish *pre-trade* and *post-trade transparency*.

2.1 Regulatory vs market transparency

When discussing transparency, it is important to distinguish to whom the information is disclosed. Much of the discussion regarding market transparency during the crisis has been related to the lack of visibility on OTC markets for regulators. This is obviously an important issue and the current trend is towards a higher degree of disclosure to regulators of prices, quotes and exposures in OTC markets, which regulators intend to use in order to monitor and enhance market stability.

Information disclosed to regulators is treated as confidential and strict rules govern the ways in which such information may be used. It is clear, however, that the same information, if disclosed publicly, may in fact act as a trigger for speculative runs on financial institutions and generate market instability. This is an extreme example of a situation where "full" transparency does not contribute to market stability and liquidity.

2.2 Pre-trade transparency

At its broadest level, pre-trade transparency consists of information accurately indicating the size and price of prospective trading interest, such as firm quotes in representative size both at the best firm bid and ask quotes and away from such quotes.

The level or degree of pre-trade transparency in a market can range from the total transparency permitted by certain electronic markets which centralize order flow in a limit order book, to markets where each participant only knows his/her own orders and obtains information from other participants through repeated bilateral negotiations. Regulators may need to assess the market's structure to determine the degree of transparency appropriate for a particular market, keeping in mind that the objective is not transparency per se but ensuring a smooth functioning and stability of the market. Nevertheless, as these

principles indicate, a minimum degree of transparency is necessary to permit the investor to make an informed investment decision.

2.3 Post-trade transparency

Post-trade transparency refers to the dissemination of trade prices and volumes of completed transactions from all markets trading that security. For exchange-traded derivatives, such transactions are recorded exhaustively. In OTC markets, post-trade transparency may be provided through central counterparties, when central clearing facilities are available or through data repositories, such as DTCC's DerivServ, where market participants register transactions on a voluntary or mandatory basis.

A crucial issue is the timing of the reporting. In many markets, such as equity markets, where timing is of essence, a delay of a few hours or even minutes may essentially diminish the value of post-trade information. In other markets, end-of-day reporting may be an acceptable norm.

When a large trade is revealed to the market, it may be seen as conveying information and may generate other large trades, thus moving prices. Reporting of large size transactions also creates opportunities for predatory positioning or front running by other market participants, thus reducing the incentive for a participant to provide liquidity for large size trades. This is especially the case where the trade is generated by a market participant considered as informed. Thus, post-trade transparency may entail *price impact* in the case of large trades and increase the cost of trading. For this reason, in many exchanges post-trade transparency rules differ for small and large trades, reporting being delayed for large trades in order to avoid generating market volatility and price impact.

2.4 Exchanges vs OTC markets

Markets organized in the form of centralized exchanges– such as the equity or futures markets– and OTC markets present different issues of transparency. In exchanges, transparency is governed by the rules of the exchange: trades and quote information are disclosed to the exchange which then disseminates it to all market participants to ensure fairness of the auction process. Auction markets provide greater pre-trade transparency –greater visibility of the best price at which any incoming order can be executed. On electronic auction markets, the limit order book shows at what price an order would execute. The following statement by the Council of Regulators of the Americas [8] summarizes common views on transparency in exchange markets:

> An adequate level of transparency for continuous markets (exchanges) consists of the dissemination of (1) last sale reports (i.e., transaction prices and volumes); and (2) firm quotes at the best prices (i.e., the inside bid and ask prices) with size, i.e., full transparency. Liquid markets should strive for full transparency, i.e., the dissemination of appropriate levels of information, both pre-trade

> and post-trade. It is critical to note that pre-trade transparency alone is not sufficient for adequate levels of investor protection. Even where firm quotes exist, a substantial number of price sensitive transactions may take place between or outside of the spread. Although quotes may help investors decide where and when to trade, transaction reports help investors determine whether the quotes are reliable, and help them assess the quality of the markets and transaction executions. Also, all market participants attempt to anticipate market trends. Without trade and volume information, there are few warnings of impending market trends. Market participants cannot respond quickly to selling or buying surges because they do not see them happening. Delayed transaction publication, e.g., reporting of transactions more than 90 seconds after the event, may harm investors and other market participants in that dealers or other investors that participated in the unreported trade have a superior informational advantage that cannot be counterbalanced. Regulators should ensure that the transaction reporting procedures for a market are not so designed as to permit professional intermediaries to benefit at the expense of unsuspecting customers.

However, even for exchange-traded instruments, regulators and market participants recongnize that full pre- and post-trade transparency may increase the price impact of large trades, deter participants from making such trades and thus impede market liquidity. Thus, while more reporting requirements certainly guarantees more transparency it may also impede the ability to execute large trades at observed prices.

This conflict between total transparency and liquidity has been long recognized by exchanges. For example, on the London Stock Exchange, smaller trades must be published within three minutes, while publication of the largest trades can be delayed up to five business days. Also, many exchanges allow for large orders that are only visible to market makers but do not appear in the limit order book displayed to market participants in order to avoid large price moves. This point illustrates the need for distinguishing small and large trades when discussing transparency. Transparency in the market increases information but, at the same time, since bids and offers are only valid for limited size transactions, liquidity is not necessarily guaranteed for large trades.

While transparency is often associated with the centralized dissemination of information on trades and quotes, in OTC markets information is typically disseminated in a decentralized way: information *trickles* gradually through the market via repetition of bilateral exchanges: this phenomenon has been called *information percolation* by Duffie et al. [11]. The way information spreads in a market is analogous to the way a drop of ink spreads through a glass of still water. Stirring the water would obviously do the job: this is analogous to disseminating information through a centralized mechanism such as an exchange or publicly disseminated limit order book. However, even in absence of any stirring, the ink will also spread through many collisions of ink particles with

water molecules which disperse them uniformly through the glass. This percolation of information through the market may be enhanced in other ways than by centralizing this pre- or post-trade information, for example by improving brokerage systems.

In exchanges, transparency is a "top-down" affair: the degree of transparency is fixed by the rules of the exchange. In contrast, transparency in OTC markets has often emerged in a self-organized fashion. For example, spot foreign exchange (FX) markets are decentralized markets with little transparency requirements imposed by regulators; yet there is a fairly high level of pre-trade transparency with quotes transmitted through electronic platforms in real time. For this reason, the foreign exchange market is interesting to compare with CDS markets since transparency has arisen without regulatory influence.

Born from the practice of hedging corporate loan exposures against default, in the 1990s, the CDS market has naturally evolved in OTC mode. One of the important differences between exchanges and OTC markets is the size of transactions. Exchanges as suitable for small trades; large trades, which are common in OTC markets, may move the market and generate "price impact".

In the CDS market, pre-trade information is available in the form of non-firm quotes disseminated by dealers to their clients, via third party vendors and services that aggregate data for customers; transaction prices are negotiated over the phone. Post-trade transparency –the public visibility of recent trading history by market participants– has also tended to be lower in CDS markets due to fewer reporting requirements, but is changing with the creation of the Trade Information Warehouse (see Section 5).

3 Credit default swap markets

3.1 Credit default swaps

Credit default swaps, introduced in 1997 by JP Morgan, have become the most common form of credit derivative. Net notional exposure of major CDS dealers has been estimated at 2.9 trillion USD in June 2009 [12].

CDS contracts are bilateral agreements in which one counterparty pays a fee, (typically semi-annually or with another periodicity) and has the right, in case of default of a *reference entity*, to collect from the other counterparty a stipulated notional amount in exchange for a bond issued by the reference entity. The stipulated amount is typically the face-value of the bond. The typical maturity of a CDS is 5 years. The reference entity may be a corporate entity or a sovereign entity. Thus the CDS acts as a protection against losses incurred by the holder of the debt in case of the default of the reference entity.

In 1997, the notional open interest in CDS was on the order of 200 billion dollars; by 2007 it had grown to approximately USD 60 trillion. The volume of the CDS market has been reduced significantly since June 2008 due to CDS compression trades [10]. According to a 2010 ISDA market survey, which monitors credit default swaps on single names and obligations, baskets and portfolios

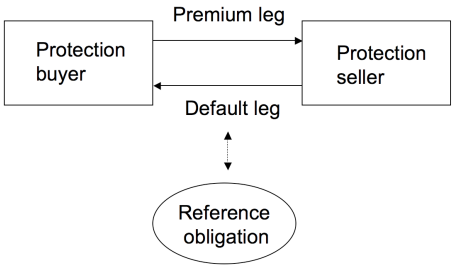

Figure 1: Structure of cash flows in a credit default swap (CDS).

of credits and index trades, the notional amount outstanding of credit default swaps (CDS) was $30.4 trillion at the end of 2009, down 3 percent from $31.2 trillion at mid-year 2009. CDS notional outstanding for the whole of 2009 was down 21 percent from $ 38.6 trillion at the end of 2008. The decreases compared to prior–year periods are due to the industry's portfolio compression efforts, in which firms reduce the number of trades outstanding without affecting their risk profiles. The $ 30.4 trillion notional amount was approximately evenly divided between bought and sold protection: bought protection notional amount was approximately $ 15.4 trillion and sold protection was about $ 15.0 trillion, with a net bought notional amount of $ 451.3 billion.

3.2 An institutional market mediated by dealers

The CDS market is an over-the-counter (OTC) market, limited to Eligible Contract Participants (ECPs), with almost all participants being institutional. Contrarily to the equity and bond markets, there is no significant "retail" component in the CDS market.

Interested parties contact each other by telephone or via Inter Dealer Brokers (IDBs) to engage in bilateral CDS transactions. Large dealers also trade actively to provide liquidity and for hedging purposes. Financial institutions such as banks and investment managers can use credit-default swaps to hedge their inventories or manage their balance sheets. Hedge funds are also active participants of this market. Accordingly, the credit-default swaps can be viewed currently as defining an asset class, which allows to transfer and trade corporate and sovereign credit risk.

The CDS market is concentrated on a small number of dealers, a dozen as of end 2009. The 10 largest dealers account for a significant portion of gross notional trading volume [12].

This results in a two-layered market structure: buy–side market participants typically do not engage in CDS transactions between themselves but transact with dealers. The dealers form a small, highly interconnected network and a large proportion of transactions is done between dealers themselves, to hedge trades done with clients or for other risk management purposes. Dealers also

act as market-makers and provide liquidity to buy side clients.

Given the small number of major dealers, buy–side market participants do not face huge search costs and have the possibility of getting quotes from several dealers before making a transaction. Thus, dealers and buy–side customers have access to different types of information. Dealers observe the order flow (pre-trade) and transaction information (post-trade) for their own customers. However, given that no single dealer dominates the market, dealers do not have access to complete pre-trade information for all customers. On the other hand, customers may obtain quotes -at a cost- from all dealers, but do not observe the order flow of other customers. "Blasts" of information on CDS quotes are disseminated to buy–side clients by dealers through Bloomberg or other information providers several times a day. Though not publicly available, these information blasts, which are broadcast to hundreds of recipients, act as an important vehicle in diffusing timely market information across the spectrum of CDS market participants.

3.3 Interdealer brokerage

Given the importance of dealers in the CDS market, a key issue is the information network connecting CDS dealers. Interdealer trades are accomplished via the use of different matching technologies. Like other OTC derivatives, the most common type of transaction is done directly between two dealers over the telephone. This method may be time consuming because the dealer has to search for a matching counterparty. In recent years, increasingly more trades have been conducted through interdealer brokers (IDBs), who match buy and sell side dealers, as well as some other market participants such as hedge funds, while offering some additional services beyond the pure matching function.

The ISDA's Operations Benchmarking Survey (2004) indicates that 34 per cent of the credit derivatives trades are arranged by brokers. This market share suggests that their services must provide some value to the dealers.

In other markets, most of the interdealer brokerage firms operate either on a fully automated electronic trading system or a voice-based system. Although voice brokers keep track of the quotes electronically, the dealers must still contact a broker over the telephone to place an order or to have a trade executed. In this setting, the interaction between the dealer and the broker may provide information that may increase the speed and probability of matching customer orders. For instance, the broker may try to surmise if there is more size behind the order than revealed and learn more about a dealer's trading incentives and true preferences. Meanwhile, the dealer can leave order contingencies with the broker. Conditioning trades on a broader set of information will improve the probability of order execution. Obviously, the network of dealers who are willing to offer liquidity is one of the most important assets of an IDB. This hidden supply of liquidity is sought by the broker in order to complete a client's trade. Both electronic and voice brokers preserve the anonymity of the dealer. However, by using a voice broker, the dealer may opt to dispense with anonymity.

This option has value depending on market conditions and the dealer's motivation for trading.

Voice brokers have a higher added value than electronic brokers and hence charge higher commissions in practice. Barclay et al. (2006) mention that for the US government bond IDB market, a voice broker's charge is roughly double the commission levied by electronic brokers. This is an explicit trading cost for the customer, who has to weigh this cost against the implicit cost incurred by any delay in trade execution. While the first type of cost is known before the trade, the second type is only ascertainable after a trade has been accomplished.

During the early years, the CDS brokerage market was only voice based; the market conditions were not ready for automation. As the market became more liquid, major IDBs adapted a different, innovative strategy from IDBs operating in the FX or Treasury markets. By integrating voice brokerage and electronic brokerage under one roof, these IDBs could cope with potential competition from fully automated trading systems. In so doing, they succeeded in internalizing the competition and gained revenues from both matching technologies. These IDBs recognized at an early stage of the market's development that the fully automated trading of CDS would not be achievable in the near future. By complementing voice brokerage, they could not only offer valuable intermediation services when necessary, but also enhance their efficiency and reach economies of scale. This market structure somewhat resembles an electronic trading system with an integrated upstairs market run by the IDBs.

Such a hybrid system offers a platform where dealers can enter quotes or hit existing quotes directly. This is a hit-and-take system where trades are triggered by dealers without using the voice broker. The firm's revenue is based on commissions per trade and a membership fee is not charged. Most IDBs charge a slightly lower commission for interdealer trades accomplished via its electronic platform compared to those executed by the voice brokers, which gives voice brokers no incentive to discourage customers from using the electronic platform. Commission schedules are defined in terms of basis points that increase with CDS premiums. The actual commission is computed as the product of the notional, maturity, and basis points (with reference to the strike interval of the fixed leg), and is charged to both sides of the trade. Each client has a different decreasing scheme of basis points with increasing volume, which encourages more transactions. After a trade is executed, the details of the trade are processed, and a trade confirmation is sent to the buyers/sellers notifying them of their counterparty. Then the sides initiate their own post-trade processing, which is normally conducted by the Depository Trust and Clearing Corporation (DTCC).

This approach to CDS trading offers the dealers a choice between two matching mechanisms that differ with respect to trading costs, level of trade execution services, and market transparency. The higher commissions charged for voice brokering are due to the services supplied beyond the pure transactional service provided by the electronic trading system. The extent to which voice brokering is used will vary depending on trade size, trade complexity, market conditions, and CDS features, such as currency. While the larger and more complex trades

may be left with the voice broker, the electronic system can be used for simpler and smaller-sized transactions in the most widely traded CDS currencies, USD and EUR. However, if the volatility of the underlying market increases or the order is of significant size, then dealers will be less willing to have their orders revealed on electronic quotation and will prefer trading via the voice broker. Under these market conditions the IDBs can offer greater liquidity because their market provides access to a wide range of institutions that supply liquidity. The two trading venues also offer a choice between different degrees of market transparency. For instance, informed traders may prefer the voice brokerage system with less transparency. Uninformed traders also stand to benefit by dealing through the voice brokers under conditions of asymmetric information; the IDB is able to certify them as uninformed, which results in trades at better prices.

The implementation of electronic platforms by interdealer brokers has led to more transparent markets, in which (anonymous) quotes can be tracked. The outlook on the CDS market is towards automation of the full trade process: according to a 2010 ISDA survey [21], 99 percent of standard CDS volume is eligible for electronic processing and 98 percent actually confirmed electronically. This will ease the exchange and processing of post-trade information and its transmission to data repositories.

4 The impact of transparency on market quality

Many studies have tried to address the effects of market transparency on liquidity and market behavior. The general findings provide arguments that show that transparency may have both positive and negative effects. We summarize here some general insights from such studies.

4.1 Theoretical insights

The impact of transparency on market quality and in particular on market liquidity has been studied theoretically in the market microstructure literature.

Madhavan (1995) examines the relation between market integration and the disclosure of trading information to market participants. He shows that some market participants prefer to trade in a fragmented market where their trades are not disclosed. For example, large traders incur smaller execution costs in a market where their trades are not disclosed. Lower pre-trade transparency also benefits dealers by reducing price competition. Madhavan (1996) shows that greater transparency lowers price volatility and improves market quality in a sufficiently large market. However opposite effects, in particular an increase in volatility, may result in a market with a small number of major players, such as the CDS market. In markets where trades are large in size and the number of players is small, greater pre-trade transparency may generate strategic behavior in the order submission process ("gaming" of orders) and enable front-running of large orders which are visible to all market participants. The recent example of the "flash crash" in equity markets, where a single large order generated

considerable price volatility, shows that the high level of pre-trade transparency of exchange-traded markets may in fact increase volatility when large orders are concerned.

Biais (1993) argues that pre-trade transparency increases both market efficiency and liquidity. Lyons (1996) suggests that the lack of post-trade transparency may lead to excess price volatility. Pagano and Roell (1996) examine whether greater pre-trade transparency -the extent to which market makers can observe the size and direction of the current order flow- enhances market liquidity. They show that greater transparency results in lower trading costs for uninformed traders, although not for all trade sizes. Naik et al. (1999) show that greater transparency can reduce inventory holding costs in a dealer market. Consistent with this prediction, Flood et al. (1999) provide experimental evidence that pretrade transparency reduces bidask spreads.

Other studies show that greater transparency may actually decrease market liquidity. For example, Bloomfield and O'Hara (1999) argue that an opaque market may give market makers incentives to quote narrow bid–ask spreads, because the order flow attracted by narrow spreads contains valuable information about market fundamentals. Bloomfield and O'Hara (2000) use laboratory experiments to examine the effects of transparency on market efficiency and bidask spreads. They show that trade bid–ask disclosure increases both the informational efficiency of price and opening bidask spreads by reducing market makers incentives to compete for order flow. As a result, trade disclosure benefits market makers at the expense of liquidity traders and informed traders. The authors find that quote disclosure has no discernible effects on market performance.

These studies are based on different assumptions and different definitions of transparency; we attempt here to summarize some key insights from this literature:

1. **Transparency can lead to lower trading costs.**
   Greater transparency reduces information asymmetries, reduces search costs and leads to lower trading costs. For example, Pagano and Roëll (1996) model transparency as the degree to which the size and current direction of the order flow is visible to the competing liquidity suppliers and report that greater transparency generates lower trading costs for uninformed traders on average, although not necessarily for every trade size.

   It is not always the case, however, that increased transparency reduces trading costs. Biais (1993) compares fragmented opaque markets to transparent centralized markets and shows that if customers can freely contact the dealers to ask for their quotes, and then allocate their trade to the best quote, transparency is irrelevant, i.e., the expected spread is the same in the two market structures. Thus moving from a bilateral OTC market to a centralized structure does not necessarily lead to lower spreads.

2. **Transparency may reduce the incentives to acquire information**

and reduce liquidity provision by market makers.

If transparency reduces spreads, and thus reduces execution costs for the uninformed liquidity demanders, it also reduces profit margins for market makers. As argued by Grossman and Stiglitz (1980) and Kyle (1989), Rindi (2002), this reduces the incentives of market makers to provide liquidity. Thus, in the CDS market where gathering information has a cost, increased transparency requirements, by requiring dealers to disclose this information to uninformed market participants, will reduce their incentives to gather information in the first place.

3. **Increased transparency benefits mostly uninformed traders, while informed market participants–large dealers and market makers– bear its costs.**

   In a market where there are a few large dealers, these extra costs may be passed on to buy–side customers and eventually counterbalance the possible reduction in spreads from greater competition between dealers.

4. **Increased post-trade transparency may reduce liquidity if it increases inventory costs.**

   Another insight is that increased post-trade transparency could deter liquidity supply by making it difficult for a dealer to unload a large inventory [4]. Once a liquidity supplier has purchased shares, she usually endeavors to resell these, to manage her inventory. If competitors have observed this initial trade, however, they may be tempted to react opportunistically. Knowing she needs liquidity, and is therefore willing to pay for it, they will charge a higher price. Thus after large trades in transparent markets, liquidity suppliers can be in a difficult bargaining position to unwind their inventory. This is an example of how post-trade transparency increases price impact. We note that this effect is significant for large trades and calls for distinguishing large and small trades when discussing post-trade transparency.

A common theme in these models is information asymmetry: there are some traders that are more informed than others and increased transparency affects these two categories differently. In the CDS market where dealers –who typically invest more resources in information gathering and thus play the role of "informed traders"– play a major role, changes in market structure are expected therefore to have a major impact on liquidity provision and any such modification must be carefully thought through prior to implementation.

Another recurring theme is the differentiation between large and small trades. Increased pre-trade transparency creates competition and may result in lower execution costs for small trades but may also make it more costly to execute large trades. Increased post-trade transparency may increase price impact of large trades and makes it more costly to unwind a large inventory. In both cases, liquidity may decrease for large trades.

4.2 Empirical evidence

Empirical evidence on the impact of market transparency on liquidity is difficult to obtain since market experiments are costly. Most empirical studies are case studies of changes in market design and their influence on liquidity.

Gemmill (1996) finds no evidence of liquidity change when the London Stock Exchange required greater post-trade transparency for large block trades. Madhavan et al. (2005) find larger execution costs and higher price volatility after the Toronto Stock Exchange increases pre-trade transparency by publicly disseminating its limit order book. Baruch (2005) analyzes the NYSE's OpenBook service and shows that traders who demand liquidity are better off when the book is open while liquidity suppliers are better off when the book is closed. Empirical studies may appear inconclusive since some point to increase in "liquidity" as a result of increased transparency and some point to the opposite. In fact, these studies use different notions of transparency and different ways of measuring "liquidity". In fact, in some studies a lower bid–ask spread is presented as an "increase in liquidity", while other studies define liquidity as the ability of the market to execute trades, including large ones. In both cases, the conclusions depend on whether one looks at small or large trades.

The market in corporate bonds provides an interesting example of an increase in transparency in dealer markets and the subsequent effects on market quality. Under a ruling by the Securities and Exchange Commission, FINRA members are required to report all trades in corporate bonds to the Trade Reporting and Compliance Engine (TRACE). Academic research has found that the reporting requirement has indeed improved price discovery, not just for TRACE-eligible bonds but also for other bonds, reduced transaction costs for small trades, and lowered both the market share as well as the cost advantage of large dealers [3, 17]. The impact on market liquidity is less clear: in fact, some findings point to a decrease in market liquidity for large trades due to the introduction of TRACE.

Bessembinder et al. (2006) analyze the effect of post-trade transparency in TRACE on execution quality in corporate bond markets. In particular, they find significant reductions in institutional execution costs after the initiation of the TRACE reporting system for both bonds eligible and bonds not eligible for TRACE reporting. Goldstein et al. (2007) show that adding transparency has either a neutral or a positive effect on liquidity. Increased transparency is not associated with greater trading volume.

These results provide some evidence that increased transparency may decrease execution costs. However, they do not imply that an increase in transparency leads to increased *market liquidity*.

Bessembinder et al. (2006) also document decreased market shares for large dealers and a smaller cost advantage to large dealers post-TRACE. This indicates that the cost of increased transparency accrues to large dealers/ market makers, while customers are the principal beneficiaries of the reduced execution costs. Overall, these conclusions do correspond to the theoretical insights provided by microstructure models and summarized in the previous section hence

provide a coherent picture of the effects of increased transparency in dealer markets.

It is not clear whether the TRACE framework is applicable *mutatis mutandis* to credit derivatives and CDS in particular. The corporate bond market is composed of many more participants, including retail clients, and information was much more dispersed prior to the introduction of the TRACE system. The CDS market, by contrast, is an institutional market, much more concentrated on a small network of dealers: search costs are lower and dissemination of pre-trade information through bilateral exchanges may be quite effective.

It is also important to distinguish CDS indices from the case of single name markets where the role of information is crucial. Due to the fundamental information asymmetry between dealers and buy–side customers in the single name CDS market and the value of this asymmetric information for dealers, greater transparency requirements may in fact either discourage them from providing liquidity and making markets or result in higher trading costs passed on to end-users. It is not clear whether the possible decrease in bid–ask spreads due to increased competition between dealers would outweigh this increased cost or ultimately lead to more liquidity.

5 Transparency in the CDS market

5.1 Central clearing of credit default swaps

The recent crisis in credit markets revealed that the bilateral nature of CDS contracts could present a risk to the system as a whole in the event that a large market participant would be unable to deliver on its obligations in case he sold protection on a reference entity that defaulted.

Central clearing of standard derivative products is broadly perceived as an important step forward in managing systemic risk [7] and their role will be reinforced by the Financial Reform bill introduced in 2010 [33]. Central clearing of inter-dealer credit default swap trades has been proposed as a possible solution for mitigating counterparty risk in the CDS markets and reducing systemic risk [7]. Regulators have recommended that bilateral CDS transactions be moved to a central clearing facility (CCP) which would monitor CDS exposures of market participants and where trades between dealers would be collateralized through a margin system. The CCP would also act as a vehicle to mutualize losses in case of default among large dealers. Starting in 2009, CCPs for credit-default swaps have been clearing a large number of contracts (index and single-name CDS), which is a positive development. The main CDS clearing facilities are currently managed by ICE Trust, ICE Clear Europe and CME. Beginning October 2009, dealers individually committed to submitting at least 95% of new eligible trades for clearing (calculated on a notional basis) [10].

Central clearing, in addition to managing counterparty risk more effectively, will contribute to dissemination of information to regulators and market participants. In early 2009, the Depository Trust and Clearing Corporation (DTCC)

announced that it would support all CCP solutions for CDS via its Trade Information Warehouse (TIW), whose capabilities include central net settlement and asset servicing. Virtually all dealers and buy–side participants along with 15 third-party service providers are already linked to the TIW and utilize its functionality.

Some of the functions of the TIW are

- maintaining the official version of each registered contract, thereby providing contract certainty across the market, for both cleared and bilateral transactions;
- publishing on a weekly basis data on notional amounts of contracts outstanding and contract turnover;
- calculating all amounts due on most types of registered contracts;
- providing for centralized, multilateral net settlement of these amounts for participating firms through CLS Bank International, DTCC's strategic partner in providing central settlement of CDS contract fees and coupon payments;
- central processing of credit events and, based on International Swaps and Derivatives Association ("ISDA") auction results, calculation of net cash settlements due; central processing of successor events and corporate actions;
- bulk novations when counterparties are merged or acquired, as in Bear Stearns' acquisition by JPMorgan Chase. The TIW also serves as the source of contracts for, and repository of the results of, the industry's portfolio compression and tear-up processes, as well as the source of contracts for automated novation consent services.

Thus an important by-product of central clearing will be to enable the end-of-day dissemination of post-trade information to a broad set of market participants. This price information will not only improve transparency in the market for cleared products but also provide better information for the pricing of related, non-cleared products such as credit correlation instruments.

5.2 Data repositories

In addition to registering centrally cleared CDS trades, TIW will also act as a data repository for other CDS trades which may not be centrally cleared: this currently concerns mainly single name and sovereign CDS positions which are increasingly registered with DTCC as part of a commitment by dealers.

In a letter to the Federal Reserve Bank of New York dated October 31, 2008, the 16 major CDS dealers and industry associations (Bank of America, Barclays Capital, BNP Paribas, Citigroup, Credit Suisse, Deutsche Bank AG, Dresdner Kleinwort, Goldman Sachs , HSBC Group, JP Morgan Chase, Merrill Lynch,

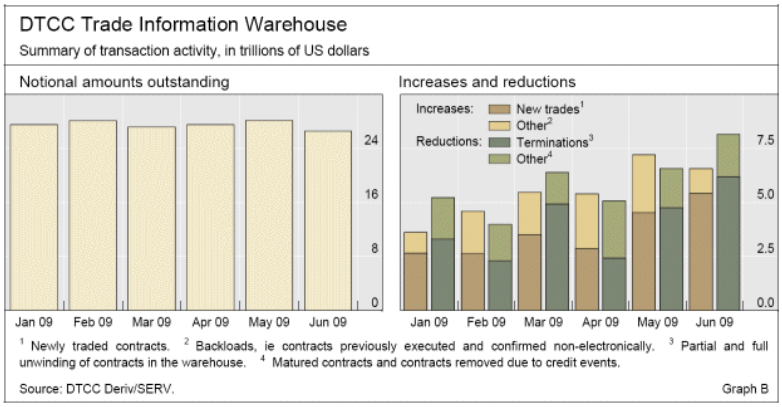

Figure 2: Source: BIS and DTCC DerivServ.

Morgan Stanley, The Royal Bank of Scotland Group, Societe Generale, UBS AG, and Wachovia Bank, as well as the Managed Funds Association and ISDA) committed to utilize the TIW as follows:

> TIW will be the "single, centralized source of industry portfolio statistics to enhance the transparency of the market for participants and supervisors." Firms will "process major life cycle events in the TIW for all electronically eligible confirmable trades including:
>
> - Clearing automatically processed through the TIW, where applicable.
> - Compression and tear-ups automatically processed through the TIW.
> - Credit Events automatically processed through the TIW."

6 Conclusions

Below is a summary of the main points raised in our study:

1. The CDS market is an over the counter market based on bilateral transactions and an inter-dealer brokerage system. Institutions which are allowed to participate in the market must satisfy significant capital requirements which rule out retail investors. The number of major dealers is small and many trade sizes are large.

2. CDS dealers and buy–side customers have access to different types of information. Dealers observe the order flow (pre-trade) and transaction information (post-trade) for their own customers. However, given that no single dealer dominates the market, dealers do not have access to complete pre-trade information for all customers. On the other hand, customers may obtain quotes -at a cost- from all dealers, but do not observe the order flow of other customers.

3. In CDS markets, dissemination of information takes place through repeated bilateral exchanges among dealers and between dealers and their customers. Given the small number of dealers, search costs are low and customers can call multiple dealers. This process is complementary to any additional transparency which might emerge from data warehouses or central clearing.

4. Despite the generally held view whereby transparency is beneficial to markets, theoretical and empirical research shows that, while increased transparency leads to lower trading costs for uniformed traders and reduced execution costs for small trades, it may actually increase execution costs for large trades, reduce the incentives to acquire information and reduce liquidity provision by market makers. In particular, increased transparency may lead to reduced liquidity. Thus increased transparency

benefits mostly uninformed traders, while informed market participants– large dealers, market makers and large buy side firms– are likely to bear its costs.

5. Increased transparency may affect large and small trades differently. Increased pre-trade transparency creates competition and may result in lower execution costs for small trades but may also make it more costly to execute large trades. Increased post-trade transparency may increase price impact of large trades and make it more costly to unwind a large inventory. In both cases, liquidity may decrease for large trades. This points to the necessity of considering different transparency requirements for large trades. Measures could include reporting of large trades with a delay as is done in some exchanges or disclosing them with volumes capped at a pre-specified amount reflecting a normal market size, as is done on TRACE.

6. A distinction should be made between regulatory transparency and market transparency. Regulatory transparency means that regulators should have access to trade information on a timely basis in order to monitor the market. Regulatory transparency in the CDS market should be increased; data repositories and central counterparties are effective tools for achieving this goal. However, transaction or position data disclosed to regulators should be treated as confidential: if made publicly available, it may generate speculative activity and have a destabilizing effect on the market.

7. Interdealer brokerage systems and electronic platforms for CDS trading have increased pre-trade transparency, in a way similar to spot foreign-exchange markets. The increasing use of electronic trade confirmation has eased the exchange and processing of post-trade information and its transmission to data repositories.

8. CDS markets are progressively moving towards central clearing of standard CDS contracts. Central clearing will increase the level of transparency while retaining the elements necessary to preserve trade anonymity. Price information disseminated to market participants in CCPs will not only improve transparency in the market for cleared products but also provide better information for the pricing of related, non-cleared products such as credit correlation instruments.

9. Data repositories such as DTCC's Trade Information Warehouse will cover a larger spectrum of products, including CDS contracts which may not be subject to central clearing. TIW disseminates information about trades, volumes and valuations to participants in the market. Increased reporting of CDS trades to data repositories is the key ingredient of a non-invasive increase in market transparency.

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