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The Determinants of CDS Bid-ask Spreads

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Abstract

We investigate the determinants of bid-ask spreads on corporate credit default swaps (CDSs). We find that proxies for dealer inventory costs such as variability of CDS premia and CDS trading volume explain as much as 80% of variation in CDS bid-ask spreads. We also analyze the influence of variables capturing systematic risk of reference entities, market-implied volatility, dealer funding costs and competition between dealers. Several of these variables are significant, but their explanatory power is moderate. Finally, we demonstrate that CDS bid-ask spreads do not widen preceding earnings announcement surprises, which suggests that private information does not hinder CDS liquidity.

Keywords: Credit default swaps, Liquidity, Bid-ask spreads, Components of bid-ask spreads.

1. Introduction

The credit default swap market has grown enormously over the last decade because it provided a convenient way to transfer default risk of corporate, municipal, and sovereign entities between financial institutions. It is an over-the-counter market wherein trades are typically done between dealer banks on the one side, and on the other side, sophisticated financial institutions including other dealer banks, hedge funds, asset managers and pension funds. Such market structure is very different compared to the limit-order equity markets, while it bears similarities to the corporate bond market. The main advantage of the CDS market is that it enables trading of credit risk in a standardized manner that is unconstrained by the amount and timing of bond issuance as well as various features of physical bonds, which (potentially) results in greater liquidity and price discovery in the CDS market.

The CDS market is characterized by the central role played by market makers. Trades in CDS contracts occur far less frequently than in stocks, trading intensity of CDSs is highly varying over time and trade sizes are relatively large. The functioning of the market is therefore critically dependent on dealers' willingness to provide immediacy. It requires dealers to assume large inventory positions, while being unable to quickly enter into offsetting positions and thus having to carry inventory sometimes for many days (Chen et al., 2011). This distinguishes the CDS market structure from the case of equity markets in which trading occurs on a more continuous basis and market-makers typically carry more limited inventories. Dealers in the CDS market also have to manage the risks of adverse selection. According to the recent studies and anecdotal evidence the adverse selection costs are potentially substantial. Acharya and Johnson (2007) point out that while the stock market is highly regulated with active surveillance of insider trading and severe penalties, the CDS market lacks these measures. Moreover, they point out that building up large short positions in credit default swaps is easier than in corporate bonds and thus the CDS market might be a preferred trading venue for informed parties.

In this paper, we investigate the determinants of bid-ask spread quotes on CDSs provided by dealers to their buy-side clients. As explanatory variables we consider proxies that are related to the inventory cost component and adverse selection component. Such approach is motivated by the broad literature on market making in the equity-markets, which proposes the 'inventory control' models (Garbade and Silber, 1979; Ho and Stoll, 1980, 1981; Amihud and Mendelson, 1980) and the 'adverse selection' models (Kyle, 1985; Glosten and Milgrom, 1985; Easley and O'Hara, 1987). We also consider several variables related to the nature of credit risk of reference entities, market-wide factors and dealer competition. This is motivated by the evidence on commonality in liquidity (e.g. Chordia et al., 2000), funding constraints (e.g. Pedersen, 2009), dealer competition (e.g. Wahal, 1997) and cross equity-CDS arbitrage (e.g. Yu, 2005).

Despite the size, importance and unique structure of the CDS market, this paper is the first comprehensive study on this subject and we are not aware of a similar study on corporate bond data. The data necessary for this study has become available only recently as a result of regulatory efforts to increase market transparency and industry initiatives to improve data collection and reporting as further discussed in Section 3. In particular, we use data from Markit[1] Liquidity reports available from April 2010, which provide daily averages of bid-ask spread quotes received by the buy-side clients. We also use data from DTCC[2] on outstanding notionals of CDS contracts and risk transfer activities available from July 2010.

The CDS market is well-standardized and thus offers a unique opportunity to investigate cross-sectional determinants of bid-ask spreads in an OTC market. Almost 50% of all transactions in single-name CDSs are for contracts with a 5 year maturity and almost all have the standard restructuring clause (Chen et al., 2011). In the bond market, observed bid-ask spreads pertain to specific bond issues with diverse characteristics such as maturity, seniority, various clauses and covenants, which coupled with low frequency of trading activity makes such study less feasible as only the most liquid bond issues would have at least several bid-ask spread quotes on a daily basis. Moreover, bid-ask spreads in the bond market are known to be highly dependent on trade sizes

[1] Markit is a leading industry provider of CDS data.

[2] Depository Trust & Clearing Corporation (DTCC) is a leading provider of clearing, settlement and information services in equities, corporate and municipal bonds, government and mortgage-backed securities, and over-the-counter derivatives. In the CDS market, the DTCC provides registration services and trade processing such as payment calculation or credit event processing. Its Trade Reporting Repository operates and maintains the centralized global electronic database for virtually all CDS contracts outstanding in the marketplace.

and on whether the buy-side client is a retail or institutional investor (Edwards et al., 2007). In contrast, the CDS market is exclusive to institutional investors who on the buy-side consist mostly of hedge funds, asset managers, and banks, and therefore trade sizes are in all cases large with a typical trade size of $5 million.

Investigating the determinants of the bid-ask spreads on CDS contracts is important for several reasons. Firstly, liquidity is a critical factor for investment decisions and market making is at its core. Second, it sheds light on the functioning of the CDS market in terms of liquidity, efficiency, competitiveness, and potential abuses related to insider trading. Thirdly, greater liquidity and price discovery as well as market resilience is beneficial to the economy and is thus of interest to regulators. For example, it is important to understand whether adverse selection or an increase in equity market volatility hinders liquidity in the CDS market.

We find that variables associated with dealer inventory costs explain about 80% of variation in bid-ask spreads. The most important variable in terms of explanatory power is the (quasi) standard deviation of past CDS premia changes. We show that it has a strong positive relationship to bid-ask spreads, which is expected because higher variability of CDS premia implies that dealers are more likely to incur large inventory losses. Also, the notional outstanding of CDS contracts on a given reference entity as well as trading volume significantly influence the bid-ask spreads in line with theoretical predictions. A larger and more active CDS market on a given reference entity implies that dealers can on average exit their positions more quickly, which lowers the inventory costs and thus results in lower bid-ask spreads.

We document moderate explanatory power of a set of variables capturing systematic risk of reference entities, market-implied volatility, dealer funding costs, and competition between dealers. Firstly, we find that a CDS market beta (i.e. beta coefficient from regressing a single-name CDS return on the CDS market return) has a negative and significant impact on bid-ask spreads. This is likely because higher CDS market beta after controlling for CDS volatility implies lower idiosyncratic risks and thus lower adverse selection costs for dealers. It also makes it easier for dealers to hedge CDSs on a given reference entity with the CDS index. Secondly, we find that the VIX index does not significantly influence CDS bid-ask spreads, which implies that CDS market liquidity is not hindered by increased equity market volatility. Thirdly, higher funding costs of dealers (e.g. TED spread) result in larger bid-ask spreads, but their impact is very limited in quantitative terms. Fourthly, the number of dealers active in a given reference entity is negatively related to bid-ask spreads suggesting that dealer competition is an important factor determining liquidity. Altogether, our set of explanatory variables jointly explains over 81% of the variation in CDS bid-ask spreads.

Having identified major cross-sectional determinants of CDS bid-ask spreads, we further investigate the adverse selection component by examining whether bid-ask spreads widen in periods preceding earnings announcements. If insider trading is a major concern, then we would expect dealers to accordingly increase bid-ask spreads before earnings announcements to prevent losses from trading against informed buy-side clients such as hedge-funds. Of course there are also concerns about insider trading at other times, but earnings announcements are the most important periodical information events which are anticipated. Surprisingly, we do not find any widening of bid-ask spreads in days or weeks prior to the earnings announcement dates, which means that the risk of trading against informed parties does not appear to be a major concern to market makers. This is consistent with Acharya and Johnson (2007) and Qiu and Yu (2012) who suggest that dealer banks are likely better informed than their clients due to their role as lenders. Furthermore, we find that both with and without controlling for the other determinants of bid-ask spreads identified in this paper, CDS bid-ask spreads are significantly lower prior to earnings announcements that turn out to be negative surprises. We consider several specifications to confirm the robustness of this finding. While we analyze CDS bid-ask spreads using a very different methodology compared to the studies of CDS price discovery by Qiu and Yu (2012) and Batta et al. (2012), our results are consistent with their finding of endogenous liquidity provision by dealers resulting in greater liquidity prior to CDS premia increases and earnings announcements.

The rest of this paper is organized as follows. Section 1.1 discusses the related literature, while Section 2 provides background on the CDS market and its recent developments. Section 3 presents theoretical considerations on the determinants of CDS bid-ask spreads and Section 4 discusses the data. Section 5 presents the results of the empirical analysis. Section 6 concludes.

1.1. Related literature

This paper contributes to the literature examining CDS bid-ask spreads and more broadly liquidity of credit default swaps, which is sparse and in most cases based on data from several years ago. Meng and Gwilym (2008) study determinants of CDS bid-ask spreads, but they use a different set of explanatory variables not focused on investigating the costs of market making. Meng and Gwilym (2008) use data from July 2003 to March 2005 when the CDS market was less developed, efficient and liquid, while we use data from July 2010 to November 2012 after important measures to improve CDS market liquidity, resilience and transparency were introduced (e.g. CDS Big Bang). Our set of variables explains over 80% of variation in CDS bid-ask spreads, which is more than the 54% explained in Meng and Gwilym (2008). That is largely because we construct a more meaningful measure of CDS premia variability and we use more detailed data on trading and outstanding notionals of CDSs, not available several years ago. Studies on CDS liquidity also include Fulop and Lescourret (2007) and Tang and Yan (2007) among others, but they do not focus on explaining bid-ask spreads.

The CDS market is most closely related to the bond market as they are both credit markets with relatively infrequent trading done over-the-counter. The existing literature on bid-ask spreads of bonds characterizes and compares trading costs between corporate, municipal and treasury bond markets as well as it analyzes the relation between the bid-ask spread and trade size, time to maturity, credit rating, volatility, retail vs. institutional type of customer, and other bond characteristics (see Schultz, 2001; Chakravarty and Sarkar, 2003; Hong and Warga, 2000, among others). These studies use realized bid-ask spreads based on matching buy and sell transactions on the same bond issues when they occur on a single day or other techniques to approximate bid-ask spreads due to unavailability of daily bid-ask quote data. Edwards et al. (2007), Bessembinder et al. (2006) and Goldstein et al. (2007) study the relationship between bond liquidity and transparency by examining the effect of the introduction of the trade reporting TRACE system. Wei and Zhou (2012) study bond trading patterns around earnings announcements. Our study contributes to the existing literature as we examine the cross-sectional determinants of corporate CDS bid-ask spreads using proxies associated with the costs of market making. The CDS market is more suitable for such analysis because it is standardized and taking advantage of recently introduced data we directly observe daily average bid-ask spread quotes, which together with CDS valuations are available for a large number of corporate entities regardless of whether actual trades occur on a given day.

Our results also contribute to the growing literature on price discovery and insider trading in the CDS market. Acharya and Johnson (2007) find evidence of significant incremental information revelation in the CDS market versus the equity market for firms that subsequently experience large negative shocks to their CDS prices. They argue that it is consistent with the use of non-public information by informed dealer banks because, as they show, price discovery is positively associated with the number of relationship banks (i.e. proxy for private information availability). Qiu and Yu (2012) extend this analysis by showing that banks (endogenously) provide more liquidity, as measured by a proxy for active dealers, in anticipation of such negative shocks. In contrast, Hilscher et al. (2013) use a different methodology and find that equity prices generally lead CDS prices even when conditioning on a large future increase in CDS premia. However, Hilscher et al. (2013) do find that CDS prices respond with a lower delay during salient news events (e.g. preceding earnings announcements), which they explain by investor inattention during normal periods. Batta et al. (2012) find that price discovery in the CDS market is faster for firms with characteristics associated with abundance of firm-level private information as well as in periods preceding earnings announcements. They also find that CDS liquidity in periods preceding earnings announcements is positively related to several proxies of private information suggesting that informed trading leads to greater liquidity. Other studies on price discovery in the CDS market include Marsh and Wagner (2012), Norden and Weber (2004), Norden and Weber (2009) and Berndt and Ostrovnaya (2007).

2. Background on the CDS market

The CDS market has developed as an opaque and unregulated over-the-counter market. On the one hand, the CDS market was hailed for its ability to transfer and spread default risks of companies between financial institutions resulting in a more efficient and arguably more robust capital markets. On the other hand, the CDS market has been a subject of controversies with concerns raised about its opaqueness and lack of regulation, potential to increase systematic risk of the financial system, abuse for speculative purposes, distortion of incentives of insured bond-holders, liquidity dry-ups under market stress and its use as a trading venue for insider-trading.

A study of transaction-level data was recently commissioned by the New York FED, see Chen et al. (2011) with the aim of understanding the nature of trading, standardization, market making and risk transfer in the CDS market with emphasis on implications for public reporting of OTC trades. The study offers a unique glimpse into the opaque CDS market because such data was not previously disclosed even to regulators. Chen et al. (2011) analyze trades occurring globally between May 1 and July 31, 2010 with a G-14 dealer on one side of the trades, which according to DTCC covers 95-98% of the market.

As for composition of the counterparties, Chen et al. (2011) find that the market is dominated by G-14 dealers[3] who are also on the other side of the trades in 77.65% of the trades as buyers and in 85.06% as sellers. The other major types of market participants on the other side of the trades, respectively as buyers and sellers, are as follows: other dealers 7.41% and 6.29%, hedge funds 6.84% and 3.19%, asset managers 3.93% and 2.47%, banks 3.36% and 2.64%, financials 0.37% and 0.20%, insurance companies 0.16% and 0.06%, and pension funds 0.09% and 0.05%. This clearly indicates that the buy-side clients are dominated by hedge funds, asset managers and banks.

Chen et al. (2011) report that a majority of reference entities for single-name CDSs trade less than once a day with a high proportion of CDS transactions conforming to standardized contractual and trading conventions. They report that both the median and modal contract notional for single-name corporate CDSs is 5 million USD or 5 million EUR depending on currency denomination, while the mean trade notional is 6.68 million USD or 5.93 million EUR, respectively. Of

[3]The G-14 dealers are the largest fourteen dealers in OTC derivatives. As of 2011 this group includes Bank of America-Merrill Lynch, Barclays Capital, BNP Paribas, Citigroup, Credit Suisse, Deutsche Bank AG, Goldman Sachs & Co., HSBC Group, J.P. Morgan, Morgan Stanley, The Royal Bank of Scotland Group, Societe Generale, UBS AG, and Wells Fargo.

all transactions 63% are denominated in USD and 35% are in EUR. Almost 50% of trades are for a 5 year tenor. We refer to Chen et al. (2011) for more detailed statistics.

Chen et al. (2011) also document that the group of the most actively traded reference entities can change substantially from one month to another over the sample period, which they argue is likely due to varying credit conditions for industry sectors as well as individual firms. They find that on average nearly 2,550 single-name trades are made per day for a notional of 18 billion USD with trading activity concentrated among the most liquid names. To summarize trading activity, Chen et al. (2011) categorize reference entities into three buckets. A sample of 1553 reference entities is first ranked by total trading frequency over the sample period; then the distribution is divided into quintiles with each quintile accounting for about one fifth of total trading activity. They report that the first quintile contains 48 most active reference entities trading an average of 10 times daily, with the top reference entity trading an average of 22 times per day. Next, the group of 219 less actively traded reference entities, i.e. quintiles 2 and 3, trades on average 4 times daily. Finally, the remaining 1286 infrequently traded reference entities, i.e. quintiles 4 and 5, trade on average less than once per day.

Chen et al. (2011) also examine the dealer's role as a market maker and they find that large trades with customers - large trades defined as having a notional greater than the 95th percentile of trades in a given reference entity - are generally not quickly hedged by trades in opposite direction in the same entity. For example, they find that "for single-name CDS contracts, on 47% of days with a large dealer trade with a customer, the dealer did not make any additional trades in the same reference entity in the opposite direction. When trades did occur, the dealer made an average of 2.7 additional trades in the opposite direction compared to 2.8 additional trades in the same direction" on that same day. Similarly, Chen et al. (2011) find no evidence of hedging on the subsequent days and point out that there is anecdotal evidence that dealers sometimes carry open positions for days or weeks before closing them with opposite trades. To some extent, imperfect hedging can also be done using the CDS index or more rarely equity or bond markets (Chen et al., 2011).[4]

[4]Che and Kapadia (2012) examine effectiveness of equity hedges for CDS positions and find it to be generally low.

Qiu and Yu (2012) argue that the CDS market, despite being an over-the-counter market, bears some similarities to the equity-like limit order markets. While the market is dominated by G-14 dealers, there seem to be fairly low barriers to entry as the number of dealers can be rather high (in our sample the maximum number of dealers is 15). According to Qiu and Yu (2012), "This blurs the traditional boundary between dealers and non-dealers; rather, it is the decision to supply or take liquidity that distinguishes the participants. To the extent that investors can obtain quotes from multiple dealers, they may have access to what resembles a small portion of a limit order book. These features suggest that we can think of CDS liquidity from the perspective of the recent literature on endogenous liquidity provision in limit order markets".

The credit default swap market has largely evolved in recent years with numerous initiatives by the industry and regulators aimed at introducing greater standardization and liquidity, facilitating settlement of defaulted entities, reducing counterparty risk, and minimizing the systematic risk embedded in the market. These initiatives were largely motivated and shaped by the perceived weaknesses of the market that became evident during the financial crisis.

Among the most important changes in the CDS market was the Big Bang protocol for the North American market implemented on April 8th, 2009, which introduced fixed coupons, standardized coupon dates, standard restructuring clauses, settlement rules etc. (see for details Markit, 2009b).[5] Another recent measure was the move towards central clearing for many reference entities (ICE settlement), which aims at reducing counterparty risk (Markit, 2009b).

The market participants also began periodical trade compressions to reduce counterparty risk when it became a major concern in August 2007. This means that existing contracts are replaced by new sets of CDS contracts whereby net positions of dealers stay the same, but they are compressed into far fewer contracts. Trade compressions eliminate the unnecessary contracts altogether and thus remove the counterparty risks as well as a possibility of litigation. In contrast, netting of contracts only hides the contracts (The Economist, 2009). Trade compressions are believed to explain a large part of the reduction in the volume of outstanding CDS contracts occurring between

[5]Analogous changes were later introduced by the Small Bang Protocol for the European CDS market (Markit, 2009a).

2007-2012. Vause (2010) reports that despite lower CDS volume outstanding, trading volumes (in CDSs) have continued the upward trend. They also point out that new trade volume in the first three quarters of 2010 were nearly double the corresponding level of 2007 according to Markit (Vause, 2010).

The financial crisis has demonstrated the shortcomings and limitations of the CDS market. While the CDS market as opposed to the CDO market has sustained its position as a leading credit market, a number of important measures to improve its resilience and robustness were promptly introduced as discussed earlier in this section. In particular, the standardization measures have likely resulted (ceteris paribus) in greater liquidity and price discovery in the CDS market, while trade compressions have reduced counterparty risks. In this study we use data from July 2010, which means that we analyze the CDS market after these measures have already been introduced. Our study is thus based on a sample period reflecting the most current CDS market environment, which means that our results are meaningful for the ongoing debate about credit derivatives. It also distinguishes this paper from most prior literature on the CDS market.

3. Theory

Having described the structure of the CDS market, we now discuss theoretical determinants of CDS bid-ask spreads. In a competitive market, bid-ask spreads are driven by the costs of market making. We identify proxies related to inventory costs and adverse selection costs following the broad literature on bid-ask spreads in equity markets. In addition, we analyze whether CDS bid-ask spreads depend on market-wide conditions, dealer funding costs and competition between dealers.

3.1. Inventory costs

Inventory costs are associated with the risk of changes in the value of unhedged CDS positions assumed by dealers in their role of providing immediacy. After making a trade, a dealer might be unable to immediately enter into an offsetting position. We assume that the inventory cost component is determined both by variability of CDS premia as well as by the expected time necessary to close a position. This follows the standard results based on the 'inventory control' models of the bid-ask spread in the equity markets (Garbade and Silber, 1979; Ho and Stoll, 1980, 1981; Amihud and Mendelson, 1980). These models assume that risk averse market makers have optimal inventory positions. Deviating from these optimal positions when providing liquidity means that dealers become exposed to risks of adverse stock price movements. The bid-ask spread is thus charged to compensate for this risk. The inventory risk can be attributed to the likelihood of adverse price changes and also the possibility that dealers will be unable to reduce their positions due to liquidity constraints (see Acker et al., 2002, for further discussion).

Inventory costs might be even more important in the CDS market because changes in CDS contract values can be abrupt and substantial as CDSs are similar to deep out-of-the money put options. Moreover, as discussed in Section 2, trading activity in the CDS market is rather low with CDSs on many reference entities trading a few times a day or less. On top of that, there is substantial time-variation in trading activity of most reference entities, which adds uncertainty about dealers' ability to timely close a position.

The realized inventory cost of a CDS position is the change in the value of the CDS contract before the position is closed. We argue that it is mostly determined by the 'absolute' and not 'relative' (percentage) change in the level of CDS premia. To illustrate the argument, let us consider two CDS contracts with a 5 year maturity, one with a CDS premium of 50 bps and the other with a CDS premium of 200 bps. In relative terms, the CDS premium for the first contract increases 20%, while for the second contract it increases only 5%. However, for a market maker with short positions in these contracts, a change in the CDS premium from 50 bps to 60 bps on the first contract is only a slightly higher loss than a change from 200 bps to 210 bps on the second contract. That is because in both cases the change in the value of the contracts is the present value of a 5-year risky annuity of 10 bps, which adds up to 50 bps of the notional corrected for discounting and (slightly different) default survival curves. Therefore, we assume that inventory costs in the CDS market are driven by the variability of 'absolute' changes in CDS premia and not 'relative' (percentage) changes. Of course, reference entities with higher CDS premia experience on average larger 'absolute' changes in CDS premia, so inventory costs associated with these reference entities will be typically larger than inventory costs associated with reference entities with lower CDS premia.

The inventory cost component is also dependent on how quickly dealers can close their open positions, which is typically done by finding a counterparty prepared to enter into a reverse trade in the same reference entity. On average, it is reasonable to assume that a dealer can close a position more quickly if there is more trading in a given reference entity and when outstanding notional of CDS contracts on a given reference entity is larger. While dealers in the CDS market do not need to carry a positive inventory to be able to trade as it is a synthetic market, the ability to trade a contract is important after a dealer makes a trade and has a non-zero position.

3.2. Adverse selection costs

The 'asymmetric information' models of the bid-ask spreads developed in the context of the equity markets assume that dealers trade either with liquidity traders or with informed traders, but cannot differentiate the type of the counterparty for individual trades. Dealers must therefore set bid-ask spreads sufficiently large to be compensated for expected losses incurred from trading against informed parties with an information advantage. Bid-ask spreads thus depend on the perceived risk of trading against informed parties and will be wider whenever dealers believe that the share of informed traders is larger. This follows from theoretical models of the bid-ask spread developed by Kyle (1985), Glosten and Milgrom (1985) and Easley and O'Hara (1987) among others (see Acker et al., 2002, for further discussion).

The aforementioned models also apply to the case of the CDS market. Trading against informed parties might be an even larger concern to dealers in the CDS market than in the equity markets because the major buy-side clients in the CDS market are hedge funds followed by asset managers (as discussed in Section 2). They are among the most sophisticated types of investors. In particular, hedge funds have relatively unconstrained risk capital and may thus take advantage of any perceived mispricing of CDS contracts. Such perceived mispricing may be due to hedge funds having superior private information or better ability to process public information and predict future price changes. There are also hedge funds dedicated to capital structure arbitrage, which is exploiting relative mispricing between equity and debt; see Yu (2005) for an analysis of capital structure arbitrage. However, the market maker's side of the trades is dominated by G-14 dealers, which is a group of the most sophisticated and largest banks active in the CDS market. This group is likely to possess private information as well due to their role as lenders to companies (Acharya and Johnson, 2007). Moreover, dealers can observe transaction demand and make inference about likely price changes. Since the CDS market is a synthetic market, dealers do not need to hold a positive inventory, but can take an aggregate short or long position in a given reference entity.

A possible way to gain insight into the relevance of the adverse selection component in the CDS market is to analyze whether companies more prone to insider trading exhibit larger bid-ask spreads. Following Batta et al. (2012) and others we assume that companies that have relatively higher exposure to the company-specific idiosyncratic risk are more prone to insider trading than companies more exposed to the common (systematic) risk. We thus analyze the influence of the CDS market beta. That is because higher CDS market beta after controlling for total variability of CDS premia implies that a company has larger systematic risk and lower idiosyncratic risk.

The existing literature on insider trading in the CDS market by Acharya and Johnson (2007) and Qiu and Yu (2012) focuses on examining time-variation of price discovery in the CDS market relative to the equity markets with the presumption that greater price discovery in the CDS market prior to large price changes is a result of insider trading done by dealers. The link between insider trading by dealers and price discovery is supported by demonstrating significant association between the speed of price discovery and various proxies for the prevalence of private information production and in particular the number of relationship banks acting as lenders to a given company. Qiu and Yu (2012) find evidence of higher liquidity (endogenous liquidity provision by dealers) before large price changes, which they argue is due to dealers' efforts to profit from their private information by taking the right side of the trades. However, Hilscher et al. (2013) use a different methodology and argue that equity returns predict CDS returns and not the other way around even when conditioning on large future CDS premia changes, thus questioning the findings of Acharya and Johnson (2007) and Qiu and Yu (2012).

The recent study by Chen et al. (2011) discussed in Section 2 reveals that the buy-side clients consist mostly of hedge funds and asset managers, so they would likely recognize if they were consistently incurring losses due to informed trading by dealer banks. Increased price discovery in the CDS markets before large negative CDS price changes might be to some extent a result of informed trading undertaken by the buy-side clients whose one-sided demand at such times would quickly lead to quote revisions by dealers. It might also be that both dealers and buy-side clients are well informed, but neither of the parties have substantial relative information advantage. In such a case, price discovery in the CDS market preceding large CDS price changes could be greater compared to the equity market because in the equity market there is a larger share of uninformed traders, while the CDS market is exclusive to professional investors. A possible reason why the CDS price discovery tends to lag behind equity prices at other times is inattention of CDS market participants during periods when CDS prices are stable as suggested by Hilscher et al. (2013).

Since the issue of insider trading is a point of disagreement in the CDS literature, we examine the behavior of CDS bid-ask spreads in the periods preceding earnings announcements. Focusing on earnings announcements is preferable to large price changes because an event defined based on the latter is forward-looking and thus not consistent with standard regression assumptions as pointed out by Hilscher et al. (2013). While in our analysis we cannot differentiate between trades driven by information and trades driven by hedging demand or other reasons, following the equity literature we expect bid-ask spreads to reflect the likelihood and severity of possible insider trading, which are arguably strongest ahead of information releases (similar assumption is made by Batta et al., 2012).

We argue that widening of bid-ask spreads preceding earnings announcements would be evidence that trading against informed parties is an important concern to dealers. If bid-ask spreads stay the same, then neither dealers nor the buy-side have superior information or such information is not exploitable due to trading costs or other reasons. It could be a manifestation of limited competition in the CDS market whereby bid-ask spreads are set wide enough at all times, so that typical bid-ask spreads are sufficient to compensate dealers even during information-pertinent periods. Another possibility is that dealers try to hedge and share information amongst each other and thus indirectly observe transaction demand from their clients and promptly revise CDS prices to reflect current information. Finally, a reduction of bid-ask spreads would be an indication of endogenous provision of liquidity consistent with Qiu and Yu (2012). However, it would still not substantiate that dealers take advantage of their private information at the expense of their clients because dealers quote both bids and asks and it is up to the clients to decide which way they want to trade. If adverse selection is a concern in the market, then dealers could not post reduced bid-ask spreads because on average their (sophisticated) buy-side clients would trade in the profitable direction. But a reduction of bid-ask spreads is consistent with neither party having informational advantage and with the presumption that CDS prices accurately reflect the available information. A reduction in bid-ask spreads could then be a result of possibly increased trading volume preceding earnings announcements.

3.3. Market-wide factors

Equity and bond literature suggest that liquidity exhibits commonality (Chordia et al. 2000; Huberman and Halka 2001; Hasbrouck and Seppi 2001; Korajczyk and Sadka 2008), which might be partly a result of overall market volatility and funding costs of dealers as suggested by Pedersen (2009). We thus analyze whether CDS bid-ask spreads are influenced by the VIX index.[6] Incorporating a measure of market implied-volatility might be important due to heightened inventory risks of dealers during periods of large market volatility. It will also be indicative of whether the CDS market exhibits liquidity disruptions in more volatile periods. We expect the VIX index to be positively related to CDS bid-ask spreads.

[6] According to CBOE (2009), "VIX measures 30-day expected volatility of the S&P 500 Index. The components of VIX are near- and next-term put and call options, usually in the first and second SPX (S&P 500 index) contract months. 'Near-term' options must have at least one week to expiration; a requirement intended to minimize pricing anomalies that might occur close to expiration. When the near-term options have less than a week to expiration, VIX 'rolls' to the second and third SPX contract months. For example, on the second Friday in June, VIX would be calculated using SPX options expiring in June and July. On the following Monday, July would replace June as the 'near-term' and August would replace July as the 'next-term'." The precise formula for the VIX index is given in CBOE (2009).

We also investigate if bid-ask spreads are related to interest rates that determine funding costs of dealers. As possible variables, we consider Libor-OIS spread (i.e. difference between 3 month Libor and overnight Libor), TED spread (i.e. difference between 3 month Treasury and 3 month Libor) and St. Louis Fed Financial Stress Index.[7] These rates are known to be highly associated with financial distress of the economy. We expect CDS bid-ask spreads to be positively related to the aforementioned rates as they increase dealers' costs.

3.4. Competition between dealers

The entry and exit of market makers is relatively unconstrained in the CDS market. The decision to enter or exit depends on the profitability and risks of market making in a given reference entity. A dealer might be wary to enter the market for a reference entity for various reasons, among others, perceived insufficient expertise in a given sector or company as well as inability to properly address adverse selection concerns. The level of competition between dealers can be proxied, for example, by the number of active dealers in a given reference entity. Bid-ask spreads on CDSs of reference entities with fewer dealers are expected to be larger. Another possibility is to use the number of quotes provided by dealers. Such relationship has been documented in the equity literature (Wahal 1997; Weston 2000; Klock and McCormick 1999).

4. Data

Having identified possible determinants of CDS bid-ask spreads, we discuss our data sources. We choose reference entities and sample period to ensure continuous series of data from a number of data sources described below. We exclude banking institutions because CDSs on banks play a special role in the financial system and they are extensively used to hedge counterparty exposure. We aim to have a relatively balanced panel, so we only select firms that have very few missing daily observations. We consider to have a missing observation for a given firm and date when any

[7] The Financial Stress Index "measures the degree of financial stress in the markets and it is constructed from 18 weekly data series: seven interest rate series, six yield spreads and five other indicators. Each of these variables captures some aspect of financial stress. (...) The average value of this index is designed to be zero. (...) Values below zero suggest below-average financial market stress, while values above zero suggest above-average financial market stress." (see http://research.stlouisfed.org/fred2/series/STLFSI/).

of the variables considered is missing. We allow for a maximum of a 3 working day gap between two consecutive observations for any firm, but these gaps occur very rarely and are thus negligible. After matching different datasets, the final sample consists of 237 corporate entities and covers the period from 2010-07-16 to 2012-11-16. The panel dataset contains 134,642 observations that are uniquely identified by the pair of reference entity name and date.

4.1. CDS bid-ask spreads

CDS bid-ask spreads are obtained from Liquidity Reports produced by Markit, the leading industry source for credit default swap data. Liquidity Reports contain the daily average of CDS bid-ask spreads for single-name corporate entities received by the buy-side clients. The data corresponds to the five-year maturity contracts on senior unsecured debt, which are the most liquid contracts. Markit extracts this data from the so-called dealer-runs, which are electronic messages sent by dealers to buy-side clients. The bid-ask spread is then converted by Markit into the running spread convention according to the standard ISDA model for conversion between upfront payments and running spreads.[8] This ensures comparability of bid-ask values regardless of quoting convention used. We only choose firms that have observed bid-ask spread sent by dealers and we exclude Markit's estimates of bid-ask spreads when the actual quotes are not available. Markit requires quotes from at least two dealers to report the actual average quote for a given reference entity on any given day. This means that our analysis focuses on the more liquid names, which limits our sample size, but ensures that we include only tradeable CDS bid-ask quotes. Markit Liquidity Reports cover CDS contracts in the most liquid variant of restructuring clause and currency denomination. For US companies this is typically the 'no restructuring' clause and USD currency, while for European companies the standard is 'modified-modified' restructuring and EUR currency.

[8]The CDS price can be quoted as a combination of an upfront payment and a quarterly coupon. Since different coupons can be used for various CDSs or even for CDS contracts on the same reference entity, the comparison of CDS pricing is done by converting the upfront payment into equivalent future coupon payments. This is done by finding the level of coupon that has the same present value as the upfront payment when discounted by the risk-neutral default survival curve. The details of the procedure are explained in ISDA (2012).

4.2. CDS premia

Daily credit default swaps premia are also obtained from Markit. We select the same contract specifications in terms of maturity, seniority, restructuring and currency as for the bid-ask spread data to ensure comparability. Markit collects CDS valuations from a number of contributing banks and then processes the data to remove inconsistent data, outliers and stale prices. The data is converted into the running spread pricing convention.

4.3. Dealer activity measures

Markit Liquidity Reports provide several variables measuring activity of CDS dealers. This data is produced at daily frequency. It includes the total number of unique quotes sent by dealers, the number of distinct dealers posting quotes and the number of financial institutions making submissions to Markit's end-of-day pricing service.

4.4. CDS notionals outstanding and transaction volume

We collect weekly data on CDS notionals outstanding and risk transfer activities from The Depository Trust & Clearing Corporation (DTCC). DTCC operates the Trade Information Warehouse that collects data from all major CDS dealers and covers almost the entire market. DTCC releases weekly data reports covering 1,000 companies with the highest notional outstanding in any given week. The data is publicly available on the DTCC's website. We take the net outstanding notionals for single-name corporates (Table 6 of DTCC data). We also take the volume of weekly risk transfer transactions (Table IVa of DTCC data). The risk transfer activity captures mostly new CDS trades and CDS terminations, while it excludes transactions not resulting in risk transfer such as those related to trade compressions.

4.5. Earnings announcements

We take earnings announcement dates from Compustat.

4.6. Interest rate and the VIX index

We take the 3-month Libor rate, OIS rate (overnight indexed swap), 3-month constant maturity Treasury rate, St. Louis Fed Financial Stress Index and VIX index all from the Federal Reserve Economic Database (FRED) of the Federal Reserve Bank of St. Louis.

4.7. Summary statistics

The summary statistics for the data are reported in Table 1. We can see that the average bid-ask spread (‘*ba_spread*’) in the sample is 10.71 bps, while the average CDS premia level (‘*CDS_level*’) is 158 bps. The average CDS net notional outstanding (‘*cds_notional*’) is $965 million, while the average weekly trade volume of risk transfer transactions (‘*cds_trade_volume_1m*’) is $112.58 million. The average *‘ted_spread’* is 0.29%, the average *‘libor_minus_ois’* is 0.20%, while the average *‘vix’* index is 21.28%. The FED’s *‘stress_index’* is on average negative and equal to -0.14 indicating that the analyzed sample period was characterized by below-median financial market stress, but the 75th percentile of *‘stress_index’* equals 0.11, which corresponds to above-median financial stress. The average number of dealers posting quotes for a given reference entity (*‘nr_dealers’*) is 8.43 and all dealers together provide an average of 49.27 unique quotes per reference entity per day (*‘nr_quotes’*). Finally, the average daily number of financial institutions making submissions to Markit’s valuation service (*‘nr_pricing_submissions’*) is 5.71.

5. Empirical analysis

In the empirical analysis, we use pooled panel regressions based on daily data to investigate the determinants of CDS bid-ask spreads. Since the data has cross-sectional and time dimensions, we apply econometric techniques discussed by Petersen (2009) and Thompson (2011) to compute robust standard errors with clustering both by reference entities and by dates. In the benchmark specifications, we perform regressions without firm fixed effects and time fixed effects. While it lowers the achievable goodness of fit, we find that even in this restrictive panel specification we can explain most of the variation in CDS bid-ask spreads.

Our approach is similar to several empirical papers analyzing equity bid-ask spreads and earnings announcements that directly regress bid-ask spreads on proxies associated with different components of the bid-ask spreads, for example, Venkatesh and Chiang (1986) and Chung and Charoenwong (1998). Venkatesh and Chiang (1986) examine under what conditions market makers in equity markets widen bid-ask spreads preceding earnings and dividend announcements, while Chung and Charoenwong (1998) show that bid-ask spreads are higher for stocks with greater tendency for insider trading.

In the empirical analysis discussed below, we add in stages explanatory variables categorized by whether they are associated with inventory costs, dealer funding costs, market-wide conditions etc. This allows us to gauge the explanatory power of different variables with respect to CDS bid-ask spreads. Such an approach is particularly convenient for our analysis because we consider a large number of possible explanatory variables. At each stage we therefore look at the significance of the variables and drop the insignificant ones before moving to the next category of variables. We start by investigating the influence of explanatory variables associated with dealer inventory costs.

5.1. Dealer inventory costs

Dealer inventory costs are dependent on the likelihood and magnitude of possible changes in the values of CDS contracts, so a measure of their variability is considered. As motivated in Section 3, possible losses incurred by dealers on holding a CDS position depend on the variability of changes in CDS premia levels. We therefore introduce variable *'cds_variability_3m'*, which is defined as the square root of the mean of squared past daily changes in CDS premia based on a 3-month trailing window. The limitation of this measure is that it is backward looking and might not be sufficient in a quickly changing market environment. Therefore, we also consider an analogous variable computed over a trailing window of 2 weeks, i.e. *'cds_variability_2w'*. Since larger variability of CDS premia changes is expected to be positively related to CDS bid-ask spreads, the coefficients on the aforementioned variables should be positive.

We also posit that dealer inventory risks depend on how quickly they can exit a position, which is expected to be related to the size of the market (i.e. notional of CDSs outstanding) as well as trading volume. We thus consider the logarithm of the net notional outstanding of CDS contracts per reference entity, i.e. *'cds_notional'*. We make a slight approximation since only the end-of-week CDS notional is available from DTCC, so we assume that it is the same for each day of the week. We also construct the variable *'cds_trade_vol_3m'* that is defined as the trailing 3-month window of the logarithm of the volume of CDS trades constituting risk transfer activity and an analogous variable based on a 1 month window (CDS trade data is available at weekly frequency, so it is assumed to be constant throughout each week). We expect larger CDS notional outstanding and higher volume of trades to be associated with lower bid-ask spreads.

The results of regressing CDS bid-ask spreads on the variables described above are presented in Table 2. In column (1), we see that the estimated coefficient on *'cds_variability_3m'* is significant at the 1% level and positive as expected.[9] Moreover, this single variable capturing the 3-month variability of CDS premia changes explains almost 75.5% of the total variation in CDS bid-ask spreads. The results in column (2) demonstrate that the 2-week variability of CDS premia is also significant with positive coefficient as expected although its additional explanatory power is rather small. It takes over some explanatory power from the 3-month variable and is thus dropped in further regressions. In the next step, in column (3) we include the logarithm of the net notional outstanding and we find that the estimated coefficient is significant and negative as expected, while the R-squared increases to 77.90%. The results reported in column (4) show that the 3-month volume of risk-transfer transactions has a negative and significant impact on bid-ask spreads as expected. Adding both the 3-month and 1-month trading volume in column (5) results in insignificant coefficient on the latter variable and therefore it is dropped in further regressions.

Altogether, the variables related to the inventory cost component in our baseline specification of column (4) explain nearly 80% of the total variation in CDS bid-ask spreads despite the inherent differences between the risk and return profiles of the underlying reference entities that belong

[9]Whenever discussing significance, we assume the 1% significance level unless stated otherwise.

to different industries, have different corporate structures, leverage levels, countries of operations etc. This is a strong result, which indicates that CDS bid-ask spreads are driven by fundamentals related to the costs of market making. These results can also be interpreted as a sign that the dealer structure of the CDS market is rather competitive and efficient.

5.2. Dealer funding costs and market-wide conditions.

Dealer funding costs are captured by the *'ted_spread'* and the *'libor_minus_ois'* rates. The latter measure has become particularly relevant since the financial crisis when concerns about the counterparty risks increased. Both the *'ted_spread'* and *'libor_minus_ois'* are expressed in percentage points. In line with theoretical predictions, the results reported in columns (2)-(3) of Table 3 show that CDS bid-ask spreads are positively related to both the *'ted_spread'* and the *'libor_minus_ois'* rates. The estimated coefficients on these rates are significant with *'libor_minus_ois'* being significant at the 1% level. Due to the high correlation between the two rates of around 97%, in further regressions we only include *'libor_minus_ois'*. Adding *'libor_minus_ois'* to the set of explanatory variables results in an increase of the R-squared by only 0.10% compared to the previous benchmark reported in column (1), but in unreported results we find that by itself this variables explains 2.66% of variation in bid-ask spreads.

In columns (4)-(5), we analyze how CDS bid-ask spreads are related to market-wide conditions and for this purpose we consider two variables. First, we use the *'vix_index'*, which measures the implied volatility of S&P 500 options. Second, variable *'stress_index'* is the St. Louis Fed Financial Stress Index, which is provided at weekly frequency. We find that the estimated coefficients on both the *'vix_index'* and *'stress_index'* are insignificant.

We have found that interest rates capturing dealer fundings costs (*'ted_spread'* and *'libor_minus_ois'*) have a positive and significant relation to CDS bid-ask spreads. Importantly, the limited quantitative impact of these variables indicates that liquidity of CDS contracts is not much affected by changes in dealer funding costs or more broadly the perception of funding risk in the market. Moreover, our finding that the *'vix_index'* as well as *'stress_index'* are insignificant further confirms that the CDS market operates robustly and remains liquid even under increased volatility or market stress.

5.3. Systematic risk and competition between dealers.

In Table 4 we start by investigating whether bid-ask spreads on CDSs are influenced by the systematic risk of CDS contracts as captured by the CDS market beta (*'beta_cds_market'*), which is obtained as a beta from regressing individual CDS returns on the CDS market return. The results reported in column (2) demonstrate that reference entities with higher CDS market beta have significantly lower bid-ask spreads as expected. Since we control for past CDS premia variability, higher beta (systematic risk) implies lower idiosyncratic risk, which is associated with lower adverse selection. The argument that companies with lower idiosyncratic risk are on average less prone to adverse selection is frequently made in the equity literature. Variable *'beta_cds_market'* adds slightly above 1% to the explained variation in CDS bid-ask spreads compared to the previous benchmark reported in column (1). This result means that companies more prone to insider trading have higher bid-ask spreads, which is consistent with theoretical predictions.

In the remaining columns of Table 4, we investigate the impact of competition between dealers. We define the variable *'nr_dealers'* as the number of dealers posting quotes, *'nr_quotes'* as the number of unique quotes sent by dealers to their clients on a given day, and finally *'nr_pricing_subm'* as the number of institutions making submissions to Markit's end-of-day pricing service. We also define the variable *'cds_notional_per_dealer'* as the logarithm of the net notional outstanding of CDS contracts per dealer and *'cds_trade_vol_per_dealer_3m'* as the average of the logarithm of the volume of trades reflecting risk transfer activity per dealer calculated based on a 3-month trailing window.

In column (3) we document that CDS bid-ask spreads are significantly decreasing in the number of dealers making a market in a given reference entity (i.e. *'nr_dealers'*) confirming the hypothesis that competition between dealers improves CDS liquidity. An additional dealer corresponds to a reduction of bid-ask spreads by 0.20 bps, while the average CDS bid-ask spread is 10.71 bps and the average number of dealers is 8.43 with a standard deviation of 2.33. This means that the impact of dealer competition is economically significant. In column (4), we can see that the estimated coefficient on *'nr_quotes'* is also negative and significant. However, this proxy is less suitable for explaining bid-ask spreads because the number of dealer quotes can vary substantially between consecutive days for most of the reference entities. Surprisingly, in column (5) we can see that the estimated coefficient on *'nr_pricing_subm'* is insignificant even at the 10% level. This proxy for liquidity is frequently used in the existing literature (e.g. Qiu and Yu, 2012), but as we can see it does not capture the same information about dealer competition as a more direct measure of the number of active dealers making a market (*'nr_dealers'*). In the last two columns of Table 4, we see that the estimated coefficients on *'cds_notional_per_dealer'* and *'cds_trade_vol_per_dealer_3m'* are both significant and positive as expected. Overall, our results imply that higher competition between dealers leads to lower bid-ask spreads. The R-squared increase from adding any of the aforementioned variables is minimal at around 0.1%. However, in unreported results we find that, for example, variable *'nr_dealers'* by itself explains approximately 2.5% of the total variation in CDS bid-ask spreads. In further regressions, we keep the specification in column (3) with variable *'nr_dealers'* as the benchmark since the estimated coefficient on *'nr_dealers'* has the highest t-statistic.

5.4. Adverse selection costs preceding earnings announcements

In the previous subsection, we have shown that companies with higher idiosyncratic risk and thus more prone to insider trading have larger CDS bid-ask spreads. Another way to investigate the adverse selection component of bid-ask spreads is to look at its time variation. As motivated in Section 3, we investigate whether CDS bid-ask spreads widen during periods of increased (private) information production such as preceding earnings announcements. For this purpose, we add several dummies to the set of explanatory variables. We define the dummy *'pre_earn_5days'* to be equal to one for a period of 5 days prior to earnings announcements and we also define analogues dummies based on windows of 1, 2, 3, 10 days as well as 8 to 3 days prior to announcements. The latter specification is motivated by some evidence in the equity literature that uncertainty about earnings announcements sometimes resolves prior to announcement dates. In this analysis, we include firm fixed effects because it ensures that for each reference entity the fitted CDS bid-ask spreads are on average closer to the actual bid-ask spreads. This is motivated by the focus on analyzing the effect of dummies indicating the pre-announcement periods.

The results presented in column (1) of Table 5 demonstrate that adding firm fixed effects increases the explained variation to as much as 86% compared to 81.2% in the previous benchmark in column (3) of Table 4. In columns (2)-(7) of Table 5, we see that the dummies indicating pre-announcement periods are insignificant and if anything the corresponding estimated coefficients are negative, which implies that dealers certainly do not widen CDS bid-ask spreads in anticipation of earnings announcements. This indicates that the risk of trading against informed parties does not appear to be a major concern to dealers as explained in Section 3.2.

In the next stage, we refine our methodology to consider only earnings announcements that turn out to be surprises, which we define on the basis of whether subsequent changes in CDS premia are large in days just following the announcements. To account for heterogeneity in the levels of CDS premia and bid-ask spreads between reference entities, we consider an earnings announcement on a given reference entity to be a surprise when the cumulative CDS change in the 5-day post-announcement period is larger than its pre-announcement bid-ask spread. That is motivated by the perspective of dealers that in such cases incur losses from carrying inventory in excess of their compensation for market making if they are on the losing side of a trade. We separately consider negative earnings surprises (i.e. CDS premia increases) and positive earnings surprises (i.e. CDS premia decreases), which might play a role if dealers have an aggregate short-position in the CDS market as suggested by Chen et al. (2011).[10]

We start by illustrating in Figure 1 the behavior of average bid-ask spreads in the 45 day window around earnings announcements. For reference, Panel A shows the average CDS bid-ask

[10] The fact that dealers have an aggregate short-position can be observed from the CDS statistics produced by DTCC summarizing total single-name CDS positions split by dealers versus non-dealers (see Section 1 of the DTCC's CDS data available on its website).

spread based on all earnings announcements. Panel B presents the case of negative earnings surprises, while Panel C shows the case of positive earnings surprises. To ensure that our results are not driven by firms with large CDS bid-ask spreads, we rescale the bid-ask spreads around each earning announcement day by the value of the bid-ask spread on the corresponding announcement day. The values plotted in the graphs are obtained by calculating averages of bid-ask spreads across all firms and all earnings announcements.

In Panel A, we can see that bid-ask spreads are fairly constant before the earnings announcement days with a slight drop on the announcement days. Following the announcement days, the average bid-ask spread starts increasing slightly. In Panel B we can clearly observe that dealers do not widen bid-ask spreads prior to negative earnings surprises. However, following the negative earnings surprise, bid-asks start increasing substantially. After 5 days, the average bid-ask spread is around 40% larger than prior to the announcement. In Panel C, we demonstrate that for positive earnings surprises, the average bid-ask spread is fairly constant in the weeks preceding the earnings announcements. Subsequently, after the announcements days, the bid-ask spreads exhibit a minute downward trend for about 10 days. Altogether, we do not find evidence of any widening of bid-ask spreads before earnings announcements in any of the three cases discussed above.

For the purpose of the regression analysis, we define dummies ‘pre_earn_5day_neg_surpr’ and ‘pre_earn_5day_pos_surpr’ to take a value of one for a period of 5 days prior to, respectively, negative and positive earnings announcement surprises. Analogous variables are defined for several different pre-announcement windows. Table 6 reports the regression results with the dummies corresponding to negative earnings surprises (i.e. CDS premia increases). We can see that all dummy coefficients are negative and significant, which implies that dealers lower bid-ask spreads prior to negative earnings surprises. The estimated dummy coefficients imply that bid-ask spreads are on average lower by around 2 bps. These results are obtained after controlling for the other determinants of bid-ask spreads identified in this paper, while in Table A1 we control only for CDS premia variability. That is done to verify whether the reduction of bid-ask spreads identified in Table 6 is possibly driven by an increase in trading volume or the number of dealers. In Table A1 we can see that it is not the case as the estimated coefficients on the dummies are significant and even a bit lower compared to Table 6.

In Table 7, we report the regression results with the dummies corresponding to positive earnings surprises and we can see that all dummy coefficients are insignificant. This implies that dealers do not adjust their bid-ask spreads prior to positive earnings surprises.

An argument can be raised that Table 6 and Table 7 investigate a forward looking event, i.e. future earnings surprise, which means that the standard assumptions of regression analysis are not met. Such approach is however used by Acharya and Johnson (2007) and Qiu and Yu (2012) and we include it for comparison to their studies. Both Acharya and Johnson (2007) and Qiu and Yu (2012) find greater price discovery in the CDS market prior to abrupt increases in CDS premia levels, but not prior to decreases in CDS premia levels. We find that CDS bid-ask spreads are lower prior to negative earnings surprises (i.e. CDS premia increase) and we also find that bid-ask spreads remain largely unchanged prior to positive earnings surprises. We thus find evidence that liquidity as captured by bid-ask spreads is higher before negative earnings surprises, which is consistent with Qiu and Yu (2012) who find evidence of endogenous liquidity provision by dealers before CDS premia increases. A possible explanation of our results is that prior to CDS premia increases the bid-ask spreads are lower because also lower is the level of CDS premia and thus its variability, which largely determines bid-ask spreads. However, if that was the reason why bid-ask spreads appear to be lower prior to negative earnings announcements, we would likewise expect bid-ask spreads to be wider prior to positive earnings surprises, which is not the case. In any case, our results in all specifications considered in this section demonstrate that liquidity as captured by CDS bid-ask spreads is not hindered by possible information asymmetry associated with scheduled earnings announcements.

While bid-ask spreads are only one dimension of liquidity, we illustrate the pattern of other measures of liquidity around earnings announcements. We consider the daily number of unique quotes provided by dealers, the number of dealers posting quotes and the number of financial institutions making end-of-day submissions to Markit's pricing service. These measures are highly associated with market depth of the CDS markets. Therefore, the figures discussed below will demonstrate that our results on bid-ask spreads showing that liquidity is not hindered prior to earnings announcements are not undermined by changes in other dimensions of liquidity.

In Figure 2, we present the average number of quotes per reference entity provided by dealers to their clients around earnings announcement days. In Panel A, we can observe that the intensity of quote provision is very fairly constant and characterized by a minimal downward trend with the only exception being the announcement day when the intensity of quote provision drops sharply from over 50 per day to around 25 per day and reverses the next day. It might be caused by a possible halt of trading for a time needed to process the information contained in the quarterly earnings releases. In Panel B, we present an analogous graph, but only based on earnings announcements that turn out to be negative surprises, while in Panel C we present the graph for positive earnings surprises. In both of these panels, we can see that the number of quotes provided by dealers does not decrease prior to earnings announcements, while it increases on the announcement days. Comparing the absolute number of quotes plotted in the three figures, we can observe that on average the number of quotes is the highest around positive earnings announcements (around 65), followed by the case of negative earnings announcements (around 60), and finally the lowest before regular earnings announcements (around 55). Overall, all panels of Figure 2 present no evidence of major changes in the intensity of quote provision by dealers prior to earnings announcements days. This suggests that market depth and liquidity of CDS markets is largely unchanged during periods of heightened information asymmetry preceding earnings announcements.

In Figure 3, we depict the behavior of the average number of dealers per reference entity around earnings announcement days. We can see that the number of dealers does not exhibit a clear pattern in any of the three panels corresponding to, respectively, all earnings announcements (Panel A), negative earnings surprises (Panel B), and positive earnings surprises (Panel C). The number of dealers oscillates around 9 in all three cases and in Panels A and C we can see that it increases slightly on the announcement days. We can draw a conclusion that the number of dealers does not change substantially before earnings announcements. Finally, in Figure 4 we present analogues graphs depicting the average number of financial institutions making submissions to Markit's end-of- day pricing service per reference entity. This measure is frequently used in the existing literature (among others Qiu and Yu 2012; Batta et al. 2012) as a proxy for liquidity and CDS market depth. Compared to the previous figure showing the number of active dealers, we can see in Figure 4 that the number of institutions submitting valuations is much more constant and likely less informative about time-variation of liquidity. Overall, the graphs presented in Figures 2, 3 and 4 further demonstrate that liquidity and market depth of the CDS markets is not hindered by information asymmetry associated with earnings announcements.

6. Conclusions

In this paper, we examine the determinants of bid-ask spreads on credit default swaps using a set of explanatory variables associated with the costs of market making. While extensive literature examines the determinants of bid-ask spreads in the equity markets, this paper extends the sparse literature on the costs of trading in over-the-counter credit markets. The credit default swap market is particularly suitable for such analysis because it is more standardized compared to the corporate bond market, which allows us to observe daily bid-ask spread data on CDSs as well as some measures of trading volume and dealer competition.

We find that variables associated with dealer inventory costs explain as much as 80% of variation in CDS bid-ask spreads. In particular, a single variable capturing variability of CDS premia changes explains over 75% of variation, while variables measuring CDS trade volume and notional outstanding are also highly significant and explain additional 5% of the bid-ask variation. Next, we find that variables capturing funding risk such as the TED spread and the 'Libor minus OIS' rate are significant and positively related to CDS bid-ask spreads, but quantitatively their impact is very limited. This suggests that funding risk does not disrupt CDS market liquidity. Moreover, we find that the VIX index and the FED's Financial Stress Index have no significant impact on CDS bid-ask spreads, which further demonstrates orderly functioning of the CDS market during periods of increased stress. Of course this goes as far as the market has experienced funding stress and increased volatility during our sample period from July 2010 to November 2012. We also find that dealer competition as proxied by the number of dealers significantly influences CDS bid-ask spreads. As expected we find that greater competition reduces bid-ask spreads. Finally, we show that CDS market beta has a negative and significant influence on bid-ask spreads suggesting that companies more prone to insider trading have higher bid-ask spreads. Overall, our set of explanatory variables explains more than 81% of variation in bid-ask spreads, which we consider a very good result given the restrictive panel specification without firm fixed effects and time fixed effects.

To further investigate the extent to which averse selection is a concern to dealers, we examine the behavior of bid-ask spreads preceding earnings announcements when information asymmetry is expected to be much larger than on average. We do not find any evidence that dealers widen CDS bid-ask spreads prior to earnings announcements suggesting that dealers are not more concerned about trading against informed parties during these periods. We analyze the behavior of bid-ask spreads prior to earnings surprises and we find that bid-ask spreads are lower prior to negative earnings surprises and unchanged prior to positive earnings surprises. We also look at the time-pattern of other measures of liquidity reflecting market depth around earnings announcements and do not uncover any indication that liquidity is lower prior to earnings announcements. Altogether, our result that dealers do not widen bid-ask spreads prior to earnings announcements is surprising given that the buy-side clients are mostly sophisticated institutions such as hedge funds and asset managers. A possible explanation of these results is that neither dealers nor the buy-side clients have significantly superior information or that any information advantage of the buy-side clients is not exploitable due to trading costs.

To summarize, our results demonstrate that most of the variation in CDS bid-ask spreads can be explained by variables related to the costs of market making. We also find that liquidity of CDS contracts is not significantly hindered by increased market volatility or funding costs as well as by information asymmetry associated with earnings announcements. The CDS market appears to be robust and functioning orderly, which gives a positive view of the current market structure.

Our results have implications for the planned reform of the CDS regulation, in particular plans for introducing trade reporting in the CDS market. Since the bid-ask spreads appear to be well-explained by fundamentals and given that liquidity is not hindered during periods associated with above-average information asymmetry, the regulators should carefully consider whether greater transparency associated with trade-reporting will not hurt liquidity. If trade-reporting will stimulate greater information production by some parties, then adverse selection might increase and CDS liquidity might decrease according to the theoretical results of Dang et al. (2012) who find that the lack of information production (symmetric ignorance) is more beneficial to liquidity provision than even the case of full information disclosure (perfect information).

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Tables

Table 1: Summary statistics.

This tables presents the summary statistics of the data. The statistics are computed across all companies and all dates pooled together. *'ba_spread'* is the bid-ask spread quote measured in basis points. *'cds_level'* is the CDS premia level expressed in percentage points. *'cds_notional'* is the net notional outstanding for each reference entity in millions of dollars. *'cds_trade_volume_1m'* is the volume of CDS trades per reference entity that constitute risk-transfer activity averaged over a 1-month trailing window and it is expressed in millions of dollars. *'ted_spread'*, *'libor_minus_ois'* are self-explanatory interest rates measured in percentage points, while *'vix'* is the implied volatility of S&P 500 options measured in percentages. *'stress_index'* is the St. Louis Fed Financial Stress Index having a value of zero on average with values below zero indicating below-average financial stress. *'no_dealers'* is the number of dealers making a market in a given reference entity, *'no_quotes'* is the number of unique quotes sent by dealers to their clients on a given day, *'no_pricing_subm'* is the number of institutions making submissions to Markit's end-of-day valuation service.

Variable	Mean	Std. Dev.	25th perc.	Median	75th perc.
	(1)	(2)	(3)	(4)	(5)
ba_spread	10.71	11.92	5.00	8.25	10.00
cds_level	1.58	1.89	0.63	1.00	1.68
cds_notional ($M)	964.98	567.72	521.72	854.10	1329.55
cds_trade_volume_1m ($M)	112.58	100.99	40.54	85.22	154.47
ted_spread	0.29	0.12	0.20	0.26	0.38
libor_minus_ois	0.20	0.11	0.10	0.18	0.31
vix	21.28	6.33	17.08	19.06	23.22
fear_index	-0.14	0.35	-0.39	-0.20	0.11
nr_dealers	8.43	2.33	7	9	10
nr_quotes	49.27	28.95	27	44	66
nr_pricing_subm	5.71	1.63	5	5	7

Table 2: Determinants of CDS bid-ask spreads related to dealer inventory costs.

This table reports the results of pooled panel regressions of CDS bid-ask spreads on variables associated with dealer inventory costs. The dependent variable is the CDS bid-ask spread measured in basis points. The independent variable *'cds_variability_3m'* is the square root of the mean of squared past changes in CDS premia based on a 3-month trailing window. Analogous variable *'cds_variability_2w'* is computed over a 2-week window. *'cds_notional'* is the logarithm of the net notional outstanding of CDS contracts per each reference entity. *'cds_trade_vol_3m'* is defined as the trailing 3-month window of the logarithm of the volume of CDS trades that constitute risk-transfer activity. Analogous variable *'cds_trade_vol_1w'* is computed over a 1-month window. Robust t-statistics adjusted with clustering both within reference-entities and dates are in parentheses. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	CDS bid-ask spread				
	(1)	(2)	(3)	(4)	(5)
cds_variability_3m	1.92***	1.66***	1.93***	2.02***	2.02***
	(11.69)	(9.63)	(11.79)	(10.88)	(10.88)
cds_variability_2w		0.30***			
		(6.79)			
cds_notional			-2.99***	-2.09***	-2.09***
			(-9.77)	(-4.08)	(-4.08)
cds_trade_vol_3m				-0.29**	-0.29**
				(-2.32)	(-2.29)
cds_trade_vol_1m					-0.00
					(-0.02)
constant	3.47***	3.46***	64.81***	51.17***	51.17***
	(6.86)	(6.89)	(10.25)	(5.51)	(5.51)
R-squared	0.755	0.761	0.779	0.798	0.798

Table 3: Determinants of CDS bid-ask spreads related to dealer funding costs and market-wide conditions.

This table reports the results of pooled panel regressions of CDS bid-ask spreads on a set of explanatory variables as in column (4) of Table 2, but with additional explanatory variables associated with dealer funding costs and market-wide conditions. The first three variables are as defined in Table 2. Variables *'ted_spread'*, *'libor_minus_ois'* and *'vix_index'* are self-explanatory. *'stress_index'* is the St. Louis Fed Financial Stress Index. Robust t-statistics adjusted with clustering both within reference-entities and dates are in parentheses. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	CDS bid-ask spread				
	(1)	(2)	(3)	(4)	(5)
cds_variability_3m	2.02***	2.01***	2.01***	2.02***	2.02***
	(10.88)	(10.58)	(10.57)	(10.84)	(10.77)
cds_notional	-2.09***	-2.13***	-2.16***	-2.09***	-2.09***
	(-4.08)	(-4.10)	(-4.15)	(-4.07)	(-4.10)
cds_trade_vol_3m	-0.29**	-0.27**	-0.25*	-0.29**	-0.29**
	(-2.32)	(-2.04)	(-1.89)	(-2.34)	(-2.36)
ted_spread		2.33*			
		(1.94)			
libor_minus_ois			3.45***		
			(3.12)		
vix				0.00	
				(0.18)	
fear_index					-0.03
					(-0.07)
constant	51.17***	50.94***	51.34***	51.05***	51.19***
	(5.51)	(5.53)	(5.53)	(5.48)	(5.53)
R-squared	0.798	0.799	0.799	0.798	0.798

Table 4: Determinants of CDS bid-ask spreads related to systematic risk and competition between dealers.

This table reports the results of pooled panel regressions of CDS bid-ask spreads on a set of explanatory variables as in column (3) of Table 3, but with additional explanatory variables associated with systematic risk and competition between dealers. The first four variables are as defined in the previous tables. Variable *'beta_cds_market'* is obtained as a beta from regressing individual CDS returns on the CDS market return. Variable *'no_dealers'* is the number of dealers making a market in a given reference entity, *'no_quotes'* is the number of unique quotes sent by dealers to their clients on a given day, *'no_pricing_subm'* is the number of institutions making submissions to Markit's end-of-day valuation service. Variable *'cds_notional_per_dealer'* is the logarithm of the net notional outstanding of CDS contracts per dealer and *'cds_trade_vol_per_dealer_3m'* is the average of the logarithm of trading volume reflecting risk transfer per dealer calculated based on a 3-month trailing window. Robust t-statistics adjusted with clustering both within reference-entities and dates are in parentheses. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	CDS bid-ask spread						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
cds_variability_3m	2.01***	2.08***	2.07***	2.08***	2.08***	2.07***	2.06***
	(10.57)	(11.09)	(10.93)	(11.16)	(11.11)	(10.93)	(10.67)
cds_notional	-2.16***	-1.73***	-1.54***	-1.66***	-1.81***	-2.95***	-1.49***
	(-4.15)	(-3.66)	(-3.44)	(-3.54)	(-3.82)	(-3.91)	(-3.58)
cds_trade_vol_3m	-0.25*	-0.03	-0.01	-0.02	-0.03	-0.00	-0.11
	(-1.89)	(-0.28)	(-0.05)	(-0.21)	(-0.30)	(-0.01)	(-1.06)
libor_minus_ois	3.45***	3.60***	2.72**	3.15***	2.64**	2.83***	2.83***
	(3.12)	(3.27)	(2.53)	(2.89)	(2.05)	(2.63)	(2.81)
beta_cds_market		-4.18***	-3.96***	-4.10***	-4.30***	-3.99***	-3.93***
		(-6.17)	(-5.73)	(-5.93)	(-6.34)	(-5.77)	(-5.42)
nr_dealers			-0.20***				
			(-3.00)				
nr_quotes				-0.01*			
				(-1.88)			
nr_pricing_submissions					0.16		
					(1.57)		
cds_notional_per_dealer						1.39***	
						(2.61)	
cds_trade_vol_per_dealer_3m							0.82*
							(1.83)
constant	51.34***	42.37***	39.66***	41.11***	43.48***	41.10***	36.92***
	(5.53)	(5.10)	(5.05)	(5.01)	(5.23)	(5.19)	(5.16)
R-squared	0.799	0.812	0.813	0.812	0.812	0.813	0.813

Table 5: CDS bid-ask spreads and pre-earnings announcement dummies.

In this table, we analyze the impact of pre-earnings announcement dummies on CDS bid-ask spreads. In the presented regressions, we control for the other determinants of CDS bid-ask spreads defined in the previous tables. Dummy variable *'pre_earn_10days'* indicates whether there is an earnings announcement day within the next 10 trading days. The other dummies are defined analogously. We also include firm-fixed effects. For comparison, in column (1) we report the previous benchmark results of column (3) in Table 4 with added firm-fixed effects, but without the dummies. In the remaining columns of the table, we analyze the impact of individual pre-earnings announcement dummies. Robust t-statistics adjusted with clustering both within reference-entities and dates are in parentheses. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	CDS bid-ask spread						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
cds_variability_3m	1.80***	1.80***	1.80***	1.80***	1.80***	1.80***	1.80***
	(7.20)	(7.20)	(7.20)	(7.20)	(7.20)	(7.20)	(7.20)
cds_notional	-2.76	-2.76	-2.76	-2.76	-2.76	-2.76	-2.76
	(-1.59)	(-1.59)	(-1.59)	(-1.59)	(-1.59)	(-1.59)	(-1.59)
cds_trade_vol_3m	-0.14**	-0.14**	-0.14**	-0.14**	-0.14**	-0.14**	-0.14**
	(-2.20)	(-2.20)	(-2.20)	(-2.20)	(-2.20)	(-2.20)	(-2.20)
libor_minus_ois	3.94***	3.93***	3.93***	3.94***	3.94***	3.94***	3.93***
	(2.59)	(2.59)	(2.59)	(2.59)	(2.59)	(2.59)	(2.59)
beta_cds_market	-2.53***	-2.53***	-2.53***	-2.53***	-2.53***	-2.53***	-2.53***
	(-4.27)	(-4.27)	(-4.27)	(-4.27)	(-4.27)	(-4.27)	(-4.27)
nr_dealers	-0.15***	-0.15***	-0.15***	-0.15***	-0.15***	-0.15***	-0.15***
	(-3.45)	(-3.42)	(-3.43)	(-3.44)	(-3.44)	(-3.45)	(-3.44)
pre_earn_10day		-0.08					
		(-1.06)					
pre_earn_5day			-0.08				
			(-0.88)				
pre_earn_3day				-0.07			
				(-0.69)			
pre_earn_2day					-0.05		
					(-0.58)		
pre_earn_1day						-0.08	
						(-0.92)	
pre_earn_8to3day							-0.05
							(-0.62)
constant	63.82*	63.91*	63.86*	63.84*	63.83*	63.83*	63.85*
	(1.94)	(1.94)	(1.94)	(1.94)	(1.94)	(1.94)	(1.94)
R-squared	0.861	0.861	0.861	0.861	0.861	0.861	0.861

Table 6: CDS bid-ask spreads and dummies indicating periods preceding negative earnings announcement surprises.

This tables shows the results of regressing CDS bid-ask spreads on the dummies indicating periods preceding negative earnings announcement surprises. We consider an earnings announcement to be a negative surprise when the cumulative CDS change in the 5-day post-announcement period is positive and of larger magnitude than the pre-announcement bid-ask spread. Dummy *'pre_earn_10day_neg_surpr'* indicates whether there is a negative surprise earnings announcement within the next 10 days. The other dummies are defined analogously. In the presented regressions, we control for the other determinants of CDS bid-ask spreads defined in the previous tables. We also include firm-fixed effects and in column (1) we report the previous benchmark results of column (3) in Table 4 with added firm-fixed effects for comparison. The remaining columns analyze the impact of the earnings announcement dummies. Robust t-statistics adjusted with clustering both within reference-entities and dates are in parentheses. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	CDS bid-ask spread					
	(1)	(2)	(3)	(4)	(5)	(6)
cds_variability_3m	1.80***	1.80***	1.80***	1.80***	1.80***	1.80***
	(7.20)	(7.21)	(7.21)	(7.21)	(7.21)	(7.20)
cds_notional	-2.76	-2.73	-2.74	-2.75	-2.75	-2.75
	(-1.59)	(-1.58)	(-1.59)	(-1.59)	(-1.59)	(-1.59)
cds_trade_vol_3m	-0.14**	-0.14**	-0.14**	-0.14**	-0.14**	-0.14**
	(-2.20)	(-2.19)	(-2.20)	(-2.20)	(-2.20)	(-2.20)
libor_minus_ois	3.94***	3.91**	3.92***	3.92***	3.93***	3.93***
	(2.59)	(2.57)	(2.58)	(2.58)	(2.59)	(2.59)
beta_cds_market	-2.53***	-2.55***	-2.54***	-2.54***	-2.54***	-2.53***
	(-4.27)	(-4.28)	(-4.28)	(-4.27)	(-4.27)	(-4.27)
nr_dealers	-0.15***	-0.15***	-0.15***	-0.15***	-0.15***	-0.15***
	(-3.45)	(-3.44)	(-3.44)	(-3.45)	(-3.45)	(-3.45)
pre_earn_10day_neg_surpr		-1.79***				
		(-3.49)				
pre_earn_5day_neg_surpr			-1.96***			
			(-3.45)			
pre_earn_3day_neg_surpr				-2.00***		
				(-3.28)		
pre_earn_2day_neg_surpr					-2.05***	
					(-3.35)	
pre_earn_1day_neg_surpr						-2.22***
						(-3.49)
constant	63.82*	63.36*	63.57*	63.65*	63.70*	63.76*
	(1.94)	(1.93)	(1.93)	(1.93)	(1.94)	(1.94)
R-squared	0.861	0.861	0.861	0.861	0.861	0.861

Table 7: CDS bid-ask spreads and dummies indicating periods preceding positive earnings announcement surprises.

This tables shows the results of regressing CDS bid-ask spreads on the dummies indicating periods preceding positive earnings announcement surprises. We consider an earnings announcement to be a positive surprise when the cumulative CDS change in the 5-day post-announcement period is negative and of larger magnitude than the pre-announcement bid-ask spread. Dummy *'pre_earn_10day_pos_surpr'* indicates whether there is a positive surprise earnings announcement within the next 10 days. The other dummies are defined analogously. In the presented regressions, we control for the other determinants of CDS bid-ask spreads defined in the previous tables. We also include firm-fixed effects and in column (1) we report the previous benchmark results of column (3) in Table 4 with added firm-fixed effects for comparison. The remaining columns analyze the impact of the earnings announcement dummies. Robust t-statistics adjusted with clustering both within reference-entities and dates are in parentheses. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	CDS bid-ask spread					
	(1)	(2)	(3)	(4)	(5)	(6)
cds_variability_3m	1.801***	1.801***	1.801***	1.801***	1.801***	1.801***
	(7.203)	(7.204)	(7.204)	(7.204)	(7.204)	(7.204)
cds_notional	-2.758	-2.754	-2.755	-2.756	-2.757	-2.757
	(-1.593)	(-1.589)	(-1.590)	(-1.591)	(-1.591)	(-1.592)
cds_trade_vol_3m	-0.139**	-0.139**	-0.139**	-0.139**	-0.139**	-0.139**
	(-2.202)	(-2.201)	(-2.200)	(-2.201)	(-2.201)	(-2.201)
libor_minus_ois	3.935***	3.935***	3.935***	3.936***	3.935***	3.935***
	(2.590)	(2.591)	(2.591)	(2.591)	(2.591)	(2.591)
beta_cds_market	-2.533***	-2.534***	-2.534***	-2.534***	-2.534***	-2.533***
	(-4.271)	(-4.271)	(-4.272)	(-4.271)	(-4.272)	(-4.271)
nr_dealers	-0.154***	-0.155***	-0.155***	-0.154***	-0.154***	-0.154***
	(-3.455)	(-3.459)	(-3.455)	(-3.453)	(-3.452)	(-3.453)
pre_earn_10day_pos_surpr		0.068				
		(0.890)				
pre_earn_5day_pos_surpr			0.104			
			(1.151)			
pre_earn_3day_pos_surpr				0.104		
				(1.012)		
pre_earn_2day_pos_surpr					0.125	
					(1.136)	
pre_earn_1day_pos_surpr						0.174
						(1.522)
constant	63.818*	63.730*	63.753*	63.782*	63.789*	63.80*
	(1.938)	(1.935)	(1.936)	(1.937)	(1.937)	(1.937)
R-squared	0.861	0.861	0.861	0.861	0.861	0.861

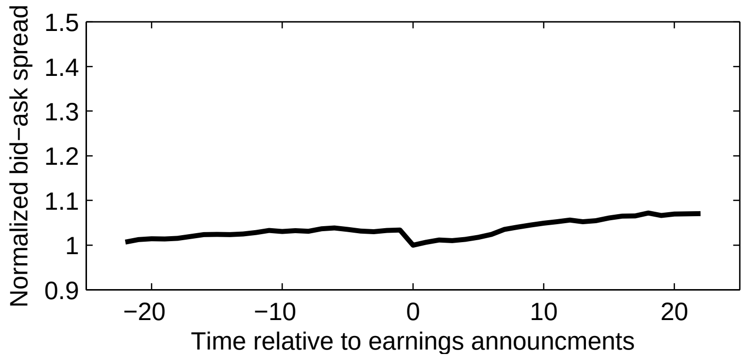
Appendix

Table A1: CDS bid-ask spreads and dummies indicating periods preceding negative earnings announcement surprises.

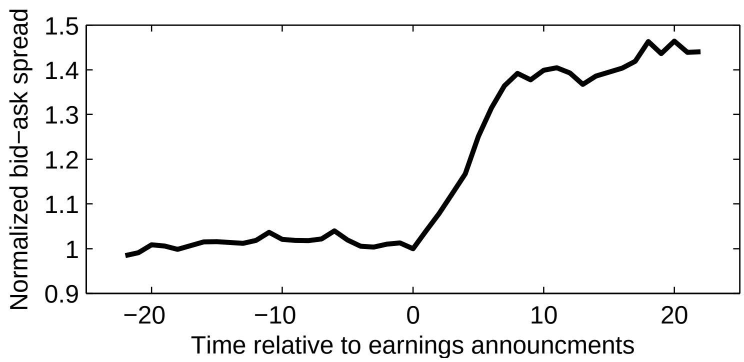
The table shows the results of regressing CDS bid-ask spreads on the dummies indicating periods preceding negative earnings announcement surprises. This tables replicates the results of Table 6, but without the previously used control variables except for *'cds_variability_3m'* and firm-fixed effects. An earnings announcement is considered to be a negative surprise when the cumulative CDS change in the 5-day post-announcement period is positive and of larger magnitude than the pre-announcement bid-ask spread. We also include firm-fixed effects and in column (1) we report the results with firm-fixed effects, but without the earnings announcement dummies. The remaining columns analyze the impact of the earnings announcement dummies. Dummy variable 'pre_earn_10day_neg_surpr' indicates whether there is a negative earnings announcement surprise within the next 10 trading days. The other dummies are defined analogously. Robust t-statistics adjusted with clustering both within reference-entities and dates are in parentheses. Significance at the 10%, 5%, and 1% levels is indicated by *, **, and ***, respectively.

	CDS bid-ask spread					
	(1)	(2)	(3)	(4)	(5)	(6)
cds_variability_3m	1.74***	1.74***	1.74***	1.74***	1.74***	1.74***
	(7.52)	(7.53)	(7.53)	(7.52)	(7.52)	(7.52)
pre_earn_10day_neg_surpr		-1.97***				
		(-4.17)				
pre_earn_5day_neg_surpr			-2.11***			
			(-3.97)			
pre_earn_3day_neg_surpr				-2.14***		
				(-3.72)		
pre_earn_2day_neg_surpr					-2.17***	
					(-3.78)	
pre_earn_1day_neg_surpr						-2.35***
						(-3.97)
constant	29.28***	29.39***	29.33***	29.31***	29.30***	29.29***
	(4.34)	(4.38)	(4.36)	(4.35)	(4.35)	(4.35)
R-squared	0.831	0.831	0.831	0.831	0.831	0.831

Panel A: All earnings announcements.



Panel B: Negative earnings announcement surprises.



Panel C: Positive earnings announcement surprises.

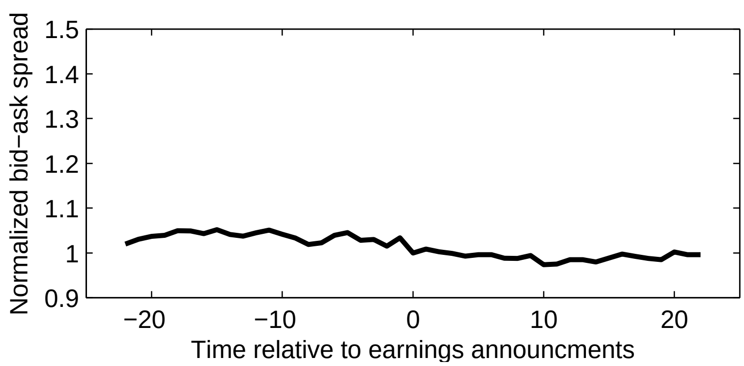
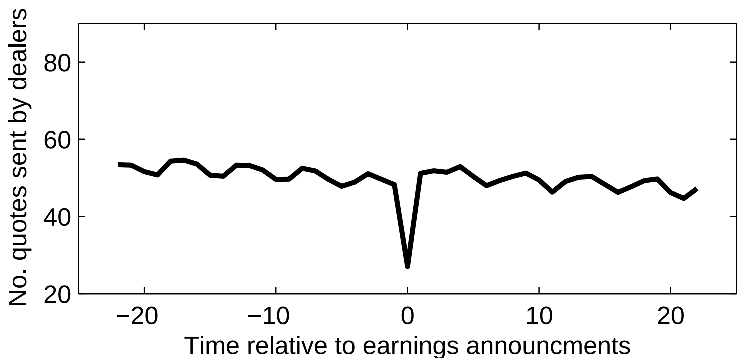
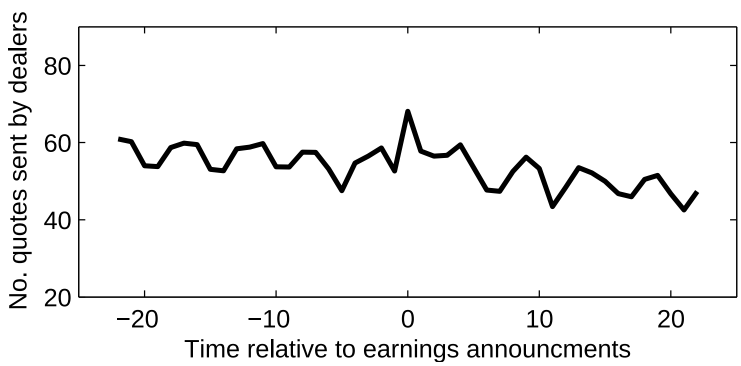


Figure 1: This figure depicts the average CDS bid-ask spread in the 45-day window around earnings announcements. The bid-ask spreads around each earnings announcement are first rescaled by the value of the bid-ask spread on the announcement day and then the average is calculated across all firms and earnings announcements. Panel A presents the average CDS bid-ask spread calculated based on all earnings announcements. Panel B presents the average CDS bid-ask spread for the negative earnings announcement surprises, while Panel C for the positive surprises. We consider an earnings announcement to be a surprise when the cumulative CDS change in the 5-day post-announcement period is larger than the pre-announcement bid-ask spread.

Panel A: All earnings announcements.



Panel B: Negative earnings announcement surprises.



Panel C: Positive earnings announcement surprises.

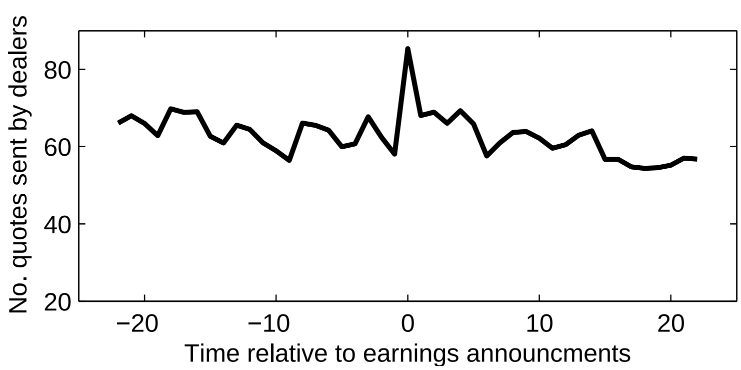
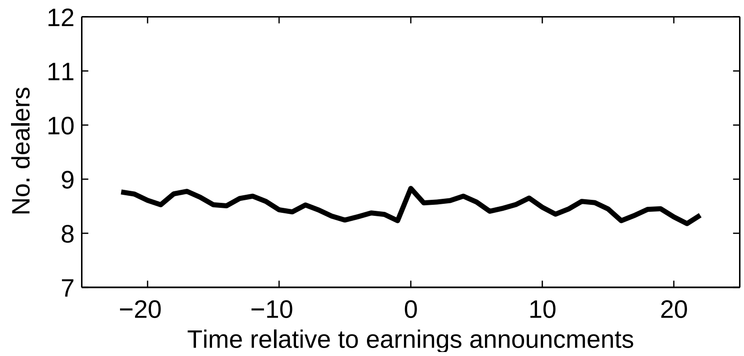
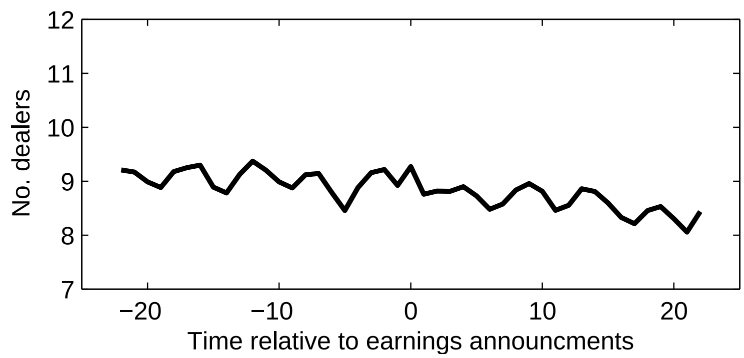


Figure 2: This figure depicts the average number of quotes per reference entity provided by dealers in the 45-day window around earnings announcements. The average number of quotes is calculated across all firms and earnings announcements. Panel A presents the average number of quotes calculated based on all earnings announcements. Panel B presents the average number of quotes provided around the negative earnings announcement surprises, while Panel C around the positive surprises. We consider an earnings announcement to be a surprise when the cumulative CDS change in the 5-day post-announcement period is larger than the pre-announcement bid-ask spread.

Panel A: All earnings announcements.



Panel B: Negative earnings announcement surprises.



Panel C: Positive earnings announcement surprises.

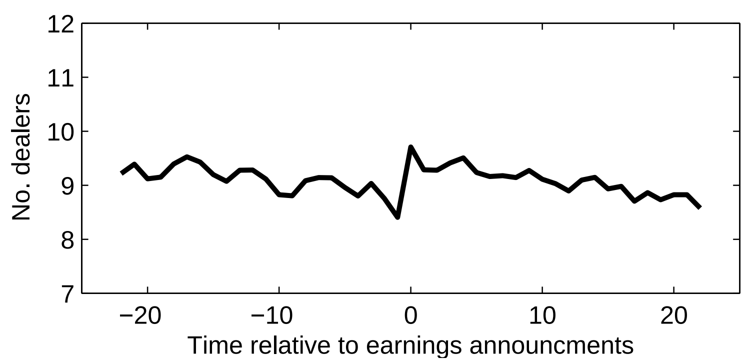


Figure 3: This figure depicts the average number of active dealers per reference entity in the 45-day window around earnings announcements. The average number of dealers is calculated across all firms and earnings announcements. Panel A presents the average number of dealers calculated based on all earnings announcements. Panel B presents the average number of dealers around the negative earnings announcement surprises, while Panel C around the positive surprises. We consider an earnings announcement to be a surprise when the cumulative CDS change in the 5-day post-announcement period is larger than the pre-announcement bid-ask spread.

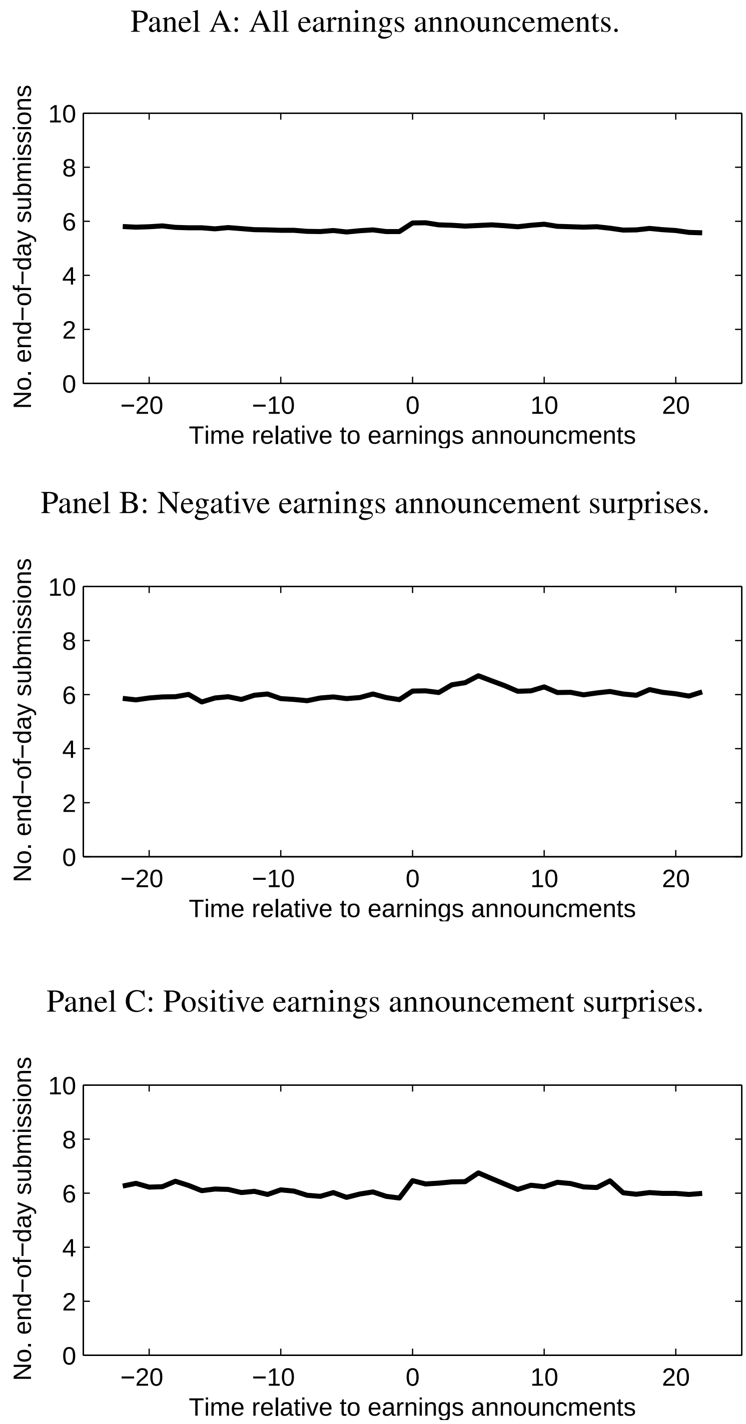


Figure 4: This figure depicts the average number of financial institutions making end-of-day submissions to Markit's valuation service per reference entity in the 45-day window around earnings announcements. The average number of financial institutions is calculated across all firms and earnings announcements. Panel A presents the average number of financial institutions calculated based on all earnings announcements. Panel B presents the average number of financial institutions around the negative earnings announcement surprises, while Panel C around the positive surprises. We consider an earnings announcement to be a surprise when the cumulative CDS change in the 5-day post-announcement period is larger than the pre-announcement bid-ask spread.