Heterogeneity in CDS Coverage *

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Abstract

Despite a three-fold growth in outstanding corporate debt, credit default swaps (CDS) exist for only a fraction of S&P 500 companies and almost 30% of S&P 500 companies never had a CDS. In this paper, we analyze the cause of this puzzling heterogeneity. We find that the existence of single-entity CDS contract is causally related to the structure of bond ownership. Specifically, we show that the number of institutional investors holding the underlying bond (*breadth*) and the concentration of institutional ownership (*depth*) affect the demand for a CDS contract. Our results support a *governance influence* hypothesis suggesting that fragmented ownership hampers the ability of the bondholders to influence management due to excessive coordination costs thereby increasing the need for external insurance. Our findings are robust to a rich set of controls and identify the breakdown in coordination through a regression discontinuity design. This novel evidence has important normative implications in the regulation of CDS markets and naked CDS strategies.

JEL Classification Code: G01, G12, G30, G39
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1 Introduction

Credit Default Swaps (CDSs hereafter) are insurance contracts that offer buyers protection against the default of the underlying firm, also termed the “reference entity.” As a type of derivative instrument, a CDS is designed to improve the functioning of the capital market and overcome market frictions. The initiation of CDS contracts is expected to provide credit risk sharing and allow lenders to hedge their credit risk exposure. Yet, despite three-fold increase in total liabilities more than 30% of the S&P 500 companies never had a CDS issued on their long term debt and only about 60% of the S&P 500 companies had CDS contracts on their bonds by the end of our sample period. This puzzling evidence also includes well-known entities such as Bed Bath & Beyond Inc., Moody’s Corp, Netapp Inc., Ross Stores Inc. and others that never had a CDS on their outstanding debt differently from their direct peers and despite having significant outstanding obligations.

In this paper, we study the cause of disparity in CDS coverage by focusing on a unique sample of CDS contracts issued on S&P 500 companies and bond ownership. We argue that the number of unique institutional investors (breadth of bond ownership) holding the underlying bond and the concentration (depth) of bond ownership determines the demand for a CDS. We formulate two opposing hypotheses, the *limited diversification hypothesis* and the *governance influence hypothesis* to support our argument that bond ownership structure governs CDS demand. Our analysis shows that high numerosity and diversified bond ownership with diluted bond holdings stimulate the demand for a CDS supporting the “governance influence hypothesis.”

We establish a connection between bond ownership and CDS demand by running a set of probit regressions on the sample of S&P 500 companies. A regression discontinuity design framework is used to determine a breakpoint where the switch is observed, with companies moving from no CDS to having a CDS. This approach yields a breakpoint at a breadth of 123 for our full sample. We next explore how corporate governance plays a role in regulating the demand for a CDS. The evidence supports our assumption that poor governance enhances the demand for a CDS with our primary variables of bond ownership (breadth and depth) maintaining their significance and direction. We even test the impact of CEO power, firm complexity and CEO overconfidence on CDS demand. Our results show that demand for a CDS is higher for firms with higher complexity, high CEO tenure and low CEO overconfidence.

These results add to the literature by providing important normative implications for the regulation of the CDS market and naked CDS strategies.

One of the relevant concerns is that the relationship between the ownership structure of a bond and the demand for the referred CDS is really a relationship between the credit quality of the bond and the CDS demand. We allay the concern by explicitly controlling for credit quality in our regression analysis. We find that our results are robust to controlling for credit quality.

The other valid concern is the fear of reverse causality. One can argue that investors are attracted to buy a particular corporate bond only after an insurance product like a CDS is introduced which leads to a larger breadth of ownership. We allay the concern by looking at trends in ownership before and after the issuance of CDS contract. We plot the trend of breadth of ownership (number of unique institutions owning the bond) around the initiation of the CDS for firms in our sample. We observe a fairly steep rise in breadth before the initiation of CDS but the breadth of ownership stabilizes after the initiation of the CDS contract.

Also, the prior literature documents the existence of significant speculative trading in the CDS market. One might argue that the heterogeneity in CDS coverage is driven by the potential for speculative demand. To address this issue we control for analyst disagreement as a proxy for speculative trading in our baseline regressions and find our results robust. At the same time we also control for bond fragmentation as CDS trading is known to be higher for firms with high bond fragmentation. We take steps to mitigate econometric concerns that might otherwise influence a study of this type. We even use the Big-Bang Protocol of 2009 as an exogenous shock and use a variety of other robustness measures and note that our results are consistent with our primary governance influence hypothesis.

There is rich literature on many aspects of CDS with its pricing, relationship with corporate governance, and corporate finance being analyzed in depth.[1]. Prior studies have noted the differences and similarities of CDS pricing with corporate bonds, equity stocks, and other equity options [2]. The literature has also identified the impact of a CDS on these markets and the information flow between CDS and various categories of markets [3]. A recent study by Oehmke and Zawadowski (2017) discusses the motivations for trading in CDS markets and the economic functions of this market. Through their analysis of data on notional CDS amount and

[1] See Duffie (1999) , Arora et al. (2012), Morrison (2005)

[2] See Longstaff et al. (2005), Blanco et al. (2005)

[3] Acharya and Johnson (2007), (2010) study the information flow between CDS and equity markets

volume, they suggest that CDS markets act as an alternative marketplace to the underlying bonds.

Our paper contributes to the recent strand of research that explores the initiation of a CDS. The initiation of CDS contracts is expected to provide credit risk sharing and allow lenders to hedge their credit risk exposure. For example, CDS helps to reduce supply-side credit constraints (see, e.g., Saretto and Tookes, 2013), stimulate information production (see, e.g., Acharya and Johnson, 2007) and facilitate real innovations (see, e.g., Chang et al., 2018). On the other hand, CDS results in an unsustainable credit boom which could eventually turn into a heightened default risk for CDS firms (see, e.g., René.M.Stulz, 2010). Through purchasing CDS, lenders successfully hedge their credit risk exposure and have less monitoring incentives. Notwithstanding retaining their credit control rights, lenders lose their economic interests with the insurance against corporate default, essentially becoming "empty creditors" as modeled in Bolton and Oehmke (2013). We are also related to CDS initiation and CEO compensation literature. For example, Hao et al. (2020) examines the effect on CEO compensation by the onset of a CDS. The authors hypothesize and prove that CEOs of firms protected by a CDS have a greater long-term compensation to compensate for their reduced incentives to monitor borrowers.[4] Danis and Gamba (2018) study the real effects of CDS introduction on firm value. They weigh the negative and positive impacts of CDS on the firm value simultaneously. Even though the introduction of a CDS reduces the firm value due to increased bankruptcy costs following high firm liquidations, the bondholders' ability to hedge risk reduces the probability of costly debt renegotiation which increases the firm value[5].

However, despite the growing importance of a CDS, relatively little is known about this disparity in the CDS coverage and the motivations that drive the demand for a CDS. Banerjee and Kong (2019) partially tries to establish the cause for this CDS coverage disparity from the perspective of pricing of credit risk. They model the reason for both demand and supply side initiation of CDS contracts and theoretically show that the market for CDS exists if the creditor's offer price is at least slightly greater than the issuer's reservation price. The root cause of this puzzle about the heterogeneity in the CDS coverage remains unsolved. In this paper, we address the existing gap in the CDS literature by identifying the reason for the

[4] Also, Banerjee et al. (2018) link CDS initiation to CEO compensation and find that the initiation of a CDS for a reference entity increases the CEO's financial protection by increasing cash compensation and ex-ante cash severance pay.

[5] The paper empirically proves that for public corporations in the United States the introduction of CDS contracts increases the firm value by 2.9%

heterogeneity in CDS coverage.

Our paper also contributes to a large literature that studies the relationship between CDS and corporate bonds. Much of the literature tries to explore the effect of how the initiation of CDS has affected the characteristics of the bond market. Nashikkar et al. (2011) find that CDS liquidity has explanatory power for the bond prices, over and above the bond's liquidity variables. They expect the CDS-bond basis to reduce as the liquidity in the CDS market increases. Massa and Zhang (2012) also provides evidence on the improvement of bond liquidity post-issuance of CDS contracts by positing a reduction in fire-sale risk when liquidity lowers due to credit downgrades. Zhu (2006) compares the pricing of credit risk in the bond market and the rapidly growing CDS markets. Their paper documents that the CDS market leads the bond market in terms of price discovery. Our paper differs from these studies and thus contributes to the literature by identifying the effect of the bond market and bond ownership structure on CDS initiation or demand.

The remainder of this paper is organized as follows. Section 2 discusses the CDS market. Section 3 describes our theoretical motivation. We discuss the data and our sample in Section 4. Section 5 describes our research methodology. Section 6 presents the empirical analysis and results. Section 7 conducts robustness analysis. Section 8 concludes.

2 CDS Market

A Credit Default Swap (CDS) is a fixed income instrument that works like an insurance contract protecting against the loss caused by a credit event. A CDS is issued on bonds, loans, and structured investment vehicles such as ABS, MBS, and CDO securities. The protection buyer pays a premium referred to as the credit spread to protect against a contingent credit event of the reference entity (company, nation, etc.). The premium is determined against the total notional amount insured and is paid as annual, semi-annual, or quarterly payments. A CDS is primarily used to *trade credit risk* (Bolton and Oehmke (2013)). Banks leverage CDS contracts as an additional tool for risk management which help them *maintain regulatory capital ratios* (Shan et al. (2014b)). Although CDS acts as insurance, it is in fact a derivative instrument closer to an option that bets on the occurrence of a credit event.

The CDS market which began in the early nineties[6] did not experience a growth in corporate

[6] There is some ambiguity about the exact date, but as noted by Tett (2009), J.P. Morgan was the first underwriter of a CDS contract in 1994.

CDS till the beginning of the next decade. By the end of 2008 about 1300 companies in the U.S. market had a CDS contract issued on their bonds as we see in Figure 1, this was a very small fraction of the total U.S. market having about eight thousand firms. We saw a decline in the corporate CDS market with the percentage of U.S. firms covered by CDS dropping down by 30% by the end of 2018. We see a similar trend for CDS coverage for the largest five hundred U.S. public companies. We observe that the CDS contracts issued on the S&P 500 companies have increased steadily from 3 in 2001 to around 413 in the first quarter of 2008. There has been a decline thereafter and this number stands at about 300 as of December 2018.

INSERT FIGURE 1 HERE

The CDS market grew to a modest gross notional amount outstanding of $180 billion by 1997 (Augustin et al. (2014)). It grew by around 30 times in the next seven years to a gross notional outstanding of about $6 trillion by the end of 2004. The market experienced a three-digit growth to reach an outstanding of $61.2 trillion just before the onset of financial crisis followed by a substantial decline, with a comparatively smaller outstanding value of about $20 trillion in 2013. The downward trend continued and the CDS market size declined to a notional outstanding of $8.1 trillion by end of 2018. According to the data reported by the Bank for International Settlements, CDS contracts represent 96% of the total credit derivatives by notional amount outstanding and are about 2% of the $544 trillion global derivatives market (notional outstanding) as of December 2018.

When the CDS market first began, insurance companies played the role of major contract sellers/underwriters with banks acting as main buyers. The CDS contracts were originally used by banks to transfer the credit risk of their loan portfolios. Over time, hedge funds entered the market and have increased their participation. Blue Mountain Capital, DE Shaw, Saba Capital Management and Citadel are few of the major hedge funds operating in this space. Over a period of two decades, it has been observed that insurance companies have had a role reversal from being net sellers to net buyers of CDS protection while the hedge funds have become the net contract sellers. As discussed by Peltonen et al. (2014), the CDS market is fairly concentrated with around 13 dealers and about 75% of gross sale being done by the 10 most active ones. They have also found that majority, around 80% of the participants in the CDS market act as net contract buyers.

Statistics published by BIS at the end of 2018 reported that about 70% of the total CDS outstanding transactions globally were carried out through central clearing processes. BIS reported that the banks and the securities firms were the primary traders of CDS contracts followed by the hedge funds.

3 Theoretical Motivation of the Empirical Design

We start by giving a theoretical motivation to the estimation problem. A bondholder or bond owner has three choices: 1) Hold the bonds; 2) Sell the bonds, and 3) Buy insurance via a CDS contract. The decision of the bondholders depend on their perception of financial risk from holding the bond. The bond owners consider buying a CDS to protect themselves of the risk of not getting paid back and thus would like to get protected against the exposure to the risk of the reference entity.

These reference entities differ in their bond ownership structure. We measure the bond ownership structure along two dimensions, *breadth* and *depth*. We call the number of institutional investors holding the bonds of a company as the *breadth* of bond ownership. Concentration of institutional ownership defined as the *depth*, is the fraction of total bond outstanding amount held by each institution. Such bond ownership structure may potentially explain the observed heterogeneity: in fact, we argue that the CDS demand is causally related to the breadth and the depth of bond ownership. For any bond issuer, the intersection between these two attributes changes the financial risk borne by the investors, which in turn determines the need for protection. In figure 2 we graphically represent the demand for a CDS as a 2x2 matrix of breadth and depth.

INSERT FIGURE 2 HERE

Each quadrant is characterized by a different combination of breadth and depth that allows us to frame our two hypotheses to determine the testable empirical predictions.

The first *limited diversification hypothesis* suggests that the demand of a CDS is increasing in the concentration of bond ownership and decreasing in the number of investors holding the bond. Consider a reference entity whose bonds are owned by a large number of buyers and each buyer holds a very small percentage of the company's bond (quadrant HL). Due to the distributed ownership and the small size of each position, the loss to each individual bondholder caused by the default of a reference entity is reduced. The demand for a CDS on the bonds of such a reference entity therefore is modest suggesting that atomistic bond ownership with high numerosity reduces the demand for a CDS. Differently, a few bond owners having a high proportion of the company liabilities (quadrant LH) would face significant capital losses in case of default of the reference entity and therefore may have a preference for buying protection increasing the demand for a CDS. Consider an entity 'A' having few buyers and highly concentrated bond ownership compared to another entity 'B'. We expect the demand for a CDS on company 'A' to be higher and the seller to have a lower $\overline{P_S}$ for company A when compared to company 'B'. At the same time, buyers have a higher reservation price for the company 'A'. At the institutional level, the institutions holding a high percentage of a single company bonds face a high risk in the case of default by the company. They may thus have a high buying reservation price ($\overline{P_B}$) and a greater demand for CDS protection. Such demand in turn provides an incentive for protection sellers to structure insurance products.

We accordingly formulate the following:

H1a. The probability of having a CDS is negatively affected by the breadth of bond ownership and positively affected by the depth of bond ownership.

A rival *governance influence hypothesis* suggests that atomistic and diversified bond ownership (quadrant HL) increases the demand for a CDS. In fact when ownership is atomistic and fragmented individual investors are too small to individually influence the governance of the bond issuing firm and coordination costs make collective influence on the company's management ineffective. As a consequence, demand for protection through a credit derivative increases. On the contrary when ownership is concentrated, investors have more leverage on managers to control risk taking and managerial discretion. This in turn reduces the need for external insurance.

To illustrate, let us consider two companies 'A' and 'B'. Company 'A' has only 2 bondholders each holding 50% of the total bond outstanding amount. The large proportion of bonds owned by each investor allows them to individually (and *a fortiori* jointly) exert influence on the management to protect their financial investment. With such ownership the need for external protection through a CDS is reduced which determines a lower incentive on protection sellers to structure insurance products. Differently, in company 'B' ownership is distributed over N bond owners each holding $1/N$ bonds. The dispersion in ownership and the high cost of coordination among investors limit the possibility of curbing managerial discretion leading to a higher risk and a related demand for protection.

These arguments lead to the following:

H1b. High breadth and low depth in bond ownership increase the probability of having a CDS.

4 Data

The data used in this paper are derived from multiple sources with non-homogeneous identifier that required careful matching.

4.1 Data Construction

S&P 500 companies are large, well established and typically have an outstanding debt with an unconditional liquidity making them ideal candidates for a CDS issuance. The presence of outstanding debt in S&P 500 companies is represented in Figure 3. Companies outside S&P 500 might have an endogenous lack of CDS due to their financial condition. We also show in Table 1 that the probability of having a CDS contract increases for companies in S&P 500. The table presents a set of probit regressions performed on a propensity score matched (PSM) panel data of companies listed in the U.S. market for the period between 2001-2018. The dependent variable is a binary variable (CDS) taking a value of 1 if a company has a CDS contract in that quarter. The primary predictor variable is again a binary variable (SP) taking a value of 1 for companies that are constituents of S&P 500 and 0 otherwise. We find that being a part of S&P 500 has a strong positive significance on the probability of having a CDS.

INSERT FIGURE 3 AND TABLE 1 HERE

We thus focus on S&P 500 companies and observe them over a period of 18 years from 2001-2018 to empirically test the heterogeneity in CDS coverage.

We collect quarterly data on CDS contracts over our sample period from the 'IHS Markit' database. The database contains contract level information like the company name, the seniority tier of the debt on which the CDS is priced, the currency of the contract and the restructuring type. It also has details about the industry, location and country of headquarter for the reference entity. The database provides information on data quality rating, composite recovery rate and the par spread of the CDS as well.

We start with collecting quarterly data on CDS for the 72 quarters in our sample. IHS Markit database reports data on a daily basis and to obtain quarterly data the last 3 market open days of each quarter are considered to produce 72 data files.

This data is then merged with S&P 500 constituents data obtained from 'Compustat-Capital IQ' for each quarter in our sample period. Because of the absence of a homogeneous identifier in the two datasets and the fact that Compustat updates the names of S&P constituents on a real time basis, while IHS Markit keeps the historical names, the majority of the merging has to be carried out manually. Additionally in case of mergers, acquisitions, name changes, delisting of companies, the names in the two databases will not match, further slowing down the process of merging.

The database is then merged with bond ownership data obtained from 'Lipper eMAXX'. We obtain the quarterly data on bond ownership for our sample period between 2001-2018. This database contains detailed fixed-income holdings for around 20,000 American and European firms. eMAXX reports its data based on regulatory disclosure to the National Association of Insurance Commissioners(NAIC), the Securities and Exchange Commission(SEC) and voluntary disclosures by few private pension funds. The database reports this data on quarterly basis at both institutional and individual levels and has data for almost all firms in the North American market, with each quarter having about 1.5 million observations. Merging this data to S&P 500 company dataset is challenging as well. The eMAXX database has the same parent company with varying CUSIP (unique identification number for each company) codes thus requiring manual intervention at each quarter for these files as well.

We then merge the database with variables from the 'Institutional Shareholder Services (ISS)' database to compute the quality of corporate governance index (E-index). We use the six provisions (variables): staggered boards, limits to shareholder bylaw amendments, poison pills, golden parachutes, and super majority requirements for mergers and charter amendments chosen by Bebchuk et al. (2004) to compute the E-index.

Next, we use the 'TRACE' database to obtain the bond transactions and thus the bond liquidity data for S&P 500 companies in our sample. We also merge the data with the 'Boardex' Database to get information on the CEOs and CEO tenure. We use '13F' data to get information on equity block holders and also merge our dataset with the 'Execucomp' database to construct the CEO overconfidence variable. We also use 'IBES database' to construct the analyst disagreement variable and the 'Mergent FISD' database for construction of the bond fragmentation variables. Our final dataset is obtained by adding financials of each company for each quarter from 'Compustat-Capital IQ' to the merged database.

After this extensive process of data collection we have a partially hand-collected sample of around 30,000 observations. Our sample is a panel data with cross-section of S&P 500 companies.

4.2 Summary Statistics

CDS coverage over the period between 2001-2018 is presented in Figure 1. Panel A of Figure 1 has two line plots. The red line indicates the number of companies in the U.S. market between 2001-2018 plotted on a quarterly basis. The blue line represents the number of companies in the U.S. market having CDS in each quarter. While the number of companies in the U.S. market has remained almost constant at about 8,000 companies per quarter, CDS contracts show a humped pattern growing from inception up to a maximum of 1,300 contracts around 2008 and dipping thereafter. Panel B of Figure 1 plots the subsample of CDS written on S&P 500 companies. We observe a similar pattern with contracts growing from an initial count of 4 at inception to 413 during the financial crisis but then dropping to 300 companies by the end of 2018.

INSERT FIGURE 1 HERE

The heterogeneity in the CDS coverage has existed since the beginning of the sample period. Table 2 provides statistics of the percentage of companies not covered by CDS on a yearly basis for the period under consideration. We see that this number began with 50% i.e. about half of the S&P 500 companies without CDS in 2001. The CDS coverage increased and reached a maximum by 2007, with about 80% of the companies having a CDS. The number of companies covered by a CDS began to drop after the financial crisis and we find that 40% i.e. around 300 companies did not have a CDS by the end of 2018. About 30% of the S&P 500 companies on an average do not have CDS contracts written on them each year.

INSERT TABLE 2 HERE

Further, we try to perform a broad examination to understand the cause for this disparity using the plot in Figure 3. In the graph, the bars represent the number of S&P 500 companies without CDS plotted quarterly between 2001-2018. The line plots the subsample of S&P 500 companies per quarter that have long term debt but do not have a CDS. The data show that about 99% of the companies that are not covered by a CDS have, however, long term debt outstanding which rules out the possibility that the drop in CDS might be due to a structural change in the capital structure of companies that led to much reduced or no leverage and therefore a mechanical absence of CDS contracts.

INSERT FIGURE 3 HERE

The graph in Figure 4 plots the CDS coverage with respect to outstanding debt in billion USD.

INSERT FIGURE 4 HERE

The total outstanding long term liabilities for the S&P 500 companies increased three fold from $1,700 billion to $5,300 billion in past 18 years. The CDS market, however, did not follow this pattern. In terms of debt covered by a CDS, about 99% of the total debt outstanding was not covered at the beginning of the sample period. As the CDS market grew, there was an increase in the coverage with about 98% ($1,862 billion) of long term debt being protected by a CDS during the period between 2004 and 2005. The ensuing decline in CDS contracts led to an increase in the proportion of debt uncovered by any CDS, with about $800 billions, or 15%, of the total long term liabilities unhedgeable by the end of 2018.

Our database includes 891 distinct companies that were included in the S&P 500 index at any point between 2001-2018. Figure 5 plots the count of companies by the percentage of times they had a CDS during our sample period. The numbers on the wedges represent the count of companies for a range when a company never had a CDS to the case when a company always had a CDS. We observe that 264 companies i.e. about 30% of the sample never had CDS during the sample period. Interestingly coverage is very heterogeneous across time with only about 10%, or 94, of 891 companies having had an uninterrupted CDS coverage during the period of observation.

INSERT FIGURE 5 HERE

The final dataset comprises of about 30,000 observations. The breadth of the companies ranges between 1 to 700 institutional investors with a mean of about 150 investors. The concentration of bond ownership has a mean of around 8.5%. The scatter plot for distribution of companies about their breadth and depth is presented in Figure 6. The 'Y' axis represents the natural log of the breadth and 'X' axis stands for the depth of bond ownership. We see that a high concentration of the companies in the sample have a breadth in the range of around 50 (e^4) to 400 (e^6) and a depth below 20%.

INSERT FIGURE 6 HERE

The summary statistics of bond ownership structure for companies with and without CDS is represented in Table 3. The table also provides the result of the two-tailed t-test conducted to test the equality of means for group of companies with and without a CDS across the parameters of breadth and depth. We see that the companies with a CDS have on an average double the number of institutional investors as compared to the companies without a CDS. Also, companies with a CDS appear to be less concentrated with their depth being almost half that of the companies without a CDS. Even the t-tests confirm that the companies with and without a CDS vary significantly in terms of their bond ownership structure.[7]

INSERT TABLE 3 HERE

We report the summary statistics of the firm characteristics in Table 4. The companies (bond issuing firms) in our sample during the period between 2001-2018 have a mean asset size of about \$62 billion and a mean debt of \$16 billion. We see that mean intangible assets constitute about 10% of the total assets and represent more than 20% of the average market value. We also find the average bond holding for each institutional investor to be about \$10.74 million. The distribution of firms by industry is reported in Table 5. We use two digit standard industrial classification (SIC) code to define the industry of the firms in our sample. Firms in the 'Manufacturing' industry constitute about 40% of the sample. Intangibles heavy industries (Finance and Services) account for 30% of the sample. Agriculture, Forestry & Fishing is the most thinly represented industry with only one firm in our sample belonging to that industry.

INSERT TABLE 4 AND 5 HERE

[7] In unreported table we perform the t-test with adjusted depth and the results remain the same.

5 Methodology

We test the two rival hypotheses: limited diversification vs. governance influence on a quarterly sample of S&P 500 companies for a period between 2001-2018.

5.1 Research Methodology

We begin our econometric analysis by performing a set of regressions on our sample. The dependent variable is a binary variable named CDS, which takes the value of 1 for companies having a CDS contract and 0 for those who don't have a CDS. The dimensions of bond ownership structure are the primary explanatory variables. Breadth is the first primary variable which denotes the number of institutional investors holding the bonds of a company. The concentration of ownership, (depth) is the second independent variable. We measure depth as the Herfindahl-Hirschman Index(D) of bond ownership calculated as follows:

$$D = \sum_{i=1}^{n} s_i^2 \tag{1}$$

where:

n = number of institutional investors

s_i = percentage holding of an investor

$= \frac{\text{Amount of bond outstanding held by investor `i'}}{\text{Total institutional bond outstanding for the reference entity}}$

The relationship between breadth and depth is mechanical and might suffer from the issue of collinearity. To address this concern we adjust for the collinearity by removing the reciprocal of breadth from each individual investor concentration and then use the Herfindahl-Hirschman index to calculate the depth. The adjusted depth is defined as:

$$Adj.Depth = \sum_{i=1}^{n} (s_i - \frac{1}{breadth})^2 \tag{2}$$

We use this adjusted depth in all our regression analysis. We use simulation to come up with the correction of depth. The detailed procedure used to derive this adjustment is presented in Appendix A3.

In our analysis we are interested in estimating the probability of having a CDS given the continuous explanatory variables of bond ownership, $P(CDS = 1|breadth, depth)$. Considering this probability to be linearly related to a continuous independent variable does not make sense conceptually. Estimating this relation using linear models might even make the predictions meaningless by driving them outside the range of (0,1). To address these problems of linear probability models (LPM) and thus the ordinary least square approach (OLS) we use *categorical models* in our regressions. The vector of independent variables that primarily define our underlying model include the breadth and the depth of bond ownership which are transformative normal. We thus use probit regressions in our analysis. To keep our results heteroskedasticity-consistent we use robust standard errors. To allow for serial dependence in the error terms, we cluster standard errors at the industry and time (quarter) level. The hypothesis is empirically tested through the following model:

$$CDS_i = \beta_0 + \beta_1 * B_{i-2} + \beta_2 * Adj.Depth_{i-2} + \gamma X_{i-2} + \epsilon \tag{3}$$

where:

$$\text{CDS}=\begin{cases} 1, \text{if company with CDS} \\ 0, \text{otherwise} \end{cases}$$

B = breadth of bond ownership

$Adj.Depth$ = adjusted depth of bond ownership

X = vector of control variables

i = one quarter

We augment our regressions using a set of control variables that may affect the CDS trading and help to control for the cross-sectional differences among firms with and without CDS, drawn from prior CDS literature. We follow the specification of CDS selection model used by Ashcraft and Santos (2009), Saretto and Tookes (2013) and Subrahmanyam et al. (2014) to select our set of control variables. These variables also serve as effective controls to anticipate future changes in the credit and financial risk of the firm which may predict the inception of CDS.

In particular, we control for firm size using natural log of total assets as a proxy. In addition, we include other firm characteristics variables namely, sales/assets, PPENT/assets, working capital (WCAP/assets), cash holdings (cash/assets) and capital expenditures (CAPEX/assets). We also have variables that control for the risk of the firm's debt, including leverage, profitability (ROA, EBIT/assets), equity volatility. An obvious candidate as a determinant of CDS coverage is the quality of the outstanding liabilities. Underwriters of high-quality bonds may feel unnecessary to buy protection given the limited downside risk whereas investors in riskier securities may have a preference for bonds that can be hedged through insurance. We control for this possible confounder using credit rating of the firm. Leverage is defined as the ratio of total debt to total assets. Total debt is further defined as the sum of long term debt and debt in current liabilities for each quarter. Return on assets (ROA) is defined as the ratio of the net interest income to the total assets. Excess return is calculated as the excess stock return of the firm over the past year. Stock volatility is the firm's annualized equity volatility. PPENT/Assets is the ratio of plant, property and equipment to total assets. Sales/Assets is the ratio of total sales to total assets. EBIT/Assets is the ratio of earnings before interest and tax to total assets. WCAP/Assets is the ratio of working capital to total assets. RE/Assets is the ratio of retained earnings to total assets. Ratio of cash and short term investments to total assets is defined as Cash/Assets. CAPEX/Assets is the ratio of capital expenditures to total assets. We use the S&P rating of the senior unsecured bond of the firm to calculate a firm's credit rating. Credit Rating is a dummy variable taking a value of 1 for the firms with credit ratings of AAA, AA, A, BBB and a value of 0 for firm's rated as BB, B. Detailed variable definitions are provided in appendix A1.

We control all our regressions for industry and quarter fixed effects to control for the time-invariant heterogeneity. Following CDS literature we use 2-digit 'Standard Industrial Classification (SIC)' code for specifying the industry. To check the consistency of our sample and control variables we try to replicate the Subrahmanyam et al. (2014) model of CDS selection on our sample without inclusion of our primary explanatory variables of breadth and depth. We run the model for a reduced time period (similar to Subrahmanyam et al. (2014) model) as well as over our sample period. We find our results to be qualitatively same for most of the important predictors and thus find our set of control variables to be aligned with their model. We attribute minor differences to difference in the samples used in both the models. The results are provided in the Appendix A2.

6 Empirical Analysis and Results

6.1 Main results

Table 6 presents the results of our analysis. Columns (1) - (3) reports the result for univariate regression performed without any controls. In column (1) we include only breadth as the explanatory variable. Column (2) includes adjusted depth as the explanatory variable. Column (3) includes both the primary predictors and the interaction of breadth and adjusted depth. In columns (4) - (6) we reestimate the regressions of columns (1) - (3) after controlling for firm characteristics and other controls discussed in 'Section 5.1'. All the regressions are controlled for time and industry fixed effects. We see that the coefficients for breadth and depth are statistically highly significant. We find the breadth to be positively associated and the depth to be negatively related to the CDS demand. The breadth and depth maintain their direction and significance even in the presence of interaction term (column (3) & column (6)). An interesting thing to note is that the interaction term of breadth and depth is also highly significant and positively related to the probability of having a CDS suggesting the importance of both the dimensions taken together. Column (6) is our *baseline regression model* and will be referred by that name in the paper.

The results confirm the effect of the bond ownership structure on the probability of having a CDS. We find our model to be significant in all the specifications with a conditional pseudo R-squared of about 45%.

INSERT TABLE 6

In the set of our control variables, total assets seem to have a significant positive impact on the dependent variable suggesting a higher demand of CDS for large sized firm. We would expect firm with higher financial and credit risk to have a higher likelihood of a credit event and thus to have a higher probability of a CDS. The results indicate the same with probability of CDS being higher for firms with higher leverage and higher stock volatility. We find that the firms with investment grade ratings are more likely to have a demand for CDS contracts.

The results presented in Table 6 confirm the *governance influence hypothesis*, suggesting that a highly fragmented and an atomistic bond ownership spurs demand for a CDS.

6.2 Economic interpretation of the probit regressions

The probit regressions are less straightforward to interpret as compared to the OLS regressions. Being non-linear in nature, probit regressions cannot use the conventional approach of associating the economic interpretation of change in the dependent variable to the coefficients of the independent variables. The marginal effect of the primary independent variables on the probability of having a CDS is presented in Figure 7.

INSERT FIGURE 7 HERE

The Figure 7, Panel A provides predicted probabilities for breadth and depth by change in each independent variable individually. We observe that an increase in the number of institutional investors from 1 by 50 increases the demand for a CDS contract by 10%. At the same time an increase in concentration of investors from 10% to 50% reduces the probability of having a CDS by 6%. We see that the demand for a CDS is more elastic to the change in breadth vis-à-vis a change in depth.

6.3 Auxiliary evidence

6.3.1 Division on leverage

Our results support the 'governance influence hypothesis' indicating that the issue of coordination among bondholders due to fragmentation and the difficulty to influence the decisions of the management due to small size of holding initiates the demand for a CDS. We expect the size of leverage(debt) to vary the impact of depth/bond concentration on likelihood of CDS. To illustrate, let us consider two firms 'A' and 'B'. Firm 'A' has a debt of $100 million equally divided among 20 investors. Firm 'B' has a debt of $100 billion divided equally among 20 investors. Both the firms have a breadth of 20 and a depth of 0.05. For firm 'B' even if the depth is low and equal to firm 'A' the value held by each investor is large in dollar terms ($ 5 billion per investor vis-à-vis $5 million per investors to firm A) to exert influence over the management to protect their financial investments and thus the bond holders of firm B are less vulnerable. For firms with high leverage(debt), small positions are thus quantitatively very large and depth would thus have limited determining power for CDS demand in such firms. For highly leveraged firms concentration of holding plays limited role and the impact of breadth dominates. For firms with low debt, lower depth would mean small holdings, more vulnerable bond investors and low depth along with high fragmentation would cause difficulty in influencing the management which would spur demand for outside insurance like CDS.

INSERT TABLE 7 HERE

To test this influence of leverage we divide our sample into 4 quartiles of leverage and run our baseline model on these subsamples. Quartile 1 consists of firms having low leverage and quartile 4 is the subsample of firms with high leverage. Regression results are reported in Table 7. We see that the breadth maintains its sign and significance for all the subsamples. However, as we conjecture the depth is negative and significant only for the lower quartiles of leverage. We find depth to have lower significance for firms with high leverage. Diffused holdings play a larger role in determining the demand for CDS as compared to the clustered holdings for highly leveraged firms. We test the significance of equality of the coefficients in quartile 1 and quartile 4 using a ttest, the results of which are reported in column (5). As expected, the depths in the two quartiles are significantly different.

6.3.2 Controlling for corporate governance, firm complexity, CEO power and CEO overconfidence

The 'governance influence hypothesis' supported by our results suggests that the inability of the bond holders to exercise influence over the governance of the bond issuing firm to protect their financial investment and their higher vulnerability due to diffused ownership initiates the demand for a CDS. The difficulty in exerting control over the management collectively can be attributed to the increased coordination cost as the number of bond holders increases. We conjecture that poor governance would further increase these coordination costs and we expect the demand for CDS to be higher for firms with poor governance. We perform a set of regressions including the corporate governance variable as a control to confirm this conjecture.

We use E-index (Bebchuck, Choen, and Ferrell index) as a proxy for quality of corporate governance following prior literature[8]. The regression results including corporate governance are presented in Table 8. The index is constructed from IRRC data using six provisions as described in Bebchuk et al. (2004). The index ranges from a feasible low of 0 to a high of 6; a high score is associated with weak shareholder rights and thus a signal of poor governance. Columns (1) uses the continuous measure of the index as a control. We find that the governance

[8] For example: Bhagat and Bolton (2008); Fatima et al. (2012); Vincent et al. (2012)

index is significant and positively related to the demand for a CDS as we hypothesized. In our regressions breadth and depth remain significant and consistent with our main results.

INSERT TABLE 8 HERE

Prior literature has shown that complex firms have higher advising needs and larger board size.[9] Exerting influence over the management would thus be challenging in a complex firm and we hypothesize that demand for CDS would increase in complexity. Following Colesa et al. (2008) we compute firm complexity using the variables/factors of log(sales), leverage and number of business segments. We perform factor analysis on these three factors and compute a factor score called 'Complexity' to determine firm complexity. The factor score is a linear combination of the transformed values of these factors obtained through factor analysis. Column (2) in Table 8 uses the continuous variable of complexity as an added control in the baseline regression. As hypothesized we find the demand for CDS to be positively and significantly related to firm complexity.

CEO power is another important determinant of CDS demand. CEO power measures how much decision making power is concentrated in the hands of the CEO. Higher CEO power would mean difficulty in following the route of managerial influence to protect the bond investment and higher vulnerability to losses. We conjecture a positive effect of CEO power on CDS demand. Following the literature on CEO power[10] we use CEO tenure as a proxy of CEO power. Column (3) of Table 8 controls for CEO tenure. We find the demand for CDS to increase with CEO tenure as expected.

It has been empirically and theoretically shown that overconfidence in CEOs explains important corporate decisions.[11] Banerjee et al. (2015) show that overconfident CEOs invest more in physical assets. These assets would constitute a collateral to debt thereby reducing the need for an outside protection like CDS. We thus expect the demand for CDS to be lower for firms with overconfident CEOs.

We construct a continuous measure of CEO confidence based on CEO's option holdings. Following Malmendier and Tate (2005) a rational CEO will exercise his options as and when they vest. Thus, holding a vested in the money option would represent a degree of overconfidence. We use the Execucomp database to construct the overconfidence variable following the

[9] see: Rose and Shepard (1998); Boone et al. (2007); Colesa et al. (2008)
[10] see: MORSE et al. (2011); Graham et al. (2020)
[11] Malmendier and Tate (2005); Goel and Thakor (2008); Baker et al. (2007)

Malmendier and Tate. (2008) approach. We first obtain the total value-per option of the in-the-money options by dividing the value of all unexercised exercisable options by the number of options. We then scale this value-per-option by the price at the end of the fiscal year as reported in Compustat. This indicates the extent to which the CEO retains in-the-money options that are vested. Higher value of this variable would indicate higher CEO overconfidence. Column (4) in Table 8 runs the baseline regression controlling for CEO overconfidence. We find the demand for CDS to reduce with increase in CEO confidence as conjectured.

It is important to note that our primary predictors of bond ownership maintain their sign and significance in all the regressions presented in Table 8 supporting our main results and the 'governance influence hypothesis'.

The predicted probabilities of CDS for changes in breadth and depth for subsamples of companies divided on corporate governance, firm complexity, CEO power and CEO overconfidence are presented in Figure 8.

INSERT FIGURE 8 HERE

6.4 Further findings

We further investigate the data to look for discontinuity in the regression design. We try to determine a particular level of investors that causes a flip in the CDS pattern and thus triggers the economic viability of having a CDS. The histogram in Figure 9 plots the fraction of companies with and without CDS by bins of breadth. Each bin considers 10 investors and measures the fraction of companies with (without) CDS over total companies with (without) CDS in the sample. We see a coordination vs diversification flip at a breadth of 123 where the fraction of companies having a CDS becomes more than the fraction of companies without a CDS. This can be thought of as a flip from coordination (limited diversification) to diversification (governance influence) hypothesis suggesting better coordination of bond holders with the management of reference entity for a breadth below 123. As the number of investors increases, coordinated influence over the managers becomes difficult and the demand for a CDS rises.

INSERT FIGURE 9 HERE

We also plot the line graph in Figure 10. The plot shows the fraction of companies with CDS over the total companies by bins (10 investors per bin) of breadth. We observe that beyond a breadth of 400, almost all the companies in our sample have a CDS.

INSERT FIGURE 10 HERE

6.4.1 Border discontinuity and probability of CDS

We run regression discontinuity design (RDD) approach to observe the border discontinuity at a breadth of 123. Figure 11 presents the RDD plot for our full sample. The solid line represents the global polynomial fit of CDS on breadth. The polynomial fit is a smooth approximation to the unknown regression function based on a second order polynomial regression fit of CDS on breadth. The dots in the plot represent the local sample means of CDS at intervals of breadth. We observe a jump is the solid line from red to blue around the breadth of 123 confirming a discontinuity at that point.

INSERT FIGURE 11 HERE

Having identified the border discontinuity from the data, we now verify that the companies above and below the border are comparable, except in their probability of having a CDS. This step is necessary to assert that we have identified a quasi-exogenous component to determining the demand for a CDS that does not merely reflect the underlying fundamental differences among the firms.

INSERT TABLE 9 HERE

Table 9 provides the comparison of companies above and below the breadth of 123. Our border sample comprises of about 1600 companies having between 115 to 130 institutional investors. The border sample has about 800 observations on both sides of the border. We run a two-tailed t-test for equality of means across parameters of assets, leverage, return on assets, net income and market value. Our results show that the t-test cannot be rejected for any of these characteristics confirming that the border sample comprises of comparable firms. At the same time, the t-test is significantly rejected for the probability of having a CDS. Our results establish a discontinuity at a breadth of 123 and confirm the role of breadth in determining the demand for CDS.

6.5 Economic interpretation of discontinuity breakpoint

The economic interpretation for the breakpoint for the regression discontinuity design (RDD) of our sample can be understood from the literature on 'threshold strategy' Nash equilibrium[12]. As we illustrated in 'Section 3' a rational customer (a bondholder in our study) has a three choices of holding, selling or buying a CDS contract to protect himself of the risk of default by the bond issuer. We have also shown that the institutional bond holders are large and it is non-trivial for them to have the need to seek protection for their bond holding.[13].

The bond holder's objective is to minimize his expected costs and thus maximize his expected utility. The expected cost for a bond holder can be given by: *E(C) = min[cost of buying a CDS, coordination costs]*. We define coordination cost as the cost of coordination amongst bond holders to collectively influence the company's management. Following from the literature on consumer queues (Hassin and Haviv (2003)), we can say that bond holders follow a threshold strategy when there are coordination costs. In other words, a bond holder buys a CDS contract if the number of bond holders (length of queue) is above a threshold. Above the threshold, congestion effects dominates and cost of coordination becomes very high. As the coordination cost rises with the increase in the number of bond holders, utility from buying a CDS outweighs the coordination costs and we observe a higher demand for CDS for firms with higher breadth. The reverse holds true as well, with a low breadth buying a CDS is costly as compared to coordinating with a handful of investors. The RDD plot in Figure 11 shows the threshold/ breakpoint for our full sample to be at a breadth of 123.

To illustrate, let us consider two companies 'A' and 'B'. Firm 'A' has two bond holders each holding 50% of the bond outstanding. Only two investors makes it easy for them to coordinate and then the large proportion of bonds held by them individually helps them exert influence on the management to protect their bond investment. On the contrary firm 'B' has 100 investors an each holding 1% of the total bond outstanding. An individual bond holder in this case is atomistic to influence the management. At the same time the coordination with 99 other bond holders is costly and thus they will be unable to exert influence as a single unit (of all bond holders). This initiates the demand for a CDS contract as the breadth of bond ownership increases. We also find that the breakpoint shifts with sample size and sample characteristics. Thus we can say that the threshold varies depending on the sample under consideration.

[12] see: Viswanathan and Tse (1989); Hassin and Haviv (1997); Laurens and Senthil (2014)
[13] see Table 4 for the summary statistics

7 Robustness Analysis

7.1 Reverse Causality

We study the cause for disparity in CDS and our results show that high breadth and low depth causes the initiation of a CDS. It can be argued that firms with higher breadth incentivize the sellers to offer CDS on them. In other words these results could suffer from the problem of endogeneity, and in particular, reverse causality. To address the concern of reverse causality we plot the breadth of the sample around the initiation of CDS, the graph is presented in Figure 12. For each firm we consider the quarter of CDS initiation as 'q_0.' Breadth is observed for three quarters before and after the CDS initiation for firms whose CDS initiation lies in our sample period. We see a rise in the breadth prior to the initiation of CDS, i.e. it rises by about 15% for the aggregate sample. After CDS is introduced for the reference entity, the growth of breadth declines and it almost flattens with breadth growing by only about 5% after CDS initiation. Thus we can say that it is the increase in breadth that causes initiation of CDS and not CDS that causes a rise in breadth of bond ownership.[14]

INSERT FIGURE 12 HERE

7.2 Subsampling by total assets and intangibles

In all our regressions we control for issuers size. However, size may have non linear effects for large vs small companies. As a first robustness check we perform a set of alternative regression analyses on several size clusters. In particular, we break our sample in quartiles based on total assets and intangible assets, the results are presented in Table 10. Columns (1) & (2) presents results for regressions on top and bottom quartiles of S&P 500 companies in our sample divided on the basis of the asset size respectively. We find the breadth and depth retains their sign and significance.

INSERT TABLE 10 HERE

Intangible assets on an average account for about 10% of the the total assets for S&P 500 companies in our sample as presented in Table 4. The distribution, however, is not uniform with companies in finance, insurance and services industries (comprising about 30% of our

[14] In unreported result we also plot this trend around 4 quarters of CDS initiation and the results remain the same.

sample)[15] having a higher proportion of intangible assets. The impact of bond ownership may not be the same for companies at two ends of the spectrum. To account for this disparity we also divide our sample on intangible assets. Columns (3) & (4) of Table 10 present regression result for subsample of firms divided on the basis of intangible assets. In column (5) We augment our regressions with a dummy called 'high intangibles' which takes the value of 1 for companies having intangible assets above the median. Companies with low values of intangible assets get a value of 0 for this dummy. We use the Peters and Taylor method Ryan and Lucian (2017) for calculation of intangible assets in column (5).[16] We find the demand for CDS to be high for firms with high intangibles as conjectured. Also, our main results hold supporting our 'governance influence hypothesis'.

7.3 Controlling for financial distress and equity blockholders

CDS acts as an insurance product to protect the bond holders in case of default due to a credit event by the reference entity. Financial distress is the main cause of a firm's default and thus we would expect firms with high financial distress likelihood to have a high demand for CDS. We use the Altman Z score[17] as a proxy for likelihood of financial distress. This is a continuous variable with higher values indicating safe firms/firms with lower probability of distress. Column 1 of Table 11 controls for Altman Z score. As conjectured we find the demand for CDS loads negatively on the Altman Z score indicating the firms with higher financial distress likelihood have a higher demand for CDS. Our primary predictor variables maintain their sign and significance.

INSERT TABLE 11 HERE

Firms with higher proportion of equity block holders pose a risk to its bond holders. Blockholders can be considered as a measure of entrenchment with blockhoders managing their own interest and the bondholders being at a higher risk of expropriation. Liao (2015) argues that monitoring by blockholders aggravates the conflict between equity and debt and the firms would prefer bank loan over public debt. A negative relation between number of blockholders and credit rating has also been documented (Skaifea et al. (2006)). We thus hypothesize a

[15] see Table 5.
[16] In unreported results we regress controlling for intangibles as reported by compustat and the results hold.
[17] Altman (1968)

positive relation between blockholder proportion and CDS demand. Column (2) of Table 11 presents the regression results after controlling for blockholders.

We use the 13F database by Thomson Reuters to construct the blockholder variable. A continuous 'Block10_prop' variable is constructed which is defined as the ratio of number of equity block holders having atleast 10% of equity holdings to the total number of institutional investors. We see from Table 11 that the demand for CDS increases with increase in the proportion of blockhoders confirming our hypothesis.

7.4 The Big-Bang Protocol

The Big-Bang Protocol was an initiative launched on April 8, 2009 by the International Swaps and Derivatives Association Inc. (ISDA) to help strengthen the credit default swap markets. The main goal of the protocol was to improve the efficiency and transparency of the CDS market. This protocol can be treated as an exogenous shock, a natural experiment which could alter the cause for initiation of a CDS contract. We thus split our sample into two sub-samples of observations before and after 2009 (big-bang protocol) and run our regression analysis on these subsamples. The results are presented in Table 12.

INSERT TABLE 12 HERE

We observe that both before and after the protocol the breadth and depth maintain their significance and direction supporting our 'governance influence hypothesis'. At the same time as expected after the passing of the Big-Bang Protocol breadth has less effect on the likelihood of a CDS.

7.5 Subsampling by constituents

Companies in S&P 500 are ideal candidates for CDS issuance as we infer from Table 1. To establish the causality between bond ownership structure and CDS demand we perform a quasi-natural experiment on our sample. We consider subsamples of firms that were added to and removed from the S&P 500 during our sample period. We have about 90 distinct firms in each subsample. For each firm in the subsample we consider 5 observation, two prior to and two post the addition/deletion. The results of probit regressions performed on the two subsamples are reported in Table 13. Panel A reports the regression results for companies added to the S&P 500 list and panel B reports the results for subsample removed from S&P 500 constituents. Column (1) - (3) reports the unconditional regressions. Column (3) - (6) replicate columns (1) -(3) after controlling for firm characteristics. We find that CDS positively loads on breadth with breadth retaining its significance. The results in both the panels are similar to those presented in our main results table, suggesting a role of bond ownership structure in determination of CDS demand.

INSERT TABLE 13 HERE

7.6 Controlling for speculative trading

CDS acts as an insurance for buyers to protect them against the loss in their underlying bonds which they hold suggesting the use of CDS as a hedge. CDS written on a bond can act as an insurance for other bonds of the same reference entity or any other comparable bond issued by another reference firm. This can be one of the reason for the outstanding amount in few CDSs being higher than that of its underlying bond. At the same time, literature also notes the existence of speculative trading in the CDS market. To control for this concern of speculative trading we construct a proxy with analyst earning disagreement following Oehmke and Zawadowski (2017). The authors show that higher is the disagreement higher is the speculative trading in the CDS market. Disagreement measure is defined as the 2 year earning per share forecast dispersion by share price. Table 14 presents the results of our regressions with speculation added as a control. We find that analyst disagreement loads positive suggesting an increase in demand for CDS with increase in speculative trading. It is important to note that our primary predictor maintain their sign and significance and our 'governance influence hypothesis' holds.

INSERT TABLE 14 HERE

7.7 Controlling for bond fragmentation

CDS contracts began trading in early nineties and represent the simplest ("plain vanilla") instrument among the class of credit derivatives. Oehmke and Zawadowski (2017) show that CDS market plays a standardization role and that the net notional CDS positions and CDS trading volumes are higher when the underlying bonds are fragmented into different issues and have varying contractual terms. Thus, it could be the bond fragmentation or less standardisation which drives the demand for CDS initiation. To test that we use two proxys for bond fragmentation and control them in our baseline regression. We use count of bond issues as a first proxy which is a continuous variable equal to the number of outstanding bond issues per firm per quarter. We use bond fragmentation dummy as the second proxy and define standardisation based on heterogeneity in contractual terms. We use Mergent FISD to obtain dummy variable information on whether a bond is (1) puttable (2) convertible (3) has a credit enhancement (4) has a fixed coupon and (5) has covenants. The bond fragmentation dummy takes a value of 0 for the firms for which these contractual features are same across issues. The results are presented in Table 15.

INSERT TABLE 15 HERE

In table 15 columns (1) - (3) uses the count of bond issues as an additional control and columns (4) - (6) use bond fragmentation dummy as a control for bond standardisation. We observe the proxies to load positively on CDS demand as expected. At the same time we find that our primary predictor of breadth and depth load positively and negatively concurrent to our main result supporting our claim that dispersed and diversified bond ownership spurs demand for a CDS.

Finally, in unreported tests, we control for bond liquidity and run all our regressions with different levels of fixed effects and standard errors. Results are robust and qualitatively unchanged.

8 Conclusion

This paper investigates the disparity in CDS coverage. We provide a novel evidence that the demand for CDS is governed by the bond ownership structure of the reference entity. Our analysis, based on partially hand-collected data of CDS on S&P 500 companies and their bond ownership structure obtained from Lipper eMAXX, suggests that the financial risk borne by the investors regulates the demand for CDS contracts. We propose a causal relation between bond ownership structure and need for a CDS. In particular the *breadth* and the *institutional depth* increases or decreases the likelihood of having CDS. The reason for the disparity in CDS coverage is identified and two opposing hypotheses (*limited diversification* and *governance influence*) are formulated to explain this puzzling heterogeneity. Our empirical results support the governance influence hypothesis and we find statistically significant results suggesting that a high breadth and a low depth initiates the need for a CDS. Highly concentrated bond ownership reduces the need for a CDS by providing the investors with the ability to exercise control over the company. A fragmented and diversified ownership leads to problems of coordination with the management, causing difficulty in exercising control and thereby stimulating the need for protection or a CDS.

The preliminary results could be strongly affected by the quality of governance, firm complexity, CEO power and CEO overconfidence. To address these concerns we control for corporate governance, firm complexity and CEO tenure (proxy for CEO power) and CEO overconfidence individually in our regressions and find the demand for CDS to be higher for firms with poor governance, high complexity, high CEO power and low CEO overconfidence with our primary results being intact.

Following our results we run a regression discontinuity design (RDD) to identify a breakpoint in the likelihood of the demand for a CDS and find the discontinuity to be at a breadth of 123. This suggests that as the number of institutional investors increases beyond 123, the ownership gets small, collective coordination with the company's management becomes difficult raising the coordination cost and increasing the demand for a CDS. The economic interpretation of such breakpoints is that of threshold equilibrium cutoffs, similar in spirit to the results in Laurens and Senthil (2014).

Overall, our novel evidence shed light on the functioning of CDS markets and has important normative implications for the design of financial markets regulation.

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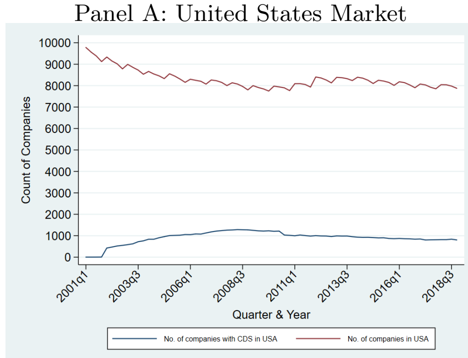
9 Figures

Figure 1: CDS Coverage

This plot provides the quarterly count of companies with CDS over a period of 18 years beginning 2001. Panel A reports statistics for companies in the U.S. market. The blue line indicates the total count of companies in U.S. market and red represents the count of U.S. companies having a CDS. Panel B plots the count of companies in S&P 500 having a CDS.

Panel A: United States Market



Panel B: S&P 500

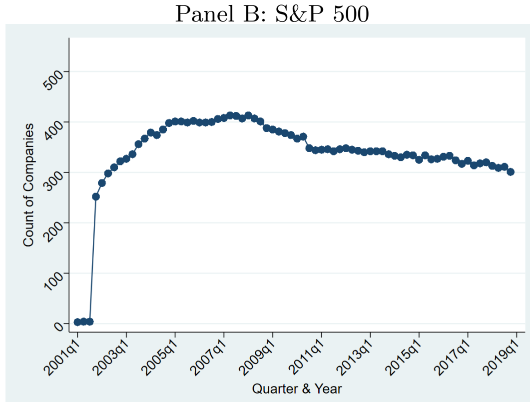


Figure 2: Requirement pattern of CDS

This is a 2X2 matrix formed by the intersection of the two bond ownership attributes - breadth & depth. The 'HH' quadrant represents the companies with high breadth and high depth. Second quadrant (LH) consists of companies with less number of bond holders and each holding high concentration of bond outstanding. Similarly 'LL' has companies with low breadth and low depth and 'HL' comprises of companies with large number of bonds owners and low concentration of ownership.

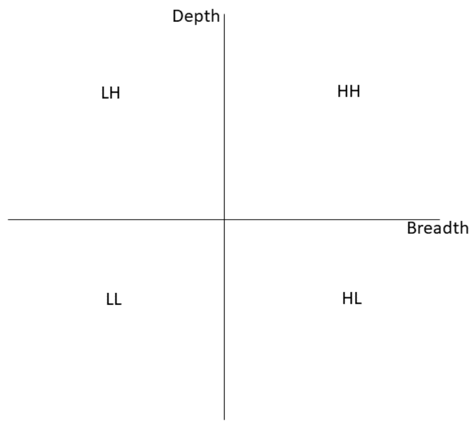


Figure 3: S&P 500 companies with long term liabilities and no CDS

In this figure the bars show the number of S&P 500 companies without CDS plotted quarterly between 2001-2018. The line corresponds to the count of S&P 500 companies that have debt but do not have CDS contract on them. For example, for the first quarter of 2001, 496 companies did not have CDS and 490 of the S&P 500 had long term debt outstanding.

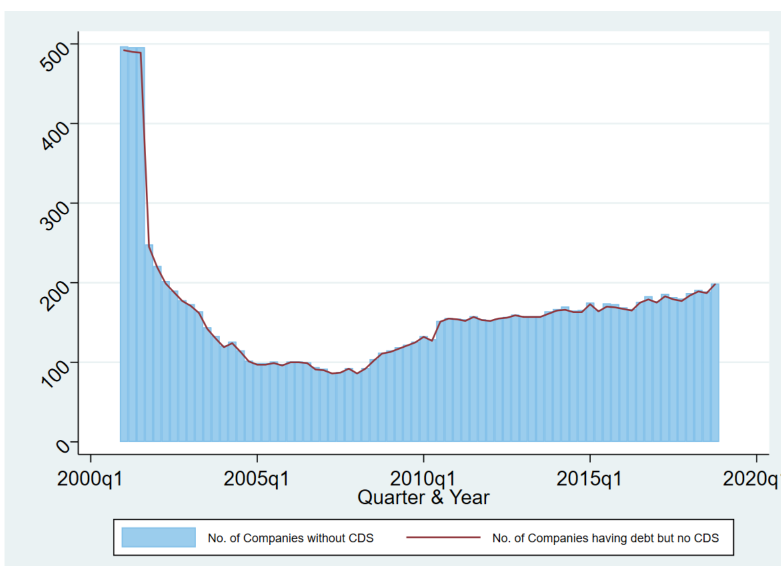


Figure 4: Comparison of Debt and CDS market

In this plot we represent the disparity in debt and CDS market. The bars show the long term liabilities in billion dollars combined for all S&P 500 companies not covered by a CDS each quarter. The line corresponds to the percentage of the total long term liabilities not covered by CDS. For example, for the last quarter of 2018 about 14% of the total long term liabilities are not covered by a CDS. This 14% corresponds to around 800 billion USD as denoted by the blue bar. The long term liabilities are represented in billion USD.

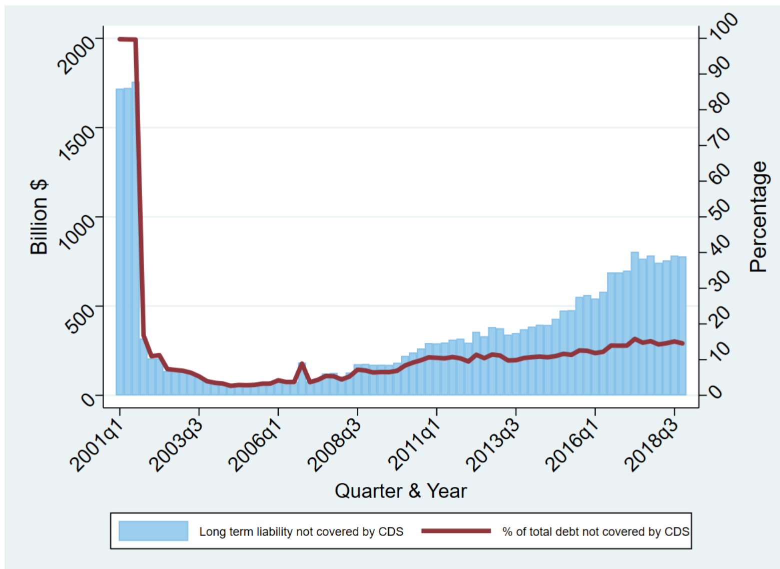


Figure 5: Distribution of companies in terms of their CDS coverage

In this figure the number on each wedge shows the count of companies not having a CDS, segregated based on the percentage of times a company did not have a CDS during the 18 years. For eg. the brown wedge shows that 264 of the 891 unique companies never had CDS in those 18 years. In the same way the slice with 'Always' shows that 94 companies always had CDS. The data set has 891 unique S&P 500 companies in the sample period.

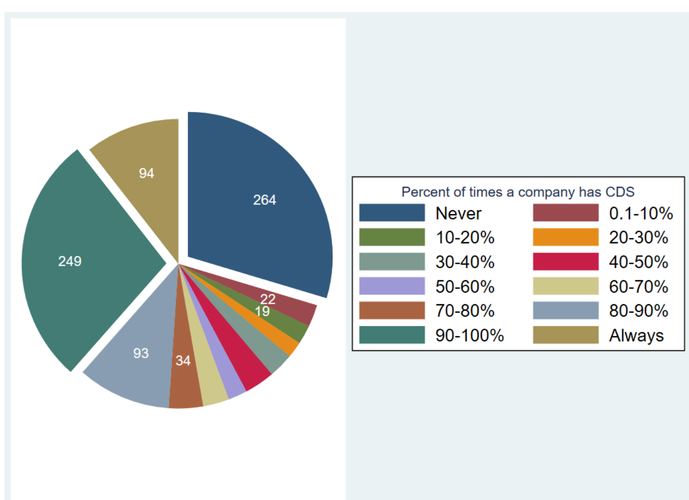


Figure 6: Distribution of companies by bond ownership structure

This is a scatter plot of companies by bond ownership structure. The 'X' axis reports the depth of a company's bond ownership and the natural log of the breadth is recorded by the 'Y' axis.

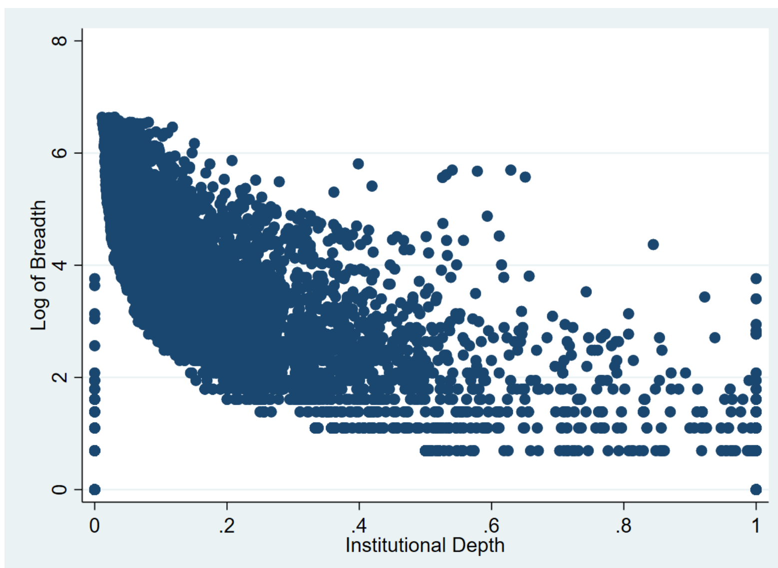
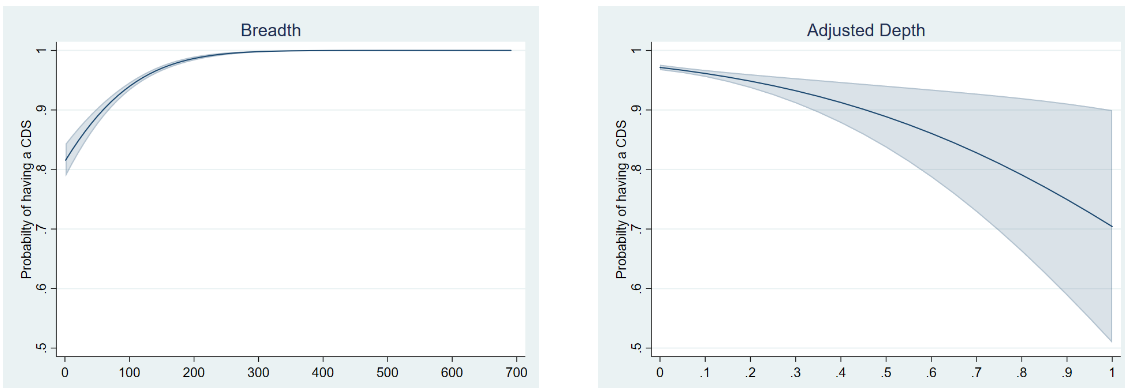


Figure 7: Marginal effects and predicted probabilities

These figures represent predicted probabilities for changes in the two explanatory variables in our baseline model. Panel A provides the change in probability of having a CDS (Y axis) for changes in breadth and depth (X axis) keeping one of the variable constant at all times. The shaded area provides the confidence interval. Panel B presents the marginal effects for interaction of breadth and depth with d1 representing the depth. X axis represents the breadth and Y axis is the predicted probability in Panel B.

PANEL A



PANEL B

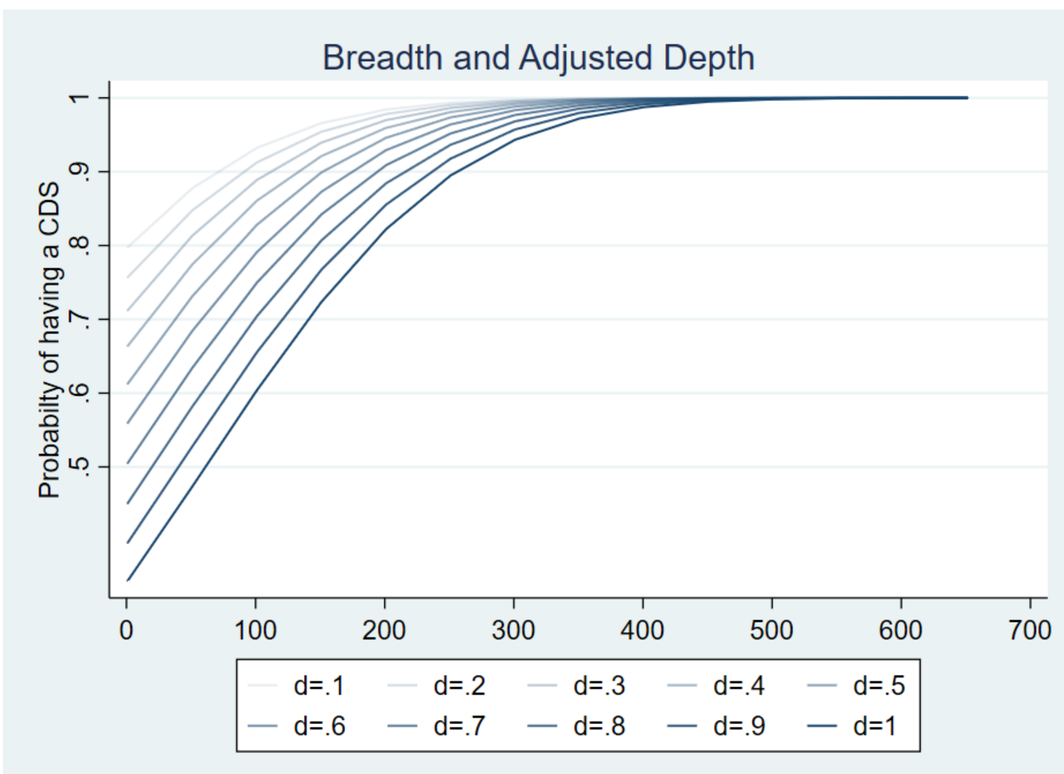
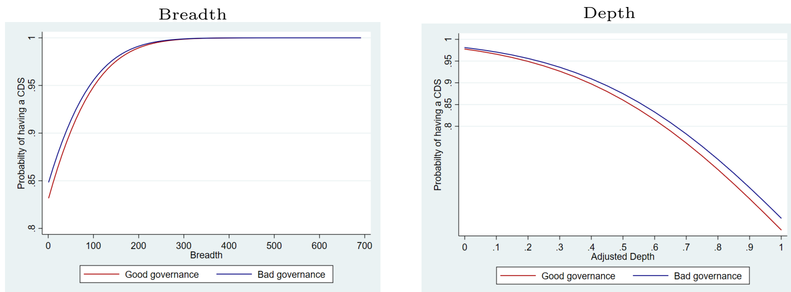


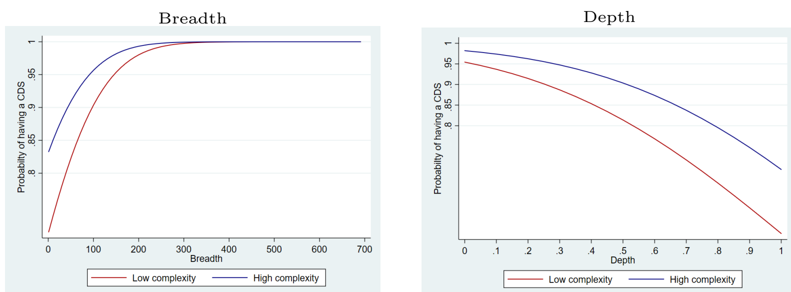
Figure 8: Marginal Effect for subsamples of companies

These figures represent predicted probabilities for changes in the two explanatory variables (breadth and adjusted depth) in our model for the subsamples of companies. Panel A presents the marginal effects on breadth and depth for firms with good and bad governance. Firm with E-index above median are terms as good governance firms and bad for below median. Panel B divides the sample into firms with high and low complexity. Firms above median level of complexity are termed as high complexity firms. Panel C presents predicted probabilities for firms with low and high CEO power. CEO power is defined high for firms with CEO in the fourth quartile of CEO tenure and low for the remaining ones. Panel D presents predicted probabilities for firms with low and high CEO overconfidence.

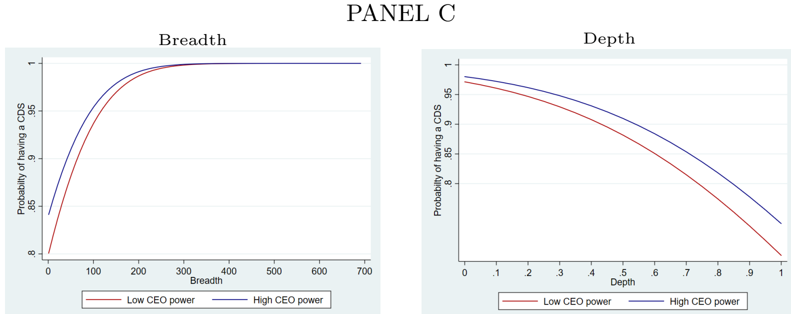
PANEL A



PANEL B



PANEL C



PANEL D

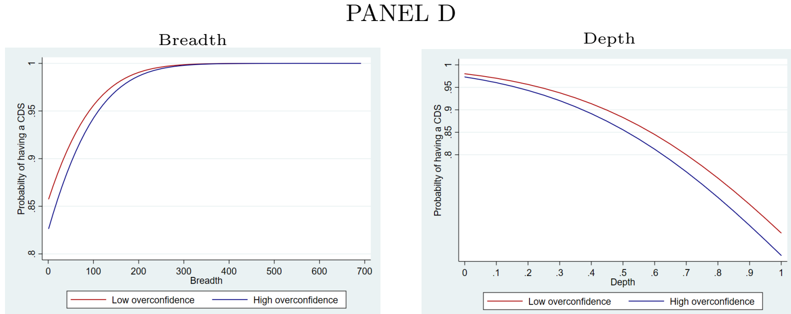


Figure 9: Histogram of Companies with and without CDS on breadth

This figure plots the histogram showing the fraction of companies with/without CDS by bins of breadth. Each bin has a width of 10. For example, the first bin represents the fraction of companies having 1-10 institutional investors. About 0.12% of the total companies without a CDS have less than 11 investors, and 0.03% of companies having a CDS lie in the first bin. We observe a flip in this fraction at a breadth of about 123.

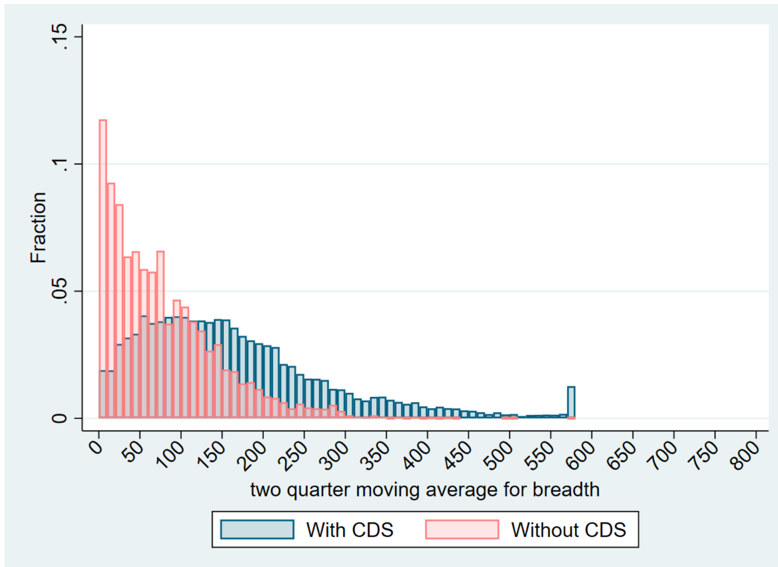


Figure 10: Histogram of Companies with and without CDS on breadth

The plot shows the fraction of companies with/without CDS over the total companies by bins (10 investors per bin) of breadth. The blue line shows the line plot for companies having a CDS and red is for the ones not having a CDS.

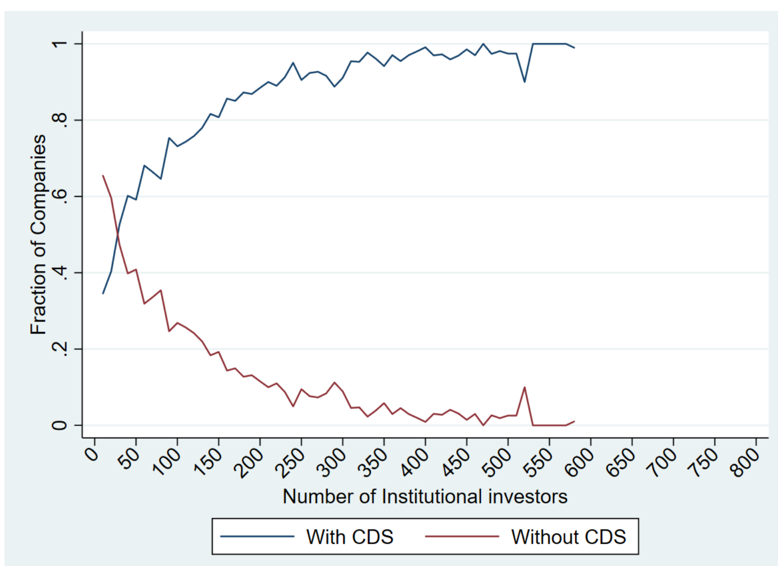


Figure 11: Regression discontinuity design (RDD) plot at breadth of 123

This is the RDD plot at a breadth of 123 for the full sample. The solid line represents the global polynomial fit of CDS on breadth, dots represent the local sample means of CDS at intervals of breadth. The red line fits the polynomial for sample below the breakpoint of 123. The blue line shows the quadratic fit for the subsample above the breadth of 123.

PANEL A

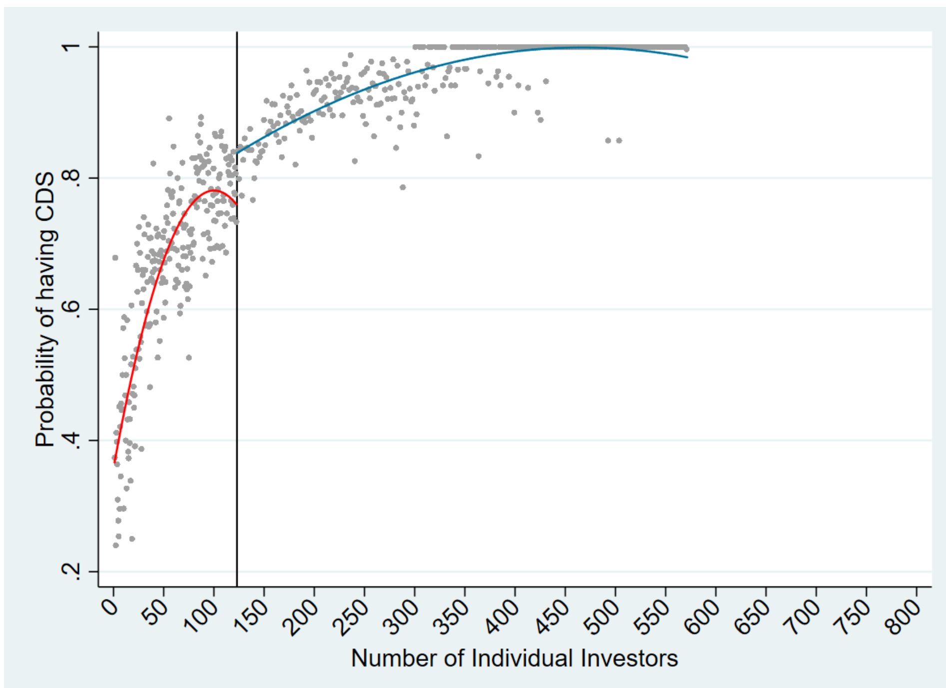
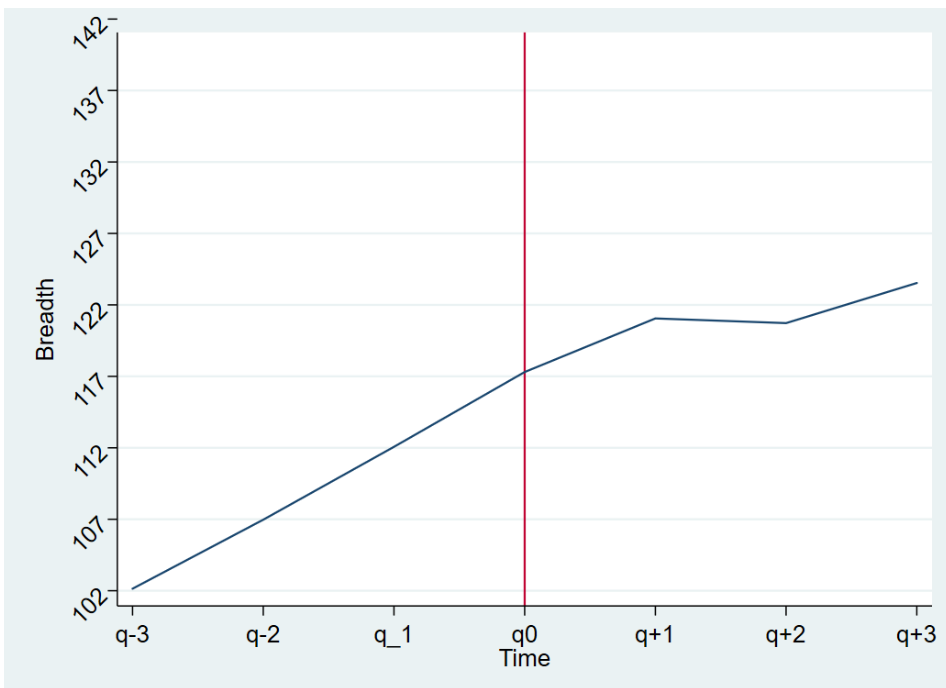


Figure 12: Reverse causality: Trend in breadth with initiation of CDS

This is plot of the sample providing the trend in breadth around the CDS initiation. 'q0' represents the quarter when a CDS got initiated.

PANEL A



10 Tables

Table 1

Impact of being in S&P 500 on having a CDS

The table presents results for a set of probit regressions performed on a PSM matched panel data of companies listed in the U.S. market for a period of 18 years or 72 quarters. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bond in that quarter. The primary predictor variable is SP = 1/0 for company being a S&P 500 company or not. In Columns (1)-(3) the independent variables have been lagged by 1 year. Column (1) presents result of unconditional regressions. Columns (2)-(3) control for firm size. In Column (4)-(6) we reestimate the specification of columns (1)-(3) with independent variables being lagged by 2 years. All the regressions have time fixed effects. Assets are defined as natural log of total assets. Long term debt is defined as the natural log of total long term debt. Natural log of change in total long term debt per year is termed as the change in leverage. Market value is the natural log of market value of the firm per quarter. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Robust standard errors are represented in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
	CDS	CDS	CDS	CDS	CDS	CDS
SP	1.266***	1.490***	0.846***	1.239***	1.446***	0.776***
	(0.011)	(0.012)	(0.020)	(0.011)	(0.012)	(0.021)
Assets		-0.004	0.081***		0.004	0.063***
		(0.008)	(0.012)		(0.007)	(0.012)
Long term debt		0.309***	0.314***		0.279***	0.297***
		(0.007)	(0.009)		(0.007)	(0.009)
Change in leverage			-0.000***			-0.000***
			(0.000)			(0.000)
Market value			0.224***			0.255***
			(0.010)			(0.010)
Constant	-1.008***	-3.274***	-4.927***	-0.749***	-2.834***	-4.935***
	(0.023)	(0.051)	(0.188)	(0.023)	(0.051)	(0.192)
Observations	63,990	61,176	34,337	60,182	57,478	31,410
Time FE	YES	YES	YES	YES	YES	YES
Wald chi^2	14376	18232	8764	12913	16454	8009
Prob $>chi^2$	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R^2	0.17	0.28	0.30	0.16	0.26	0.29

Table 2
Sample descriptive statistics

This table presents summary statistics for percentage of S&P 500 companies not covered by a CDS each year during the sample period between 2001-2018. For example in 2009, 25.20% of the S&P 500 companies did not have a CDS contract on their debt.

Year	Percentage	Year	Percentage
2001	49.60	2010	31.20
2002	35.60	2011	30.80
2003	26.60	2012	32.00
2004	20.40	2013	32.80
2005	19.60	2014	33.20
2006	19.80	2015	34.60
2007	18.60	2016	36.60
2008	22.40	2017	36.00
2009	25.20	2018	39.80
		Total	30.20

Table 3
Summary statistics of bond ownership by CDS

The table presents the summary statistics of breadth and depth for companies with and without CDS. Breadth is defined as the number of institutional owners. Depth is defined as the concentration of ownership. The table also provides the results for the t-test on equality of means conducted across group of companies with and without CDS.

	Without CDS	With CDS	Difference	p-Value
Breadth				
Mean	84.77	172.57	87.80***	0.00
Median	67.00	149.00		
Standard Deviation	75.11	123.55		
Depth				
Mean	0.13	0.07	0.07***	0.00
Median	0.06	0.04		
Standard Deviation	0.19	0.10		

Table 4
Summary statistics of firms

This table reports the summary statistics of firm characteristics for the companies (bond issuing firms) and institutional investors (bond holding firms) in our sample during the period between 2001-2018. Assets are defined total assets per quarter. Debt is defined as the sum of long term debt and debt in current liabilities for each quarter. Leverage is defined as the ratio of debt to total assets. Intangibles include the total intangible assets of a firm per quarter. Market value, net income, cash and total revenue are obtained from 'Compustat-Capital IQ' on a quarterly basis. Tobin Q is calculated as the market value of equity plus book value of short and long term debt by total assets. Total Q is the 'Peters and Taylor's adjusted Q. The values are presented in million USD.

Variable	Obs	Mean	Std. Dev.	Min	Max
Bond Issuing Firms					
Assets	28,464	62151.38	197516.30	386.29	2622532.00
Debt	27,145	16894.68	63103.77	0.00	916322.00
Leverage	27,145	0.28	0.17	0	2.44
Intangibles	26,878	6539.23	15545.06	0.00	312576.00
Market Value	27,669	30094.34	52522.96	89.57	1073391.00
Net Income	28,457	390.93	1344.91	-61659.00	32551.00
Total Revenue	26,949	5210.62	9626.70	-25623.00	126267.00
Cash	28,401	7725.50	36985.44	-26.00	748548.00
Tobin Q	25,866	1.51	1.16	0.03	16.21
Total Q	24,381	1.17	4.88	-97.16	106.45
Bond Holding Firms					
Bond outstanding per investor	28,990	10.74			
Average of unique bond investors per quarter	28,990	951.61			

Table 5
Distribution of firms by industry

This table presents the distribution of firms in our sample during the period between 2001-2018 by industry. We use 2 digit Standard Industrial Classification (SIC) code to define the industry of the 766 unique firm during our sample period.

Industry	**Frequency**	**Percent (%)**
Agriculture, Forestry and Fishing	1	0.13
Construction	8	1.4
Finance, Insurance & Real Estate	146	19.06
Manufacturing	308	40.21
Mining	48	6.27
Non-classifiable items	4	0.52
Retail Trade	50	6.53
Services	80	10.44
Transportation & Public Utilities	106	13.84
Wholesale Trade	15	1.96
Total	766	100.00

Table 6

Impact of bond ownership on CDS coverage

This table presents results for set of panel data probit regressions on our sample of quarterly data of S&P 500 companies for a period between 2001-2018. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bonds in that quarter. Indicators of bond ownership structure i.e. the breadth (number of institutional investors holding the bonds) and institutional depth (concentration of ownership) are the predictor variables. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. Columns (1) - (3) presents unconditional regression with breadth, depth and combination of both breadth and depth respectively. In columns (4)-(6) reestimates the specifications of columns (1)-(3) with addition of firm controls. Ln[Assets] is defined as natural log of total assets. Leverage is defined as the ratio of total debt to total assets. Total debt is further defined as the sum of long term debt and debt in current liabilities for each quarter. Return on assets (ROA) is defined as the ratio of the net interest income to the total assets. Excess return is the firms excess return over the past year. Stock volatility is the firm's annualized equity volatility. PPENT/Assets is the ratio of plant, property and equipment to total assets. Sales/Assets is the ratio of total sales to total assets. EBIT/Assets is the ratio of earnings before interest and tax to total assets. WCAP/Assets is the ratio of working capital to total assets. RE/Assets is the ratio of retained earnings to total assets. Ratio of cash and short term investments to total assets is defined as Cash/Assets. CAPEX/Assets is the ratio of capital expenditures to total assets. Credit Rating is a dummy variable taking a value of 1 for the firms with credit ratings of AAA, AA, A, BBB and a value of 0 for firm's rated as BB, B. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1) CDS	(2) CDS	(3) CDS	(4) CDS	(5) CDS	(6) CDS
Breadth	0.011***		0.010***	0.008***		0.007***
	(0.000)		(0.000)	(0.000)		(0.000)
Adjusted Depth		-3.212***	-0.429**		-2.230***	-1.367***
		(0.161)	(0.210)		(0.279)	(0.302)
Breadth*Adj. Depth			0.038***			0.043***
			(0.006)			(0.008)
Ln [Assets]				0.618***	0.908***	0.610***
				(0.031)	(0.027)	(0.031)
Leverage				0.517***	1.367***	0.467***
				(0.158)	(0.183)	(0.156)
ROA				-1.686**	-1.870**	-1.770**
				(0.793)	(0.820)	(0.801)
Excess stock returns				-0.019	-0.052	-0.031
				(0.056)	(0.057)	(0.057)
Stock volatility				0.555***	0.593***	0.585***
				(0.195)	(0.195)	(0.197)
PPENT/Assets				1.305***	1.282***	1.247***
				(0.167)	(0.162)	(0.166)
Sales/Assets				1.592***	1.451***	1.583***
				(0.224)	(0.223)	(0.223)
EBIT/Assets				-2.589***	-2.448***	-2.566***
				(0.897)	(0.876)	(0.900)
WCAP/Assets				-1.549***	-1.418***	-1.581***
				(0.205)	(0.199)	(0.203)
RE/Assets				0.293***	0.216***	0.303***
				(0.046)	(0.041)	(0.046)
Cash/Assets				0.196	0.082	0.244
				(0.204)	(0.200)	(0.208)
CAPEX/Assets				-3.261***	-2.896***	-3.192***
				(0.686)	(0.655)	(0.696)
Credit Rating				0.256***	0.256***	0.252***
				(0.058)	(0.059)	(0.060)
Constant	-4.054***	-0.603*	-3.992***	-10.502***	-11.917***	-10.393***
	(0.548)	(0.341)	(0.519)	(0.623)	(0.578)	(0.618)
Observations	27,458	27,458	27,458	16,204	16,204	16,204
Time FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Wald chi^2	6404.00	7135.00	6434.00	3837.00	3974.00	3920.00
Prob $>chi^2$	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R^2	0.38	0.22	0.38	0.46	0.43	0.46

Table 7

Auxiliary evidence: division on leverage

This table presents the our baseline regression results for subsamples divided into quartiles based on leverage. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bonds in that quarter. Indicators of bond ownership structure i.e. the breadth (number of institutional investors holding the bonds) and institutional depth (concentration of ownership) are the predictor variables. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. We augment all our regressions with the set of firm controls. Quartile 1 represents the results for the subsample of firms having low leverage. Leverage value increases for quartile 2 and 3 and is the highest for firms in quartile 4. Ln[Assets] is defined as natural log of total assets. Leverage is defined as the ratio of total debt to total assets. Total debt is further defined as the sum of long term debt and debt in current liabilities for each quarter. Return on assets (ROA) is defined as the ratio of the net interest income to the total assets. Excess return is the firms excess return over the past year. Stock volatility is the firm's annualized equity volatility. PPENT/Assets is the ratio of plant, property and equipment to total assets. Sales/Assets is the ratio of total sales to total assets. EBIT/Assets is the ratio of earnings before interest and tax to total assets. WCAP/Assets is the ratio of working capital to total assets. RE/Assets is the ratio of retained earnings to total assets. Ratio of cash and short term investments to total assets is defined as Cash/Assets. CAPEX/Assets is the ratio of capital expenditures to total assets. Credit Rating is a dummy variable taking a value of 1 for the firms with credit ratings of AAA, AA, A, BBB and a value of 0 for firm's rated as BB, B. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1)	(2)	(3)	(4)
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Breadth	0.006***	0.007***	0.007***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Adjusted Depth	-2.024***	-0.634	-3.548***	-0.371
	(0.494)	(0.584)	(0.738)	(0.931)
Breadth*Adj. Depth	0.083***	0.002	0.064***	0.051***
	(0.025)	(0.014)	(0.019)	(0.015)
Ln [Assets]	0.667***	0.613***	0.757***	0.724***
	(0.068)	(0.066)	(0.062)	(0.093)
Leverage	5.960***	2.053*	3.300***	-0.753*
	(1.108)	(1.149)	(1.091)	(0.456)
ROA	-3.936*	-0.666	-5.706**	3.099
	(2.124)	(1.124)	(2.357)	(2.042)
Excess stock returns	-0.321**	0.264**	-0.045	0.028
	(0.125)	(0.134)	(0.112)	(0.127)
Stock volatility	-0.325	1.026***	1.547***	1.432***
	(0.408)	(0.390)	(0.560)	(0.530)
PPENT/Assets	0.677*	2.828***	1.198***	1.323***
	(0.404)	(0.405)	(0.303)	(0.417)
Sales/Assets	1.159***	2.005***	4.008***	2.739***
	(0.340)	(0.344)	(0.574)	(0.730)
EBIT/Assets	1.496	-3.775***	-1.916	-12.381***
	(1.005)	(1.352)	(2.340)	(2.825)
WCAP/Assets	-1.779***	-1.624***	-2.038***	-2.828***
	(0.514)	(0.458)	(0.452)	(0.508)
RE/Assets	0.751***	-0.222*	0.275**	0.532***
	(0.123)	(0.117)	(0.121)	(0.111)
Cash/Assets	1.336***	0.326	-0.065	0.110
	(0.471)	(0.444)	(0.526)	(0.577)
CAPEX/Assets	-0.169	-7.460***	-0.909	1.060
	(1.774)	(1.104)	(1.186)	(2.551)
Credit Rating	0.107	0.759***	0.445***	0.308**
	(0.148)	(0.128)	(0.146)	(0.133)
Constant	-5.781***	-8.799***	-9.841***	-6.762***
	(0.986)	(0.956)	(0.828)	(1.046)
Observations	2,905	3,889	4,151	3,338
Time FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Wald chi^2	995.50	1049.00	1102.00	986.90
Prob $>chi^2$	0	0	0	0
Pseudo R^2	0.47	0.42	0.51	0.57

Table 8

Auxiliary evidence: controlling for corporate governance, firm complexity, CEO power and CEO overconfidence

This table presents the results for set of panel data probit regressions on our sample of S&P 500 companies for a period between 2001-2018. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bonds in that quarter. Indicators of bond ownership structure i.e. the breadth (number of institutional investors holding the bonds) and institutional depth (concentration of ownership) are the predictor variables. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. We augment all our regressions with an extra control of bond liquidity. Columns (1) adds a continuous control for corporate governance in the regression equations. We use E-index as a proxy for governance. In column (2) we augment our regressions with a control for firm complexity. Firm complexity is a continuous variable which is calculated using factor analysis and includes the variables of firm sales, leverage and count of business segments. Column (3) controls for CEO power. We measure CEO power by tenure of the CEO which is a binary variable taking a value of 1 for CEO tenures lying in the fourth quartile and 0 otherwise. We control for CEO overconfidence in column (4) using a continuous variable of in the moneyness of options as a proxy. All our regressions are controlled for firm characteristics each of which are defined in the appendix. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1) Corporate Governance	(2) Firm Complexity	(3) CEO Power	(4) CEO Overconfidence
Breadth	0.007***	0.008***	0.007***	0.006***
	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted Depth	-1.744***	-1.529***	-1.438***	-1.760***
	(0.361)	(0.344)	(0.297)	(0.331)
Breadth*Adj. Depth	0.049***	0.046***	0.048***	0.060***
	(0.012)	(0.009)	(0.008)	(0.010)
E-index	0.132***			
	(0.022)			
Complexity		0.198***		
		(0.038)		
High CEO tenure			0.156***	
			(0.041)	
CEO In the moneyness				-0.528***
				(0.078)
Ln [Assets]	0.689***	0.452***	0.574***	0.594***
	(0.041)	(0.042)	(0.032)	(0.034)
Leverage	0.493**	-0.018	0.337**	0.434**
	(0.198)	(0.192)	(0.163)	(0.186)
ROA	-2.405***	-2.094**	-1.713**	-1.648*
	(0.933)	(0.890)	(0.806)	(0.845)
Excess stock returns	-0.071	-0.027	-0.016	0.095
	(0.063)	(0.058)	(0.058)	(0.060)
Stock volatility	0.601***	0.561***	0.653***	0.738***
	(0.222)	(0.208)	(0.208)	(0.200)
PPENT/Assets	1.213***	1.634***	1.233***	0.975***
	(0.190)	(0.188)	(0.171)	(0.181)
Sales/Assets	1.299***	1.213***	1.444***	1.462***
	(0.237)	(0.246)	(0.218)	(0.226)
EBIT/Assets	-1.571*	-2.790***	-2.006**	-1.375
	(0.900)	(0.972)	(0.839)	(0.856)
WCAP/Assets	-1.882***	-1.212***	-1.719***	-1.468***
	(0.233)	(0.212)	(0.208)	(0.221)
RE/Assets	0.388***	0.199***	0.310***	0.302***
	(0.053)	(0.047)	(0.048)	(0.050)
Cash/Assets	0.684***	0.207	0.347	0.104
	(0.235)	(0.219)	(0.216)	(0.240)
CAPEX/Assets	-4.157***	-3.088***	-3.302***	-2.521***
	(0.730)	(0.725)	(0.716)	(0.743)
Credit Rating	0.185**	0.232***	0.234***	0.353***
	(0.073)	(0.070)	(0.063)	(0.064)
Constant	-8.275***	-8.958***	-10.080***	-10.280***
	(0.759)	(0.699)	(0.620)	(0.644)
Observations	12,719	12,956	15,487	14,007
Time FE	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Wald chi^2	3086.00	3730.00	3969.00	3795.00
Prob $>chi^2$	0.00	0.0	0.00	0.00
Pseudo R^2	0.44	0.47	0.46	0.47

Table 9

Comparison of groups above and below border discontinuity

This table compares traits of companies above and below border discontinuity. The border sample comprises of about 1600 companies having a breadth between 115 to 130 around the breakpoint of 123. The company characteristics are tested for equality of means using a two-tailed t test. Ln[Assets] is defined as natural log of total assets. Leverage is defined as the ratio of total debt to total assets. Total debt is further defined as the sum of long term debt and debt in current liabilities for each quarter. Return on assets (ROA) is defined as the ratio of the net interest income to the total assets.Ln[Net Income] and Ln[Market value] is the natural log of net income and firm's market value. The values are in million USD.

	Below Border Observations	**Above Border Observations**	**Two-tailed t-test for equality of means**
Basic Characteristics			
Ln [Total Assets]	9.588	9.662	0.102
Leverage	0.290	0.302	0.160
ROA	0.012	0.013	0.767
Ln [Net Income]	5.160	5.141	0.736
Ln [Market Value]	9.437	9.449	0.787
Depth	0.052	0.050	0.130
CDS	0.788	0.825	0.063
Observations	842	788	

Table 10

Robustness: size and tangibility

The table represents probit regression results for subsamples created on the basis of asset size of the firm. The full sample is divided based on total assets and intangible assets respectively. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. Panel A presents results for quartile division on total assets. Columns (1) - (2) presents result for the first and the fourth quartile (top 25% of the companies) subsample divided on total assets. Columns (3) - (4) divide the sample on the basis of intangible assets. Column (5) augments our baseline regression with control for intangible assets used in calculation of 'Peters and Taylor's total Q'. High intangibles in a binary variable taking a value of 1 for firms having intangibles above the median and 0 otherwise. All our regressions are controlled for firm characteristics with the control variables defined in the appendix. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1) Low Assets	(2) High Assets	(3) Low Intangibles	(4) High Intangibles	(5) Intangibles Control
Breadth	0.020***	0.009***	0.010***	0.011***	0.007***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.000)
Adjusted Depth	-1.839***	0.027	-4.856***	4.931***	-1.347***
	(0.465)	(2.161)	(0.936)	(1.465)	(0.305)
Breadth*Adj. Depth	0.064***	0.063	0.073***	-0.020	0.041***
	(0.019)	(0.039)	(0.021)	(0.019)	(0.008)
High Intangibles					0.209***
					(0.047)
Ln [Assets]	0.326***	0.757**	1.619***	0.308***	0.553***
	(0.112)	(0.343)	(0.112)	(0.098)	(0.034)
Leverage	-0.636**	0.938	1.697***	-0.642	0.449***
	(0.275)	(2.001)	(0.409)	(0.416)	(0.157)
ROA	-3.528**	-3.840	-1.706	5.977	-1.753**
	(1.679)	(4.956)	(1.494)	(3.738)	(0.802)
Excess stock returns	-0.109	-0.195	-0.236*	0.614***	-0.036
	(0.085)	(0.378)	(0.122)	(0.202)	(0.057)
Stock volatility	1.016***	0.739	0.172	-0.819	0.595***
	(0.335)	(1.541)	(0.466)	(0.719)	(0.196)
PPENT/Assets	-1.689***	8.940***	0.131	6.440***	1.410***
	(0.354)	(1.045)	(0.462)	(0.846)	(0.174)
Sales/Assets	2.627***	-3.088***	3.700***	2.062**	1.613***
	(0.383)	(0.836)	(0.498)	(0.830)	(0.220)
EBIT/Assets	-1.724	16.585**	-4.460**	-9.057**	-2.649***
	(1.671)	(7.249)	(2.023)	(4.014)	(0.915)
WCAP/Assets	-2.833***	2.946*	1.338**	-4.352***	-1.426***
	(0.355)	(1.718)	(0.606)	(0.741)	(0.205)
RE/Assets	0.310***	0.050	-0.108	0.646***	0.300***
	(0.082)	(0.303)	(0.097)	(0.136)	(0.047)
Cash/Assets	1.169***	-7.096***	0.092	1.509**	0.150
	(0.404)	(2.280)	(0.548)	(0.744)	(0.210)
CAPEX/Assets	-3.809***	-6.526**	-3.574***	3.678	-3.381***
	(1.387)	(3.323)	(0.935)	(4.077)	(0.704)
Credit Rating	0.263**		-0.029	1.313***	0.236***
	(0.112)		(0.144)	(0.177)	(0.060)
Constant	-2.535**	-10.501**	-14.451***	-3.590***	-10.005***
	(0.995)	(4.125)	(1.375)	(1.263)	(0.624)
Observations	3,308	1,973	3,068	3,375	16,204
Time FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Wald chi^2	1491.00	306.50	1019.00	697.90	3938.00
Prob $>chi^2$	0.00	0.00	0.00	0.00	0.00
Pseudo R^2	0.45	0.64	0.59	0.57	0.46

Table 11
Robustness: controlling for financial
distress and equity block holders

This table presents the results for set of panel data probit regressions on our sample of S&P 500 companies for a period between 2001-2018. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bonds in that quarter. Indicators of bond ownership structure i.e. the breadth (number of institutional investors holding the bonds) and institutional depth (concentration of ownership) are the predictor variables. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. We augment all our regressions with an extra control of bond liquidity. Columns (1) adds a continuous control for bankruptcy measured by Altman Z score in the regression equations. We control for blockholders of a firm's stocks by using 10% blockholder proportion as a covariate in the regression in column (2). Block10 prop if defined as the fraction of equity investors holding more that 10% of a firm's shares. All our regressions are controlled for firm characteristics with the control variables defined in the appendix. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1) Altman Z	(2) 10% Block Holder
Breadth	0.007***	0.006***
	(0.000)	(0.000)
Adjusted Depth	-1.510***	-1.906***
	(0.317)	(0.365)
Breadth*Adj. Depth	0.046***	0.047***
	(0.008)	(0.010)
Altman Z	-0.092***	
	(0.025)	
Block10 prop		37.423***
		(10.886)
Ln [Assets]	0.599***	0.651***
	(0.032)	(0.035)
Leverage	0.190	0.606***
	(0.172)	(0.182)
ROA	-1.494*	-2.432**
	(0.811)	(1.010)
Excess stock returns	1.237***	1.476***
	(0.167)	(0.196)
Stock volatility	1.688***	1.293***
	(0.217)	(0.225)
PPENT/Assets	0.552**	0.552**
	(0.225)	(0.220)
Sales/Assets	0.490***	0.321***
	(0.075)	(0.055)
EBIT/Assets	-2.741***	-4.041***
	(0.723)	(0.780)
WCAP/Assets	-1.598*	-2.272**
	(0.844)	(1.019)
RE/Assets	-1.311***	-1.799***
	(0.218)	(0.222)
Cash/Assets	0.010	-0.016
	(0.061)	(0.064)
CAPEX/Assets	0.723***	0.861***
	(0.190)	(0.211)
Credit Rating	0.290***	0.174**
	(0.062)	(0.071)
Constant	-10.303***	-10.727***
	(0.617)	(0.632)
Observations	15,611	14,271
Time FE	YES	YES
Industry FE	YES	YES
Wald chi^2	3680.00	3805.00
Prob $>chi^2$	0.00	0.00
Pseudo R^2		0.47
0.48		

Table 12
Robustness: Subsampling around the Big-Bang protocol

TThe table represents probit regression results for subsamples created around the Big-Bang protocol of 2009. The full sample is divided into two samples one before 2009 and one after 2009. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. Columns (1), (3) and (5) presents result of our main regression for the subsample of observations before 2009. Columns (2), (4) and (6) replicates the results for the subsample of observations after 2009. All our regressions are controlled for firm characteristics with the control variables defined in the appendix. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
	Before 2009	After 2009	Before 2009	After 2009	Before 2009	After 2009
Breadth	0.015***	0.008***			0.011***	0.008***
	(0.002)	(0.000)			(0.002)	(0.001)
Adjusted Depth			-3.263***	-0.864	-2.532***	1.955**
			(0.356)	(0.635)	(0.470)	(0.813)
Breadth*Adj. Depth					0.083***	0.016
					(0.023)	(0.011)
Ln [Assets]	0.620***	0.682***	0.914***	1.046***	0.626***	0.656***
	(0.048)	(0.047)	(0.048)	(0.041)	(0.049)	(0.048)
Leverage	1.007***	0.437**	2.108***	1.370***	0.924***	0.436**
	(0.308)	(0.215)	(0.312)	(0.225)	(0.311)	(0.218)
ROA	-0.962	0.209	-1.233	0.053	-1.161	0.199
	(0.976)	(1.472)	(0.943)	(1.541)	(1.004)	(1.475)
Excess stock returns	-0.096	0.071	-0.106	0.003	-0.115	0.075
	(0.075)	(0.091)	(0.074)	(0.093)	(0.076)	(0.092)
Stock Volatility	0.358	0.110	0.415	0.233	0.278	0.017
	(0.265)	(0.366)	(0.263)	(0.352)	(0.280)	(0.367)
PPENT/Assets	-0.608**	3.387***	-0.246	3.094***	-0.651**	3.410***
	(0.274)	(0.272)	(0.272)	(0.265)	(0.272)	(0.273)
Sales/Assets	0.854**	2.482***	0.898**	2.205***	0.766**	2.472***
	(0.360)	(0.328)	(0.376)	(0.345)	(0.354)	(0.326)
EBIT/Assets	-0.037	-9.137***	0.223	-7.833***	-0.041	-9.142***
	(0.842)	(1.883)	(0.741)	(1.801)	(0.824)	(1.902)
WCAP/Assets	-0.404	-2.798***	-0.266	-2.420***	-0.563*	-2.763***
	(0.308)	(0.280)	(0.321)	(0.272)	(0.305)	(0.283)
RE/Assets	0.361***	0.426***	0.252***	0.298***	0.391***	0.444***
	(0.081)	(0.067)	(0.079)	(0.062)	(0.083)	(0.068)
Cash/Assets	0.123	0.710***	0.045	0.387	0.465	0.633**
	(0.332)	(0.275)	(0.348)	(0.270)	(0.337)	(0.279)
CAPEX/Assts	-1.351	-5.118***	-1.590	-4.329***	-1.142	-5.100***
	(1.185)	(1.120)	(1.031)	(1.087)	(1.192)	(1.137)
Credit Rating	0.324***	0.373***	0.206**	0.460***	0.235**	0.433***
	(0.099)	(0.086)	(0.099)	(0.089)	(0.103)	(0.090)
Constant	-12.703***	-5.725***	-12.109***	-8.331***	-12.008***	-5.722***
	(1.024)	(0.588)	(0.781)	(0.552)	(1.012)	(0.595)
Observations	7,082	7,058	7,082	7,058	7,082	7,058
Time FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Wald chi^2	926.00	2083.00	1450.00	1981.00	1178.00	2128.00
Prob $>chi^2$	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R^2	0.54	0.45	0.50	0.41	0.54	0.45

Table 13

Robustness: addition and removal from S&P 500

The table represents probit regression results for subsamples created on companies added to and deleted from the S&P 500 list during our sample period, presented in Panel A and B respectively. For each subsample we consider 5 observations per company, two before and two after the addition/deletion. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bonds in that quarter. Indicators of bond ownership structure i.e. the breadth (number of institutional investors holding the bonds) and institutional depth (concentration of ownership) are the predictor variables. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. Columns (1) - (3) presents unconditional regression with breadth, depth and combination of both breadth and depth respectively. In columns (4)-(6) reestimates the specifications of columns (1)-(3) with addition of firm controls. Ln[Assets] is defined as natural log of total assets. Leverage is defined as the ratio of total debt to total assets. Total debt is further defined as the sum of long term debt and debt in current liabilities for each quarter. Return on assets (ROA) is defined as the ratio of the net interest income to the total assets. Excess return is the firms excess return over the past year. Stock volatility is the firm's annualized equity volatility. PPENT/Assets is the ratio of plant, property and equipment to total assets. Sales/Assets is the ratio of total sales to total assets. EBIT/Assets is the ratio of earnings before interest and tax to total assets. WCAP/Assets is the ratio of working capital to total assets. RE/Assets is the ratio of retained earnings to total assets. Ratio of cash and short term investments to total assets is defined as Cash/Assets. CAPEX/Assets is the ratio of capital expenditures to total assets. Credit Rating is a dummy variable taking a value of 1 for the firms with credit ratings of AAA, AA, A, BBB and a value of 0 for firm's rated as BB, B. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

PANEL A: ANALYSIS OF SUBSAMPLE ADDED TO S&P 500

	(1)	(2)	(3)	(4)	(5)	(6)
	CDS	CDS	CDS	CDS	CDS	CDS
Breadth	0.006***		0.005***	0.009**		0.003
	(0.001)		(0.001)	(0.005)		(0.005)
Adjusted Depth		-1.108***	-0.297		-3.049***	-3.397**
		(0.329)	(0.373)		(1.044)	(1.509)
Breadth*Adj. Depth			0.051**			0.110**
			(0.021)			(0.056)
Ln [Assets]				1.390***	1.473***	1.363***
				(0.366)	(0.355)	(0.387)
Leverage				-1.604	-1.038	-1.455
				(1.046)	(1.007)	(1.099)
ROA				10.129	9.571	9.603
				(6.543)	(7.157)	(6.924)
Excess stock return				-0.367	-0.583	-0.584
				(0.362)	(0.378)	(0.407)
Stock volatility				-0.882	0.988	1.030
				(1.566)	(1.619)	(1.676)
PPENT/Assets				1.073	0.700	1.262
				(1.075)	(1.145)	(1.175)
Sales/Assets				-0.863	-0.679	-1.179
				(1.650)	(1.485)	(1.546)
EBIT/Assets				-7.077	-8.275	-1.520
				(7.756)	(8.005)	(8.596)
WCAP/Assets				5.018**	4.675**	4.352*
				(2.245)	(2.130)	(2.256)
RE/Assets				-3.770***	-4.071***	-4.365***
				(0.899)	(1.028)	(1.277)
Cash/Assets				-2.244	-1.681	-1.116
				(2.425)	(2.139)	(2.210)
CAPEX/Assets				-3.740	-3.058	-6.751**
				(3.243)	(3.407)	(3.344)
Credit rating				0.921**	1.010***	1.120***
				(0.380)	(0.377)	(0.387)
Constant	-0.816	-0.120	-1.146	-15.342***	-15.452***	-16.413***
	(0.851)	(0.826)	(0.830)	(4.121)	(4.114)	(4.481)
Observations	630	630	630	222	222	222
Time FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Wald chi^2	282.10	251.20	290.50			
Prob $>chi^2$	0.00	0.00	0.00			
Pseudo R^2	0.30	0.26	0.31	0.50	0.50	0.52

PANEL B: ANALYSIS WITH SUBSAMPLE DELETED FROM S&P 500						
	(1)	(2)	(3)	(4)	(5)	(6)
	CDS	CDS	CDS	CDS	CDS	CDS
Breadth	0.003***		0.002***	0.002		0.004*
	(0.001)		(0.001)	(0.002)		(0.002)
Adjusted Depth		-0.579	-0.214		1.830***	2.382***
		(0.364)	(0.417)		(0.493)	(0.598)
Breadth*Adj. Depth			0.034**			0.165***
			(0.015)			(0.063)
Ln [Assets]				0.437***	0.574***	0.084
				(0.152)	(0.129)	(0.184)
Leverage				2.412**	3.509***	2.029**
				(0.940)	(0.856)	(0.924)
ROA				-1.670	-2.787	-2.492
				(3.785)	(3.769)	(3.511)
Excess stock return				-0.329	-0.267	-0.199
				(0.274)	(0.285)	(0.308)
Stock volatility				-0.948	-0.807	-0.822
				(0.954)	(0.990)	(1.016)
PPENT/Assets				3.355***	3.455***	3.858***
				(0.806)	(0.812)	(0.927)
Sales/Assets				3.703***	4.035***	4.654***
				(0.904)	(0.934)	(1.012)
EBIT/Assets				0.372	0.434	0.698
				(2.135)	(2.139)	(2.308)
WCAP/Assets				2.318**	2.791**	2.527**
				(1.064)	(1.136)	(1.198)
RE/Assets				0.343	0.394*	0.235
				(0.223)	(0.230)	(0.245)
Cash/Assets				-1.293	-1.632	-1.456
				(1.178)	(1.206)	(1.360)
CAPEX/Assets				-6.590*	-7.249*	-7.957**
				(3.921)	(3.872)	(3.970)
Credit rating				-0.453*	-0.381	-0.094
				(0.254)	(0.258)	(0.298)
Constant	-1.003	0.031	-0.913	-7.032***	-8.939***	-6.512***
	(0.824)	(0.799)	(0.831)	(1.861)	(1.806)	(2.034)
Observations	731	731	731	350	350	350
Time FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Wald chi^2	182.80	174.40	194.50	184.80	196.90	185.30
Prob $>chi^2$	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R^2	0.18	0.16	0.18	0.27	0.29	0.32

Table 14

Robustness: controlling speculative trading

This table presents results for set of panel data probit regressions on our sample of quarterly data of S&P 500 companies for a period between 2001-2018. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bonds in that quarter. Indicators of bond ownership structure i.e. the breadth (number of institutional investors holding the bonds) and institutional depth (concentration of ownership) are the predictor variables. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. All the regressions are controlled for analyst disagreement as a proxy of speculation as an additional control over our main set of control variables. Definitions of control variables is provided in the appendix A1. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1) CDS	(2) CDS	(3) CDS
Breadth	0.007***		0.006***
	(0.000)		(0.000)
Adjusted Depth		-2.166***	-1.556***
		(0.340)	(0.359)
Breadth*Adj. Depth			0.040***
			(0.009)
Analyst disagreement	28.322***	31.987***	28.642***
	(6.031)	(6.731)	(6.056)
Ln [Assets]	0.660***	0.945***	0.656***
	(0.034)	(0.030)	(0.034)
Leverage	0.593***	1.344***	0.543***
	(0.166)	(0.190)	(0.165)
ROA	-0.696	-0.885	-0.802
	(0.980)	(1.027)	(0.994)
Excess stock returns	0.098	0.087	0.082
	(0.062)	(0.063)	(0.063)
Stock volatility	0.287	0.344	0.342
	(0.214)	(0.217)	(0.215)
PPENT/Assets	1.284***	1.262***	1.233***
	(0.182)	(0.181)	(0.182)
Sales/Assets	1.505***	1.390***	1.507***
	(0.225)	(0.226)	(0.225)
EBIT/Assets	-2.681***	-2.646***	-2.639***
	(1.010)	(1.011)	(1.015)
WCAP/Assets	-1.678***	-1.594***	-1.710***
	(0.214)	(0.206)	(0.212)
RE/Assets	0.281***	0.232***	0.288***
	(0.052)	(0.049)	(0.052)
Cash/Assets	0.397*	0.332	0.441**
	(0.220)	(0.216)	(0.223)
CAPEX/Assets	-3.742***	-3.405***	-3.706***
	(0.753)	(0.730)	(0.763)
Credit Rating	0.383***	0.418***	0.365***
	(0.060)	(0.062)	(0.063)
Constant	-10.761***	-12.435***	-10.683***
	(0.635)	(0.609)	(0.630)
Observations	14,972	14,972	14,972
Time FE	YES	YES	YES
Industry FE	YES	YES	YES
Wald chi^2	4062.00	3976.00	4120.00
Prob $>chi^2$	0.00	0.00	0.00
Pseudo R^2	0.48	0.46	0.48

Table 15

Robustness: controlling for bond fragmentation

This table presents results for set of panel data probit regressions on our sample of quarterly data of S&P 500 companies for a period between 2001-2018. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bonds in that quarter. Indicators of bond ownership structure i.e. the breadth (number of institutional investors holding the bonds) and institutional depth (concentration of ownership) are the predictor variables. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. Columns (1) - (3) run our main regression controlling for bond fragmentation which is calculated as the number of bond issues outstanding for a firm in each quarter. In columns (4)-(6) reestimates the our main specification with addition of bond standardisation as a control. Bond standardisation is a dummy which takes a value of 1 if all bond issues of a firm are equal in their contractual terms. All the regressions are controlled firm characteristics. Definitions of controls are provided in appendix. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1) CDS	(2) CDS	(3) CDS	(4) CDS	(5) CDS	(6) CDS
Breadth	0.004***		0.002***	0.007***		0.006***
	(0.001)		(0.001)	(0.001)		(0.001)
Adjusted Depth		-1.782***	-1.795***		-2.292***	-1.646***
		(0.413)	(0.457)		(0.426)	(0.447)
Breadth*Adj. Depth			0.033***			0.039***
			(0.009)			(0.009)
Bond count	0.129***	0.150***	0.130***			
	(0.009)	(0.009)	(0.009)			
Bond standardization				-0.286***	-0.340***	-0.289***
				(0.040)	(0.041)	(0.040)
Ln [Assets]	0.571***	0.698***	0.571***	0.566***	0.890***	0.557***
	(0.042)	(0.038)	(0.042)	(0.042)	(0.035)	(0.042)
Leverage	0.623***	0.862***	0.557***	0.738***	1.490***	0.674***
	(0.179)	(0.178)	(0.180)	(0.190)	(0.221)	(0.188)
ROA	-2.310**	-2.618**	-2.444**	-2.202**	-2.857***	-2.339**
	(1.072)	(1.069)	(1.076)	(1.039)	(1.062)	(1.044)
Excess stock returns	0.037	0.023	0.025	0.057	0.040	0.046
	(0.067)	(0.068)	(0.068)	(0.067)	(0.068)	(0.068)
Stock volatility	0.526**	0.660***	0.631***	0.523**	0.715***	0.605***
	(0.240)	(0.238)	(0.240)	(0.228)	(0.223)	(0.230)
PPENT/Assets	1.861***	1.858***	1.817***	2.044***	2.065***	1.984***
	(0.224)	(0.227)	(0.224)	(0.221)	(0.227)	(0.221)
Sales/Assets	1.871***	1.750***	1.837***	1.789***	1.518***	1.772***
	(0.229)	(0.225)	(0.230)	(0.231)	(0.225)	(0.232)
EBIT/Assets	-5.492***	-5.275***	-5.384***	-5.030***	-4.416***	-4.924***
	(1.545)	(1.530)	(1.547)	(1.440)	(1.377)	(1.443)
WCAP/Assets	-2.510***	-2.556***	-2.564***	-2.395***	-2.324***	-2.437***
	(0.247)	(0.243)	(0.246)	(0.246)	(0.241)	(0.246)
RE/Assets	0.542***	0.568***	0.556***	0.395***	0.381***	0.408***
	(0.059)	(0.059)	(0.060)	(0.055)	(0.054)	(0.056)
Cash/Assets	0.933***	1.023***	1.012***	0.804***	0.773***	0.859***
	(0.246)	(0.247)	(0.251)	(0.242)	(0.242)	(0.247)
CAPEX/Assets	-4.862***	-4.638***	-4.852***	-5.441***	-4.984***	-5.410***
	(0.900)	(0.916)	(0.911)	(0.831)	(0.820)	(0.841)
Credit Rating	0.370***	0.349***	0.340***	0.354***	0.393***	0.340***
	(0.073)	(0.076)	(0.076)	(0.071)	(0.072)	(0.074)
Constant	-6.935***	-7.809***	-6.911***	-6.187***	-8.494***	-6.181***
	(0.477)	(0.458)	(0.480)	(0.470)	(0.442)	(0.470)
Observations	12,149	12,149	12,149	12,149	12,149	12,149
Time FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Wald chi^2	3365.00	3422.00	3397.00	3409.00	3477.00	3464.00
Prob $>chi^2$	0.00	0.00	0.00	0.00	0.00	0.00
Pseudo R^2	0.48	0.47	0.48	0.46	0.44	0.46

Appendix

A1 : Definitions

Breadth: It is the total number of institutional bond investors.
Depth: Herfindahl index is used to calculate depth and defined as concentration of bond ownership.
Adjusted Depth: $\sum_{i=1}^{n}(s_i - \frac{1}{breadth})^2$ **Assets**: Total assets.
Debt: Sum of long term debt and debt in current liabilities.
Leverage: Ratio of debt to beginning total assets.
Return on assets (ROA): Net income, scaled by beginning total assets.
Excess stock return: excess stock return over CRSP-value weighted index
Stock volatility: Annualized standard deviation of trailing 252-days stock return.
PPENT/Assets: Net plant,property and equipment, scaled by beginning total assets.
Sales/Assets: Quarterly sales scaled by beginning total assets.
EBIT/Assets: Ratio of earnings before interest and tax to beginning total assets. Calculated using (revtq-xoprq-dpq)/l.atq from compustat.
WCAP/Assets: Working capital to lagged total assets.
RE/Assets: Ratio of retained earnings to beginning total assets.
Cash/Assets: Cash and short term investments, scaled by beginning total assets.
All the variables are calculated for each firm for each quarter.

The reference entity: The institution who is the primary borrower on whose debt a CDS contract is written.
The buyer of the contract: The creditor of the reference entity. This includes the institutional investors, hedge funds, insurance companies and individuals ideally holding the debt of the reference entity.
The seller of the CDS contract: The underwriter/seller who designs the terms of a CDS contract and guarantees the underlying debt between the issuer and the buyer. This is a third party seller, usually large banks or insurance companies.

A2: Table

Subrahmanyam et al. (2014) CDS selection model

This table replicates the CDS selection model of Subrahmanyam et al. (2014) and presents results for set of panel data probit regressions on our sample of quarterly data of S&P 500 companies. The dependent variable is the binary variable (CDS) taking a value of 1 if the company has a CDS contract on its bonds in that quarter. Indicators of bond ownership structure i.e. the breadth (number of institutional investors holding the bonds) and institutional depth (concentration of ownership) are the predictor variables. Two quarter moving average is taken for independent variables of breadth and depth. For a moving average of t and t-1 of the independent variables, CDS value of t+2 is considered. t here is time period quarter. Columns (1) presents regression results for sample period between 2001- Aug, 2009. Column (2) replicates the results for our full sample period of 2001-2018. Ln[Assets] is defined as natural log of total assets. Leverage is defined as the ratio of total debt to total assets. Total debt is further defined as the sum of long term debt and debt in current liabilities for each quarter. Return on assets (ROA) is defined as the ratio of the net interest income to the total assets. Excess return is the firms excess return over the past year. Stock volatility is the firm's annualized equity volatility. PPENT/Assets is the ratio of plant, property and equipment to total assets. Sales/Assets is the ratio of total sales to total assets. EBIT/Assets is the ratio of earnings before interest and tax to total assets. WCAP/Assets is the ratio of working capital to total assets. RE/Assets is the ratio of retained earnings to total assets. Ratio of cash and short term investments to total assets is defined as Cash/Assets. CAPEX/Assets is the ratio of capital expenditures to total assets. Credit Rating is a dummy variable taking a value of 1 for the firms with credit ratings of AAA, AA, A, BBB and a value of 0 for firm's rated as BB, B. All our regressions control for time and industry fixed effects. Significance at 10%,5% and 1% level is denoted by *, ** and *** respectively. Standard errors, clustered by industry and quarter are shown in parentheses.

	(1) 2001-2009	(2) 2001-2018
Ln [Assets]	0.917***	0.923***
	(0.045)	(0.027)
Leverage	2.580***	1.541***
	(0.301)	(0.189)
ROA	-1.688*	-1.774**
	(0.941)	(0.825)
Excess stock return	-0.069	-0.035
	(0.071)	(0.057)
Stock volatility	0.435*	0.511***
	(0.236)	(0.191)
PPENT/Assets	-0.168	1.283***
	(0.259)	(0.162)
Sales/Assets	1.104***	1.485***
	(0.379)	(0.224)
EBIT/Assets	0.293	-2.453***
	(0.695)	(0.878)
WCAP/Assets	-0.097	-1.303***
	(0.323)	(0.201)
RE/Assets	0.261***	0.215***
	(0.075)	(0.043)
Cash/Assets	-0.527	-0.159
	(0.338)	(0.197)
CAPEX/Assets	-1.706*	-2.795***
	(1.018)	(0.653)
Credit rating	0.394***	0.352***
	(0.092)	(0.057)
Constant	-12.564***	-12.257***
	(0.748)	(0.573)
Observations	7,315	16,204
Time FE	YES	YES
Industry FE	YES	YES
Wald $chi2$	1425.00	3946.00
Prob $>chi^2$	0.00	0.00
Pseudo R^2	0.48	0.43

A3: Depth adjustment

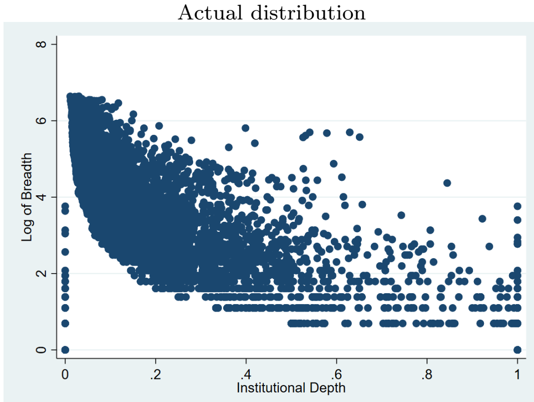
Depth is calculated by HHI:

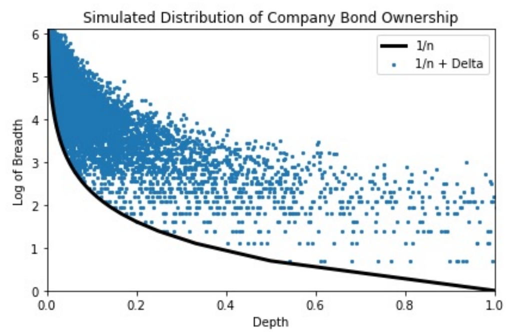
$$D = \sum_{i=1}^{n} s_i^2 = \sum_{i=1}^{n} (\frac{1}{n} + \triangle_i)^2$$

where: $\triangle_i = s_i - \frac{1}{n}$

We simulate the breadth of 10,000 firms using the reported means, medians and variances to calibrate a Weibull distribution. $\sum_{i=1}^{n} \triangle_i^2$ is simulated with a strictly random nose component proportional to $\frac{1}{n}$. The simulated distribution looks similar to the distribution of actual breadth and depth. The plots are provided below.

Actual distribution





We thus adjust our depth by subtracting reciprocal of breadth (n) from each institutional concentration (s_i) and caclulate the HHI of this adjusted concentration ($D - \frac{1}{n}$).[18]

[18] We thank Ariel Lohr for his suggestion of depth adjustment.