Credit Market Choice *

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Abstract

Which markets do institutions use to change exposure to credit risk? Using a unique dataset of transactions in corporate bonds and CDS by large financial institutions, we show that simultaneous transactions in both markets are rare, with an average institution having a five percent probability of transacting in both the CDS and the bond market in the same entity in an average week. When institutions do transact in both markets simultaneously, they increase their speculative positions in CDS by 16 cents per dollar of bond transactions, and their speculative positions by 26 cents per dollar of bond transactions. We find evidence that, during the post-crisis rule implementation period, the incentive to hedge corporate bond transactions through CDS transactions is reduced but so is the incentive to speculate using the CDS market. Finally, when single name contracts become eligible for central clearing, globally systemically important institutions become more likely to use single name CDS contracts instead of index CDS contracts.

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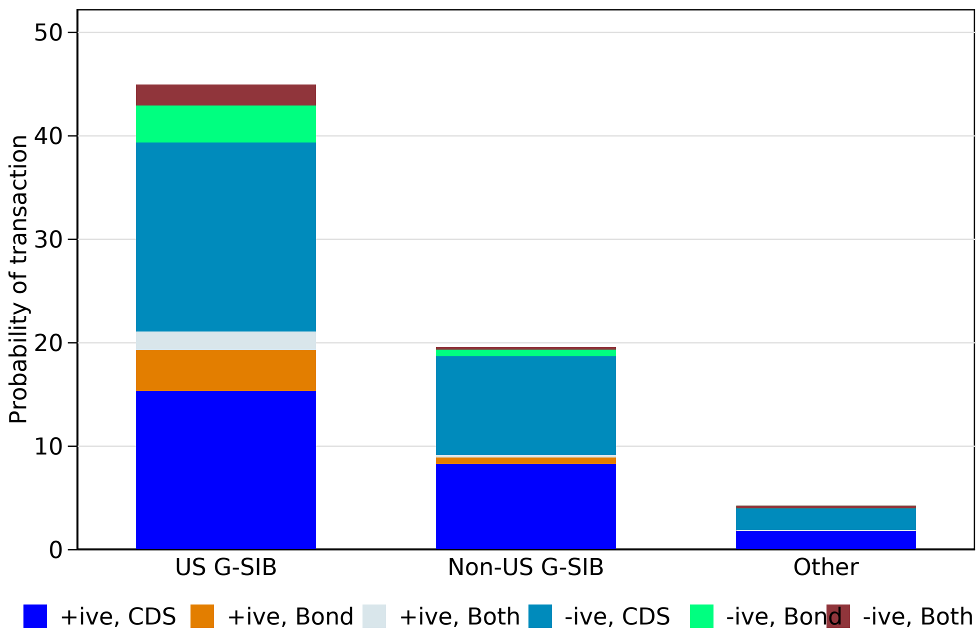
1 Introduction

Large financial institutions have a choice of which market to use when changing their credit risk. For example, an institution wishing to increase its exposure to a particular reference entity can do so by either purchasing corporate bonds directly, selling protection on the reference entity in the credit default swap (CDS) market, or a combination of both. Such institutional participation decisions are key for liquidity of these markets and for financial stability more broadly. This paper is the first to investigate the choice of an institution to allocate credit risk in individual U. S. corporate reference entities through CDS and corporate bond markets.

We document three fundamental facts. First, as shown in Figure 1, even large financial institutions have a low probability of changing their exposure to any particular reference entity in an average week. Global systemically important banks (G-SIBs) domiciled in the U. S. have a 45 percent probability of changing their exposure; G-SIBs based in other countries have a 20 percent probability of changing their exposure; and other institutions that trade in both CDS and corporate bond markets have a 5 percent probability of changing their exposure. Consistent with CDS markets being more liquid than corporate bond markets, institutions are more likely to use the CDS market when they do change their exposure. More striking, institutions rarely transact in both markets in the same week; U. S. G-SIBs are the most likely to do so and have a 5 percent probability of changing their credit risk exposure through paired CDS and bond transactions. The rarity of paired transactions suggests that aggregated transactions data, even at the reference entity level, may be misleading about the extent to which market participants use the CDS market for either hedging or speculative purposes, as the set of institutions accounting for the majority of the transactions in the corporate bond market in a given week might be different from the set of institutions that account for the majority of CDS transactions.

Second, both G-SIBs and other institutions have a high probability of using index CDS contracts to change their exposure to credit risk, either through transactions in the index contract alone or through transactions in both index and single name contracts. Thus, studying transactions in both single name and index CDS is important for understanding how institutions use the CDS market to redistribute corporate credit risk within the financial sector. When institutions use index CDS contracts to change their exposure to a single reference entity, they also create "orphaned" exposures

Figure 1. Probability of transactions. This figure summarizes the probability of different types of paired bond–CDS transactions by number of observations. "CDS" indicates a trade in either the index or single name CDS contract but not in the bond; "Bond" indicates a trade in only the bond; "Both" indicates a trade in both bond and CDS; "+ive" indicates an increase in net exposure to credit risk; "-ive" indicates a decrease in net exposure to credit risk. Sample: Jan 2010 – Dec 2017.



to the remaining constituents of the index. Given the lower liquidity of single name CDS contracts relative to index contracts, these exposures may create systemic vulnerabilities as index positions cannot be easily hedged with transactions in the single name market.

Finally, we show that institutions change their participation decisions in response to changes in the regulatory environment. In particular, we find that G-SIBs are less likely to use index CDS contracts and hedge a lower fraction of their corporate bond transaction flow in the CDS market after January 2014. Similarly, G-SIBs increase the volume and frequency of their transactions in single name CDS after the single name contract becomes eligible for clearing and the institution faces lower capital constraints on the single name positions. As we discuss in greater detail in Section 5, these results suggest that regulatory capital constraints play an important role in determining which markets institutions use to change their exposure to corporate credit risk.

To our knowledge, this is the first comprehensive study of trading in both CDS and bond markets by the same institutions in the same reference entities for a large segment of the global credit market.[1] While our analysis is largely descriptive, the goal of the paper is to provide evidence on the amount of hedging activity in credit markets and to show how institution-level constraints affect the incentives to hedge.

We use confidential positions-level data from the CDS trade repository maintained by the Derivatives Trust & Clearing Corporation (DTCC), which provides detailed information on the position, including the identities of both parties to the trade, the characteristics of the contract, such as notional size, maturity, and price. In our analysis, we focus on week-over-week changes in the net exposure taken by each participant in an individual reference entity. This flow of participant-reference entity exposure captures how much a participant increases or decreases its derivative exposure to the credit risk of an individual firm within a week. Institutions with positive CDS positions are short credit risk, whereas institutions with negative CDS positions are long credit risk.

We match the flows of exposure from the CDS market to trading flows in the secondary corporate bond market. We use a regulatory version of the Trade Reporting and Compliance Engine (TRACE), provided by the Financial Industry Regulatory Authority (FINRA). In this version of TRACE, in

[1] As of Q2 2016, the market value of debt instruments outstanding issued by the U. S. non-financial corporate sector accounted for 21 percent of the market value of debt instruments outstanding issued by the non-financial corporate sector globally. In comparison, the market value of debt instruments outstanding issued by the non-financial corporate sectors in all advanced economies represented 59 percent of the global total. Source: BIS total credit statistics.

addition to the standard trade information, the identities of the reporting FINRA's members are given. Non-members, including clients and non-member affiliates, are not required to report and therefore their identities are marked as "C" or "A", respectively. The available identities in both datasets allow us to link the activity of large financial institutions in the U. S. corporate bond market and the U. S. CDS market in order to study an institution's decision to transact in the derivative market jointly with their activity in the corresponding cash product.

A few empirical studies have investigated the relationship between the use of credit derivatives and fundamental credit exposures. Minton et al. (2009) find that the net notional of credit derivatives reported by bank holding companies as hedges for their loan books represents less than 2 percent of the total notional amount of derivatives held and less than 2 percent of the face value of their loans. Shan et al. (2016) examine how banks use CDS, which is recognized as a form of credit protection in Basel II, to mitigate capital constraints and to increase their regulatory capital adequacy. Hirtle (2009) studies whether banks that are more active users of credit derivatives are able to expand their supply of credit, but finds limited evidence of this hypothesis. Oehmke and Zawadowski (2016) use aggregated (across participants), truncated DTCC data to investigate the motivation for trading in CDS markets and find evidence consistent with CDS positions being used, at least partially, for hedging purposes. Nijskens and Wagner (2011) show that a bank's stock market beta increases after their first usage of a credit risk transfer method – through either CDS or collateralized loan obligations (CLOs) – suggesting that banks use credit derivatives to hedge idiosyncratic risk. In contrast to this prior literature, we focus on weekly transactions at the institution-reference entity level and find that institutions rarely use both the CDS and the bond market in the same week. Thus, using lower frequency, aggregate data may overstate the amount of hedging done by individual institutions.

From a theoretical perspective, a number of papers have investigated the costs and benefits associated with hedging fundamental credit exposures using CDS markets. Parlour and Winton (2013) find that banks may choose to use CDS contracts to hedge exposure to the credit risk of safer loans, supporting better loan monitoring and more efficient risk sharing, while outright loan sales are the preferred risk management alternative for riskier loans. Instefjord (2005) investigates a simple model of financial distress and concludes that, while credit derivatives improve risk sharing, they also increase the attractiveness of acquiring additional credit risk. As the credit markets become more competitive, the second effect dominates and may lead to unstable financial systems. Bolton and Oehmke (2011) argue that the existence of CDS contracts improves lenders' bargaining power and reduce lenders' incentives to rollover loans, and thus lowers the incidence of strategic defaults. They show, however, that in equilibrium, lenders over-insure, leading to inefficiently high incidences of bankruptcies. Similarly, Campello and Matta (2012) find that the existence of CDS contracts may lead to risk-shifting, increasing the probability of default.

This paper is also related to the emerging literature using contract-level data to study the properties of the CDS market. Chen et al. (2011) evaluate the market's size and composition, frequency of trading activity and level of standardization of CDS products using three months of global CDS transactions involving a G14 dealer.[2] Shachar (2013) uses transactions in financial firm CDS and index CDS during the financial crisis to show that bilateral exposures in the interdealer market are an important component of intermediation capacity and market resiliency. Similarly, Gündüz et al. (2013) show that, between January 2009 and June 2011, CDS premia on single name CDS with German corporate reference entities reflect market frictions rather than the credit risk of the underlying reference entity. Also focusing on the provision of credit to German firms, Gündüz et al. (2017) show that, following the Small Bang in the European CDS market, banks with existing credit relationships increased their activity in CDS in the corresponding reference entities and increased the provision of credit only if the banks were properly hedged prior to the Small Bang. Siriwardane (2018) investigates the relationship between risk-bearing capital of CDS sellers and CDS premia using a granular dataset of DTCC positions involving either North American reference entities or U. S. market participants, and finds that the CDS premia of reference entities sold by participants experiencing losses to other parts of their CDS portfolio are adversely affected. Most closely related (in terms of data) to our paper, Du et al. (2017) use an earlier sample of supervisory transactions data to study counterparty risk management in CDS contracts, and find that market participants manage their counterparty risk exposure through changes in their bilateral relationships. Our study is broader relative to this literature as we focus on the decisions of institutions to participate in both the CDS and the corporate bond market in the U. S., examining both the extensive and intensive margin of such decisions.

[2]"G14" are the largest 14 dealers in fixed income derivatives: Bank of America-Merrill Lynch, Barclays Capital, BNP Paribas, Citi, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JP Morgan, Morgan Stanley, RBS, Societe Generale, UBS and Wells Fargo Bank.

The rest of the paper is organized as follows. Section 2 discusses institutions' decision to participate in either the cash market, the derivatives credit market, or both, and then sets-out our empirical hypotheses. Section 3 describes the datasets we use and the matching procedure between the different datasets. We examine the overall participation decisions in Section 4. Section 5 studies the impact of post-crisis regulatory changes and market structure changes on participation decisions. Section 6 concludes.

2 Empirical Hypotheses

The theoretical literature on the usage of derivatives has identified several economic motives for participating in derivatives markets. In this section, we describe the three main hypotheses that arise from these motives.

First, credit derivatives redistribute credit risk within the financial system: an institution that has exposure to a corporate through either bonds or loans may choose to insure itself against that credit risk exposure by buying protection in the CDS market. Indeed, this is the original purpose of the CDS contract invented in 1994 by J. P. Morgan to insure its credit exposure to Exxon in the wake of the Exxon Valdez oil spill. Unexpected changes in the value of corporate bond positions that an institution seeks to insure should thus precipitate changes in the derivative position being held for hedging purposes.

Second, institutions may use credit derivatives to express their beliefs about the credit worthiness of the reference entity, regardless of whether they own bonds or loans of the entity (see e.g. Fostel and Geanakoplos, 2012; Che and Sethi, 2014). To the extent that an institution uses credit derivatives to speculate on credit risk, predictable changes in demand for credit risk should be associated with greater speculative activity.

Finally, institutions may use both credit derivatives and cash products to achieve their desired exposure to credit risk. When there are more frictions in the market for the underlying cash products, the derivatives market should be more attractive. The transaction costs in both markets then play a role in determining the optimal allocation decision between derivative and cash products, and changes in the transaction costs will precipitate changes in the optimal allocation.

It is also worth noting that the dealers can change their exposure to corporate credit risk by transacting in other markets, such as the syndicated loan market and the equity options market. We choose to focus on the relationship between the CDS and the corporate bond market as the CDS is the natural hedging product for corporate bonds. Dealers that face exogenous changes to their corporate bond positions are thus more likely to use the CDS market to bring their overall corporate credit exposure back in line with the desired levels. Syndicated loans, on the other hand, are less liquid and thus require a longer period of adjustment, while equity options only provide an indirect hedge against corporate credit risk.

3 Data Description

We construct a novel weekly flows dataset of corporate bonds and CDS held by financial institutions. The two primary underlying datasets that allow us to assemble our dataset are supervisory versions of CDS position-level data and corporate bond transaction-level data. The supervisory versions contain identifying information on the transacting participants in the two markets, which is then used to link the flows across markets at the security-participant level. In this section we review the datasets and discuss the participant and security matching procedures.

3.1 CDS-Level Dataset

DTCC operates a global trade repository, the Trade Information Warehouse (TIW), which records transaction information. According to DTCC estimates, TIW captures approximately 98 percent of all standard credit derivatives contracts, including both cleared and bilateral contracts. DTCC provides relevant subsets of the global trade repository to regulators worldwide[3] for performing oversight functions and governmental responsibilities in the CDS market.[4]

In this paper, we use DTCC data received through the supervisory authority of the Federal Reserve Board (FRB). The FRB is entitled to access positions in which one of the parties to the transaction is an institution supervised by the FRB, and positions where the reference entity is an institution supervised by the FRB. Institutions that are supervised by the FRB include the largest dealer banks in the U. S., such as Bank of America, Citigroup, Goldman Sachs, JP Morgan

[3]These include prudential regulators, market regulators, and (supervising) central banks.

[4]The range of access varies according to the type of the regulator set forth in the June 2010 OTC Derivatives Regulators Forum (ODRF) guidance on access to trade repository held data on CDS.

Chase and Morgan Stanley. Hence, we observe all positions held by these major dealers and all CDS positions that are held on these dealer banks as reference entities. Although this data covers only a subset of the overall transactions in the CDS market and thus has inherent limitations, the institutions for whom we observe all open positions on a report date are large participants in the market, and represent the lion share of the trading activity in this market. Comparing the positions observed in our sample to the total market activity captured by DTCC TIW, we find that the positions of the supervised institutions account for, on average, about 70 percent of the total activity in single-name derivatives, and 60 percent of the activity in index products, as measured by the number of contracts and gross notional exposures.

Some recent papers, such as Chen et al. (2011), Shachar (2013), Gündüz et al. (2013), Siriwardane (2018), and Du et al. (2017), use variations of the DTCC transactions and positions data, studying CDS trading activity in isolation from other credit markets. While our CDS sample is most similar to the one used in Du et al. (2017), our paper is the first to study the cross-market credit exposure choice of individual financial institutions at a granular level.

The CDS positions data track the life-cycle of all open, "certain"[5] positions at a weekly frequency. Key contractual terms, such as names of the protection buyer and protection seller, reference entity, trade date, maturity date, notional amount, and currency, are available. The positions are reported at the account level of participants, so we first aggregate positions to the institution-level that may contain a collection of accounts within that institution (henceforth we use participant and institution interchangeably). Then, for each institution, we calculate the weekly, newly added net exposure as the difference between new positions where the institution acts as a buyer of protection and the new positions where it acts as a seller of protection. New positions that were created and unwinded within the same week are not captured in the weekly snapshots of the CDS positions.

In the analysis, we consider the credit exposure assumed in the CDS market as positions that were taken through single-name CDS contracts and through CDS index contracts, both separately and jointly. To account for credit exposure stemming from a new position in the CDS index, we disaggregate the index positions to the individual single-name CDS constituents, according to their weight in the version of the index series as of the report date.[6] Since our sample is later

[5] *Certain transaction* is a transaction that was confirmed by both counterparts of the trade.

[6] The *series* of the index is determined by the red_id, which is the key identifier for CDS index products in DTCC. For the same index family the red_id is different across different series, but will be the same across different versions

constrained by the information available of U. S. corporate bond flows, we only consider positions in the CDX.NA.IG and CDX.NA.HY Indices and their sub-indices, which include only North-American reference entities. CDX.NA.IG index includes 125 North American entities with investment grade credit ratings at each index roll date, and CDX.NA.HY index includes 100 North American entities with high yield credit ratings as of the index roll date.

3.2 Bond-Level Dataset

All FINRA member firms[7] are required to report to TRACE transactions of eligible U. S. corporate bonds, as prescribed by the Financial Industry Regulatory Authority (FINRA) Rule 6700. The transaction record information includes the bond cusip, execution date and time, price, and quantity, size, and time. The reporting party also includes its side of the transaction, and identifying information about its counterparty. The counterparty will be fully identified if its a FINRA member, or marked as “C" if it is a non-member client, or as “A" if it is a non-member affiliate.[8] The identities of the members are reported to the system, but are not disseminated. These identities are only available to supervisors. The identifying information includes the firm name, its “doing business as” name,[9] and its market participant identifier.[10]

We normalize the TRACE data by accounting for cancellations and corrections, and assigning the buyer and seller roles based on the value of the give-up fields. For corrections and cancellations filtering, we use the buyer and seller information and execution time to link reversals across days before February 6, 2012. After February 6, 2012, we use the linking system control number instead. We also apply filters to remove records containing price and/or size outliers. Using the clean sample

of the same series. Therefore, we use the information in the index annex that is closest to the report date. As a robustness check, we also consider the weights as of the trade date, rather than the report date. Since we consider new positions, the difference between the trade date and the report date is not more than 7 days.

[7] FINRA members are U. S.-registered broker-dealers. Most brokers and dealers must register with the SEC and join a self-regulatory institution; FINRA and the national securities exchanges are SROs. Nevertheless, not all broker-dealers are required to registered as FINRA members. If a broker-dealer restricts its transactions to the national securities exchanges of which it is a member and meets certain other conditions, it may be required only to be a member of those exchanges. If a broker-dealer effects securities transactions other than on a national securities exchange of which it is a member, however, including any over-the-counter business, it must become a member of FINRA, unless it qualifies for the exemption in Rule 15b9-1. For more details see https://www.sec.gov/rules/proposed/2015/34-74581.pdf.

[8] The distinction between “C" and “A" starts in November 2, 2015. Prior to that, “A" would be marked as “C".

[9] The phrase “doing business as" (DBA) is a legal term, meaning that an assumed or fictitious name under which the business or operation is conducted business and presented to the public is not the legal name of the business that actually owns and is responsible for the former.

[10] The market participant identifier is *MPID*, which is a 4 character alpha code used to report trades.

of corporate bond transactions, we construct daily buy and sell flows for each participant and bond issue. The net flow is defined as the difference between the buys and the sales. We merge the corporate bond flows data with Mergent FISD to get bond characteristics, such as amount outstanding, maturity, and rating.

3.3 Cross-Market Linkages

To track the flow of risks assumed by the overlapping participants who trade in both the CDS and the corporate bond markets, we link their activities along two dimensions: reference entity level and participant-level.

Multiple bonds can be mapped to the same CDS contract. Then, a question arise how to determine which bonds' flow to consider jointly with the CDS trading. We would like to consider all bonds that the CDS contract specifies as "deliverable" upon default. The full universe of deliverable bonds, however, is unknown until default.[11] Therefore, we proxy the basket of deliverable corporate bonds by filtering on characteristics that generally satisfy deliverable obligation characteristics. Specifically, we keep bonds that are not sub-ordinated, with U. S. Dollar currency, with maturity between 1 year and 30 years, and not contingent. The net flows of these bonds is aggregated to the participant-reference entity level.

Our choice not to constraint bonds based on a matched maturity to the CDS contract is based on two observations. First, single-name CDS exposure is often assumed through contracts with 5 year maturity. Second, same-maturity paired activity is less common. Figure 2 shows the fraction of notional amount traded by different maturity buckets in single-name CDS (Figure 2a) and index CDS (Figure 2b). Regardless of whether participants assume long or short credit exposure, we observe that most of the single-name CDS transactions are on contracts with original maturity less than 5 years, while 80 percent of the index CDS transactions are on contracts with original maturity of about 5 years, and 20 percent are on contracts with original maturity of about 10 years. If trades across the term-structure were common, we should have observed more disperse pattern across maturity buckets. Therefore, it seems that liquidity that is concentrated around the 5 years

[11] Only when a credit event is triggered, ISDA then reviews obligations submitted by market participants to determine whether the obligation's terms meet the Deliverable Obligation Characteristics specified in the ISDA agreement. If the obligation is determined to be a Deliverable Obligation then it is added to the List of Deliverable Obligations, otherwise it is added to the List of Non-Deliverable Obligations. See, for example, Procedures for Determining Lists of Deliverable Obligations for the CDS Protocol in respect of Lehman Brothers Holding Inc.

is the main consideration of CDS market participants when trading single-name contracts. Given that the spectrum of maturities of bonds is much less concentrated, we report in the main text the results based on a sample of bonds with time-to-maturity between 1 year to 30 years, and repeat the analysis with matched maturity as a robustness check.

Next, we match institutions' identities in the DTCC data and in the supervisory TRACE data by their full name, taking into consideration that the credit risk trading may be done under affiliated entities within the same institution. For example, Goldman Sachs has most of its plain vanilla derivatives books in its bank entity, whereas most of the derivatives for Morgan Stanley are conducted outside the commercial bank. Hence, we match broker-dealer subsidiaries as they appear in FINRA either to a name of a firm that appear in DTCC (exact match) or to a financial holding company, if that can also be matched to a firm name in DTCC. We also exploit "Report of Changes in Organizational Structure" (FR Y-10 form) that include controlled and regulated affiliates of the bank holding company.[12] The form allows us to map between a U. S. top holder BHC and its subsidiaries that are under its regulatory control.

To simplify the analysis and its interpretation we classify institutions into three categories: U. S. Globally Systemically Important Banks (G-SIBs), non-U. S. G-SIBs and other types of institutions. This classification captures the extent to which institutions are constrained in the post-crisis period, with G-SIBs facing greater regulatory and supervisory burdens worldwide, including higher capital buffer requirements, resolvability requirements, higher supervisory expectations, and, starting in 2019, total loss-absorbing capacity (TLAC) requirements. We use the full names of the institutions that we identify as participating in both markets to classify them to G-SIBs, non-U. S. G-SIBs, and other, with both domestic and foreign G-SIBs identified using the annual lists from the Financial Stability Board (FSB).[13]

Figure 3 plots the fraction of transaction volume in single-name CDS (Figure 3a), index CDS (Figure 3b) and corporate bonds (Figure 3c) by different types of institutions. Non-G-SIBs account for a small fraction of corporate bond transactions but are significant participants in both the index and single-name CDS contracts, accounting for 60 percent of notional traded in the index contracts

[12]For a detailed description of the form, see https://www.federalreserve.gov/apps/reportforms/reportdetail.aspx?sOoYJ+5BzDaGhRRQo6EFJQ==.

[13]We report the 2016 list in Table A.1, together with the G-SIB surcharge faced by and the domicile of the institutions.

and 35 percent notional traded in the single-name contracts. U. S. G-SIBs account for a large fraction of notional traded in all three markets, representing 45 percent of the notional traded in single-name contracts, 35 percent traded in index contracts, and 60 percent of the notional traded in corporate bonds. Non-U. S. G-SIBs instead have low participation in the index contract but account for 35 percent of the notional traded in corporate bonds and 15 percent of the notional traded in single-name CDS.

The differences in transaction volume between U. S. and non-U. S. G-SIBs cannot be explained by the relative size of the institutions alone. In Figure 4, we compare the fraction of the overall transaction volume accounted for by G-SIBs facing different capital surcharge levels, with institutions facing higher surcharges proxying for larger institutions. Except for the intermediate category (institutions facing a 2 percent G-SIB capital surcharge), institutions within a domicile account for a similar fraction of the overall transaction volume regardless of their systemic score. In the intermediate range, domestic institutions account for almost no volume in the CDS market and around 5 percent of the transactions in the corporate bond market; foreign institutions in this category, on the other hand, account for 20 percent of the overall transaction volume in the corporate bond market, 5 percent of the volume traded in the index contract, and 10 percent of the volume traded in the single-name contracts.

3.4 Corporate Bond Market Events

We consider two types of events that generate exogenous transaction flow in the corporate bond market: bond credit rating downgrades from BBB (investment grade) to BB (high yield), together with the corresponding BB to BBB upgrades, and additions and deletions from a leading corporate bond index that is closely tracked by market participants.

To identify events when a bond is downgraded from an investment-grade to a high yield credit rating and when it is upgraded from a high yield to an investment-grade credit rating, we use ratings history from Moody's, S&P, and Fitch that are available in Mergent FISD. We convert each rating to numeric equivalent (AAA=1; Aa1/AA+=2, etc.), and then define a rating change event as the first change (within a 90-days window) below or above 10 by any of the three agencies. We use 90-day window to exclude events that are due to lagged update of the rating by one of the agencies.

To identify changes to the bond index we use the Bank of America Merrill Lynch U. S. Corporate

Index (C0A0 in Bloomberg) that tracks the performance of US dollar denominated investment grade corporate debt publicly issued in the U. S. domestic market.[14] The index constituents are rebalanced every month, with qualifying bonds selected three business days prior to the last business day of the month ("lock-out date"). Rating changes occurring on or before the lock-out date are included at the upcoming rebalancing, while those occurring after that date wait until the following rebalancing. The rating of index constituents is determined by a simple average between Moody's, S&P, and Fitch. By comparing subsequent monthly versions of the index, we determine the addition and deletion events, and then flag such changes that are also rating change related.

4 Credit Market Participation

Figure 1 shows that, on average, institutions change their exposure to a particular reference entity in fifty percent of the weeks in the sample. In this Section, we examine the probability of different types of transactions in greater detail. We then study the intensity with which institutions use the CDS market to hedge their corporate bond market transactions.

4.1 Extensive margin

We begin by studying the extensive margin of the decision to participate in CDS and bond markets. We classify transactions in our dataset into three broad categories: market-neutral (basis) trades, hedging transactions, and speculative transactions. In a market-neutral trade, the change in net exposure through transactions in the bond market is perfectly offset with transactions in the CDS market. In a hedging transaction, an institution offsets an increase in net exposure through transactions in the bond market with an increase in the protection bought through the CDS market, so that the total increase in exposure to the reference entity is smaller than the original bond buy position. Finally, in a speculative transaction, either an increase in net exposure through transactions in the bond market is accompanied by an increased in the protection sold in the CDS market (so that the total increase in exposure to the reference entity is larger than the original bond buy position) or the transaction in the CDS market is unaccompanied by a transaction in the bond market ("naked CDS" transaction) or the transaction in the bond market is unaccompanied by a transaction in

[14]For further details see http://www.mlindex.ml.com/gispublic/bin/getdoc.asp?fn=C0A0&source=indexrules

the CDS market ("naked bond" transaction). Table 1 summarizes these three transaction types, together with the possible combinations of bond and CDS trades and what these trades imply for changes in net exposures. In this paper, we primarily focus on hedging and speculative transactions and leave the market-neutral trades for future research.

In our empirical exploration, we further separate the change in the overall CDS position into changes due to transactions in single name CDS contracts and changes due to transactions in index CDS (CDX) contracts. From an economic perspective, this distinction is meaningful as transactions in CDX engender changes in net exposure to multiple reference entities. If an institution uses CDX to hedge exposure to a particular reference entity, the transaction in the index contract will simultaneously generate exposure changes to the other members of the index. Similarly, if an institution uses CDX to take a speculative position in a particular reference entity, the transaction in the index contract will also simultaneously generate speculative positions in the other members of the index. Thus, index contracts represent a blunt instrument both for hedging exposure to individual reference entities and for taking speculative positions in individual reference entities as they generate "orphaned" exposures to the other members of the index.

Figure 5a reports the average probability of different types of institutions either increasing or decreasing their net exposure. For each reference entity b, institution d and transaction type j, we count the number of weeks in the sample in which institution d has transaction of type j in reference entity b. The probability of institution d having transaction of type j in entity b is then given by

$$\mathbb{P}_{b,d,j} = \frac{\#\text{weeks}_{b,d,j}}{\#\text{weeks}_b},$$

where $\#\text{weeks}_b$ is the number of weeks in which any institution has a transaction of any type in reference entity b. Using the overall number of weeks that reference entity b is traded, rather than the number of weeks that institution d trades in reference entity b, is important as we also want to investigate the probability of an institution not changing its exposure to a particular reference entity. Indeed, as we noted in the introduction, Figure 1 shows that institutions do not change their exposure to the average reference entity in a large fraction of the weeks.

When they do change credit exposure, the probability of an institution increasing exposure is roughly equal to the probability of an institution decreasing exposure. U. S. G-SIBs, on average, have a thirty percent probability of decreasing their exposure and a twenty percent probability of increasing their exposure. Non-U. S. G-SIBs decrease their exposure with an eleven percent probability and increase their exposure with a ten percent probability. Other types of institutions transact much less frequently in our sample, and have around three percent probability of increasing their exposure and around three percent probability of decreasing their net exposure to a reference entity.

In addition to having different probabilities of changing their net exposure, different types of institutions also pursue different strategies to change their net exposures. U. S. G-SIBs use single name CDS contracts much more frequently than other types of institutions do. In contrast, non-G-SIBs primarily use index contracts to change their net exposure. U. S. G-SIBs also have a higher probability transacting in the CDS and bond markets simultaneously, while other institutions primarily transact in either one market or the other. What all three types of institutions do have in common is their frequent use of index CDS contracts alone. This is symptomatic of institutions using index CDS contracts to change exposure to a particular reference entity which then creates orphaned changes in net exposures to other constituents of the index.

Figure 5b plots the gross-volume-weighted probability of different types of institutions either increasing or decreasing their net exposure. In particular, the gross-volume-weighted probability $\omega_{b,d,j}$ of institution d having transaction of type j in reference entity b is given by

$$\omega_{b,d,j} = \frac{|\text{Bond volume}|_{b,d,j} + |\text{CDS volume}|_{b,d,j}}{\sum_j \left(|\text{Bond volume}|_{b,d,j} + |\text{CDS volume}|_{b,d,j}\right)}.$$

Notice that, while the unweighted transaction probabilities are high for transaction types that happen frequently, the gross-volume-weighted transaction probabilities are high for transaction types in which institutions have a high volume of trade. Thus, the gross-volume-weighted transaction probability can be high for transaction types that happen relatively infrequently. In addition, unlike the unweighted transaction probabilities, the gross-volume-weighted transaction probabilities can only be computed for instances where the institution actually transacts in reference entity b. Despite these differences, Figure 5b shows that the patterns we observe with the unweighted transaction probabilities are also present in the gross-volume-weighted probabilities. U. S. G-SIBs are more likely to trade single name CDS contracts than other types of institutions are, while non-G-SIBs have a large probability of having naked index transactions, particularly when decreasing their net exposure to the reference entity.

One possible explanation for the differences in strategies pursued by different types of institutions is size: if U. S. G-SIBs have a larger trading book in general, they might be more willing to participate in more markets at once than non-U. S. G-SIBs and other institution types. We investigate this hypothesis in Figure 6, by comparing the participation decisions made by U. S. and non-U. S. G-SIBs across G-SIB surcharge groups. The G-SIB capital surcharge is larger for institutions to be more systemic by the Financial Stability Board (FSB) and thus proxies for the overall size of the institution globally. Comparing the transaction probabilities for U. S. G-SIBs in Figure 6a to the transaction probabilities for non-U. S. G-SIBs in Figure 6b, we see that, within domicile, the participation decisions are similar across different surcharge categories. This suggests that the main difference between U. S. and non-U. S. G-SIBs is in their domicile rather than their size.

Overall, Figure 5 illustrates the decisions made by institutions in an average week, and includes exposure changes motivated by the institutions' own portfolio rebalancing as well as the adjustments they make in response to client demand. To separate these two motives, we next consider whether participation decisions change in weeks when a bond is either downgraded from an investment-grade to a high yield credit rating or when a bond is upgraded from a high yield to an investment-grade credit rating. As shown in Ellul et al. (2011), credit rating downgrades to high yield can trigger fire sales of the downgraded bonds by insurance companies that face greater capital requirements in holding high yield bonds. Since the fact of the downgrade but not the exact timing is usually anticipated, the transaction volume generated by insurance company divestment represents unanticipated flow for the dealers. When a bond is upgraded to investment-grade rating, insurance companies may choose to buy the bond; the effect of an upgrade is thus similar to that of a downgrade but may be of smaller magnitude as there is no requirement for insurance companies to "fire buy" the bond. Indeed, Table A.3 in the Appendix shows that, the week before the downgrade, BHCs experience an abnormal positive net bond transaction volume which they then offset in the following weeks by buying more protection in the CDS market and selling a relatively higher volume of bonds. The response to bond upgrades is, instead, much more muted, with the positive net bond transaction volume the week before an upgrade not offset in the following weeks.

Figure 7 plots the average transaction probability by institution type the week of a bond downgrade (Figure 7a) and the week of a bond upgrade (Figure 7b). For each week $i = -1, 0, 1$ around a bond downgrade, institution d and transaction type j, we count the number of reference entities in the sample in which institution d has transaction of type j in week i. The probability of institution d having transaction of type j in week $i = -1, 0, 1$ before a downgrade is then given by

$$\mathbb{P}_{d,j}^{i,-} = \frac{\#\text{weeks}_{d,j}^{i,-}}{\#\text{downgrades}},$$

where #downgrades is the number of downgraded reference entities in our sample. The probability of institution d having transaction of type j in week $i = -1, 0, 1$ before an upgrade is similarly defined as

$$\mathbb{P}_{d,j}^{i,+} = \frac{\#\text{weeks}_{d,j}^{i,+}}{\#\text{upgrades}},$$

where #upgrades is the number of upgraded reference entities in our sample.

Three features are striking in comparing the average probabilities plotted in Figure 5 to the probabilities around credit rating changes plotted in Figure 7. First, G-SIBs are more likely to transact in a week with credit rating changes than in an average week, with U. S. G-SIBs having nearly a hundred percent probability of changing their exposure in a week when the bond gets downgraded and an eighty percent probability of changing their exposure in a week when the bond gets upgraded. Thus, while, on average, the probability of an institution changing their exposure in a particular week is low, institutions do trade in response to changes in the economic outlook of the reference entity.

Second, while U. S. G-SIBs are more likely to decrease their net exposure the week a bond gets upgraded, non-U. S. G-SIBs are more likely to increase their exposure. Comparing the response to credit rating downgrades, we see that non-U. S. G-SIBs act as shock amplifiers: they are more likely to increase exposure in weeks when the reference entity is upgraded and more likely to decrease exposure in weeks when the reference entity is downgraded. In contrast, U. S. G-SIBs act as shock absorbers in response to bond upgrades and are more likely to decrease their exposure to the reference entity.

Finally, though all institution type adjust their exposures in response to credit rating changes, they use different strategies to do so. Consistent with their greater use of single name CDS contracts overall, U. S. G-SIBs primarily adjust their exposure through changes in their single name CDS positions. Non-U. S. G-SIBs use a combination of changes in single name CDS and index CDS positions. Other institutions instead primarily use index CDS contracts to change their exposure.

4.2 Intensive margin

Consider now the volume traded in CDS and bonds when institutions use both markets to change their net exposure. We estimate the following relationship between the net CDS transactions and the net bond transactions by institution d in reference entity b in week t

$$\begin{aligned}\text{CDS net flow}_{d,b,t} = {} & \beta_S \text{Bond net flow}_{d,b,t} + \beta_H \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \\ & + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t},\end{aligned} \tag{1}$$

where $\mathbf{1}_{Hedge,d,b,t}$ is an indicator equal to 1 when the CDS net flow hedges the bond net flow. The coefficient β_S measures elasticity of net CDS flows to bond flows when the CDS market is used to amplify the change in exposure through the bond market. When β_S is negative, a one dollar increase in the bond buy position corresponds to a β_S dollar increase in the net protection sold by the institution. Similarly, β_H measures the fraction of bond net flow hedged by transactions in the CDS market. When β_H is positive, a one dollar increase in the bond buy position is accompanied by a β_H dollar increase in the net protection bought by the institution.

Table 2 reports the estimated coefficients β_H and β_S for net flow in the single name CDS contracts, index CDS contracts, and both single name and index CDS contracts. When an institution uses the CDS market to speculate, it increases its net protection sold by sixteen cents for every dollar of corporate bonds bought. When an institution uses the CDS market to hedge corporate bond transactions, a one dollar increase in the bond buy position is accompanied by a 29 cents increase in the net protection bought by the institution. These magnitudes are both economically and statistically significant, with a one standard deviation increase in bond net flow translating into around \$2.8 million increase in net protection sold when the CDS market is used to speculate and around \$5 million increase in net protection bought when the CDS market is used for hedging purposes, relative to an average transaction size in CDS of \$0.5 million protection sold.[15]

Table 2 also shows that U. S. G-SIBs have a greater elasticity of CDS flows to bond flows than non-U. S. G-SIBs do, suggesting that U. S. G-SIBs are more nimble in adjusting their overall credit exposure. Comparing single name CDS net flow elasticities to index CDS net flow elasticities, we see that U. S. G-SIBs use the index CDS contract more intensely than the single name CDS contracts, while non-U. S. G-SIBs use the index contract to speculate and the single name contracts to hedge bond net flows.

As with the average probabilities above, the intensive margin of institutions' participation decisions is also a result of both the institutions' own portfolio rebalancing as well as the adjustments they make in response to client demand. To evaluate the contribution of exogenous customer flows to institutions' intensive margin decisions, we modify the baseline specification (1) as follows

$$
\begin{aligned}
\text{CDS net flow}_{d,b,t} = \beta_S \text{Bond net flow}_{d,b,t} &+ \sum_{i=-1}^{1} \beta_{S,+,i} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Upgrade,b,t-i} \\
&+ \sum_{i=-1}^{1} \beta_{S,-,i} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Downgrade,b,t-i} \\
&+ \beta_H \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \\
&+ \sum_{i=-1}^{1} \beta_{H,+,i} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{Upgrade,b,t-i} \\
&+ \sum_{i=-1}^{1} \beta_{H,-,i} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{Downgrade,b,t-i} \\
&+ \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t},
\end{aligned}
$$

where $\mathbf{1}_{Upgrade,b,t-i}$ is an indicator equal to 1 if bond b is upgraded from speculative to investment grade in week $t-i$ and $\mathbf{1}_{Downgrade,b,t-i}$ is an indicator equal to 1 if bond b is downgraded from investment to speculative grade in week $t-i$. The coefficients $\{\beta_{S,\pm,i}\}_{i=-1}^{1}$ capture the extent to which speculative decisions by the institutions are influenced by exogenous order flows around credit rating upgrades and downgrades; when $\beta_{S,\pm,i}$ is positive, institutions speculate less in week i following a credit rating change. Similarly, the coefficients $\{\beta_{H,\pm,i}\}_{i=-1}^{1}$ capture the extent to which

[15] The standard deviation of bond flow in the sample of paired transactions is \$18 million. Multiplying by the estimated coefficients β_S and β_H in Table 2, we obtain the above results. See Table A.2 for these and further summary statistics of transaction sizes.

hedging decisions by the institutions are influenced by exogenous order flows around credit rating upgrades and downgrades; when $\beta_{H,\pm,i}$ is negative, institutions hedge a smaller fraction of their bond transactions in week i following a credit rating change.

Table 3 reports the estimated coefficients β_H, $\{\beta_{H,\pm,i}\}_{i=-1}^{1}$, β_S, and $\{\beta_{S,\pm,i}\}_{i=-1}^{1}$ for net flow in the single name CDS contracts, index CDS contracts, and both single name and index CDS contracts, controlling for weeks around credit rating upgrades and downgrades. Comparing the estimated coefficients β_S and β_H in Table 2 to the estimates in Table 3, we see that the elasticities of CDS transaction volume to hedging and speculative motives remain the same after controlling for exogenous events in the bond market. This suggests that the elasticities estimated in Table 2 are primarily driven by institutions' endogenous portfolio allocation decisions, and not by their responses to stressed customer order flow.

Table 3 also shows that institutions respond differently to downgrades than to upgrades, consistent with the interpretation that bond downgrades create fire sales but bond upgrades do not engender "fire buys". In the single name CDS market, all institutions engage in less speculation and less hedging the week after a bond downgrade, with a one dollar transaction in corporate bonds accompanied by a two cent reduction in net protection sold if the CDS transaction is used for further speculation, and by a three cent increase in net protection bought is the CDS transaction is used for hedging of the bond transaction. In contrast, transaction volume in the single name market does not change significantly around weeks in which the bond is upgraded.

Institutions do, however, change the transaction volume in index CDS contracts around bond upgrades, undoing the incentives to hedge bond transactions the week before and the week of bond upgrades and reversing the incentives to speculate in the index CDS market the week before the upgrade. In particular, in the week before a bond upgrade, when an institution uses the CDS market to speculate, it decreases its net protection sold by nine cents for every dollar of corporate bonds bought.

Overall, Table 3 shows that institutions use both the single name and the index CDS markets to respond to abnormal transaction volume the week after bonds are downgrade, and use the index market in anticipation of and contemporaneous with a bond upgrade. Controlling for these responses does not, however, change the estimated average responses, suggesting that institutions' own demand for credit exposure is the primary determinant of their transaction volume choices.

5 Incentives to Hedge

The previous Section studied institutions' participation decisions taking participation costs as given. As we discussed in Section 2, transaction, as well as market participation, costs affect the optimal portfolio choice of institutions: *ceteris paribus*, an institution will prefer to use the market with the lowest transaction cost to change exposure. In this Section, we study the extent to which transaction costs feature in institutional decision making by examining how institutions' choices change after transaction costs change. We consider two types of transaction cost changes: those engendered by regulatory reforms of the banking sector in response to the financial crisis, and those that arise from central clearing. As we discuss in greater detail below, post-crisis regulations changes the costs of participation in both CDS and corporate bond markets, central clearing changes the cost of participating in the CDS market only.

5.1 Changes in regulatory regimes

The financial crisis of 2007-09 highlighted shortcomings in the regulatory framework of banks and dealers. Subsequent regulatory reforms were motivated by institutions' experience of both solvency and liquidity problems during the crisis. While some regulations focus on the general health of regulated entities, others directly restrict certain types of trading activities.[16] In the U. S., the Basel III capital and leverage rules, the liquidity coverage ratio (LCR) and the Volcker rule have particular saliency for credit markets. Basel III capital regulation increases the cost of holding corporate bond positions by including the notional amount of the repurchase agreements usually used to fund bond positions in leverage ratio calculations and increases the cost of holding derivative positions by recognizing a fraction of the notional amount of the derivative position.[17] Indeed, over sixty percent of survey participants in European Systemic Risk Board (ESRB) 2016 qualitative assessment exercise described capital requirements as disincentivising market making activity (see ESRB, 2016). In addition, the Volcker rule prohibits regulated entities in the U. S. from participating in markets for proprietary trading purposes, making institutions less likely to participate in the corporate bond

[16] The discussion of all relevant regulations is outside the scope of this paper. See discussions in Adrian et al. (2017) and Boyarchenko et al. (2016a) for a subset of relevant regulations and a regulation implementation time line.

[17] Prior to Basel III, off-balance-sheet activities such as repo funding and derivatives exposure were not recognized for leverage calculations. See Boyarchenko et al. (2016b) for an in-depth discussion of the effect of Basel III leverage requirements on the corporate bond and CDS markets.

market. On the other hand, the LCR does provide an incentive for holding corporate bonds rather than derivatives by recognizing the corporate bond positions as part of institutional holdings of high quality liquid assets, albeit with a smaller weight than cash-equivalent instruments. Thus, while some regulations disincentivize institutions from participating in both CDS and corporate bond markets, others are more beneficial for one market relative to the other.

Evaluating the impact of individual regulation is further complicated by the clustering of regulation over time. In addition, some institutions responded to regulations in advance of the rules being finalized, as the broad contours of the reforms was often known before the rules were finalized. Because of these considerations, we follow prior literature (see e.g. Bessembinder et al., 2016; Adrian et al., 2017) and compare participation decisions across different subperiods. We split our sample into two subperiods – rule writing (January 1, 2010 – December 31, 2013) and rule implementation (January 1, 2014 – end of sample) – and consider the overall impact of regulatory changes on credit markets.

Figure 8 shows the transaction probabilities[18] for the rule writing (Figure 8a) and the rule implementation (Figure 8b) periods. Consistent with Basel III requirements increasing the cost of participating in credit markets overall, G-SIBs have a significantly lower probability of changing their credit exposure during the rule implementation period, while the transaction probability of the non-G-SIB institutions does not appear to be different across the two subsamples. The decrease in the probability of G-SIBs to change exposures is primarily driven by a lower probability of using index CDS to change exposure, both when the index CDS is used alone and when the index CDS is used in conjunction with the single name CDS contract. This could be the result of increased capital costs for unhedged credit exposures, increased difficulty in netting CDS positions for leverage calculation purposes, and the contribution of the gross notional of derivative positions to the G-SIB score.

Figure 8 intimates a potential beneficial effect of regulation: institutions take on orphaned exposures through the index CDS contract less frequently. We now turn to examining whether

[18]Similarly to the full sample probabilities, the probability of institution d having transaction of type j in entity b in a given subperiod τ is given by

$$\mathbb{P}^{\tau}_{b,d,j} = \frac{\#\text{weeks}_{b,d,j,\tau}}{\#\text{weeks}_{b,\tau}},$$

where $\#\text{weeks}_{b,\tau}$ if the number of weeks in subperiod τ in which any institution has a transaction of any type in reference entity b.

the relationship between bond and CDS transaction flows changes during the rule implementation period. In particular, we modify the baseline specification (1) and estimate

$$\begin{aligned}\text{CDS net flow}_{d,b,t} = {} & \beta_S \text{Bond net flow}_{d,b,t} + \beta_{S,RI} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{\text{Rule imp.}} \\ & + \beta_H \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \\ & + \beta_{H,RI} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{\text{Rule imp.}} \\ & + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t},\end{aligned}$$

where $\mathbf{1}_{\text{Rule imp.}}$ is an indicator equal to 1 in the rule implementation period. The coefficients $\beta_{S,RI}$ and $\beta_{H,RI}$ capture the extent to which institutions' speculative and hedging activities, respectively, are affected by changes in the regulatory regime. When $\beta_{S,RI}$ is positive, institutions engage in less speculation during the rule implementation period than during the rule writing period. Similarly, when $\beta_{H,RI}$ is negative, institutions engage in less hedging during the rule implementation period.

Table 4 reports the estimated coefficients β_S, $\beta_{S,RI}$, β_H and $\beta_{H,RI}$ for net flow in the single name CDS contracts, index CDS contracts and both single name and index CDS contracts. The change in the regulatory regime has the biggest impact on G-SIBs, with institutions reducing both their speculative and their hedging activity in the CDS market. In the rule implementation period, when a G-SIB uses the CDS market to hedge corporate bond transactions, a one dollar increase in the bond buy position is accompanied by only a 3 cent increase in the net protection bought. Similarly, when a G-SIB uses the CDS market to speculate during the rule implementation period, the institution increases net protection sold in CDS by 1 cent for every dollar of corporate bonds bought. These effects are similar when looking at transactions in the single name and the index contracts individually, though some of the interaction coefficients are not statistically significant for the non-U. S. G-SIBs sample.

Finally, the estimates in Table 4 reflect institutions aggregate hedging and speculative activity. Table A.4 investigates whether the contribution of exogenous customer flows to institutions' hedging decisions changes during the rule implementation period. Consistent with the full sample results in Table 3, we see that changes in the elasticities of CDS transaction volume to hedging and speculative motives during the rule implementation period remain the same after controlling for exogenous events in the bond market.

5.2 Changes in CDS market structure

Just as new capital and liquidity regulation was introduced in the aftermath of the crisis to improve resilience of financial institutions, the CDS market has also evolved since the financial crisis exposed its imperfections. In this paper, we focus on the impact of the introduction of central clearing for the single name CDS market. In the U. S., single name CDS contracts are not mandatorily cleared, and become eligible for clearing when a clearing house accepts them for clearing; we use the dates that single name contracts become eligible for clearing on the Intercontinental Exchange (ICE Clear Credit). The impact of clearing eligibility on the propensity to use single name CDS contracts is ambiguous. On the one hand, when a contract becomes clearing eligible, institutions subject to SLR face lower capital requirements, and all institutions face lower counterparty credit risk when trading the cleared contract. On the other hand, the CCPs require all institutions to post margins; prior to the recent introduction of mandatory margin rules, CDS dealers were not required to post margin.

Figure 9 shows the transaction probabilities[19] for reference entities that have uncleared (Figure 9a) and cleared (Figure 9b) single name contracts. When the single name contract becomes eligible for clearing, both U. S. and non-U. S. G-SIBs increase their use of single name CDS contracts, while the transaction probabilities of non-G-SIBs remain unchanged. U. S. G-SIBs in particular have a higher probability of using the single name CDS in conjunction with either the index CDS contract or with corporate bond transactions. The increased willingness of G-SIBs to use single name contracts after they become cleared suggest that, at least for these institution types, the benefits of clearing outweigh the costs of posting higher margin when transacting with a central clearing party (CCP). The differential impact on G-SIBs relative to the non-G-SIB institutions suggests that considerations such as lower capital requirements for cleared contracts are a more significant determinant of CDS market participation than reduced counterparty risk of such contracts is.

Table 5 shows that, in addition to having a larger probability to transact in the single name

[19] Similarly to the full sample probabilities, the probability of institution d having transaction of type j in entity b in when the single name is cleared is given by

$$\mathbb{P}^{Cleared}_{b,d,j} = \frac{\#\text{weeks}_{b,d,j,cleared}}{\#\text{weeks}_{b,cleared}},$$

where $\#\text{weeks}_{b,cleared}$ if the number of weeks in which any institution has a transaction of any type in reference entity b and the single name CDS contract is eligible for clearing.

CDS market, U. S. G-SIBs have higher transaction volumes in single name contracts when the single name contract becomes eligible for clearing. These changes are both statistically and economically significant, with U. S. G-SIBs buying $2 million more single name contracts and selling $2.5 million more single name contracts in an average week after the contract becomes eligible for clearing, corresponding to two-thirds of the full sample average transaction volume. Table 5 also shows that, when the single name becomes eligible for clearing, G-SIBs reduce their transaction volumes in the corresponding index contract. That is, both U. S. and non-U. S. G-SIBs substitute away from using index contracts to using single name contracts, reducing the volume of index transactions at a greater rate than they increase the volume of single name transactions. At the same time, non-G-SIBs increase the volume of their transactions in the index contract, suggesting that transaction volume in the index contract migrates from G-SIBs to other types of institutions as G-SIBs increase their participation in the single name contract.

Finally, Table 6 shows that, although G-SIBs have a higher transaction volume in the single name market after the contract becomes eligible for clearing, clearing eligibility does not affect the relationship between CDS net flow and corporate bond net flow. Table A.5 does, however, suggest that institutions may hedge a lower fraction of corporate bond volume in anticipation of bond downgrades when the single name contract is eligible for clearing.

6 Conclusion

This paper studies the credit market participation decisions at the reference entity level of institutions that trade in both corporate bonds and CDS by analyzing both the extensive (the probability of transactions) and the intensive (the CDS net transaction flow relative to net bond transaction flow) margins of participation decisions. Using a unique dataset of paired institution-reference entity-level transactions in corporate bonds, and of direct exposure through single name and indirect exposure through index CDS, we uncover four facts.

First, the probability of an institution changing its exposure to a particular reference entity in an average week is small: U. S. G-SIBs have a 45 percent probability of changing their exposure in an average week, non-U. S. G-SIBs have a 20 percent probability, and other types of institutions have a 5 percent probability. When they do change exposure, institutions also have a low probability in transacting in both the CDS and the corporate bond market in the same week. Thus, using aggregate transaction flows, even at the reference entity level, to study hedging and speculation in the CDS market may be misleading about the extent to which market participants use the CDS market for either hedging or speculative purposes.

Second, different types of institutions pursue different strategies when participating in the CDS market. While G-SIBs participate in both single name and index CDS markets, other types of institutions primarily use index contracts and, in our sample, account for 60 percent of volume traded in index contracts. When an institution uses index CDS contracts to change exposure to an individual reference entity, it also inadvertently changes its exposure to the other members of the index, creating "orphaned" positions. If the liquidity of single name contracts is different from index contracts, orphaned positions created by the index are not easily hedged with single name positions and may create systemic risk vulnerabilities.

Third, innovations in the global regulatory environment introduced after the 2007-2009 financial crisis had a significant impact on the participation decisions of G-SIBs. During the later half of our sample (January 1, 2014- October 27, 2017), G-SIBs reduce the probability of using index CDS to change their credit risk exposure, thus lowering the overall probability of naked CDS transactions, but they also hedge a lower fraction of their corporate bond transaction volume using CDS transactions. Thus, post-crisis capital rules have had both the beneficial effect of reducing speculative activity in the CDS market by large systemic institutions but also the detrimental effect of reducing the use of CDS for hedging purposes.

Finally, single name clearing eligibility increases the probability of G-SIBs to use single name CDS contracts to change exposure but has little effect on the propensity of other types of institutions to use single name CDS. This implies that, for large institutions, the benefits of reduced capital requirements for centrally cleared contracts outweigh the costs of posting margin to the CCP. In addition, in increasing their single name transactions, G-SIBs substitute away from transacting in the corresponding index contract, while other types of institutions increase the volume of transactions in the index. That is, index transaction volume moves from G-SIBs to smaller institutions when the single name constituents of the index become eligible for clearing, which may reduce liquidity of the index contract.

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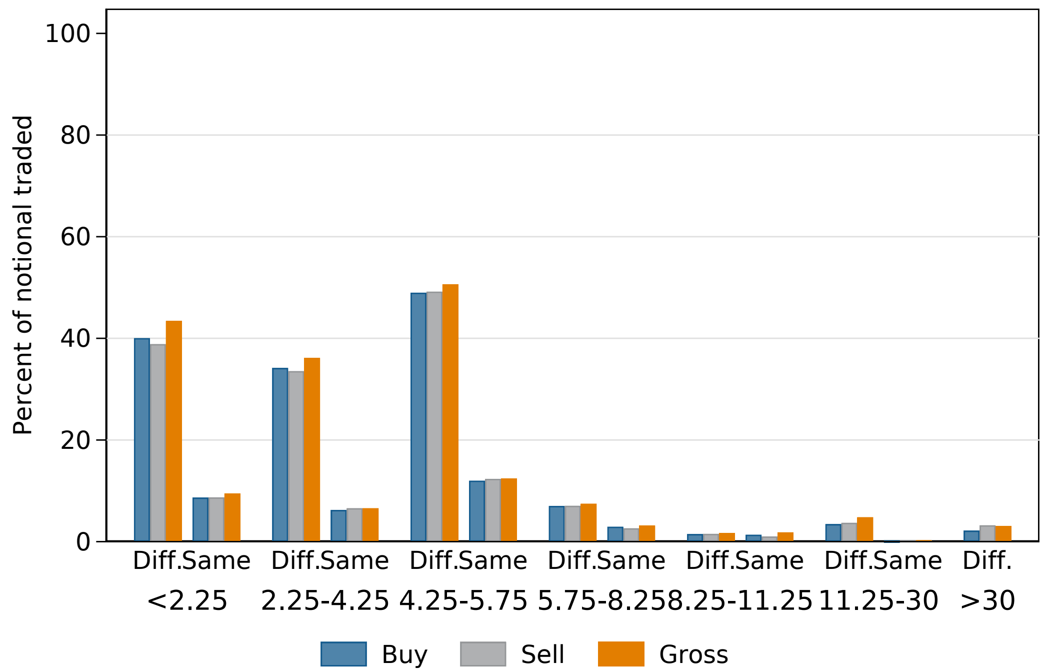
Figure 2. Maturity of CDS contracts traded. This figure summarizes the fraction of notional traded each week by original maturity of the CDS contract and whether the original maturity of the CDS contract matches the time-to-maturity of the bond ("Same"). Sample: Jan 2010 – Oct 2017.

(a) Single name contracts



(b) Index contracts

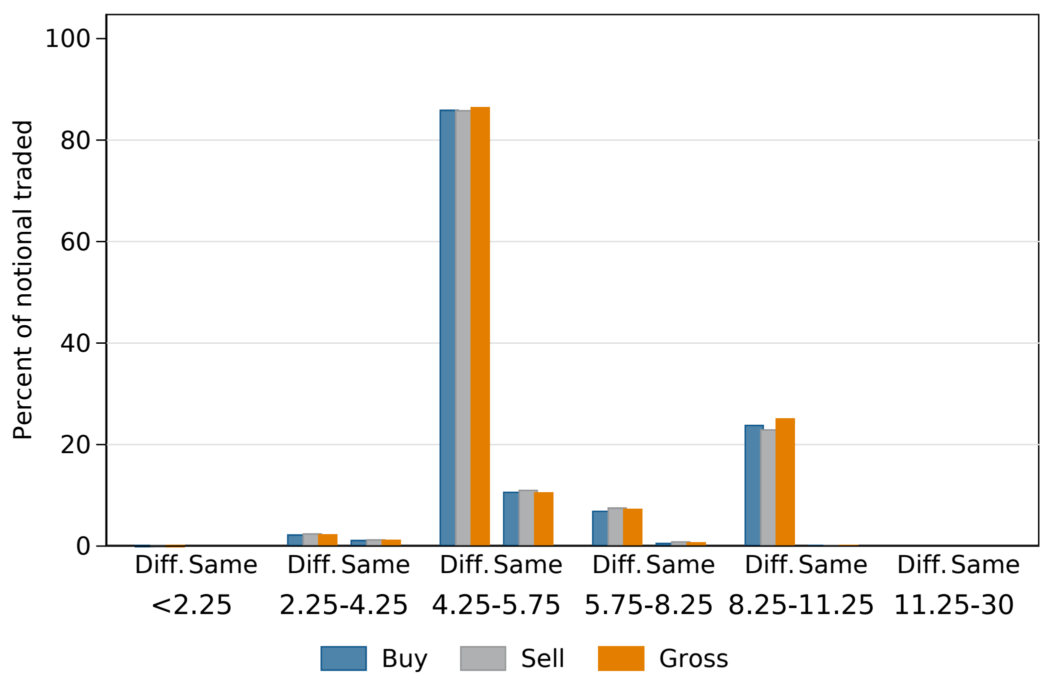
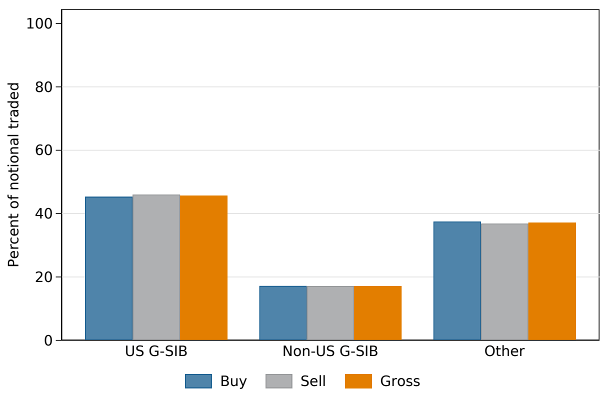
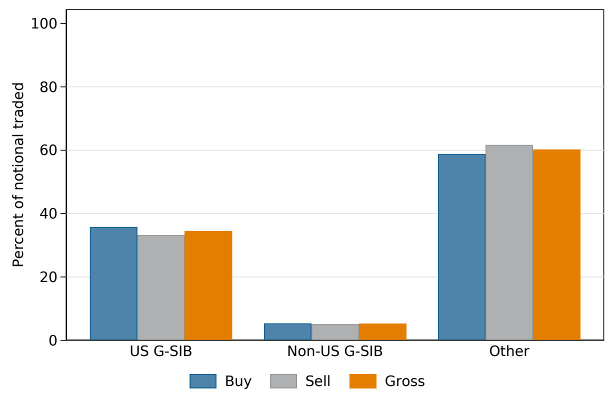


Figure 3. Transaction volume by institution type. This figure summarizes the fraction of notional traded in single name CDS contracts, index CDS contracts, and corporate bonds by type of institution. Sample: Jan 2010 – Oct 2017.

(a) Single name contracts



(b) Index contracts



(c) Corporate bonds

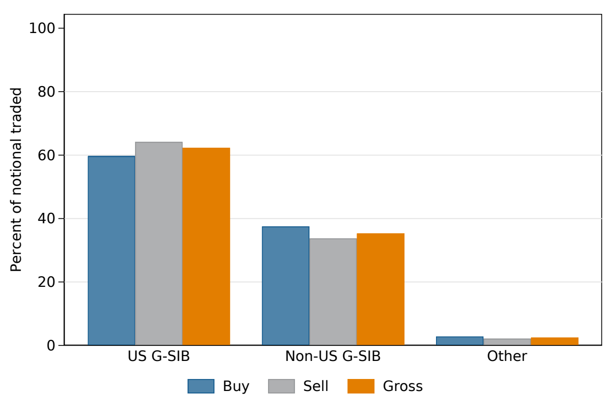
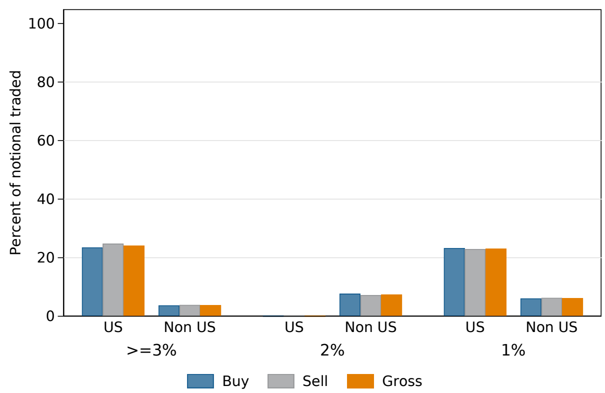
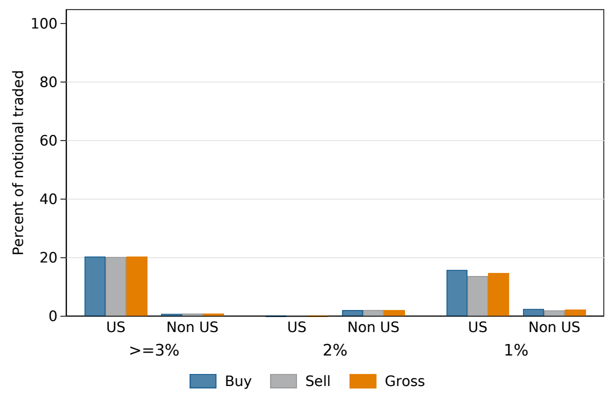


Figure 4. Transaction volume by G-SIB surcharge. This figure summarizes the fraction of notional traded in single name CDS contracts, index CDS contracts, and corporate bonds by G-SIB surcharge bucket for U. S. and non-U. S. G-SIBs. Sample: Jan 2010 – Oct 2017.

(a) Single name contracts



(b) Index contracts



(c) Corporate bonds

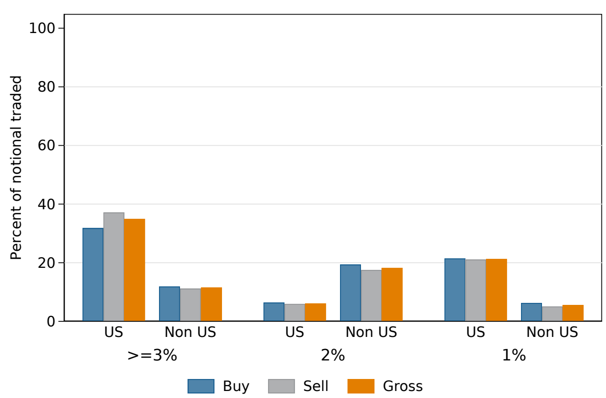
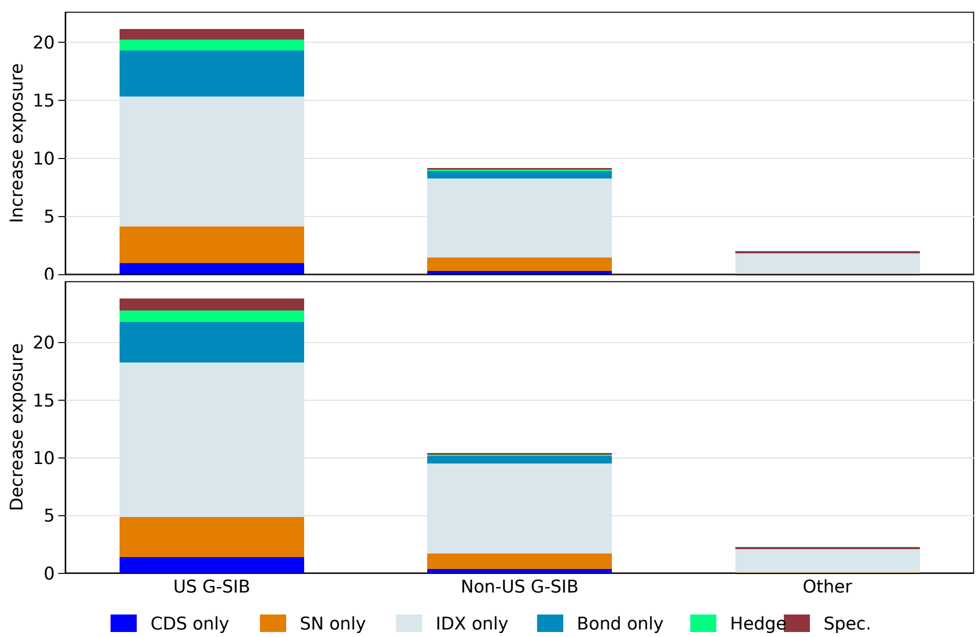


Figure 5. Transaction type probability. This figure summarizes the probability of different types of paired bond–CDS transactions. Figure 5a shows the unweighted probabilities, and Figure 5b shows the probabilities weighted by gross transaction volume. "CDS only" indicates a trade in both the index and single name CDS contract but not in the bond; "SN only" indicates a trade in only the single name CDS contract; "IDX only" indicates a trade in only the index CDS contract; "Bond only" indicates a trade in only the bond; "Hedge" indicates a trade in both bond and CDS with the CDS change in net exposure offsetting the change in the bond exposure; "Spec." indicates a trade in both bond and CDS with the CDS change in net exposure amplifying the change in the bond exposure. Sample: Jan 2010 – Oct 2017.

(a) Unweighted



(b) Gross-volume-weighted

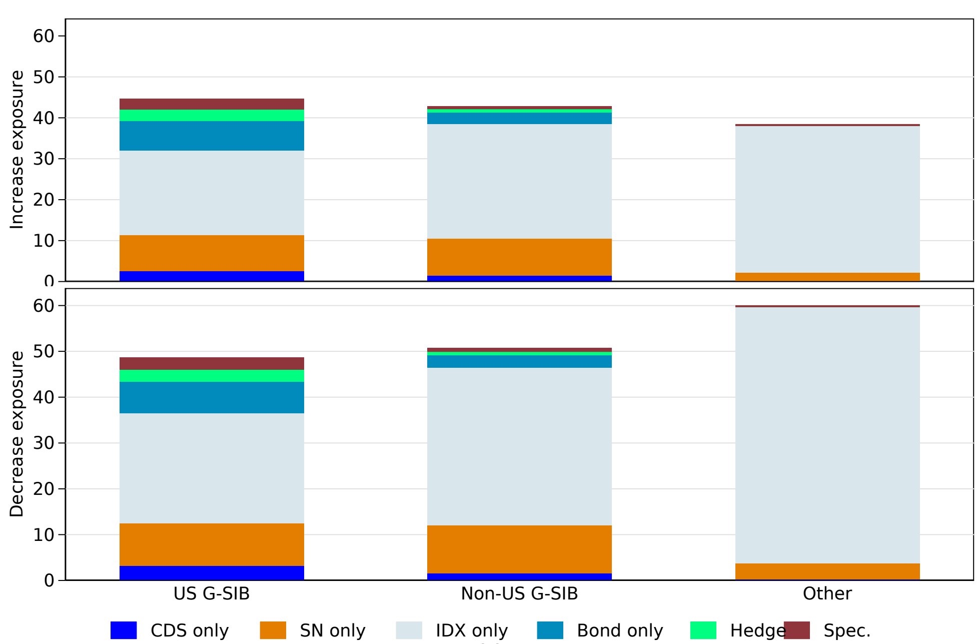
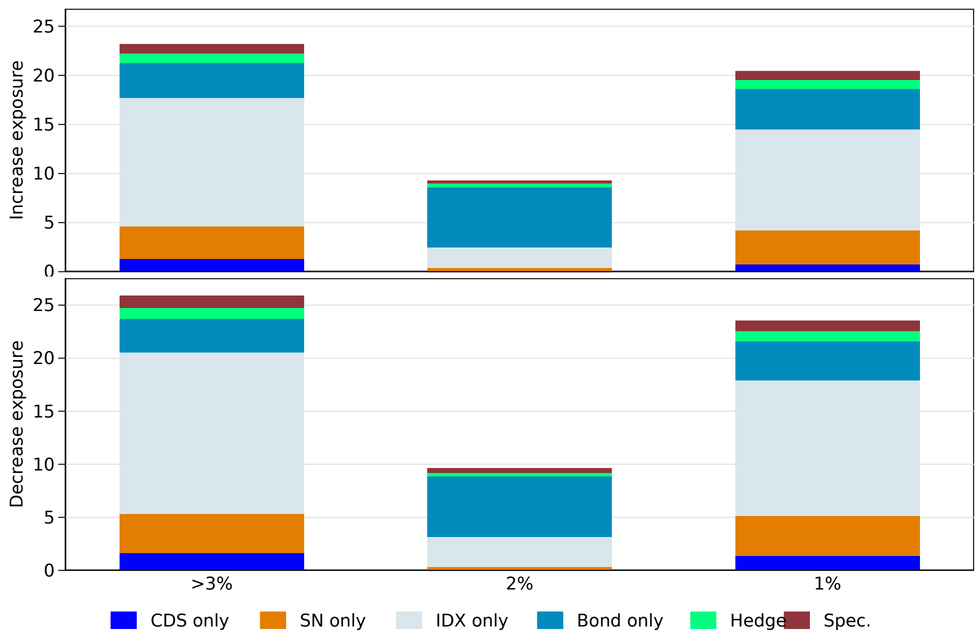


Figure 6. Probability of transaction by institutions' systemicness. This figure summarizes the probability of different types of paired bond–CDS transactions by G-SIB surcharge bucket for U. S. and non-U. S. institutions. "CDS only" indicates a trade in both the index and single name CDS contract but not in the bond; "SN only" indicates a trade in only the single name CDS contract; "IDX only" indicates a trade in only the index CDS contract; "Bond only" indicates a trade in only the bond; "Hedge" indicates a trade in both bond and CDS with the CDS change in net exposure offsetting the change in the bond exposure; "Spec." indicates a trade in both bond and CDS with the CDS change in net exposure amplifying the change in the bond exposure. Sample: Jan 2010 – Oct 2017.

(a) U. S. G-SIBs



(b) Non-U. S. G-SIBs

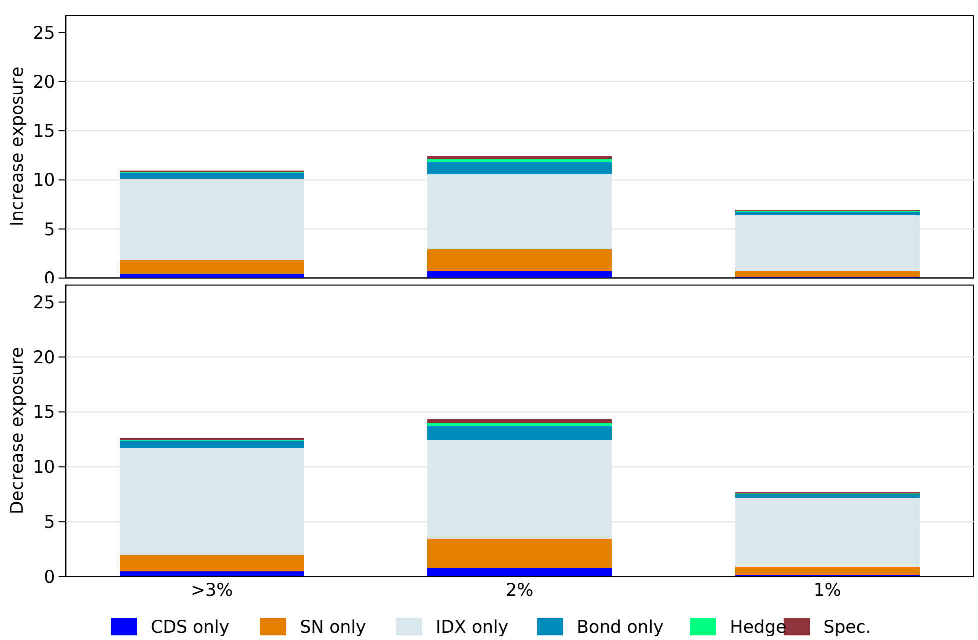
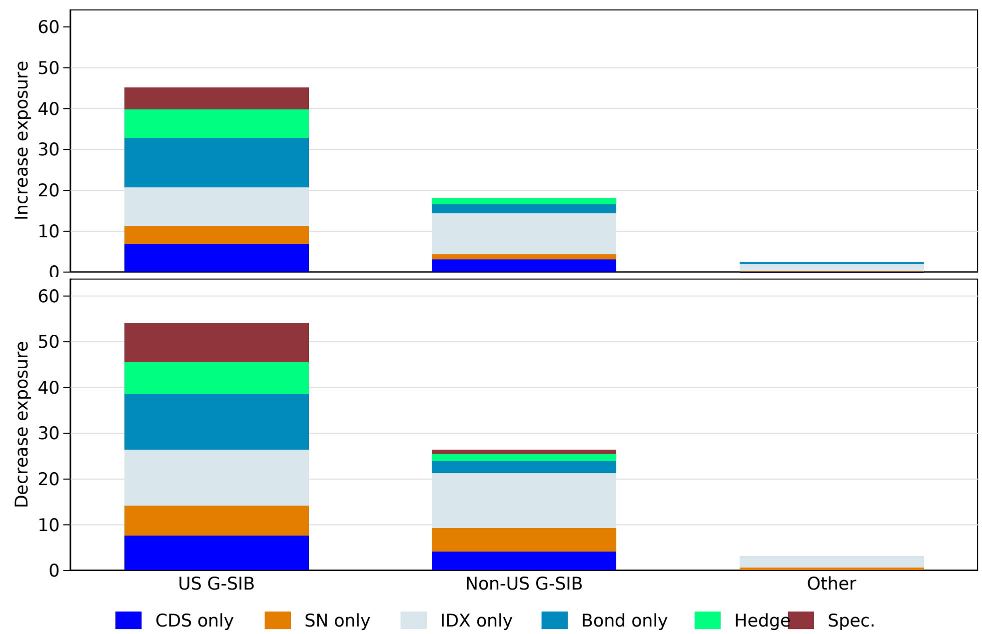


Figure 7. Probability of transactions after credit events. This figure summarizes the probability of different types of paired bond–CDS transactions the week of a bond downgrade from investment-grade to high yield credit rating (7a) and the week of a bond upgrade from high yield to investment-grade credit rating (7b). "CDS only" indicates a trade in both the index and single name CDS contract but not in the bond; "SN only" indicates a trade in only the single name CDS contract; "IDX only" indicates a trade in only the index CDS contract; "Bond only" indicates a trade in only the bond; "Hedge" indicates a trade in both bond and CDS with the CDS change in net exposure offsetting the change in the bond exposure; "Spec." indicates a trade in both bond and CDS with the CDS change in net exposure amplifying the change in the bond exposure. Sample: Jan 2010 – Oct 2017.

(a) Downgrades



(b) Upgrades

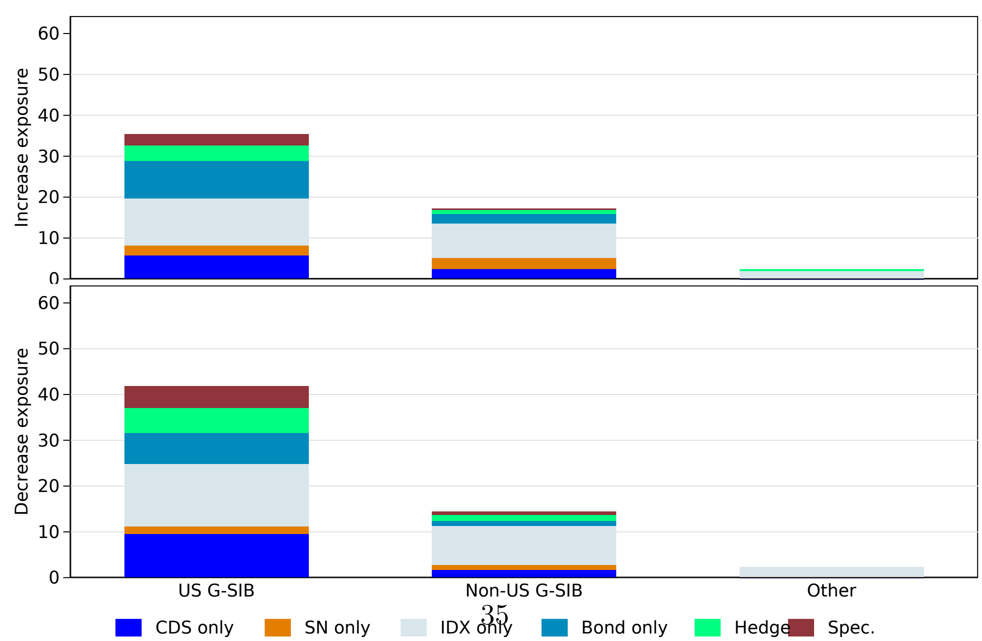
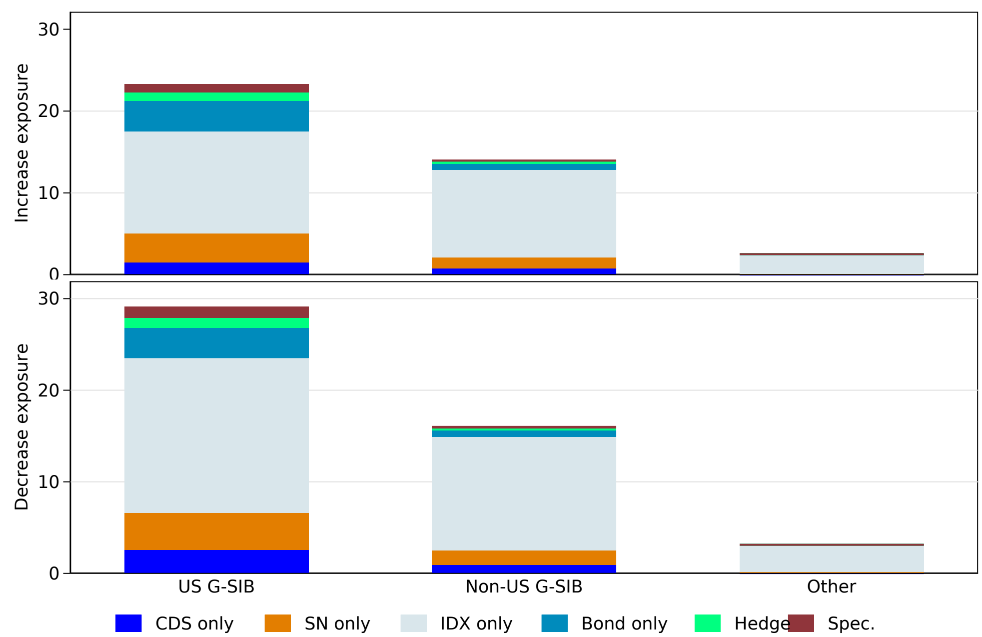


Figure 8. Probability of transactions by regulatory regime. This figure summarizes the probability of different types of paired bond–CDS transactions across different regulatory regimes. "Rule writing" is the period Jan 2010 – Dec 2012; "rule implementation" is the period Jan 2013 – Oct 2017. "CDS only" indicates a trade in both the index and single name CDS contract but not in the bond; "SN only" indicates a trade in only the single name CDS contract; "IDX only" indicates a trade in only the index CDS contract; "Bond only" indicates a trade in only the bond; "Hedge" indicates a trade in both bond and CDS with the CDS change in net exposure offsetting the change in the bond exposure; "Spec." indicates a trade in both bond and CDS with the CDS change in net exposure amplifying the change in the bond exposure. Sample: Jan 2010 – Oct 2017.

(a) Rule writing



(b) Rule implementation

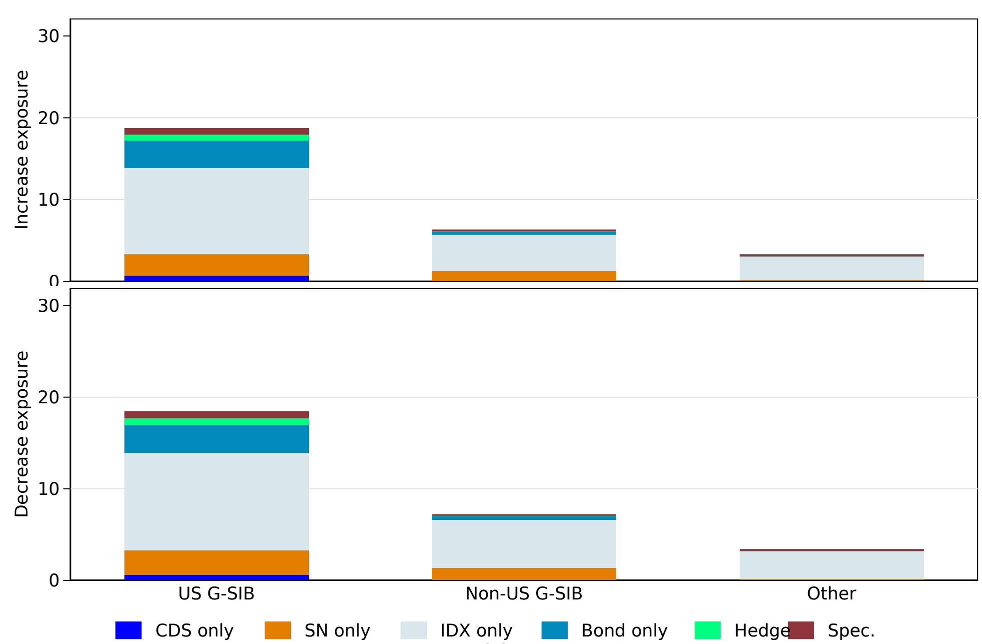
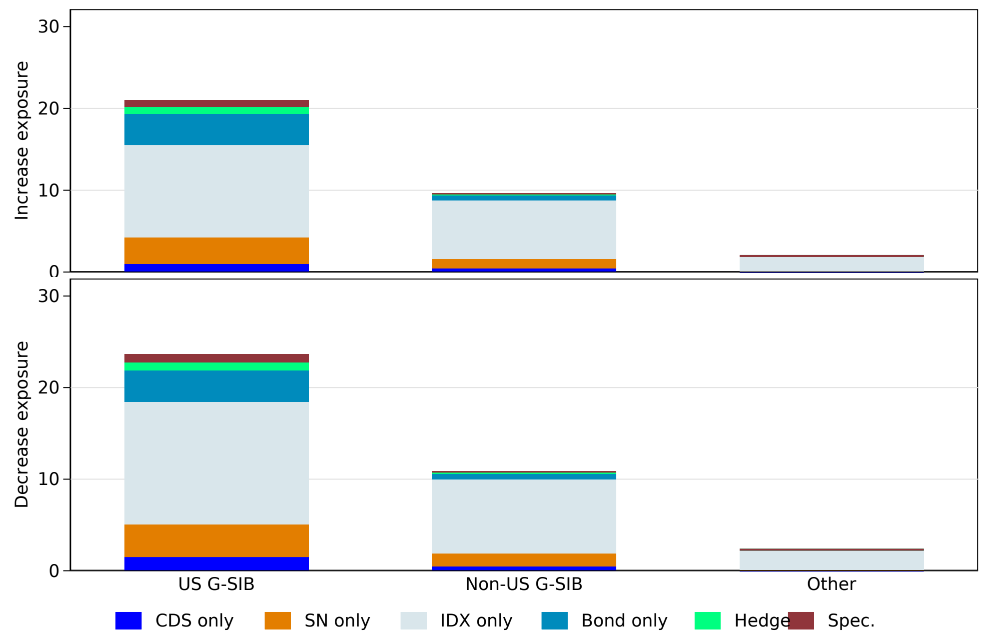


Figure 9. Probability of transactions by clearing eligibility. This figure summarizes the probability of different types of paired bond–CDS transactions by clearing eligibility of single name contracts. "CDS only" indicates a trade in both the index and single name CDS contract but not in the bond; "SN only" indicates a trade in only the single name CDS contract; "IDX only" indicates a trade in only the index CDS contract; "Bond only" indicates a trade in only the bond; "Hedge" indicates a trade in both bond and CDS with the CDS change in net exposure offsetting the change in the bond exposure; "Spec." indicates a trade in both bond and CDS with the CDS change in net exposure amplifying the change in the bond exposure. Sample: Jan 2010 – Oct 2017.

(a) Not eligible



(b) Eligible

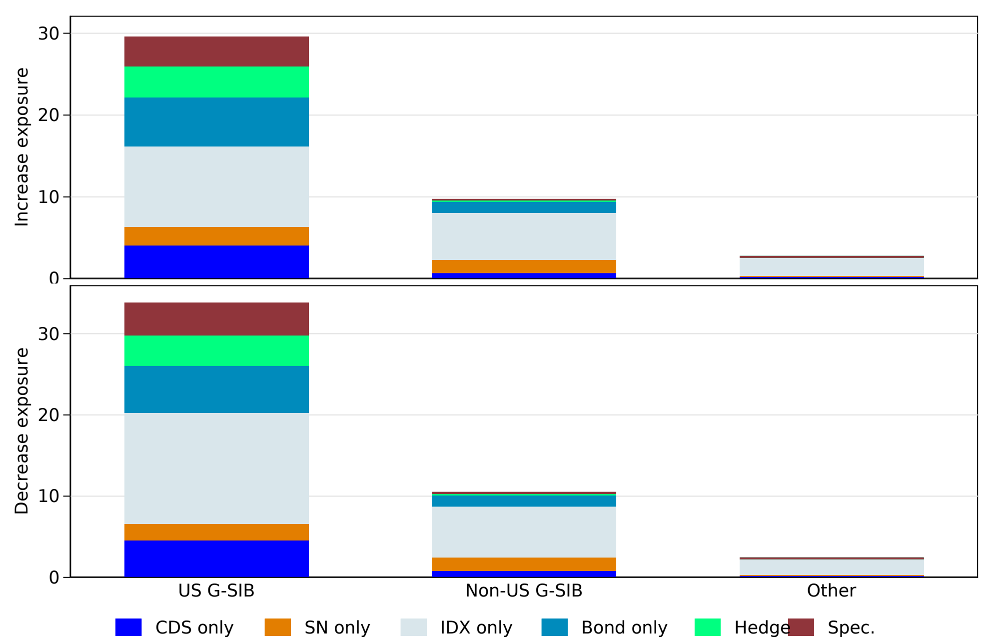


Table 1: Types of transactions. This table reports the paired transaction types considered in this paper, with a transaction in the CDS market occurring the same week as a transaction in the corporate bond market. "CDS" refers to the net transaction in single name and index contracts, signed so that a positive change corresponds to an increase in protection bought.

Transaction type	Δ Bond	Δ CDS	Δ Net exposure
Market-neutral	0	0	0
	\$X>0	\$X>0	0
	\$X<0	\$X<0	0
Hedging	\$X>0	\$Y>0	$\$(X-Y)$
	\$X<0	\$Y<0	$\$(X-Y)$
Speculative	$\$X\neq 0$	0	\$X
	0	$\$Y\neq 0$	-\$Y
	\$X>0	-\$Y<0	$\$\,(X+Y)$
	\$X<0	-\$Y>0	$\$\,(X+Y)$

Table 2: Relationship between CDS and bond net flows. This table reports the estimated coefficients β_S and β_H from the regression

$$\text{CDS net flow}_{d,b,t} = \beta_S \text{Bond net flow}_{d,b,t} + \beta_H \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t},$$

where $\mathbf{1}_{Hedge,d,b,t}$ is an indicator of whether the transaction in the CDS is hedging the bond transactions. Sample: Jan 2010 – Oct 2017. T-statistics based on standard errors clustered at the quarter-BHC level reported below point estimates; all regressions include week, bond, BHC, BHC-bond, bond-week and BHC-week fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%.

		SN			IDX			Both	
	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB
Bond flow	-0.07	-0.05	-0.04	-0.11	-0.14	-0.01	-0.16	-0.19	-0.07
	(0.02)***	(0.02)***	(0.03)	(0.03)***	(0.04)***	(0.00)***	(0.04)***	(0.06)***	(0.02)***
Hedging × Bond flow	0.12	0.10	0.12	0.18	0.21	0.03	0.26	0.29	0.13
	(0.03)***	(0.04)**	(0.05)**	(0.05)***	(0.07)***	(0.01)***	(0.07)***	(0.09)***	(0.03)***
Adj. R-sqr.	-0.07	-0.09	0.08	0.30	0.28	0.50	0.25	0.23	0.22
N. of obs.	53648	40374	3726	135771	100358	16199	135771	100358	16199

Table 3: Relationship between CDS and bond net flows around credit events. This table reports the estimated coefficients β_S, $\beta_{S,\pm,i}$, β_H and $\beta_{H,\pm,i}$ from the regression

$$\text{CDS net flow}_{d,b,t} = \beta_S \text{Bond net flow}_{d,b,t} + \sum_{i=-1}^{1} \beta_{S,+,i} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Upgrade,b,t-i} + \sum_{i=-1}^{1} \beta_{S,-,i} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Downgrade,b,t-i} + \beta_H \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} + \sum_{i=-1}^{1} \beta_{H,+,i} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{Upgrade,b,t-i}$$
$$+ \sum_{i=-1}^{1} \beta_{H,-,i} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{Downgrade,b,t-i} + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t},$$

where $\mathbf{1}_{Hedge,d,b,t}$ is an indicator of whether the transaction in the CDS is hedging the bond transactions, $\mathbf{1}_{Upgrade,b,t-i}$ is an indicator of bond b upgraded from high yield to investment-grade in week $t-i$, and $\mathbf{1}_{Downgrade,b,t-i}$ is an indicator of bond b downgraded from investement-grade to high yield in week $t-i$. Sample: Jan 2010 – Oct 2017. T-statistics based on standard errors clustered at the quarter-BHC level reported below point estimates; all regressions include week, bond, BHC, BHC-bond, bond-week and BHC-week fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%.

		SN			IDX			Both	
	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB
Bond flow	-0.07	-0.05	-0.04	-0.15	-0.19	-0.01	-0.16	-0.19	-0.06
	(0.02)***	(0.02)***	(0.03)	(0.04)***	(0.06)***	(0.00)***	(0.04)***	(0.06)***	(0.02)***
Wk before downgrade × Bond flow	0.06	0.03	0.00	0.15	0.23	2.08	0.15	0.20	0.24
	(0.11)	(0.09)	(.)	(0.06)**	(0.15)	(0.34)***	(0.06)**	(0.11)*	(0.52)
Wk of downgrade × Bond flow	0.18	0.40	0.00	-1.95	-1.90	0.12	-1.30	-1.05	-1.01
	(1.10)	(1.05)	(.)	(0.99)**	(1.06)*	(0.30)	(1.08)	(0.98)	(1.48)
Wk after downgrade × Bond flow	0.09	0.07	0.00	0.22	0.24	0.02	0.20	0.21	0.01
	(0.03)***	(0.03)**	(.)	(0.08)***	(0.09)***	(0.02)	(0.05)***	(0.06)***	(0.05)
Wk before upgrade × Bond flow	-0.02	-0.36	0.00	0.24	0.38	0.00	0.20	0.32	0.01
	(0.11)	(1.01)	(.)	(0.10)**	(0.19)**	(0.01)	(0.07)***	(0.14)**	(0.03)
Wk of upgrade × Bond flow	-0.02	-0.04	-10.91	0.33	0.27	0.05	0.20	0.11	-1.14
	(0.06)	(0.07)	(18.09)	(0.21)	(0.11)**	(0.11)	(0.19)	(0.18)	(2.85)
Wk after upgrade × Bond flow	0.06	0.15	-1.18	-0.45	-0.41	-0.02	-0.34	-0.61	0.26
	(0.57)	(0.66)	(1.53)	(0.57)	(0.76)	(0.09)	(0.50)	(0.61)	(0.42)
Hedging × Bond flow	0.12	0.10	0.12	0.26	0.32	0.03	0.26	0.29	0.13
	(0.03)***	(0.04)**	(0.05)**	(0.07)***	(0.10)***	(0.01)***	(0.07)***	(0.09)***	(0.03)***
Wk before downgrade × Hedging × Bond flow	0.61	0.43	0.00	-0.20	-0.27	-0.53	-0.17	-0.23	0.17
	(0.45)	(0.40)	(.)	(0.12)*	(0.17)	(0.13)***	(0.12)	(0.15)	(0.30)
Wk of downgrade × Hedging × Bond flow	-0.32	-0.51	0.00	1.72	1.64	0.00	1.15	0.91	0.00
	(1.18)	(1.14)	(.)	(0.97)*	(1.03)	(.)	(1.12)	(1.04)	(.)
Wk after downgrade × Hedging × Bond flow	-0.09	-0.07	0.17	-0.00	-0.04	-0.02	-0.09	-0.16	-0.10
	(0.05)*	(0.05)	(0.53)	(0.27)	(0.28)	(0.06)	(0.15)	(0.16)	(0.16)
Wk before upgrade × Hedging × Bond flow	-0.03	0.50	0.00	-0.30	-0.58	-0.02	-0.23	-0.43	-0.04
	(0.10)	(1.04)	(.)	(0.12)***	(0.26)**	(0.01)*	(0.10)**	(0.19)**	(0.04)
Wk of upgrade × Hedging × Bond flow	-0.05	0.39	10.66	-0.50	-1.41	-0.06	-0.41	-1.48	1.09
	(0.10)	(0.46)	(17.80)	(0.25)**	(1.00)	(0.11)	(0.23)*	(1.05)	(2.82)
Wk after upgrade × Hedging × Bond flow	-0.12	0.00	1.64	0.39	0.88	0.01	0.27	0.73	-0.32
	(0.57)	(0.62)	(1.43)	(0.56)	(0.65)	(0.09)	(0.50)	(0.57)	(0.43)
Adj. R-sqr.	-0.07	-0.09	0.07	0.34	0.32	0.57	0.25	0.23	0.22
N. of obs.	53648	40374	3726	111465	82302	13962	135771	100358	16199

Table 4: Relationship between CDS and bond net flows across regulatory regimes. This table reports the estimated coefficients β_S, $\beta_{S,Post}$, β_H and $\beta_{H,Post}$ from the regression

$$\text{CDS net flow}_{d,b,t} = \beta_S \text{Bond net flow}_{d,b,t} + \beta_{S,Post}\text{Bond net flow}_{d,b,t} \times \mathbf{1}_{\text{Rule impl.}} + \beta_H \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} + \beta_{H,Post}\text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{\text{Rule impl.}} + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t},$$

where $\mathbf{1}_{Hedge,d,b,t}$ is an indicator of whether the transaction in the CDS is hedging the bond transactions and $\mathbf{1}_{\text{Rule impl.}}$ is an indicator for the "rule implementation" period (Jan 2014 – Oct 2017). Sample: Jan 2010 – Oct 2017. T-statistics based on standard errors clustered at the quarter-BHC level reported below point estimates; all regressions include week, bond, BHC, BHC-bond, bond-week and BHC-week fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%.

		SN			IDX			Both	
	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB
Bond flow	-0.10	-0.09	-0.04	-0.21	-0.31	-0.01	-0.23	-0.31	-0.07
	(0.02)***	(0.03)***	(0.03)	(0.05)***	(0.08)***	(0.00)***	(0.05)***	(0.08)***	(0.02)***
Rule implementation × Bond flow	0.09	0.08	0.06	0.21	0.31	0.09	0.22	0.30	0.06
	(0.02)***	(0.03)**	(0.04)	(0.05)***	(0.08)***	(0.07)	(0.05)***	(0.08)***	(0.03)**
Hedging × Bond flow	0.20	0.20	0.12	0.34	0.49	0.03	0.40	0.54	0.13
	(0.04)***	(0.06)***	(0.05)**	(0.09)***	(0.13)***	(0.01)***	(0.09)***	(0.14)***	(0.03)***
Hedging × Rule implementation × Bond flow	-0.17	-0.18	-0.14	-0.35	-0.50	0.18	-0.38	-0.51	-0.13
	(0.04)***	(0.06)***	(0.08)*	(0.09)***	(0.13)***	(0.15)	(0.09)***	(0.14)***	(0.05)**
Adj. R-sqr.	-0.07	-0.09	0.08	0.34	0.32	0.57	0.25	0.24	0.22
N. of obs.	53648	40374	3726	111465	82302	13962	135771	100358	16199

Table 5: CDS transaction size after clearing eligibility. This table reports the estimated coefficient β_C from the regression

$$\text{CDS Flow}_{d,b,t} = \beta_C \mathbf{1}_{Cleared,b,t} + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{d,t} + \epsilon_{d,b,t},$$

where $\mathbf{1}_{Cleared,b,t}$ is an indicator equal to 1 whenever the single name CDS contract on reference entity b is eligible for clearing. Flows are reported in USD millions. Sample: Jan 2010 – Oct 2017. T-statistics based on standard errors clustered at the quarter-BHC level reported below point estimates; all regressions include week, bond, BHC, BHC-bond, and BHC-week fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%.

(a) Buy

	SN				IDX				Both			
	All	US G-SIB	Non-US G-SIB	Other	All	US G-SIB	Non-US G-SIB	Other	All	US G-SIB	Non-US G-SIB	Other
Eligible	2.03	2.56	0.22	3.82	-4.96	-26.59	-2.23	12.90	-2.00	-21.67	-2.26	18.85
	(0.56)***	(0.68)***	(0.24)	(3.97)	(3.36)	(6.10)***	(0.72)***	(4.21)***	(3.51)	(5.37)***	(0.73)***	(6.08)***
Adj. R-sqr.	0.38	0.26	0.19	0.44	0.56	0.52	0.52	0.57	0.52	0.48	0.36	0.54
N. of obs.	421174	225114	117418	78642	4163614	999234	893333	2271047	4372918	1103963	963350	2305605

(b) Sell

	SN				IDX				Both			
	All	US G-SIB	Non-US G-SIB	Other	All	US G-SIB	Non-US G-SIB	Other	All	US G-SIB	Non-US G-SIB	Other
Eligible	2.58	2.93	0.57	5.66	-3.32	-26.49	-2.40	13.77	-0.93	-20.37	-2.38	18.62
	(0.60)***	(0.77)***	(0.40)	(3.14)*	(3.35)	(6.23)***	(0.68)***	(4.43)***	(3.39)	(5.17)***	(0.68)***	(5.93)***
Adj. R-sqr.	0.38	0.26	0.21	0.43	0.57	0.52	0.55	0.59	0.53	0.47	0.38	0.56
N. of obs.	401505	220666	109868	70971	3835615	959258	859873	2016484	4041920	1070352	925817	2045751

Table 6: Relationship between CDS and bond net flows by clearing eligibility. This table reports the estimated coefficients β_S, $\beta_{S,Clear}$, β_H and $\beta_{H,Clear}$ from the regression

$$\text{CDS net flow}_{d,b,t} = \beta_S \text{Bond net flow}_{d,b,t} + \beta_{S,Post} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{\text{Cleared},b,t} + \beta_H \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} + \beta_{H,Post} \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{\text{Cleared},b,t} + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t},$$

where $\mathbf{1}_{Hedge,d,b,t}$ is an indicator of whether the transaction in the CDS is hedging the bond transactions and $\mathbf{1}_{\text{Cleared},b,t}$ is an indicator for the single name contract being eligible for clearing on ICE. Sample: Jan 2010 – Oct 2017. T-statistics based on standard errors clustered at the quarter-BHC level reported below point estimates; all regressions include week, bond, BHC, BHC-bond, bond-week and BHC-week fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%.

	SN			IDX			Both		
	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB
Bond flow	-0.07	-0.05	-0.04	-0.16	-0.20	-0.01	-0.16	-0.19	-0.06
	(0.02)***	(0.02)**	(0.03)	(0.04)***	(0.06)***	(0.00)***	(0.04)***	(0.06)***	(0.02)***
Eligible × Bond flow	-0.01	-0.01	-0.03	0.05	0.07	-0.01	-0.00	0.03	-0.01
	(0.03)	(0.03)	(0.07)	(0.04)	(0.06)	(0.01)	(0.04)	(0.06)	(0.03)
Hedging × Bond flow	0.11	0.09	0.12	0.27	0.36	0.03	0.26	0.29	0.12
	(0.03)***	(0.04)**	(0.05)**	(0.07)***	(0.11)***	(0.01)***	(0.07)***	(0.10)***	(0.03)***
Eligible × Hedging × Bond flow	0.06	0.08	-0.10	-0.11	-0.18	0.03	0.00	-0.04	0.06
	(0.05)	(0.05)	(0.15)	(0.06)*	(0.09)**	(0.02)*	(0.07)	(0.09)	(0.05)
Adj. R-sqr.	-0.07	-0.09	0.08	0.34	0.32	0.57	0.25	0.23	0.22
N. of obs.	53648	40374	3726	111465	82302	13962	135771	100358	16199

A Reference Obligation

A.1 SRO

One of the changes in the 2014 ISDA Credit Derivatives Definitions is the standardization of reference obligations by publishing a Standard Reference Obligation (SRO) for a specified reference entity and seniority level. The published SRO will then be the reference obligation for all trades on that reference entity and seniority level, regardless of when the trade was executed. The parties can specify SRO as applicable or not applicable in the Confirmation. If the Confirmation is silent, the 2014 Definitions default to SRO applicable.

Prior to the change, CDS transactions referencing the same Reference Entity and seniority level might specify different obligations as the Reference Obligation. The lack of Reference Obligation standardization means that CDS transactions on the same terms apart from the Reference Obligation may not perfectly offset each other, exposing parties to potential basis risk between transactions that have the same Reference Entity but different Reference Obligations. This is exacerbated by (i) the market-standard Reference Obligations changing from time to time for reasons other than maturity or redemption; (ii) Substitute Reference Obligations being chosen bilaterally for some Credit Derivative Transactions and no other and (iii) some CDS transactions inadvertently specifying an obligation that would not qualify as a deliverable Obligation for purposes of that CDS transaction if it had not been specified as the Reference Obligation. The lack of Reference Obligation standardization is also a specific concern in the clearing context, as CCPs may change the Reference Obligation for a CDS transactions at the time of submission for clearing or after is has been submitted. This lead to potential basis risk between cleared and uncleared trades and between trades that are cleared in different CCPs. The SRO concept addresses these issues where an SRO is published, by applying a standardized Reference Obligation across all CDS transactions that apply the SRO, and selecting and replacing SROs according to a rigorous rules-based process.

Generic Reference Obligation identifier is used to indicate both applicability of SRO and the seniority level. There are two new reference identifiers for SRO: XSSNRREFOBL0 for senior transactions, and XSSUBREFOBL0 for subordinated transactions. Markit maintains the publishes the SRO List with each published SRO for the relevant reference entity and seniority level. SRO are selected according to a set of pre-defined rules (published September 16, 2014), including: (i) Meet specified maturity, size and liquidity thresholds; (ii) have the requisite seniority level; (iii) are either deliverable, or not deliverable for the same reasons as an approved benchmark bond. If there are multiple potential SROs, the selection is made to minimize replacement frequency.

On November 2014, ISDA published Best Practices for Single-Name Credit Default Swap Confirmations Regarding Reference Obligation or Standard Reference Obligation. The best practices supports using generic SRO identifier (XSSNRREFOBL0 / XSNOREFOBL00 for standard, senior reference obligation traded with 2014 Definitions; XSNOSROSNRL0 for non-standard, senior reference obligation traded with 2014 Definitions;), which avoid the need for the parties to match on specific ISIN.

No SRO is expected to be published for any monoline insurer.

B Additional Results

Table A.1: Globally systemically important banks. This table lists institutions classified as globally systemically important (G-SIB) by the Financial Stability Board in 2016, together with their domicile and the applicable G-SIB surcharge bucket.

Domicile	Institution	Surcharge
U. S.	Citigroup J. P. Morgan Chase	4%
	Bank of America	3%
	Goldman Sachs Wells Fargo	2%
	Bank of NY Mellon Morgan Stanley State Street	1%
U. K.	HSBC	3%
	Barclays	2%
	Royal Bank of Scotland Standard Chartered	1%
Euro	BNP Paribas Deutsche Bank	3%
	Groupe BPCE Groupe Crédit Agricole ING Bank Nordea Santander Société Générale Unicredit Group	1%
Switzerland	Credit Suisse	2%
	UBS	1%
China	Industrial and Commercial Bank of China Limited	2%
	Agricultural Bank of China Bank of China China Construction Bank	1%
Japan	Mitsubishi UFJ FG	2%
	Mizuho FG Sumitomo Mitsui FG	1%

Table A.2: Average transaction size. This table reports the average and the standard deviation of transaction sizes for transactions in which the institution trade in both bond and CDS markets. Transaction sizes reported in USD millions.

	mean	sd
Bond, buy	5.86	24.95
Bond, sell	5.89	25.85
Bond, net	-0.04	17.91
SN, buy	3.65	21.88
SN, sell	3.74	22.38
SN, net	-0.09	13.12
IDX, buy	14.94	55.10
IDX, sell	15.32	59.22
IDX, net	-0.38	30.89
CDS, buy	18.59	64.33
CDS, sell	19.06	68.35
CDS, net	-0.47	33.48
Observations	172889	

Table A.3: Transactions around credit events. This table reports the estimated coefficients $\beta_{+,i}$ and $\beta_{-,i}$ from the regression
$\text{Flow}_{d,b,t} = \sum_{i=-1}^{1} \beta_{+,i} \mathbf{1}_{Upgrade,b,t-i} + \sum_{i=-1}^{1} \beta_{-,i} \mathbf{1}_{Downgrade,b,t-i} + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{d,t} + \epsilon_{d,b,t}$,
where $\mathbf{1}_{Upgrade,b,t-i}$ is an indicator of bond b upgraded from speculative-grade to investment-grade in week $t-i$, and $\mathbf{1}_{Downgrade,b,t-i}$ is an indicator of bond b downgraded from investement-grade to speculative-grade in week $t-i$. Sample: Jan 2010 – Oct 2017. T-statistics based on standard errors clustered at the quarter-BHC level reported below point estimates; all regressions include week, bond, BHC, BHC-bond, and BHC-week fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%.

(a) Bonds

	Buy			Sell		
	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB
Wk before downgrade	12.67	12.26	13.40	11.65	12.40	8.80
	(2.60)***	(2.83)***	(5.93)**	(2.42)***	(3.10)***	(2.94)***
Wk of downgrade	2.76	2.16	4.67	2.65	2.28	3.79
	(1.14)**	(1.25)*	(2.69)*	(1.06)**	(1.16)*	(2.49)
Wk after downgrade	7.09	8.89	1.29	8.57	11.09	0.99
	(3.19)**	(4.11)**	(1.61)	(3.74)**	(4.92)**	(1.49)
Wk before upgrade	8.49	9.37	5.90	4.33	5.01	2.03
	(3.30)**	(4.13)**	(4.27)	(2.44)*	(2.82)*	(4.94)
Wk of upgrade	-0.06	-1.26	3.11	1.77	0.66	5.39
	(0.94)	(0.79)	(2.61)	(1.19)	(1.16)	(3.21)*
Wk after upgrade	0.01	-1.61	5.26	-1.69	-2.34	0.18
	(1.62)	(1.30)	(5.02)	(1.77)	(2.25)	(2.25)
Adj. R-sqr.	0.13	0.10	0.19	0.13	0.09	0.20
N. of obs.	448144	339570	106374	433427	324911	106507

(b) CDS

	Buy			Sell		
	All	US G-SIB	Non-US G-SIB	All	US G-SIB	Non-US G-SIB
Wk before downgrade	-0.29	2.63	-0.44	0.62	4.12	-0.11
	(1.23)	(3.26)	(0.70)	(1.29)	(3.25)	(0.56)
Wk of downgrade	6.63	21.05	5.75	7.49	20.92	6.66
	(2.22)***	(6.67)***	(2.87)**	(2.61)***	(7.22)***	(3.32)**
Wk after downgrade	-0.20	2.72	-0.80	0.31	2.51	0.06
	(1.57)	(4.69)	(0.50)	(1.63)	(4.44)	(0.54)
Wk before upgrade	-1.86	-4.11	0.81	-1.91	-4.05	0.16
	(1.03)*	(1.97)**	(0.69)	(1.08)*	(2.28)*	(0.53)
Wk of upgrade	-2.66	-6.25	-1.15	-3.35	-8.49	-0.93
	(1.06)**	(2.27)***	(0.50)**	(1.08)***	(2.54)***	(0.40)**
Wk after upgrade	-3.32	-8.03	-0.85	-3.40	-8.78	-1.02
	(0.97)***	(2.08)***	(0.31)***	(1.07)***	(2.39)***	(0.41)**
Adj. R-sqr.	0.52	0.47	0.36	0.53	0.47	0.38
N. of obs.	4372918	1103963	963350	4041920	1070352	925817

Table A.4: Relationship between CDS and bond net flows across regulatory regimes and credit events. This table reports the estimated coefficients β_S, $\beta_{S,Post}$, β_H and $\beta_{H,Post}$ from the regression

$$\text{CDS net flow}_{d,b,t} = \beta_S \text{Bond net flow}_{d,b,t} + \beta_{S,Post}\text{Bond net flow}_{d,b,t} \times \mathbf{1}_{\text{Rule impl.}} + \beta_H \text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} + \beta_{H,Post}\text{Bond net flow}_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{\text{Rule impl.}} + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t},$$

where $\mathbf{1}_{Hedge,d,b,t}$ is an indicator of whether the transaction in the CDS is hedging the bond transactions and $\mathbf{1}_{\text{Rule impl.}}$ is an indicator for the "rule implementation" period (Jan 2014 – Oct 2017). Sample: Jan 2010 – Oct 2017. T-statistics based on standard errors clustered at the quarter-BHC level reported below point estimates; all regressions include week, bond, BHC, BHC-bond, bond-week and BHC-week fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%.

	SN		IDX		Both	
	All	US G-SIB	All	US G-SIB	All	US G-SIB
Bond flow	-0.10	-0.09	-0.21	-0.31	-0.23	-0.31
	(0.02)***	(0.03)***	(0.05)***	(0.08)***	(0.05)***	(0.08)***
Wk before downgrade × Bond flow	-0.14	-0.09	0.21	0.71	0.21	0.24
	(0.38)	(0.27)	(0.07)***	(1.70)	(0.08)***	(1.76)
Wk of downgrade × Bond flow	-0.32	0.74	-5.19	-5.59	-5.11	-4.57
	(2.94)	(2.57)	(1.00)***	(1.04)***	(3.39)	(3.44)
Wk after downgrade × Bond flow	1.09	1.03	0.96	1.29	1.13	2.31
	(0.77)	(0.97)	(0.99)	(2.77)	(1.08)	(2.91)
Wk before upgrade × Bond flow	-0.00	0.04	0.30	0.56	0.26	0.49
	(0.12)	(0.91)	(0.12)**	(0.28)**	(0.09)***	(0.21)**
Wk of upgrade × Bond flow	0.02	-0.01	0.38	0.43	0.27	0.27
	(0.06)	(0.07)	(0.21)*	(0.14)***	(0.19)	(0.20)
Wk after upgrade × Bond flow	0.10	0.19	-0.43	-0.37	-0.29	-0.54
	(0.58)	(0.66)	(0.60)	(0.86)	(0.52)	(0.64)
Rule implementation × Bond flow	0.09	0.08	0.21	0.31	0.22	0.30
	(0.02)***	(0.03)**	(0.05)***	(0.08)***	(0.05)***	(0.08)***
Rule implementation × Wk before downgrade × Bond flow	0.12	0.07	-0.20	-0.70	-0.20	-0.21
	(0.38)	(0.28)	(0.07)***	(1.70)	(0.08)**	(1.76)
Rule implementation × Wk of downgrade × Bond flow	0.31	-0.76	5.22	5.62	5.13	4.58
	(2.94)	(2.57)	(1.00)***	(1.03)***	(3.38)	(3.43)
Rule implementation × Wk after downgrade × Bond flow	-1.06	-1.01	-0.98	-1.31	-1.12	-2.30
	(0.77)	(0.97)	(0.99)	(2.77)	(1.08)	(2.91)
Rule implementation × Wk before upgrade × Bond flow	0.09	-1.89	-0.29	-0.55	-0.25	-0.49
	(0.06)	(1.92)	(0.12)**	(0.28)*	(0.10)***	(0.21)**
Rule implementation × Wk of upgrade × Bond flow	0.00	0.00	-0.40	-0.49	-0.81	-0.92
	(.)	(.)	(0.33)	(0.31)	(0.77)	(0.74)
Rule implementation × Wk after upgrade × Bond flow	0.00	0.00	0.38	0.28	0.03	0.28
	(.)	(.)	(0.63)	(0.85)	(0.54)	(0.65)
Hedging × Bond flow	0.20	0.21	0.34	0.49	0.41	0.54
	(0.04)***	(0.06)***	(0.09)***	(0.13)***	(0.09)***	(0.14)***
Hedging × Wk before downgrade × Bond flow	1.90	4.80	-0.28	-0.79	-0.30	-0.38
	(0.68)***	(2.34)**	(0.14)**	(1.70)	(0.16)*	(1.77)
Hedging × Wk of downgrade × Bond flow	-1.23	-1.60	4.11	4.18	3.40	2.96
	(3.02)	(2.84)	(0.96)***	(0.94)***	(3.61)	(3.65)
Hedging × Wk after downgrade × Bond flow	-1.07	-0.87	-0.39	-0.42	-0.45	-1.61
	(0.91)	(1.21)	(1.26)	(2.95)	(1.29)	(3.03)
Hedging × Wk before upgrade × Bond flow	-0.10	1.85	-0.39	-0.77	-0.36	-0.47
	(0.10)	(1.78)	(0.14)***	(0.63)	(0.12)***	(0.52)
Hedging × Wk of upgrade × Bond flow	-0.14	0.33	-0.58	-2.79	-0.55	-2.95
	(0.11)	(0.47)	(0.25)**	(1.74)	(0.24)**	(1.45)**
Hedging × Wk after upgrade × Bond flow	-0.20	-0.09	0.34	0.77	0.15	0.56
	(0.58)	(0.62)	(0.60)	(0.72)	(0.52)	(0.59)
Hedging × Rule implementation × Bond flow	-0.17	-0.18	-0.35	-0.50	-0.38	-0.51
	(0.05)***	(0.06)***	(0.09)***	(0.13)***	(0.09)***	(0.14)***
Hedging × Rule implementation × Wk before downgrade × Bond flow	-1.87	-4.77	0.30	0.80	0.32	0.38
	(0.69)***	(2.34)**	(0.14)**	(1.70)	(0.16)*	(1.77)
Hedging × Rule implementation × Wk of downgrade × Bond flow	1.25	1.62	-4.16	-4.23	-3.43	-2.98
	(3.02)	(2.84)	(0.94)***	(0.91)***	(3.60)	(3.64)
Hedging × Rule implementation × Wk after downgrade × Bond flow	1.04	0.84	0.38	0.41	0.43	1.58
	(0.91)	(1.21)	(1.26)	(2.95)	(1.29)	(3.03)
Hedging × Rule implementation × Wk before upgrade × Bond flow	0.00	0.00	0.31	0.68	0.25	0.35
	(.)	(.)	(0.14)**	(0.63)	(0.12)**	(0.53)
Hedging × Rule implementation × Wk of upgrade × Bond flow	0.00	0.00	0.57	2.82	1.04	3.55
	(.)	(.)	(0.37)	(1.78)	(0.80)	(1.63)**
Hedging × Rule implementation × Wk after upgrade × Bond flow	0.00	0.00	0.46	0.08	2.32	1.95
	(.)	(.)	(0.84)	(0.91)	(1.06)**	(1.09)*
Adj. R-sqr.	-0.07	-0.09	0.34	0.32	0.25	0.24
N. of obs.	53648	40374	111465	82302	135771	100358

Table A.5: Relationship between CDS and bond net flows by clearing eligibility and credit events. This table reports the estimated coefficients β_S, $\beta_{S,Clear}$, β_H and $\beta_{H,Clear}$ from the regression
CDS net flow$_{d,b,t} = \beta_S$Bond net flow$_{d,b,t} + \beta_{S,Post}$Bond net flow$_{d,b,t} \times \mathbf{1}_{\text{Cleared},b,t} + \beta_H$Bond net flow$_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t}$ $+ \beta_{H,Post}$Bond net flow$_{d,b,t} \times \mathbf{1}_{Hedge,d,b,t} \times \mathbf{1}_{\text{Cleared},b,t} + \alpha_d + \alpha_b + \alpha_t + \alpha_{d,b} + \alpha_{b,t} + \alpha_{d,t} + \epsilon_{d,b,t}$,
where $\mathbf{1}_{Hedge,d,b,t}$ is an indicator of whether the transaction in the CDS is hedging the bond transactions and $\mathbf{1}_{\text{Cleared},b,t}$ is an indicator for the single name contract being eligible for clearing on ICE. Sample: Jan 2010 – Oct 2017. T-statistics based on standard errors clustered at the quarter-BHC level reported below point estimates; all regressions include week, bond, BHC, BHC-bond, bond-week and BHC-week fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%.

	SN		IDX		Both	
	All	US G-SIB	All	US G-SIB	All	US G-SIB
Bond flow	-0.07	-0.05	-0.16	-0.20	-0.16	-0.19
	(0.02)***	(0.02)**	(0.04)***	(0.06)***	(0.04)***	(0.06)***
Wk before downgrade × Bond flow	-0.30	-0.37	0.18	0.90	0.17	0.58
	(0.27)	(0.22)*	(0.06)***	(1.23)	(0.07)**	(0.89)
Wk of downgrade × Bond flow	-1.73	-1.47	-1.52	-1.43	-2.98	-2.63
	(1.76)	(1.64)	(1.33)	(1.39)	(2.72)	(2.71)
Wk after downgrade × Bond flow	0.98	0.97	1.04	1.51	1.06	1.57
	(0.61)	(0.72)	(0.95)	(2.75)	(0.83)	(1.93)
Wk before upgrade × Bond flow	-0.03	0.02	0.26	0.47	0.20	0.39
	(0.11)	(0.92)	(0.11)**	(0.26)*	(0.08)**	(0.20)*
Wk of upgrade × Bond flow	-0.02	-0.05	0.34	0.33	0.21	0.15
	(0.06)	(0.08)	(0.21)	(0.13)**	(0.19)	(0.20)
Wk after upgrade × Bond flow	0.06	0.15	-0.49	-0.48	-0.36	-0.66
	(0.57)	(0.66)	(0.60)	(0.86)	(0.53)	(0.65)
Eligible × Bond flow	-0.01	-0.01	0.05	0.07	-0.00	0.02
	(0.03)	(0.03)	(0.04)	(0.06)	(0.04)	(0.06)
Eligible × Wk before downgrade × Bond flow	0.39	0.45	-0.45	-0.77	-0.14	-0.44
	(0.28)	(0.23)**	(0.44)	(1.25)	(0.14)	(0.89)
Eligible × Wk of downgrade × Bond flow	3.99	3.69	-0.92	-0.99	3.22	2.86
	(2.18)*	(2.10)*	(1.76)	(1.83)	(2.78)	(2.78)
Eligible × Wk after downgrade × Bond flow	-0.89	-0.90	-1.01	-1.39	-0.88	-1.40
	(0.61)	(0.73)	(0.95)	(2.74)	(0.82)	(1.91)
Eligible × Wk before upgrade × Bond flow	0.00	-2.11	-0.14	-0.33	-0.04	-0.22
	(0.06)	(1.92)	(0.11)	(0.26)	(0.09)	(0.20)
Eligible × Wk of upgrade × Bond flow	0.00	0.00	-0.12	-0.12	-1.09	-1.02
	(.)	(.)	(0.32)	(0.27)	(0.80)	(0.83)
Eligible × Wk after upgrade × Bond flow	0.00	0.00	0.59	0.59	0.34	0.67
	(.)	(.)	(0.64)	(0.86)	(0.56)	(0.68)
Hedging × Bond flow	0.11	0.09	0.28	0.36	0.26	0.29
	(0.03)***	(0.04)**	(0.07)***	(0.11)***	(0.07)***	(0.10)***
Hedging × Wk before downgrade × Bond flow	1.47	1.63	-0.22	-0.97	-0.19	-0.62
	(0.58)**	(1.07)	(0.10)**	(1.23)	(0.12)	(0.90)
Hedging × Wk of downgrade × Bond flow	2.16	2.10	0.74	0.54	3.19	2.91
	(2.29)	(2.40)	(1.66)	(1.75)	(3.37)	(3.60)
Hedging × Wk after downgrade × Bond flow	-1.02	-1.00	-0.81	-1.34	-1.01	-1.55
	(0.62)*	(0.73)	(1.06)	(2.81)	(0.86)	(1.93)
Hedging × Wk before upgrade × Bond flow	-0.03	2.03	-0.33	-0.63	-0.24	-0.22
	(0.10)	(1.79)	(0.13)**	(0.63)	(0.10)**	(0.51)
Hedging × Wk of upgrade × Bond flow	-0.04	0.42	-0.52	-2.66	-0.41	-2.74
	(0.10)	(0.47)	(0.25)**	(1.70)	(0.24)*	(1.43)*
Hedging × Wk after upgrade × Bond flow	-0.11	0.01	0.41	0.91	0.29	0.78
	(0.57)	(0.62)	(0.60)	(0.72)	(0.52)	(0.60)
Hedging × Eligible × Bond flow	0.07	0.09	-0.11	-0.18	0.00	-0.03
	(0.05)	(0.05)*	(0.06)*	(0.09)**	(0.07)	(0.09)
Hedging × Eligible × Wk before downgrade × Bond flow	-1.33	-1.50	-0.20	1.01	-0.06	0.72
	(0.62)**	(1.12)	(0.44)	(1.71)	(0.44)	(0.99)
Hedging × Eligible × Wk of downgrade × Bond flow	-4.54	-4.46	1.65	1.84	-3.54	-3.25
	(2.66)*	(2.77)	(2.03)	(2.13)	(3.44)	(3.68)
Hedging × Eligible × Wk after downgrade × Bond flow	0.96	0.90	0.15	1.27	1.24	1.54
	(0.62)	(0.74)	(1.25)	(2.80)	(0.89)	(1.92)
Hedging × Eligible × Wk before upgrade × Bond flow	0.00	0.00	0.09	0.36	-0.09	-0.12
	(.)	(.)	(0.14)	(0.63)	(0.13)	(0.54)
Hedging × Eligible × Wk of upgrade × Bond flow	0.00	0.00	0.22	2.38	1.22	3.53
	(.)	(.)	(0.36)	(1.72)	(0.89)	(1.69)**
Hedging × Eligible × Wk after upgrade × Bond flow	0.00	0.00	0.00	0.00	0.00	0.00
	(.)	(.)	(.)	(.)	(.)	(.)
Adj. R-sqr.	-0.07	-0.09	0.34	0.32	0.25	0.23
N. of obs.	53648	40374	111465	82302	135771	100358