Corporate Leverage, Debt Maturity and Credit Supply: The Role of Credit Default Swaps*

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Abstract

Does the ability of suppliers of corporate debt capital to hedge risk through credit default swap (CDS) contracts impact firms' capital structures? We find that firms with traded CDS contracts on their debt are able to maintain higher leverage ratios and longer debt maturities. This is especially true during periods in which credit constraints become binding, as would be expected if the ability to hedge helps alleviate frictions on the supply side of credit markets.

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1. Introduction

The recent credit crisis has brought an intense policy debate regarding the impact of financial innovation and derivatives, particularly credit default swaps (CDS).[1] Given the sheer size of the credit default swap market,[2] it is crucial to identify and quantify as many as possible of the potential effects that these markets might have on the economy. This paper asks whether and how firms' capital structures are affected by the ability of suppliers of debt capital to hedge credit risk through CDS contracts. We examine the capital structures of non-financial firms in the S&P 500 index during 2002-2009 and find that, even after controlling for factors that are known to impact demand for leverage and debt maturity, firms with CDS contracts trading on their debt are able to maintain higher leverage ratios and longer debt maturities.

Why would CDS markets impact firms' financing? The ability of capital suppliers to hedge can reduce frictions on the supply side. This can occur in several ways. First, if treasuries are in short supply, the existence of CDS markets can make holding corporate debt more attractive to a broad group of potential investors. Second, financial institutions such as banks and insurance companies are frequent providers of corporate debt capital. Holding single-name CDSs can provide these buyers the opportunity to reduce regulatory capital requirements.[3] This can increase the supply of credit to firms if there is a separation between those willing to hold credit risk and those with capital that they would like to lend. Anecdotal evidence of the existence of binding regulatory capital constraints is consistent with this market segmentation. For example, AIG states in its Annual Report that at the

[1] A credit default swap is essentially an insurance contract on a firm's debt, in which, in the event of default, the seller gives the buyer a payment corresponding to the difference between the nominal and the market value of the debt. The buyer pays the seller a periodic premium for this protection. These can be useful for hedging or to speculate on credit risk.

[2] The amount of CDSs outstanding has declined from a peak of $62.2 trillion notional in the second half of 2007, but the market has far from disappeared. The International Swaps and Derivatives Association (ISDA) reports that the notional amount of outstanding CDSs during the first half of 2010 was $26.3 trillion, similar to the size of the market in 2006, and far greater than the $5.4 trillion and $12.4 trillion in the first half of 2004 and 2005, respectively. See: http://www.isda.org/statistics/pdf/ISDA-Market-Survey-results1987-present.xls

[3] "Guarantees issued by or protection provided by entities with a lower risk weight than the counterparty exposure is assigned the risk weight of the guarantor or protection provider." (Basel II, page 49, Article 141)

end of 2009 it had \$150 billion in notional CDSs outstanding (written), which it wrote to provide regulatory capital relief to financial institutions for their corporate loans. Third, CDSs enable banks to provide loans for the purpose of maintaining client relationships, while mitigating portfolio risk. In one of the most comprehensive surveys of CDS market participants to date, the British Bankers' Association estimates that in 2006, 20% of purchasers of credit protection were banks making these purchases to hedge their loan portfolios (British Bankers' Association, *Credit Derivatives Report* (2006)). Finally, a liquid secondary market for credit risk provides a resale option and may make holding credit risk more attractive. These potential channels, along with the growing empirical evidence that supply frictions are generally important (e.g., Faulkender & Petersen (2006); Lemmon & Roberts (2010); Massa, Yasuda & Zhang (2009); Sufi (2009); Leary (2009); Duchin, Ozbas & Sensoy (2010); Choi, Getmansky, Henderson & Tookes (2010)) suggest that CDSs could have economically significant effects on firms' capital structures.

Although there are several reasons why we might expect CDSs to relax firms' capital supply constraints, the empirical evidence thus far has been rather weak. In particular, in their study of credit spreads, Ashcraft & Santos (2009) find that the onset of CDS trading does not lower the cost of capital for the average firm, and leads to a small reduction in bond and loan spreads of firms that are safer and more transparent. Even though the S&P500 firms that we study (presumably, the most important firms in the economy) are likely to be part of this group of safer firms experiencing reductions in spreads, the small magnitude of the reductions is still somewhat surprising. If the inability of suppliers of capital to hedge is an important supply friction then why should we observe such an economically small effect of the introduction of CDS on spreads? One explanation is that the demand curve for credit is relatively flat, so an outward shift in supply has a greater impact on quantities than on prices. A second, perhaps more plausible, explanation is that non-price terms are also impacted by the introduction of CDS. If suppliers of credit become more willing to relax non-price contract terms (such as debt maturity and collateral requirements), then this may dampen any observed impact on prices. Ashcraft & Santos (2009) focus on the impact of the introduction of CDS on a single dimension (i.e., price) of debt financing. Our analysis of both leverage (quantity) and debt maturity (a non-price contract term) helps complete the picture.

Our focus on debt maturity, in addition to leverage, allows us to take a potentially important step towards capturing variation in the firms' financial contracts as a result of shifts in the ability of suppliers of debt capital to hedge. There is widespread acceptance in the banking literature that maturity is an important non-price contract term. For example, Strahan (1999) reports evidence that banks use price and non-price terms such as maturity and collateral requirements as complements in loan contracting. This complementarity is also reported in Dennis, Nandy & Sharpe (2000). Melnik & Plaut (1986) explicitly model the tradeoff between price and other contract terms, including debt maturity, loan commitment fees and collateral requirements. All else equal, shortening maturity allows suppliers of capital to mitigate risk, keeping borrowers under close control; lengthening maturities without requiring higher rates is therefore interpreted as a relaxation of supply.

There are two main findings from the analysis. First, the introduction of CDS markets increases firm leverage and extends debt maturity. These increases are both statistically and economically significant. Depending on the definition of leverage (i.e., market or book leverage) used in the empirical specification, the estimated increase in debt ratios due to CDSs is between 0.035 and 0.066 (i.e., between 22 and 26 percent of mean leverage). The estimated increase in debt maturity is between 1.2 and 1.7 years (i.e., between 13 and 19 percent of mean debt maturity). Second, we find that the impact of CDSs on leverage and maturity is greatest in the periods in which credit supply constraints are most binding. An ideal test of the hypothesis that the ability of suppliers to hedge becomes more important when credit constraints bind would identify a supply shock that impacts some firms in our sample but not others. We use defaults by other firms headquartered in the same state (but different industry) as the sample firm as a proxy for a local credit supply shock. This analysis uses previous findings in the literature that institutional investors exhibit local biases in their portfolio allocations (e.g., Coval & Moskowitz (1999), Bharath, Dahiya, Saunders & Srinivasan (2007), and Massa, Yasuda & Zhang (2009)) and are therefore likely to be affected by a default of a local firm. Consistent with the supply-side interpretation of the impact of CDSs, we observe a greater effect of CDSs on firms' ability to maintain greater leverage and longer maturities when local supply shocks occur.

A potential concern with any study of the impact of CDS markets on financing choice is the possibility that CDS firms are different from non-CDS firms based on unobservable variables that are systematically related to leverage and maturity choice. To mitigate this concern, our empirical approach exploits variation in the timing of the introduction of CDS markets. We follow Ashcraft & Santos (2009) and include two CDS variables in the benchmark regressions: *CDS Traded*, an indicator equal to one if there is a CDS market for the firm's debt at any time during the 2002-2009 sample period; and *CDS Trading*, an indicator variable equal to one if there is a traded CDS on its debt during year t. *CDS Traded* controls for unobservable differences between CDS and non-CDS firms. *CDS Trading* is the main variable of interest and captures the impact of CDSs on leverage and maturity in the years following CDS introduction. Alternatively, we replace the *CDS Traded* variable with firm fixed effects to account for time-invariant differences between firms, whether or not they have CDS contracts trading on their debt. In robustness analysis, we avoid concerns about selection altogether by looking *within* the sample of CDS firms to test whether the effects that we observe are stronger for firms whose CDS contracts are easier and cheaper to trade. In this way, rather than focusing on the availability of CDS (a binary variable), we focus on how liquid the contracts are. We identify two very coarse measures of liquidity: the number of daily CDS quotes and the average CDS bid-ask spread. Despite the expected noise in these measures, we find that our results are robust to this alternative specification.

The benchmark empirical approach is useful in that it allows us to measure the effect of the onset of CDS trading; however, it also assumes that the timing of CDS introduction is exogenous. To address the potential concern that the emergence of CDS markets is simultaneously determined with the firm's leverage and maturity decisions, we take a second approach to the analysis and allow for the endogeneity of the existence of a CDS market. We instrument *CDS Trading* with *Bond Turnover*, defined as the turnover in the market for the firm's public corporate bonds. The choice of instrument is based on the observation that CDS markets are important venues for trading credit risk. In fact, the British Bankers' Association estimates that in 2006, 39 percent of purchases of credit protection were due to banks' trading activities (distinct from hedging). Trading demands are expected to have a causal effect on the emergence of CDS markets. At the same time, we do not expect the desire of speculators to trade in a firm's credit to drive firms' leverage or maturity decisions directly. We find that our results are robust, even after accounting for the potential endogeneity of CDS markets.

Finally, because the benchmark analysis uses the entire post-CDS introduction period to estimate the impact of CDS markets, we introduce a third approach in which we isolate the CDS introduction event. We employ a difference in differences approach and examine the changes in leverage and maturity from the end of year *t-1* to the end of years *t* and *t+1* relative to CDS introduction, compared with the changes in a matched sample of non-CDS firms. Matched firms are identified based on the propensity score method in Rosenbaum & Rubin (1983). We find substantial increases in both leverage and debt maturity near CDS introduction.

In interpreting the main results it is useful to ask whether greater leverage and debt maturity are "good" for firms. Recent evidence from the 2007-2009 financial crisis suggests that this is indeed the case. For example, Almeida, Campello, Laranjeira & Weisbenner (2009) find that firms with debt coming due during the 2007-2008 period cut back on investment. Ivashina & Scharfstein (2010) find that firms with expired lines of credit cut down on investment activity relative to firms whose lines were not expiring. Duchin, Ozbas & Sensoy (2010) report declines in non-financial firms' investment as a result of the credit crisis, with the greatest declines for financially constrained firms and those dependent on external finance. Survey evidence is consistent with these studies. Campello, Graham & Harvey (2010) report that 86 percent of CFOs in financially constrained firms curtailed investment in attractive projects during the financial crisis. Overall, the evidence suggests that relaxing credit constraints and extending debt maturities would improve real investment. Even in non-crisis times, longer debt maturities allow firms to mitigate the potential rollover risk associated with short maturity debt, as in Flannery (1986) and Diamond (1991).

The remainder of the paper is organized as follows. Section 2 describes the literature on capital supply constraints, debt maturity and credit default swaps. Section 3 describes the data and presents the benchmark empirical specification. Section 4 presents results of the analysis of the impact of suppliers' ability to hedge on leverage and maturity. Section 5 concludes.

2. Supply Constraints, Capital Structure and Debt Maturity

This paper contributes to three main strands of literature: recent papers that measure the role of capital supply constraints in firms' financing and investment decisions; research that focuses on debt maturity choice and the recent work on the implications of CDS contracts for firms.

2.1. The Role of Capital Supply Constraints in Firms' Financing Decisions

The idea that supply frictions can impact capital structure and investment patterns has been the subject of a number of recent papers. Faulkender & Petersen (2006) find that firms with access to public debt markets (i.e., a credit rating) have substantially more debt in their capital structures. Sufi (2009) shows that firms with a loan rating use more debt after the introduction of syndicated bank loan ratings. Lemmon & Roberts (2010) and Leary (2009) use events to show how shocks to the supply of credit impact financing and investment. Massa, Yasuda & Zhang (2009) find that capital supply uncertainty has a negative impact on leverage and also affects firms' maturity choices. Choi et al. (2010) find strong links between convertible bond issuance and a variety of measures of supply of capital from convertible bond arbitrage hedge funds. Erel, Julio, Kim & Weisbach (2011) provide time series evidence on the relationship between macroeconomic condition and firms capital raising. They report that the supply of capital has a more important impact on capital raising than demand during downturns. On the theoretical side, Morellec (2010) models dynamic corporate investment and financing decisions when firms have uncertain access to credit and finds that credit supply is crucial to the determination of equilibrium capital structure. All of these papers link capital supply to firms' capital structures or to investment decisions. They make obvious the need for an improved understanding of the precise role of supply. Our focus on the impact of CDS markets provides an initial step, as it allows us to understand one mechanism by which these constraints can become more or less binding: variation in the ease with which suppliers of capital can hedge their positions.

2.2. Corporate Debt Maturity

Despite a vast empirical literature on the debt versus equity choice (see e.g., Parsons & Titman (2009) for a recent survey), there are only a handful of empirical studies on the determinants of firms' debt maturity decisions and none of these address the potential impact of suppliers' ability to hedge. Barclay & Smith (1995) find that low growth options firms and large firms choose more long-term debt. Stohs & Mauer (1996) find that: (1) large, less risky firms with long asset maturity have longer term debt; (2) firms with more earnings surprises have more short-term debt; (3) a non-monotonic relationship between debt rating and maturity, with very high and low rated firms having short-term debt. Johnson (2003) is the first to explicitly account for the potential simultaneity between leverage and maturity. We follow Johnson (2003) and the subsequent debt maturity literature (e.g., Datta, Iskandar-

Datta & Raman (2005); Aivazian, Ge & Qiu (2005) and Billett, King & Mauer (2007)) and estimate leverage and maturity jointly.

Guedes & Opler (1996) study new bond issues and focus on incremental debt maturity. One benefit of analyzing bond issues is that the authors do not have to rely on Compustat, which aggregates all debt with maturities greater than five years, to calculate maturities. The limitation is that the analysis is limited to bonds, leaving out other potentially important sources of debt.[4] Our debt maturity data capture the actual maturities of all components of firms' capital structures (in years). This allows us to provide economically meaningful interpretations of our estimates and to capture more cross sectional variation in the maturity structure of debt than the Compustat categories allow.

2.3. Credit Default Swaps

The recent credit crisis has brought an intense policy debate regarding the impact of financial innovation and derivatives, particularly CDSs. For example, Stout (2009) identifies Congress's passage of the Commodity Futures Modernization Act in 2000, which made derivatives contracts legally enforceable, as the root of the recent financial crisis. On the other hand, Stulz (2010) argues that despite the popular claim that CDS markets facilitated the crisis, much of the crisis stemmed from the declines in the housing market, not from CDSs. It is clear that there are both costs and benefits; however, despite being crucial to informed policy-making, their magnitudes are generally unknown. Our analysis provides evidence of the impact of one potential channel through which CDSs might matter: primary markets for firms' debt.

CDSs allow suppliers of capital to reduce credit risk exposure, potentially increasing their willingness to supply capital to firms. The two most closely related empirical papers on the implications of CDS contracts for firms are Ashcraft & Santos (2009) and Hirtle (2009). In their study of credit spreads, Ashcraft & Santos (2009) find that the onset of CDS trading

[4] In our sample the total issuance of publicly traded bonds represents, on average, 18 percent of the total issuance of all types of debt.

does not lower the cost of capital for the average firm, and leads to a small reduction in bond and loan spreads of firms that are safer and more transparent. It is possible that, holding spreads constant, benefits from CDSs are manifested in non-price terms such as debt maturities or quantities. For example, Petersen & Rajan (1994) find that relaxation of small business loan supply constraints result in increased quantities of credit, rather than a price outcome. They argue that this can occur if the market for credit supply is not perfectly competitive. We take as given the findings in Ashcraft & Santos (2009) that the cost of corporate debt is unaltered by the existence of CDSs and test whether CDS contracts have economically meaningful effects on firms' leverage and debt maturities.

Hirtle (2009) uses proprietary bank data to examine derivatives use by banks and credit provision, at the bank portfolio level. She finds that greater use of derivatives leads banks to increase credit. Like our paper, she examines both price and nonprice dimensions of credit provision. Unlike our analysis, Hirtle (2009) measures total derivatives use by the banks, not CDSs on individual names of firms. The emphasis in Hirtle (2009) is on aggregate bank supply of business loans while we focus on the entire capital structures of individual firms. In addition, we exploit time series variation in the role of CDSs, based on the idea that they may become more important when credit constraints bind.

3. Data and Empirical Specification

3.1. Data

There are three main data sources: Compustat, Bloomberg and Capital IQ. We begin with all non-financial firms in the S&P 500 index during the years 2002-2009, as reported by Compustat.[5] We use Compustat for all firm-level financial information and require all

[5] We focus on large-capitalization firms (presumably the most important firms in the economy); however, we acknowledge that small firms are underweighted in the analysis. On the other hand, many previous studies of debt maturity use cross-sectional Compustat data and overweight smaller firms.

firms to have non-missing data for all variables of interest. We obtain CDS quotes from Bloomberg.[6] The Bloomberg quote data allow us to identify firms for which there exist CDS contracts with substantial trading activity and about which there is sufficiently broad dissemination of information that a supplier of debt capital can easily find a counterparty to hedge his credit exposure. Moreover, the supplier of debt capital has a benchmark quote regarding the cost of insurance.[7]

We are interested in the impact of CDSs on both leverage and debt maturity; however precise maturity information is not available in standard datasets. We use the Capital IQ capital structure detail data to calculate debt maturities. For each firm and year, we use the Capital IQ lookup tool to locate the firm, based on ticker. We then confirm that the company name in Capital IQ matches the company name in Compustat. If there is no ticker match, we perform the search based on company name. Wherever there is uncertainty, which can occur especially in firms undergoing restructuring (for example, the historical source documents under the name "Sears Holding Company" are Kmart 10Ks; "Sears Roebuck" historical documents are Sears 10Ks), we examine the underlying source document to confirm that the maturity data being extracted are for the correct firm.

Capital IQ lists each component of debt in the firms' capital structures, including principal, maturity and type of debt (i.e., bonds and bank notes, commercial paper, term loans, revolvers, leases, trust preferred and other). Occasionally, maturity information is missing. When this is the case, we assume that the maturity of the debt component is the same as the average maturity of the firm's other debt of the same type. Given the importance of debt heterogeneity documented in Rauh & Sufi (2010), we expect that using information from decomposed debt will allow us to capture meaningful cross-sectional variation. There are also occasions in which maturity ranges are given in the data (e.g., debt of a given type

[6] The sample begins in 2002 because that is the first year for which we have CDS quote data from Bloomberg. We match Bloomberg data with Compustat data using the six-digit CUSIP number the CDS reference bond.

[7] Of course, market participants may be able to hedge risk through bilateral contracts that are not traded, but in such cases, it is difficult to locate prices and potential counterparties.

maturing in years t through $t + k$ are aggregated). In these cases, as long as the stated range is less than 10 years, we take the midpoint of the stated range.[8] An example of a Capital IQ screen from which we extracted data is included in the Appendix. [9] Outside of Stohs & Mauer (1996), ours is the only paper to our knowledge to analyze actual maturities of firm debt in a large sample. As in Stohs & Mauer (1996), we define *Debt Maturity* as the principal weighted maturity of all components of the firm's capital structure.[10]

We require non-missing information on debt maturity for inclusion in the final sample. The impact of initial filtering on the sample is as follows: approximately 84 percent of the sample of S&P 500 firms are industrial and 88 percent of those firms have debt information available on Capital IQ. Because maturity is undefined for firms with zero debt, we exclude zero debt firms (approximately 31 observations per year). If we included these firms by coding both leverage and maturity as zero, the estimated impact of CDSs would become even larger. The final sample contains 2,820 firm-year observations and 1,370 firm-years in which CDS contracts are trading.

Table 1 presents summary statistics for the full sample of non-financial firms in the S&P 500 index, as well as separate summary statistics for firm/year observations with and without CDS contracts trading.[11] There are several important observations from the table. First,

[8] If the stated range for a given component of the firm's debt is greater than 10 years, the observation is treated as missing order to reduce noise in the debt maturity measure. We have also run the analysis without pre-filtering the data on wide maturity ranges and the main results hold.

[9] When month and year maturity information is given, we assume that the debt matures at the end of the stated month. When only year is given, we assume that the debt matures on June 30 of the stated year.

[10] In addition to the maturity of debt, we are able to observe the type of debt, including commercial paper. In the case of commercial paper, several firms report the maturity of their commercial paper programs (typically one year), rather than the maturity of the paper itself. For example, the GE 10K states, "We rely on the availability of the commercial paper markets to refinance maturing short-term commercial paper debt throughout the year," but GE's commercial paper is reported in Capital IQ as maturing at the end of year *t+1*. The program maturity is relevant because rollover risk is reduced during the life of the program, however, the actual maturity of the commercial paper may also be relevant. The main analysis uses reported commercial paper maturities. In an un-tabulated robustness test, we set all commercial paper maturities to 30 days, regardless of the maturity reported in Capital IQ (30 days is the average maturity of commercial paper according the the Federal Reserve). Our results are robust to this alternative definition of commercial paper maturity.

[11] The fraction of sample firms with CDSs climbs over the sample period, from 23.4 percent in 2002 to 61.8 percent in 2009.

average leverage is substantial, with mean book leverage of 0.25 and market leverage of 0.16. The leverage variables also exhibit substantial cross-sectional variation, with standard deviations of 0.14 and 0.12, respectively. Second, debt maturity is quite long, with mean (median) debt maturity of 8.9 (7.2) years. This is substantially longer than the average maturity of 3.4 years reported in Stohs & Mauer (1996) for 323 manufacturing firms over the 1980-1989 period and suggests that debt maturities of large firms have increased significantly over the past two decades. Datta, Iskandar-Datta & Raman (2005) also report evidence that firms have increased their debt maturities in recent years: they report that 61 percent of the debt for their sample of firms matures in greater than 3 years, in contrast to 46 percent in the earlier sample of Johnson (2003). This trend implies that Compustat data, which only provides information on debt maturing over 1, 2, 3, 4 and 5+ year horizons, may restrict the ability of researchers to capture important variation in debt maturity. Third, the debt decomposition shows that bonds and notes make up the vast majority of debt for firms in the sample, with a mean ratio of bonds and notes to total debt of 0.73. Term loans and revolving lines of credit comprise 0.12 and commercial paper 0.06 of total debt respectively, and all other components are less than 0.05 of total debt.

Comparing the CDS and non-CDS samples provides useful insights. CDS firms have substantially higher average leverage and longer debt maturities relative to non-CDS firms. Importantly, CDS and non-CDS firms have similar credit ratings, with a mean S&P rating of A- for CDS firms and A for non-CDS firms. The median rating for both CDS and non-CDS firms corresponds to an S&P rating of A-, suggesting that CDS trading is not a proxy for credit risk. At the same time, CDS firms are larger, with lower market-to-book ratios and have slightly more bond and note debt and less debt from term loans and revolvers. When CDS firms obtain bond and note debt, the average maturity on this debt is more than two years longer than that of non-CDS firms. Regression analysis will shed more concrete light on these patterns.

3.2. Empirical Specification

There are two main goals of the analysis. The first is to examine the impact of CDSs on leverage and maturity decisions. We use the CDS market as a proxy for suppliers' ability to hedge, which is expected to relax credit supply constraints. The second goal is to exploit the time series dimensions of the data to see whether the impact of CDSs on leverage and maturity choice varies as supply conditions change.

The dependent variables of interest are leverage and debt maturity. Leverage is defined as either book leverage (*Book Leverage*) or market leverage (*Market Leverage*). *Book Leverage* is defined as total debt (long-term debt plus debt in current liabilities), divided by the book value of assets. *Market Leverage* is defined as total debt divided by firm value, where firm value is defined as the book value of assets, minus the book value of common equity, plus the market value of equity and deferred taxes. We include both of these leverage variables in all of the empirical analyses, for robustness. *Debt Maturity* is defined as the principal-weighted maturity of all debt, as reported in Capital IQ. We estimate the (*Leverage*) and (*Maturity*) equations separately and, because the choice of leverage and debt maturity may occur jointly (see e.g., Barclay, Marx & Smith (2003)), we follow Johnson (2003) and also estimate the two equations simultaneously by two-stage least squares. The single equation estimates are referenced "OLS " and the simultaneous equation estimates are referenced as "2SLS. "

Table 2 provides a summary of all variables in the leverage and maturity equation specifications, along with their predicted signs. Definitions of all variables are in Table 1. As in Ashcraft & Santos (2009), we include two credit default swap variables in the empirical specifications. *CDS Trading* is an indicator variable equal to one if the firm has quoted CDS contracts on its debt during year *t*. *CDS Traded* is an indicator variable equal to one if the firm has a traded CDS contract on its debt at any time during the 2002-2009 sample period. *CDS Traded* captures unobservable differences between CDS and non-CDS firms. The main goal of this paper is to determine the impact of the ability of suppliers of capital to hedge risk on leverage and maturity. By including both the *CDS Trading* and *CDS Traded* indicator variables, we are able to exploit differences in timing of CDS introduction across CDS firms to estimate the impact of having a CDS contract on leverage and debt maturity. The main coefficient of interest in both the leverage and maturity equations is that on *CDS Trading*, which captures the change in leverage and maturity in all years following CDS introduction.

The other explanatory variables shown in Table 2 are primarily from Johnson (2003) and reflect general findings from the capital structure literature. In particular, in the leverage equation, we include *Debt Maturity* based on the idea that, if firms face liquidity/rollover risk, firms with shorter maturity debt are expected to choose less leverage (see for example, the findings in Massa, Yasuda & Zhang (2009)). We also include an *Industry Leverage*[12], *Market to Book, Fixed Assets, Profitability*, *Size*, *Volatility*, *Tax Credit*, *Loss Carry Forward*, *Abnormal Earnings*, *Rated* and *Investment Grade*. The latter variable is not in Johnson (2003); however, given the findings in the British Bankers' Association survey that the majority of single name CDSs are on firms with investment grade debt, we want to be sure that any observed impact of CDS is not due to a difference in credit quality.

In the *Debt Maturity* equation, *Leverage* is included due to the potential rollover risk. We also include *Market-to-Book*, *Size*, *CP Program* (an indicator equal to one if the firm has a commercial paper program at the beginning of year t), *Tax Credit* and *Loss Carry Forward*, *Volatility*, *Abnormal Earnings*, *Asset Maturity*, *Rated* and *Investment Grade.* With the exception of *CP Program* and *Investment Grade*, all of these variables are from Johnson (2003). Barclay & Smith (1995) and Barclay, Marx & Smith (2003) also use *CP Program* and, consistent with Diamond (1991), they find that firms with commercial paper programs have shorter maturity debt, on average.[13] As in the *Leverage* regression, *Investment Grade* is included as a control variable to ensure that inference about the impact of CDS is not due

[12] Johnson (2003) does not include this industry control. However, Leary & Roberts (2010) find that industry leverage is an important determinant of firms' capital structures.

[13] Johnson (2003) uses size-squared to capture this non-monotonic relationship; however, this variable does not have explanatory power in our sample. Results are not sensitive to including it.

to differences in credit quality.[14]

For the simultaneous equations model to be identified, the exclusion restriction must be satisfied. From Table 2, notice that *Industry Leverage, Fixed Assets* and *Profitability* are in the leverage equation but are excluded from the *Debt Maturity* equation. *Industry Leverage* is excluded from the Maturity equation because the theoretical link between leverage and maturity comes from rollover risk. That is, highly levered firms might be expected to choose longer debt maturities to limit problems rolling over maturing debt. By contrast, if competitors are highly levered, modifying a firm's own debt maturity decision would do nothing to limit rollover risk. We also do not expect asset tangibility, which tells us nothing about asset maturity, or one-period profit to have a direct impact on debt maturity, except through its impact on leverage. Similarly, after controlling for asset tangibility, *Asset Maturity* should not be related to a firm's debt capacity, nor is whether a firm has a commercial paper program in place. These variables are excluded from the leverage equation. This identification in the simultaneous equations model is similar to the identification in Johnson (2003).[15]

In the empirical implementation, most regressions are estimated with year and industry (based on the Fama-French 10 groupings) fixed effects and also allow for clustering of standard errors at the firm level. In some specifications, we replace the industry fixed effects and the *CDS Traded* dummy variable with firm fixed effects.

[14] Johnson (2003) also includes a Regulated dummy variable for firms in SIC codes 4900 to 4939. We include industry fixed effects in all regressions, based on the Fama-French 10 industry groupings. Regulated maps to the utility industry fixed effect.

[15] There are only two differences between our identification and that in Johnson (2003). First, *Rated* is an additional identifying variable in the *Debt Maturity* equation in Johnson (2003). However, we also include it in the leverage equation due to Faulkender & Petersen (2006), who examine the impact of credit supply frictions on leverage. They use having a credit rating as a proxy for access to public debt markets and find support for the hypothesis that this variable impacts debt ratios. Second, *Industry Leverage* is an additional identifying variable in the *Leverage* equation (see Leary & Roberts (2010)).

4. Results

4.1. Benchmark Results

Table 3 reports the estimated coefficients of the leverage and maturity equations obtained by ordinary least squares (OLS) and two-stage least squares (2SLS). We show both sets of results throughout and only report the second stage estimates in the case of 2SLS (for brevity). *Leverage* is the dependent variable in the results shown in Panel A and *Debt Maturity* is the dependent variable in Panel B. In both panels, Columns (1) through (4) measure debt using book leverage and Columns (5) through (8) measure debt using market leverage. The benchmark specification is given in Columns (1), (3), (5), and (7). As described in the previous section, the regression specifications are based on Johnson (2003), with *CDS Traded* and *CDS Trading*, *Industry Leverage*, *Investment Grade* and *CP Program* as the only additional explanatory variables. In Columns (2), (4), (6) and (8), we replace *CDS Traded* and industry fixed effects with firm fixed effects to rule out the possibility that any observed CDS effect is due to unobserved (time-invariant) heterogeneity between firms.

The most important observation from the *Leverage* equation results in Table 3 is the positive and statistically significant coefficients on *CDS Trading* in all four of the benchmark regressions (Columns (1), (3), (5), and (7)). The magnitudes of the coefficients are economically significant. With all variables at their mean levels, the 2SLS coefficients in the benchmark specification (Columns 3 and 7) imply that the introduction of CDS trading implies an increase in book leverage of 26 percent (increase of 0.066 from a mean of 0.25) and an increase in market leverage of 22 percent (increase of 0.035 from a mean of 0.16).[16] One potential concern is that equity returns of CDS firms are lower than non-CDS firms;

[16]Separate from the direct hedging effects of CDSs, Bolton & Oehmke (2010) show that they can improve firms' debt capacities by providing ex ante commitment of creditors to be "tough" in debt renegotiations. Ex ante, CDS improves creditors' bargaining power and decreases strategic default of firms, which increases debt capacity. Our finding of greater leverage of CDS firms is consistent with this prediction. Campello & da Matta (2011) predict that CDSs are most beneficial for safer, more valuable firms. Our sample of S&P500 firms are likely to be part of this group.

however, the consistency of results across both the book leverage and market leverage specifications shows that equity performance is not driving the results. Moreover, the firm fixed effects regressions (Columns 2, 4, 6 and 8) show that CDS has a statistically significant effect in 3 of 4 specifications. The only firm fixed effects specification in which the *CDS Trading* coefficient is not statistically significant is in the 2SLS regression, Column 8. However we note that the point estimate (0.011) is very close to that obtained in the corresponding OLS specification (Column 6), suggesting that the lack of significance is due to higher variance of the two stage estimator. In general, the standard errors are higher in the case of firm fixed effects than in the benchmark specification due to the decline in degrees of freedom (and decline in power to identify cross-sectional differences) that comes with introducing firm level effects (Roberts & Whited (2011)). Overall, the evidence strongly suggests that our results are not due to unobservable firm-specific heterogeneity.

The *CDS Traded* coefficients in Table 3, Panel A, are statistically insignificant in the regressions. While this variable is used as a control so that the *CDS Trading* variable captures the effect of the introduction of a CDS contract, the coefficients are interesting in that they do not show an average difference in leverage across CDS and non-CDS firms after controlling for other characteristics. The other variables that are consistently statistically significant in the leverage equation are *Industry Leverage*, *Fixed Asset*, *Size* (in the book leverage regressions), *Rated* and *Investment Grade*. The signs of the estimated coefficients on these variables are largely consistent with the predictions described in Table 2. The estimated coefficients on the alternative tax shield variables are inconsistent with the predictions, and either have statistically insignificant coefficients or coefficients of the opposite sign. While positive coefficients on alternative tax shields are somewhat puzzling, note that Johnson (2003) finds similar results for net loss carry forwards in the leverage equation. Interestingly, after we control for *CDS Trading*, we find that debt maturity is not an important determinant of leverage. We find this in both the OLS and 2SLS specifications.

The results from the *Debt Maturity* regression are presented in Table 3, Panel B. Similar to Panel A, we find strong evidence that the ability of suppliers of capital to hedge impacts firms' capital structures. We find positive and statistically significant coefficients on the *CDS Trading* coefficients in all specifications. As in the leverage regressions, the magnitudes of the estimated coefficients are economically significant. With all variables at their mean levels, the results of the benchmark specification (Columns 1, 3, 5 and 7) suggest that the introduction of CDS contracts increase debt maturity by between 1.2 and 1.7 years. Unlike Panel A, the coefficients on *CDS Traded* in Panel B are marginally significant, suggesting that the firms that eventually have CDS contracts on their debt tend to start with longer debt maturities. These maturities are further increased once CDSs are introduced. The *CDS Trading* are also statistically significant in the firm fixed effects specifications (Columns 2, 4, 6 and 8), allowing us to rule out unobservable firm-specific heterogeneity as an alternative interpretation of the main findings.

The estimated coefficients on *Asset Maturity* in Table 3, Panel B are consistent with maturity matching (Myers (1977)). Since both debt maturity and asset maturity are measured in years, the interpretation of the coefficients in the benchmark specification (Columns 1, 3, 5 and 7) is straightforward: a one-year increase in asset maturity increases debt maturity by between 0.15 and 0.18 years (approximately 2 months). After controlling for asset maturity and *CDS Trading*, *Tax Credit* and *CP Program* are the other estimated coefficients that are significant. With the exception of *Tax Credit*, the signs on the estimated coefficients are consistent with the predictions given in Table 2. Similar to the leverage regression, we do not find evidence that leverage is a significant determinant of maturity. In the firm fixed effects regressions (Columns 2, 4, 6 and 8), all results are similar to the benchmark specification except that *CP Program* is insignificant. This is because *CP Program* does not vary much at the firm level, as firms with commercial paper programs tend to have them for the entire sample period.

The specification of the simultaneous equations system, based primarily on prior literature, identifies more than one instrument for the leverage and maturity equations. This allows us to perform diagnostics on the endogeneity of maturity and leverage. Under the assumption that we have identified at least one valid instrument, Table 3 shows diagnostic analysis, based on the Hausman test. In all but the book leverage equation (Column 1), we fail to reject the null hypothesis of exogeneity. This suggests that, for our sample of firms, instrumenting for leverage and maturity is generally unnecessary. However, to be consistent with the prior literature, we present both OLS and 2SLS throughout the paper.

4.2. Credit Supply Tightening

4.2.1. Aggregate Time Series Patterns

In interpreting the results in Table 3, it is useful to ask whether the CDS effect becomes more important during times in which credit constraints bind, as would be expected if the ability to hedge helps alleviate frictions on the supply side of credit markets. To shed light on this question, we exploit the time series properties of the data and re-estimate the regressions in Table 3 except that instead of using year fixed effects, we estimate the regressions separately by year.[17] Of particular interest is the role of CDSs when credit constraints become more and less binding. Given the financial crisis of 2007-2009, we would expect the effects to be greatest during the recent crisis period, a significant negative shock to credit supply.

Figure 1 shows the time series patterns of the estimated impact of CDSs on leverage and maturity. The leverage regression results are shown in the top panel in Figure 1. The estimated coefficients are positive in all years. More interestingly, the magnitudes of the impact of CDSs on leverage exhibit a U-shaped pattern over the 2002-2008 period, with a sharp decline in 2009, precisely when the credit constraints brought by the crisis began to improve. The results of year-by-year estimation of the impact of CDSs on *Debt Maturity*

[17] We estimate parameters of the 2SLS specifications reported in Columns (3) and (7) of Panel A of Table 3 for leverage and Panel (B) for maturity, obtaining therefore 4 time-series of coefficients and report the 4 time-series in Figure 1. We make one modification as we are only able to include *CDS Trading* since estimating coefficients on both *CDS Trading* and *CDS Traded* requires time series variation in the CDS status of firms.

are shown in the bottom panel of Figure 1 and, similar to the leverage regressions, show a striking U-shaped pattern during the 2002-2008 period, with a modest decline in 2009.

To provide a tighter link between the patterns shown in Figure 1 and constraints in U.S. credit markets, we look to the Federal Reserve's Senior Loan Officer Opinion Survey, which provides indicators of credit supply tightening.[18] If CDSs matter more when credit constraints bind, then we would expect to observe variation in the survey data similar to that shown in Figure 1. Figure 2 shows the net percentage of respondents reporting commercial and industrial loan tightening to large and medium sized firms over the sample period. The data reflect a U-shaped pattern that is remarkably similar to the observed coefficients on the *CDS Trading* dummy variable in Figure 1. Not surprisingly, given the patterns in Figures 1 and 2, the correlations between the Senior Loan Officer Opinion Survey data and all four of the series of estimated coefficients on the *CDS Trading* shown in Figure 1 are positive and are mainly statistically significant. The correlations between the survey data series and the *CDS Trading* coefficients in the book and market leverage regressions are 0.91 and 0.83, respectively (with t-statistics of 2.57 and 2.35). The correlation coefficients between the survey data and the estimated coefficients of *CDS Trading* in the maturity regressions are 0.57 and 0.62 (with t-statistics of 1.60 and 1.77).

Figures 1 and 2 provide suggestive time series evidence that CDS markets become more important when credit constraints begin to bind, however, the same credit cycles are hitting all firms in the sample simultaneously. The credit tightening early years of the sample followed the recession of 2001 as well as large corporate governance scandals of 2001-2002 such as those that took place at Enron, WorldCom and Tyco and had effects that rippled

[18]The Federal Reserve conducts quarterly survey interviews with senior loan officers of domestic and foreign large commercial banks. The purpose of the survey is to collect information on credit availability, credit demand, and loan practices. One of the data fields collected and reported by the Federal reserve is the net percentage of respondents tightening standards for commercial and industrial loans. Details about the survey can be found at http://www.federalreserve.gov/boarddocs/snloansurvey/about.htm. Recent empirical findings in the banking literature are also consistent with the Fed survey data: Cornett, McNutt, Strahan & Tehranian (2010) find that lines of credit and loans both declined during the 2001 recession, although the decline was not as steep as in 2008.

through the entire U.S. economy. The tightening in the later years and final loosening in 2009 coincides with the credit crisis of 2007-2009. To test formally the hypothesis that CDS markets become more important when credit constraints begin to bind, we would ideally exploit the panel nature of our data and identify an event in which we expect credit constraints to become more binding for some sample firms and not others. In the next section, we use defaults by other firms in the same geographic region as a proxy for regional supply shocks. This helps us isolate the importance of CDSs as local credit supply conditions tighten.

4.2.2. Regional Supply Shocks: Within State Debt Defaults

Under the assumption that local suppliers of credit are important sources of debt financing for firms, we test the hypothesis that a negative shock to local credit supply, defined as defaults of firms headquartered in the same state as the sample firm but not in the same industry, increases the importance of suppliers' ability to hedge. Our key assumption that local bond investors and banks exhibit local biases in their portfolios is consistent with the literature. For example, in the case of equity investors, Coval & Moskowitz (1999) find a strong bias of investment managers for local firms, possibly driven by asymmetric information between local and non-local investors. Massa, Yasuda & Zhang (2009) find that local bias also exists among bond investors. Approximately 38 percent of bonds in their sample of firms are held by local investors, statistically different from the 15 percent that would be held if the investors were regionally diversified. Bharath et al. (2007) report that firms are more likely to choose lenders that are headquartered in the same state, suggesting that states are relevant for defining local credit supply.

To illustrate the intuition of the state default analysis presented in this section, imagine a bank with a portfolio consisting largely of local loans. When a large default occurs, the bank becomes less willing to lend to other local firms either because it is now closer to becoming constrained by regulatory capital requirements or because it is updating its credit screening abilities (as in Murfin (2010)). In both cases, these local investors are likely to find the ability to hedge credit exposure to be particularly appealing after experiencing negative portfolio shocks.

In the regression results shown in Table 4, we repeat the Table 3 analysis but we include *State Default*, defined as the dollar value of all defaulted debt by Compustat firms headquartered in the sample firm's state during year *t-1*, divided by the total book value of debt of all Compustat firms headquartered in the state at the beginning of year *t-1*. To mitigate the concerns that a local default might reflect a demand shock common to more than one local firm, the observation of *State Default* for each firm only measures the defaults of firms that are head-quartered in that firm's state but *outside* of that firm's industry. This allows us to remove the link between the variable, which is intended to measure the local supply shock, from potential direct shocks to the firm's demand for debt.

Since our focus is on the impact of defaulted debt on the suppliers' ability to hedge credit exposure to a particular issuer, we include in the regression an interaction term of *CDS Trading* with *State Default*. The main hypothesis is that the coefficient on the interaction term is positive. That is, when local credit constraints begin to bind, CDS firms are able to maintain higher leverage and longer debt maturities than non-CDS firms.

We compile a list of default events by combining information available on Bloomberg of firms that are either in default on one of their publicly traded bonds (missed interest or principal payment) or filed for Chapter 11 (bankruptcy) or Chapter 7 (liquidation). Some information on bank debt is available from Moody's research papers. There are a total of 693 default events during our sample period, which we can match to publicly traded firms, representing a total of $365.7 billion of debt in default. While there is substantial variation, the defaults can be important local events. Recall that *State Default* measures the ratio of defaulted debt to total Compustat debt outstanding in a given state. The time-series of the cross-sectional average of *State Default* behaves similarly to other measures of default intensity: it is high in 2002 and 2009 (around 2 percent) and it is low in 2004 throughout 2007 (around 0.4 percent).

Consistent with our hypothesis, Table 4, shows positive and statistically significant coefficients on the *CDS Trading* × *State Default* interaction variable in all specifications. Panel A shows that the 2SLS estimated coefficients are 0.549 and 0.253 in the book and market leverage regressions, respectively. These imply that, in addition to the main CDS effect, a one standard deviation increase in the amount of defaulted debt by same-state firms (i.e., increase in the intensity of the supply shock) allows CDS firms to maintain book leverage ratios that are 1.6 percent higher and market leverage ratios that are 0.8 percent higher (i.e., 6.4 percent and 4.7 percent higher than the respective sample means) than the non-CDS firms that are subject to the same shock. Similarly, in Panel B, the 2SLS coefficients are 24.532 and 24.002 in the *Debt Maturity* regressions using market and book leverage, respectively. These imply that a one standard deviation increase in the amount of defaulted debt by same state firms allows CDS firms to maintain debt maturities that are about 8.6 months longer than non-CDS firms. The effect of *State Default*, taken by itself, is negative (as one would expect), but statistically insignificant in the regressions. The other estimated coefficients are similar to those in Table 3.

The state default analysis allows us to use both the time series and cross-sectional properties of the data to compare differences between CDS and non-CDS firms over a common time period, following a supply shock that is relevant to some firms and not others. We interpret the results in Table 4 and in Figures 1 and 2 as evidence that the ability of suppliers of capital to hedge credit risk has a significant impact on leverage and maturity, especially during times in which credit constraints bind.

4.3. Potential Endogeneity of CDS Contracts: Three Equation System

One potential concern with any study of the impact of CDS markets on financing choice is the possibility that CDS firms are different from non-CDS firms in ways that are systematically related to the leverage and maturity choice. The empirical approach that we have followed so far accounts for time-invariant differences between CDS and non CDS firms (by using the *CDS Traded* control) and for time-invariant differences between firms, whether or not they are CDS firms (via firm fixed effects). However, both of these approaches assume that the timing of CDS introduction is exogenous to firms' leverage and maturity decisions. One might be concerned that, anticipating firms' leverage and debt maturity decisions, creditors initiate hedging contracts and CDS markets emerge. To tackle this potential problem, we need to identify an important reason for the emergence of CDS markets that is exogenous to the leverage and maturity decisions of firms.

We use the fact that CDS markets are attractive to traders to help identify a good instrument for CDS. There is substantial evidence that investors use CDSs to trade and speculate on credit risk (for example, Berndt & Ostrovnaya (2007), Acharya & Johnson (2007), and Acharya & Johnson (2010)). In fact, the British Bankers' Association estimates that in 2006, 39 percent of purchases of credit protection were due to banks *trading* activities (distinct from hedging). These market participants are motivated to trade (not hold) CDSs and provide an exogenous source of variation in whether a CDS market exists for a firm's debt.

In order to address concerns about potential simultaneity, we estimate the coefficients of a system of three simultaneous equations.[19] In addition to the leverage and maturity equations, we introduce a probit model for CDS trading. We use *Bond Turnover*, the turnover of the firm's publicly traded bonds, to identify whether a firm has traded CDS on its debt. The assumption here is that trading activity in a firm's bonds is proportional to the overall trading demand in a firm's credit. Trading demands are expected to have a causal effect on the emergence of CDS markets. At the same time, we do not expect the desire of speculators to trade in a firm's credit to drive leverage or maturity decisions

[19]Billett, King & Mauer (2007) also estimate a three equation system; however, their focus is different from ours in that they are interested in the role of debt covenants in firms' bond issuance decisions.

directly.[20] Importantly, we use turnover, not dollar volume, to avoid any mechanical links between the instrument and leverage.

Trading volume in firms' publicly traded debt is obtained from the Trade Reporting and Compliance Engine (TRACE) system.[21] *Bond Turnover* is defined as the total trading volume in the firm's publicly traded bonds, divided by the total bonds outstanding as reported in the Capital IQ database.[22] We also include *Market to Book*, *Size*, *Volatility*, *Abnormal Earnings*, *Rated* and *Investment Grade* as exogenous explanatory variables in the CDS equation. We expect that market participants are more likely to trade CDS in bigger, rated firms with investment grade ratings and greater earnings volatility. *Market to Book* is included as a control variable, but its expected sign is ambiguous. Growth opportunities increase firm volatility, which could be attractive to CDS traders. At the same time, a low market-to-book value indicates financial distress, which is also attractive to these market participants. *Abnormal Earnings* is also included as a control variable. If there is positive private information about firms with higher abnormal earnings then informed traders may find these firms attractive.

As in the benchmark two-stage least squares analysis, the exclusion restriction must be satisfied for the system to be identified. *Industry Leverage, Fixed Assets* and *Profitability* identify the leverage equation and *Asset Maturity* and *CP Program* identify the *Maturity* equation. None of these variables are expected to have a direct impact on the demand for a CDS market other than through their impact on firm leverage and maturity, respectively. For example, there is no reason to believe that changes in the leverage of a given firm's

[20]Empirically, the relation between *Bond Turnover* and *Leverage* or *Debt Maturity* is small, positive and statistically insignificant.

[21]TRACE collects and distributes transaction information from the over-the-counter corporate bond market for all TRACE-eligible bonds (i.e., publicly traded investment grade, high yield and convertible corporate debt). Dissemination of information for TRACE-eligible bonds was phased in over two years, beginning in July 2002 with all investment grade issues of $1 billion or more and an additional 50 high yield issues. Because our sample consists of S&P 500 firms, dissemination occurred largely in 2002. For robustness, we repeated the analysis excluding the phase-in period (we did this excluding years 2002-2003 and again, excluding years 2002-2004) and all results hold.

[22]This value is zero for the 137 firm-year observations without publicly traded bonds.

competitors will impact investors' desires to trade that firm's credit risk. Nor will changes in fixed assets (after controlling for firm size) or profitability (after controlling for abnormal earnings, which might impact informed traders' decisions). Similarly, although having a commercial paper program in place is correlated with being large and high credit quality, both of which are expected to attract CDS investors, after controlling for firm size and credit rating, having a commercial paper program is not expected to attract CDS market participants directly. Finally, *Asset Maturity* measures how quickly firms consume their production technologies. There is no reason to expect that firms with shorter or longer asset maturities should be more or less likely to have traded CDS contracts.

Table 5 presents estimation results of the three equation system in the case where each equation is individually estimated (Columns 1 and 3) and in the case where they are jointly estimated using a two step procedure (Columns 2 and 4).

The leverage and debt maturity results in Panels A and B are largely consistent with the benchmark regression results reported in Table 3: the estimated effect of CDSs is substantial, even after controlling for potential endogeneity. From Panel A, the estimated coefficients on the instrumented *CDS Trading* in the two-stage regressions suggest that moving from the mean probability (the unconditional probability is 48 percent) to a probability of one would imply an increase in book leverage of 0.053 and an increase in market leverage of 0.065 (from means of 0.25 for book leverage and 0.16 for market leverage). The estimated coefficients on the instrumented *CDS Trading* in Panel B suggest that this shift in the probability of having a CDS contract would increase debt maturity by 2.1 to 2.3 years. The estimated coefficients of the other variables in Panels A and B of Table 5 are similar to the benchmark results given in Table 3. Panel C of Table 5 presents results of the *CDS Trading* equation. The pseudo R-squares of the regressions are substantial, at approximately 0.3 and the estimated coefficients on the identifying variable *Bond Turnover* is statistically significant in all specifications, suggesting that the system is well-specified. Interestingly the *Debt Maturity* variable is significant in the OLS estimation but not significant in the two-stage estimation, suggesting that after adjusting for the simultaneous impact of *CDS* on *Debt Maturity*, *Debt Maturity* is not a determinant of CDS trading.

4.4. The Introduction of CDS: Difference in Differences Analysis

The approach that we have adopted thus far captures the impact of CDSs over long horizons (i.e., estimates of the coefficients on *CDS Trading* capture the change in leverage and maturity in all of the years following CDS introduction). As an alternative, we can isolate firms near CDS introduction and measure changes in leverage and maturity from the year *t-1* through the end of year *t* and year *t+1* relative to CDS introduction. We begin by matching all CDS firms to non-CDS firms using the Compustat universe.

The matched sample of non-CDS firms is chosen based on propensity scores obtained by estimating a probit model of the likelihood of CDS trading similar to the one reported in Panel C of Table 5. In such model, to guarantee that no outcome variable is included as a regressor, all independent variables are lagged by 1 year. Further, to guarantee that firms are on parallel trends prior to the CDS introduction, one-year changes in leverage and debt maturity are also included as regressors. For each CDS firm, we choose between one and up to four non-CDS firms that are in the S&P 500 sample and that are the closet matches, based on this propensity score. We sample with replacement in identifying matches. We obtain matches for 140 firms in the sample with CDS market introductions during the sample period.[23] Identification comes from the assumption that, conditional on the matching based on the variables in Table 5, CDS outcomes are random.

Table 6 provides univariate analysis of the change in leverage and maturity of CDS firms minus the change for matching firms. In the analysis in which we choose the closest match for

[23] The number of possible CDS firms is reduced by the fact that we have to observe a CDS introduction after the start of the sample period and the firm must be in the S&P 500 index in the years before and after the introduction of CDS. The latter requirement eliminates the years 2002 and 2009. The total number of firms that have CDS trading in our sample is 265, of those 201 start trading between 2003 through 2008. 44 of those enter the S&P 500 sample in the same year that the CDS is introduced, and 5 exit the sample the year after the introduction, 12 are lost for lack of data fields (specifically the changes in debt maturity) leaving us with a sample of 140 firms.

each treatment firm, we observe increases in leverage ratios of 0.029 and 0.020 from year *t-1* through year *t*, and of 0.042 and 0.021 from year *t-1* through year *t+1* for book and market leverage, respectively. We also observe increases in debt maturity of 1.25 years from *t–1* through *t* and of 0.96 years from *t–1* through *t+1* relative to CDS introduction. Importantly, the difference in difference results are similar, even as we add additional matching firms. As noted earlier, we expect that bond market investors and banks will find CDSs particularly appealing. When we examine decomposed debt, the difference in differences that we observe are consistent with this. We find increases in the ratio of bonds and notes to total assets, as well as an increase in the maturity of bond and note debt near CDS introduction. We do not find these increases in the other components of debt.

Given that we are able to find good matches based on the propensity score matching technique (the mean distance between the treatment and matching firms of approximately 0.01), the univariate analysis provides the main difference-in-differences results. However, for comparison with earlier tables, we also conduct regression analysis in which we condition on changes in all of the right-hand-side variables given in Table 3, using data on only treated firms and their matched firms. Rather than examining levels, we transform all variables to differences, reflecting the change from year *t-1* to year *t* of the CDS introduction, as well as from year *t-1* through year *t+1.* In choosing the number of matching firms for the regression analysis, we trade off the precision obtained from using more control firms with the potential bias due to adding extra firms with larger propensity score distances from the treatment firm. We choose to include two matches in regression analysis; however, the qualitative results do not depend on this choice.

These results are presented in Table 7. As in the benchmark analysis, we observe a positive role for CDSs. The estimated coefficients of the leverage regression in Panel A of Table 7 suggest that, all else equal, the introduction of a CDS increases book leverage by 0.03 and market leverage by 0.01 by the end of the year following CDS introduction. The maturity results in Panel B suggest an increase in maturity of between 10 and 11 months by the end of the year following CDS introduction. While the change leverage appears to be increasing by the end of the year after CDS introduction, the change in maturity is relatively constant. All these are similar in magnitude to the univariate analysis difference in difference estimates.

The difference in difference approach is useful since it sheds light on how capital structure evolves following CDS introduction when comparing firms for which a CDS market arises to firms that are ex-ante similar, but for which no CDS market is created. In this context the treatment is the CDS introduction, which captures an increase in the availability of hedging instruments to suppliers of capital. A drawback of this approach is that it does not completely eliminate potential concerns about selection bias.

An alternative approach, which completely overcomes selection concerns, is to look within the sample of CDS firms and relate the leverage and maturity decisions made by these firms to the ability to use CDS contracts as hedging instruments. Rather than focusing on the availability of CDS (a binary variable), we focus on how liquid the contracts are. The underlying assumption is that suppliers of capital find it easier to hedge using CDSs if they are cheaper to trade and easier to locate.

4.5. CDS Market Liquidity Proxies

We study the sample of 1,370 firm/year observations for which *CDS Trading* equals one and focus on variation in CDS market liquidity, which captures variation in the ability of suppliers of debt capital to hedge using CDS contracts. By examining only CDS firms, we are able to completely avoid concerns about selection of CDS firms (relative to non-CDS firms). The drawback is that CDSs trade over-the-counter, which leads to substantial noise in the liquidity proxies. Ideally, we would observe daily trading activity for CDSs, as we do for equities that trade on exchanges. Because these data are largely unavailable for CDSs, we calculate two somewhat coarse proxies of market liquidity: (1) the natural log of the number of daily Bloomberg CDS quotes that we observe for the firm during year t and (2) the average bid-ask spreads for the firm's CDSs during year t. The Bloomberg bid and ask quotes are limited in that they are based only on information from contributing dealers, however, we do not expect potential noise from sampling a small group of dealers to be systematically related to leverage or maturity decisions.

Table 8 reports results from regressions in which we replace *CDS Trading* and *CDS Traded* with the liquidity proxies. We find evidence that firms with more liquid CDS markets (lower quoted spreads and greater number of CDS quotes) are able to maintain higher leverage ratios and longer debt maturities. In the leverage regressions (Panel A), the estimated signs on all of the coefficients are consistent with the benchmark findings in Table 3; however, the significance of the estimated coefficients is lower than in the benchmark analysis. All four estimated coefficients are statistically significant in the regressions using CDS quoted spreads and one of four are significant in the regressions using a count of the number of quotes (although two are marginal, with t-statistics greater than 1.5). The estimated coefficients of the 2SLS leverage regression in Panel A of Table 8 suggest that, all else equal, a one standard deviation increase in the number of quotes increases book leverage by 0.030 and market leverage by 0.015. A one standard deviation decrease in bid-ask spreads increases book leverage by 0.025 and market leverage by 0.004 (this is 9.3 percent of mean book leverage and 2.2 percent of mean market leverage for the sample of CDS firms). In the maturity results shown in Panel B, we find similar results, but with greater statistical significance. All eight of the estimated coefficients are statistically significant (four in the regressions using quoted spreads and four using number of quotes). The maturity results in Panel B suggest a increase in maturity, of approximately 1.1 years, following a one standard deviation increase in the number of quotes. In the case of spreads, the coefficients imply an increase in maturity of between 8 and 9 months following a one standard deviation decrease in bid-ask spreads.

Taken together, all of the results from Tables 3 through 8 suggest an important role for insurance contracts (CDSs) in both leverage and debt maturity.

5. Conclusions

Consistent with the idea that borrowers benefit from a relaxation of credit constraints due to the ability of suppliers of debt capital to hedge their risk, we find a strong role for CDSs in both leverage and debt maturity. We take three approaches in the empirical analysis. The first exploits variation in whether firms have traded CDS contracts and in the timing of the adoption of CDS trading. In the second approach, we allow for the potential endogeneity of the existence of a CDS market for a firm's debt by introducing a third simultaneous equation for CDS trading. Finally, we focus on the CDS adoption event and use a matched sample of firms with no CDS but that have similar characteristics, based on a propensity score research design. We measure changes in leverage and maturity near CDS introduction.

All three empirical approaches lead to similar conclusions: CDS markets allow firms to maintain higher leverage and longer debt maturities (both in the time series and the cross section). Moreover, we exploit the time series properties of the data and find that the role for CDS becomes stronger as credit constraints bind, suggesting important time series variation in the impact of capital supply on firm capital structure.

Appendix

Alcoa, Inc. (NYSE:AA) > Financials > Capital Structure Details

[<< Return to Capital Structure Summary]

Key Stats | Income Statement | Balance Sheet | Cash Flow | Multiples | **Cap. Structure** | Ratios | Supplemental | Industry Specific | Pension/OPEB | Segments

Source: A 2008 filed Feb-17-2009

Currency: Reported Currency **Conversion:** Historical Go [More Options >>]

Principal Due in Millions of the reported currency.

FY 2008 Capital Structure As Reported Details

Description	Type	Principal Due (USD)	Coupon Rate	Maturity	Seniority	Secured	Convertible	Repayment Currency
5.375% Notes, due 2013	Bonds and Notes	600.0	5.375%	2013	Senior	No	No	USD
5.55% Notes, due 2017	Bonds and Notes	750.0	5.550%	Feb-01-2017	Senior	No	No	USD
5.72% Notes, due 2019	Bonds and Notes	750.0	5.720%	2019	Senior	No	No	USD
5.87% Notes, due 2022	Bonds and Notes	627.0	5.870%	2022	Senior	No	No	USD
5.9% Notes, due 2027	Bonds and Notes	625.0	5.900%	2027	Senior	No	No	USD
5.95% Notes due 2037	Bonds and Notes	625.0	5.950%	2037	Senior	No	No	USD
6% Notes, due 2012	Bonds and Notes	517.0	6.000%	2012	Senior	No	No	USD
6% Notes, due 2013	Bonds and Notes	750.0	6.000%	2013	Senior	No	No	USD
6.5% Bonds, due 2018	Bonds and Notes	250.0	6.500%	2018	Senior	No	No	USD
6.5% Notes, due 2011	Bonds and Notes	584.0	6.500%	2011	Senior	No	No	USD
6.625% Notes, due 2008	Bonds and Notes	-	6.625%	2008	Senior	No	No	USD
6.75% Bonds, due 2028	Bonds and Notes	300.0	6.750%	2028	Senior	No	No	USD
6.75% Notes, due 2018	Bonds and Notes	750.0	6.750%	2018	Senior	No	No	USD
7.375% Notes, due 2010	Bonds and Notes	511.0	7.375%	2010	Senior	No	No	USD
Alcoa Alumnio S.A. 7.5% Export Notes, due 2008	Bonds and Notes	-	7.500%	2008	Senior	Yes	No	USD
Commercial Paper	Commercial Paper	1,535.0	4.000%	Dec-31-2009	Senior	No	No	USD
Loans - BNDES	Term Loans	100.0	NA	Sep-01-2029	Senior	Yes	No	USD
Medium-Term Notes, due 2009-2013	Bonds and Notes	23.0	7.100%	2009 - 2013	Senior	No	No	USD
Other Debt	Other Borrowings	189.0	NA	-	Senior	No	No	USD
Project Loans - BNDES	Term Loans	196.0	NA	Apr-01-2015	Senior	Yes	No	USD
Project Loans - BNDES	Term Loans	250.0	NA	Apr-01-2015	Senior	Yes	No	USD
Short-Term Accounts Payable Settlement Arrangements with Certain Vendors and Third-party Intermediaries	Other Borrowings	236.0	NA	Dec-31-2008	Senior	No	No	USD
Short-Term Borrowings	Other Borrowings	242.0	NA	Dec-31-2008	Senior	No	No	USD

FY 2007 Capital Structure As Reported Details

Description	Type	Principal Due (USD)	Coupon Rate	Maturity	Seniority	Secured	Convertible	Repayment Currency
5.375% Notes, due 2013	Bonds and Notes	600.0	5.375%	2013	Senior	No	No	USD
5.55% Notes, due 2017	Bonds and Notes	750.0	5.550%	Feb-01-2017	Senior	No	No	USD
5.72% Notes, due 2019	Bonds and Notes	750.0	5.720%	2019	Senior	No	No	USD
5.87% Notes, due 2022	Bonds and Notes	627.0	5.870%	2022	Senior	No	No	USD
5.9% Notes, due 2027	Bonds and Notes	625.0	5.900%	2027	Senior	No	No	USD
5.95% Notes due 2037	Bonds and Notes	625.0	5.950%	2037	Senior	No	No	USD
6% Notes, due 2012	Bonds and Notes	517.0	6.000%	2012	Senior	No	No	USD
6% Notes, due 2013	Bonds and Notes	-	6.000%	2013	Senior	No	No	USD
6.5% Bonds, due 2018	Bonds and Notes	250.0	6.500%	2018	Senior	No	No	USD
6.5% Notes, due 2011	Bonds and Notes	584.0	6.500%	2011	Senior	No	No	USD
6.625% Notes, due 2008	Bonds and Notes	150.0	6.625%	2008	Senior	No	No	USD
6.75% Bonds, due 2028	Bonds and Notes	300.0	6.750%	2028	Senior	No	No	USD
6.75% Notes, due 2018	Bonds and Notes	-	6.750%	2018	Senior	No	No	USD
7.375% Notes, due 2010	Bonds and Notes	511.0	7.375%	2010	Senior	No	No	USD
Alcoa Alumnio S.A. 7.5% Export Notes, due 2008	Bonds and Notes	21.0	7.500%	2008	Senior	Yes	No	USD
Commercial Paper	Commercial Paper	856.0	5.400%	Dec-31-2008	Senior	No	No	USD
Medium-Term Notes, due 2009-2013	Bonds and Notes	43.0	7.100%	2009 - 2013	Senior	No	No	USD
Other Debt	Other Borrowings	200.0	NA	-	Senior	No	No	USD
Short-Term Accounts Payable Settlement Arrangements with Certain Vendors and Third-party Intermediaries	Other Borrowings	314.0	NA	Dec-31-2008	Senior	No	No	USD
Short-Term Borrowings	Other Borrowings	249.0	NA	Dec-31-2008	Senior	No	No	USD

Financial data provided by Capital IQ A Standard & Poor's Business

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Figure 1: Impact of CDS Trading, by Year

This figure shows the time series of estimated coefficients on the CDS Trading dummy variable in the Book Leverage, Market Leverage and Debt Maturity regressions. We estimate parameters of the 2SLS specifications reported in Columns (3) and (7) of Panel A of Table 3 for leverage and of Panel (B) of Table 3 for maturity, obtaining therefore 4 time-series of coefficients. The "Book Leverage" lines show the time series of estimated coefficients from the regressions using book leverage. The "Market Leverage" lines show the coefficients from the regressions using market leverage.

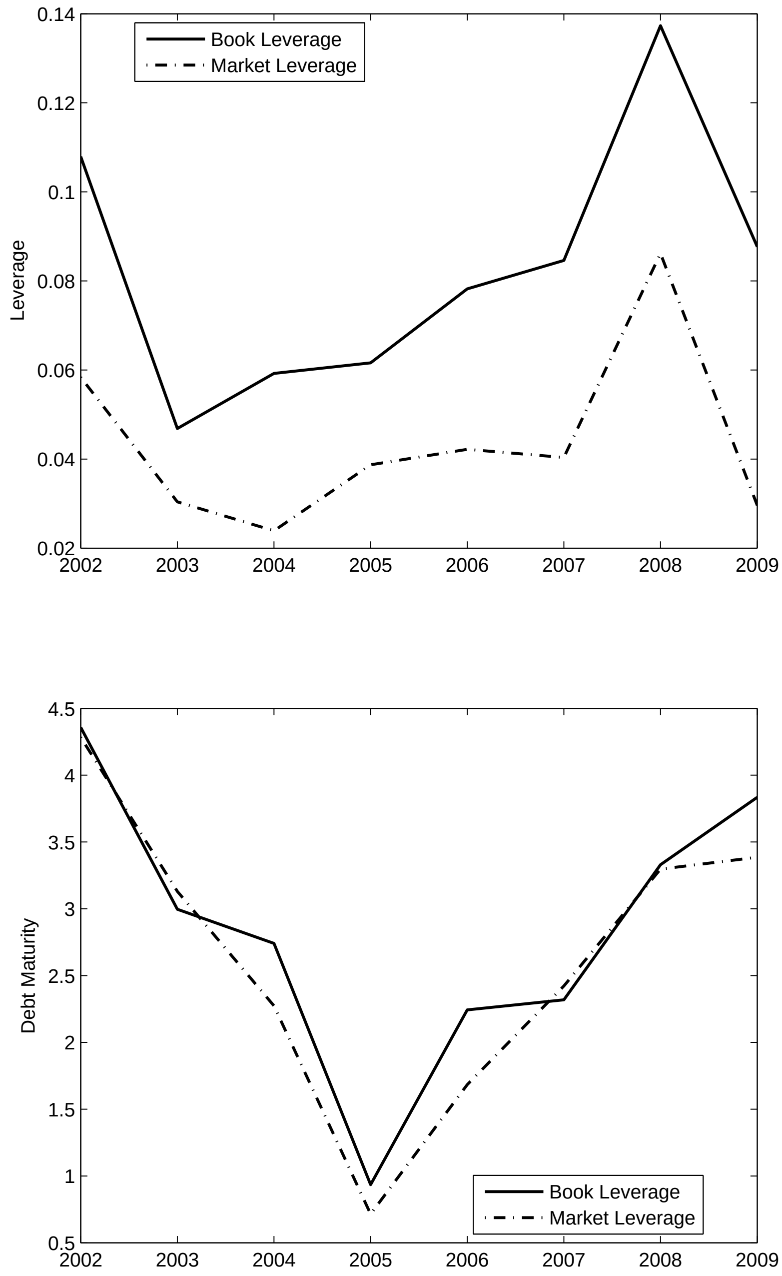

Figure 2: Net Tightening of Credit Supply, by Year

This figure shows the net percentage of senior loan officers reporting commercial and industrial loan tightening to large and medium sized firms over the 2002-2009 sample period. Higher values indicate tightening of credit supply. Data are from the Federal Reserve's Senior Loan Officer Opinion Survey.

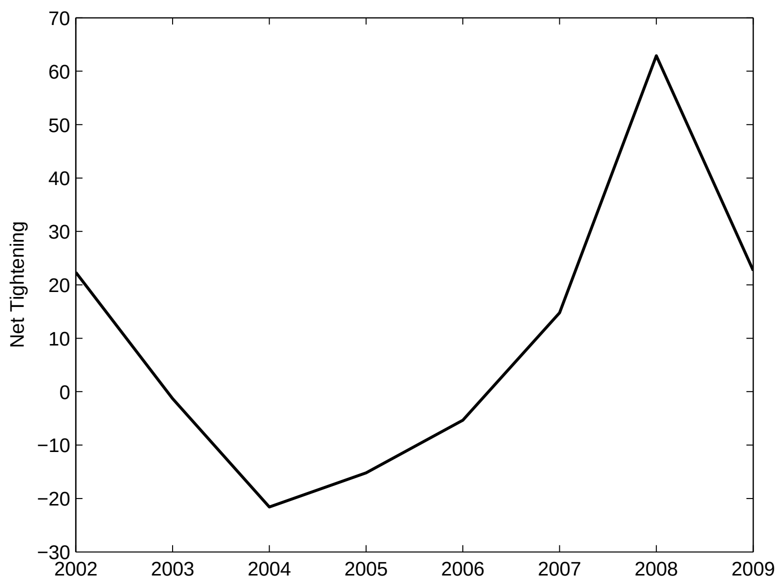

Table 1: Summary Statistics

This table presents summary statistics for the sample of non-financial firms in the S&P500 index during the 2002-2009 period. Panel A presents summary statistics for firm variables used in the main analyses. Panel B presents summary statistics of debt decomposition variables. Book Leverage is book leverage, defined as total debt (long-term debt plus debt in current liabilities), divided by the book value of assets. Market Leverage is market leverage, defined as total debt, divided by firm value, where firm value is defined as the book value of assets, minus the book value of common equity, plus the market value of equity, plus the book value of deferred taxes. Debt Maturity is debt maturity in years, defined as the principal-weighted maturity of all debt, as reported in Capital IQ. Asset Maturity is the weighted maturity of the firm's assets, defined as: (gross PPE divided by depreciation expense, times gross PPE divided by total assets) plus (current assets divided by cost of goods sold, times current asses divided by total assets). Market to Book is the firm's market-to-book ratio, defined as the market value of assets (equity market capitalization plus the book value of other liabilities), divided by the book value of assets. Fixed Assets is defined as net PPE, dived by the book value of total assets. Profitability is defined as earnings before interest and taxes, divided by the book value of assets. Size is the natural logarithm of total sales, in $millions. CP Program is a dummy equal to one if the firm has a commercial paper program at the beginning of year t. Volatility is defined as the standard deviation of annual changes in earnings over years t through t-5, divided by the book value of assets as the end of year t. Abnormal Earnings is defined as the change in earnings per share from year t–1 to year t, divided by the share price as the end of year t. Tax Credit is defined as the investment tax credit (if any), divided by the book value of assets. Loss Carry Forward is defined as the net operating loss carry forwards (if any), divided by the book value of assets. Rating is the S&P credit rating of the firm, where the value 1 corresponds to an S&P rating of AAA+; 2 corresponds to AAA; 3 corresponds to AAA-, and so on. Rated is a dummy variable equal to one if the firm has a Standard and Poor's rating. Investment Grade is a dummy equal to one if the firm has an investment grade rating (i.e., BBB or higher). Bond/Debt is the fraction of total debt that are bonds and notes. Bond Maturity is the maturity of the firms bonds and notes, in years. Lease/Debt is the fraction of total debt that are lease obligations. Lease Maturity is the maturity of lease obligations, in years. Loan/Debt is the fraction of total debt that are term loans or revolvers. Loan maturity is the maturity of term and revolver loan obligations, in years. CP/Debt is the fraction of commercial paper in total debt. CP Maturity is the stated maturity of the firm's Commercial Paper Program. TP/Debt is the fraction of trust preferred obligations in total debt. TP Maturity is defined as the maturity of trust preferred obligations, in years. Other/Debt is the fraction of other obligations in total debt. Other Maturity is defined as the maturity of other obligations. "S&P 500 and CDS" indicates that the firm is in the S&P 500 sample and has traded CDS contracts on its debt (CDS quoted in Bloomberg) during year t. "S&P and no CDS" indicates that the firm does not have traded CDS on its debt.

Panel A: Firm Variables

	S&P 500					S&P 500 and CDS Trading					S&P 500 and no CDS Trading				
	Mean	Median	Stdev	Min	Max	Mean	Median	Stdev	Min	Max	Mean	Median	Stdev	Min	Max
Book Leverage	0.25	0.23	0.14	0.00	0.99	0.27	0.26	0.13	0.00	0.81	0.22	0.20	0.15	0.00	0.99
Market Leverage	0.16	0.13	0.12	0.00	0.71	0.18	0.16	0.11	0.00	0.62	0.13	0.10	0.12	0.00	0.71
Debt Maturity	8.90	7.24	6.72	0.33	72.45	10.00	8.55	6.93	0.34	72.45	7.87	6.11	6.34	0.33	59.53
Asset Maturity	8.04	6.16	5.99	0.45	71.82	8.49	6.81	5.70	0.45	35.15	7.62	5.59	6.23	0.46	71.82
Market to Book	1.94	1.64	1.01	0.57	13.73	1.72	1.53	0.70	0.57	7.44	2.14	1.80	1.19	0.58	13.73
Fixed Assets	0.31	0.25	0.22	0.00	0.93	0.34	0.29	0.23	0.00	0.93	0.29	0.22	0.22	0.01	0.92
Profitability	0.14	0.14	0.08	-0.32	0.90	0.14	0.13	0.08	-0.32	0.68	0.15	0.15	0.09	-0.21	0.90
Size	9.00	8.96	1.15	4.62	12.96	9.54	9.41	1.00	6.91	12.91	8.48	8.44	1.05	4.62	12.96
CP Program	0.32	0.00	0.46	0.00	1.00	0.38	0.00	0.49	0.00	1.00	0.26	0.00	0.44	0.00	1.00
Volatility	0.03	0.02	0.04	0.00	0.38	0.03	0.02	0.03	0.00	0.38	0.04	0.02	0.04	0.00	0.37
Abnormal Earnings	0.01	0.01	0.36	-9.49	7.89	0.01	0.00	0.27	-2.11	4.21	0.01	0.01	0.43	-9.49	7.89
Tax Credit	0.04	0.02	0.05	-0.00	0.28	0.05	0.02	0.06	0.00	0.28	0.04	0.02	0.05	-0.00	0.26
Loss Carry Forward	0.05	0.00	0.20	0.00	5.48	0.03	0.00	0.07	0.00	0.52	0.07	0.00	0.27	0.00	5.48
Rating	8.62	9.00	3.98	0.00	27.00	9.29	9.00	2.84	0.00	27.00	7.98	9.00	4.73	0.00	27.00
Rated	0.91	1.00	0.28	0.00	1.00	1.00	1.00	0.04	0.00	1.00	0.83	1.00	0.37	0.00	1.00
Investment Grade	0.72	1.00	0.45	0.00	1.00	0.82	1.00	0.38	0.00	1.00	0.62	1.00	0.48	0.00	1.00

Panel B: Debt Decomposition

	S&P 500					S&P 500 and CDS Trading					S&P 500 and no CDS Trading				
	Mean	Median	Stdev	Min	Max	Mean	Median	Stdev	Min	Max	Mean	Median	Stdev	Min	Max
Bond/Debt	0.73	0.83	0.29	0.00	1.00	0.76	0.84	0.25	0.00	1.00	0.71	0.81	0.31	0.00	1.00
Bond Maturity	9.57	7.93	7.63	0.00	75.45	10.87	9.31	8.05	0.00	75.45	8.34	6.62	6.99	0.00	66.05
Lease/Debt	0.03	0.00	0.10	0.00	1.00	0.02	0.00	0.05	0.00	0.60	0.03	0.00	0.13	0.00	1.00
Lease Maturity	10.25	5.00	14.37	0.00	88.50	10.96	5.50	13.18	0.08	86.50	9.60	4.50	15.41	0.00	88.50
Loan/Debt	0.12	0.01	0.22	0.00	1.00	0.09	0.01	0.16	0.00	1.00	0.15	0.02	0.26	0.00	1.00
Loan Maturity	1.63	1.00	2.80	0.00	31.25	1.64	1.00	3.04	0.00	31.25	1.63	1.00	2.55	0.00	29.08
CP/Debt	0.06	0.00	0.14	0.00	1.00	0.06	0.00	0.14	0.00	1.00	0.06	0.00	0.15	0.00	1.00
CP Maturity	1.34	1.00	1.10	0.00	7.50	1.43	1.00	1.15	0.00	6.50	1.21	1.00	1.02	0.00	7.50
TP/Debt	0.01	0.00	0.07	0.00	0.88	0.02	0.00	0.08	0.00	0.84	0.01	0.00	0.05	0.00	0.88
TP Maturity	25.64	26.78	11.60	0.58	55.66	27.20	29.26	9.96	0.58	54.50	22.87	21.50	13.67	0.70	55.66
Other/Debt	0.05	0.00	0.13	0.00	1.00	0.06	0.01	0.14	0.00	0.98	0.04	0.00	0.12	0.00	1.00
Other Maturity	4.54	2.00	6.21	0.00	42.50	5.16	2.00	7.08	0.00	42.50	3.58	2.00	4.40	0.00	26.50

Table 2: Predicted Signs

This table presents predicted signs of the coefficients in the simultaneous equations model of leverage and maturity.

Variable	Leverage Equation Sign	Leverage Equation Explanation	Maturity Equation Sign	Maturity Equation Explanation
CDS Trading	+	CDSs allow suppliers of capital to hedge risk and increase their willingness to extend credit.	+	CDSs allow suppliers of capital to hedge risk and increase their willingness to extend longer maturity credit.
CDS Traded	+/−	This variable controls for unobservable differences between firms that eventually have CDS versus non-CDS firms.	+/−	This variable controls for unobservable differences between firms that eventually have CDS versus non-CDS firms.
Leverage			+	Firms face liquidity risk when they roll over short-term debt. Firms with high leverage choose more long maturity debt to avoid excessive liquidation.
Debt Maturity	+	Firms face liquidity risk when they roll over short-term debt. Firms with short maturity debt will therefore choose less leverage.		
Asset Maturity			+	Maturity matching of assets and liabilities can reduce underinvestment problems Myers (1977).
Industry Leverage	+	Firms in the same industries have common characteristics that might impact leverage ratios.		
Market to Book	−	Firms with high growth opportunities should use low leverage to mitigate underinvestment incentives (Meyers, 1977).	−	Firms with high growth opportunities will choose short maturity debt so that debt is due before options to invest expire, thereby mitigating underinvestment problems.
Fixed Assets	+	Tangible assets have high collateral values, increasing firms' debt capacity.		
Profitability	+/−	The free cash flow hypothesis (e.g., Jensen (1986)) predicts that firms with high profitability will take on greater leverage since interest payments discipline wasteful spending incentives. On the other hand, Meyers (1984) argues that firms have a pecking order, first using internal funds. High profit firms would therefore have less leverage.		
Size	+/−	Larger firms are more diversified, so may have greater debt capacity (Lewellen, 1971). Larger firms also have fewer asymmetric information problems so will have greater access to equity markets, decreasing debt.	+	Diamond (1991) predicts an increasing and then decreasing relationship between debt maturity and credit quality/liquidity risk.
CP Program			−	Diamond (1991) predicts an increasing and then decreasing relationship between debt maturity and credit quality/liquidity risk.
Volatility	−	Increased earnings volatility increases default probabilities, decreasing debt capacity.	−	Increased earnings volatility increases default probabilities, decreasing optimal maturity.

Variable	Leverage Equation Sign	Leverage Equation Explanation	Maturity Equation Sign	Maturity Equation Explanation
Abnormal Earnings	+	If there is a signaling effect associated with leverage choice (Ross, 1977), leverage will be positively related to abnormal earnings.	–	If there is a signaling effect associated with maturity choice (as in Diamond (1991) and Flannery (1986)), maturity will be negatively related to abnormal earnings.
Tax Credit	–	Alternative tax shields can reduce the value of long term debt.	–	Alternative tax shields can reduce the value of long-term debt (e.g., Brick and Raviv (1995) in which upward sloping yield curve makes long term-debt more valuable).
Loss Carry Forward	–	Alternative tax shields can reduce the value of long-term debt.	–	Alternative tax shields can reduce the value of long-term debt.
Rated	+	Rated firms are expected to have higher leverage due to access to public debt markets (as in Faulkender and Petersen (2006)).	+	Unrated firms have lower credit quality and may find it more difficult to borrow longer-term debt.
Investment Grade	+/–	Control variable. The assets underlying CDSs tend to be investment grade. We include this dummy variable to ensure that our inferences about the impact of CDS are not due to differences in credit rating.	+/–	Control variable. The assets underlying CDSs tend to be investment grade. We include this dummy variable to ensure that our inferences about the impact of CDS are not due to differences in credit rating.

Table 3: Corporate Leverage, Debt Maturity and Credit Default Swaps

Panel A presents ordinary least square (OLS) and two-stage least squares (2SLS) regression results of annual leverage on the explanatory variables from Johnson (2003), plus two credit default swap variables, an industry leverage control, and debt rating dummies. Panel B reports the results of the maturity equation regression. CDS Trading is a dummy variable equal to one if the firm has quoted CDS contracts on its debt during year t. We also add CDS Traded, a dummy variable equal to one if the firm has a traded CDS during the 2002-2009 sample period. The explanatory variable not already defined in Table 1 is Industry Leverage, defined as the mean leverage of all firms in the 2-digit SIC code. Industry Leverage is based on industry book leverage in the Book Leverage regressions and on industry market leverage in the Market Leverage regressions. Both leverage and maturity are treated as endogenous variables and their equations are estimated simultaneously using two stage least squares. The regression specification shown in Columns 1, 3, 5 and 7 include year and industry fixed effects. Industry fixed effects and the CDS Traded dummy variable are replaced with firm fixed effects in the specification shown in Columns 2, 4, 6 and 8. All standard errors are clustered at the firm level. The identifying variables for the leverage equation are Industry Leverage, Fixed Assets and Profitability. The identifying variables for the debt maturity equation are Asset Maturity and CP Program. Diagnostic analysis of the two-equation system is given by the Hausman test. In Panel A (the leverage regression) the null hypothesis of the Hausman test is that debt maturity is exogenous. Similarly, in Panel B (the maturity regression), the null hypothesis is that leverage is exogenous. The sample is composed of non-financial firms in the S&P 500 index during the 2002-2009 period.

Panel A: Leverage Regression

	Book Leverage				Market Leverage			
	OLS	OLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.314	0.319	0.380	0.407	0.222	0.248	0.226	0.249
	(6.29)	(2.37)	(6.05)	(2.39)	(6.37)	(2.68)	(5.08)	(1.97)
Debt Maturity	0.000	0.001	-0.008	-0.007	-0.000	-0.000	-0.001	-0.000
	(0.20)	(1.05)	(-1.67)	(-0.87)	(-0.30)	(-0.06)	(-0.16)	(-0.02)
Industry Leverage	0.371	0.267	0.336	0.280	0.364	0.304	0.362	0.304
	(5.50)	(3.74)	(4.54)	(3.75)	(6.98)	(5.66)	(6.08)	(5.28)
Market to Book	-0.010	-0.015	-0.012	-0.014	-0.032	-0.028	-0.032	-0.028
	(-1.90)	(-3.02)	(-2.15)	(-2.89)	(-5.71)	(-4.53)	(-5.61)	(-4.50)
Fixed Assets	0.080	0.060	0.105	0.053	0.044	0.001	0.045	0.001
	(2.37)	(1.07)	(2.85)	(0.97)	(1.97)	(0.02)	(1.89)	(0.02)
Profitability	0.131	-0.043	0.103	-0.052	-0.071	-0.151	-0.073	-0.151
	(1.63)	(-0.66)	(1.26)	(-0.80)	(-1.49)	(-3.70)	(-1.47)	(-3.60)
Size	-0.019	-0.023	-0.020	-0.025	-0.005	-0.010	-0.005	-0.010
	(-3.50)	(-1.62)	(-3.76)	(-1.71)	(-1.25)	(-1.00)	(-1.28)	(-0.97)
Volatility	-0.159	-0.002	-0.192	-0.061	-0.135	-0.078	-0.136	-0.079
	(-1.34)	(-0.02)	(-1.58)	(-0.45)	(-1.99)	(-1.11)	(-2.04)	(-0.92)
Abnormal Earnings	0.008	0.003	0.009	0.005	0.007	0.004	0.007	0.004
	(1.44)	(0.60)	(1.53)	(0.94)	(1.34)	(0.65)	(1.35)	(0.70)
Tax Credit	0.042	-0.029	0.169	0.027	-0.023	-0.032	-0.016	-0.032
	(0.34)	(-0.19)	(1.18)	(0.15)	(-0.27)	(-0.30)	(-0.16)	(-0.27)
Loss Carry Forward	0.043	0.007	0.050	-0.007	0.020	-0.005	0.021	-0.005
	(2.12)	(0.22)	(2.42)	(-0.21)	(1.65)	(-0.17)	(1.63)	(-0.16)
Rated	0.105	0.131	0.103	0.121	0.076	0.077	0.076	0.077
	(4.67)	(2.93)	(4.57)	(2.65)	(5.54)	(3.60)	(5.48)	(3.48)
Investment Grade	-0.082	-0.035	-0.078	-0.035	-0.081	-0.037	-0.081	-0.037
	(-6.47)	(-3.14)	(-5.92)	(-3.15)	(-7.88)	(-3.65)	(-7.47)	(-3.66)
CDS Traded	-0.000		0.010		0.000		0.001	
	(-0.00)		(0.73)		(0.01)		(0.07)	
CDS Trading	0.057	0.017	0.066	0.023	0.035	0.011	0.035	0.011
	(5.33)	(2.23)	(5.54)	(2.22)	(4.84)	(1.83)	(4.30)	(1.29)
Time Fixed Effects	X	X	X	X	X	X	X	X
Industry Fixed Effects	X		X		X		X	
Firm Fixed Effects		X		X		X		X
Clustered SE	X	X	X	X	X	X	X	X
Adj-R^2	0.325	0.771	0.327	0.771	0.524	0.830	0.524	0.830
Hausman Test	0.008	0.007			0.000	0.000		
t-Statistic	(1.71)	(0.94)			(0.13)	(0.01)		
Obs	2820	2820	2820	2820	2820	2820	2820	2820
CDS Obs	1370	1370	1370	1370	1370	1370	1370	1370

Panel B: Maturity Regression

	Book Leverage				Market Leverage			
	OLS	OLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	5.573	9.205	9.398	11.269	6.075	9.933	9.069	7.852
	(2.05)	(1.85)	(1.87)	(1.31)	(2.32)	(1.97)	(2.10)	(1.16)
Leverage	0.117	1.935	-9.100	-3.088	-1.609	0.207	-12.226	6.586
	(0.06)	(1.09)	(-0.97)	(-0.19)	(-0.68)	(0.09)	(-1.07)	(0.52)
Asset Maturity	0.145	0.143	0.180	0.146	0.150	0.144	0.179	0.139
	(2.17)	(2.13)	(2.41)	(2.15)	(2.25)	(2.14)	(2.46)	(2.05)
Market to Book	-0.255	0.068	-0.334	-0.022	-0.321	0.041	-0.753	0.267
	(-1.45)	(0.30)	(-1.76)	(-0.06)	(-1.68)	(0.17)	(-1.55)	(0.54)
Size	0.031	-0.081	-0.167	-0.221	0.020	-0.132	-0.035	-0.022
	(0.10)	(-0.13)	(-0.42)	(-0.29)	(0.07)	(-0.21)	(-0.11)	(-0.03)
CP Program	-1.634	-0.013	-1.386	0.037	-1.618	0.004	-1.539	-0.045
	(-3.34)	(-0.04)	(-2.46)	(0.09)	(-3.35)	(0.01)	(-3.08)	(-0.12)
Volatility	-2.613	-7.045	-3.543	-7.050	-2.712	-7.039	-3.286	-6.796
	(-0.49)	(-1.44)	(-0.68)	(-1.46)	(-0.51)	(-1.46)	(-0.63)	(-1.37)
Abnormal Earnings	0.069	0.202	0.146	0.220	0.076	0.208	0.119	0.196
	(0.37)	(1.38)	(0.72)	(1.36)	(0.41)	(1.42)	(0.63)	(1.32)
Tax Credit	13.804	4.755	15.004	4.922	13.830	4.819	13.898	4.789
	(1.71)	(0.56)	(1.88)	(0.58)	(1.73)	(0.57)	(1.75)	(0.57)
Loss Carry Forward	1.067	-1.791	1.417	-1.762	1.109	-1.780	1.358	-1.777
	(1.25)	(-1.13)	(1.59)	(-1.12)	(1.31)	(-1.13)	(1.60)	(-1.12)
Rated	-0.396	-1.622	0.670	-0.896	-0.248	-1.361	0.641	-1.926
	(-0.43)	(-1.22)	(0.49)	(-0.35)	(-0.27)	(-1.02)	(0.48)	(-1.14)
Investment Grade	0.909	-0.001	0.056	-0.189	0.753	-0.065	-0.210	0.201
	(1.43)	(-0.00)	(0.05)	(-0.21)	(1.13)	(-0.09)	(-0.17)	(0.24)
CDS Traded	1.105		1.178		1.108		1.126	
	(1.55)		(1.64)		(1.56)		(1.59)	
CDS Trading	1.244	0.755	1.757	0.852	1.310	0.790	1.704	0.711
	(2.06)	(2.07)	(2.18)	(1.75)	(2.20)	(2.15)	(2.34)	(1.75)
Time Fixed Effects	X	X	X	X	X	X	X	X
Industry Fixed Effects	X		X		X		X	
Firm Fixed Effects		X		X		X		X
Clustered SE	X	X	X	X	X	X	X	X
Adj-R^2	0.094	0.669	0.096	0.669	0.094	0.669	0.096	0.669
Hausman Test	9.851	5.130			11.600	-6.730		
t-Statistic	(1.08)	(0.31)			(1.02)	(-0.50)		
Obs	2820	2820	2820	2820	2820	2820	2820	2820
CDS Obs	1370	1370	1370	1370	1370	1370	1370	1370

Table 4: Regional Supply Shocks: Within State Debt Defaults

This table presents ordinary least squares (OLS) and two-stage least squares (2SLS) regression results of leverage and debt maturity on the explanatory variables in Table 3, plus a local credit market supply shock variable. State Default is the credit market supply shock variable, defined as defined as the dollar value of all defaulted debt by Compustat firms outside of the sample firm's industry and headquartered in the sample firm's state during year t-1, divided by the total book value of debt of all Compustat firms outside of the sample firms industry and headquartered in the state at the beginning of year t-1. State Default × CDS Trading is the credit supply shock and CDS Trading interaction variable. All other variables are defined in Tables 1 and 3. Leverage regression results are shown in Panel A. Results of the Maturity regression are in Panel B. The identifying variables for the leverage equation are Industry Leverage, Fixed Assets and Profitability. The identifying variables for the debt maturity equation are Asset Maturity and CP Program. Year and industry fixed effects are included in all regressions. Standard errors are clustered at the firm level. The sample is composed of non-financial firms in the S&P 500 index during the 2002-2009 period.

Panel A: Leverage Regression

	Book Leverage				Market Leverage			
	OLS	OLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.314	0.316	0.379	0.385	0.222	0.223	0.225	0.228
	(6.28)	(6.32)	(6.06)	(6.10)	(6.37)	(6.40)	(5.11)	(5.13)
Debt Maturity	0.000	0.000	-0.008	-0.008	-0.000	-0.000	-0.001	-0.001
	(0.20)	(0.15)	(-1.68)	(-1.74)	(-0.31)	(-0.36)	(-0.16)	(-0.21)
Industry Leverage	0.371	0.371	0.336	0.334	0.364	0.364	0.362	0.361
	(5.50)	(5.50)	(4.55)	(4.52)	(6.98)	(7.00)	(6.09)	(6.09)
Market to Book	-0.010	-0.010	-0.012	-0.012	-0.032	-0.032	-0.032	-0.032
	(-1.90)	(-1.89)	(-2.14)	(-2.14)	(-5.71)	(-5.70)	(-5.61)	(-5.60)
Fixed Assets	0.080	0.081	0.105	0.107	0.044	0.045	0.045	0.046
	(2.37)	(2.40)	(2.86)	(2.90)	(1.98)	(2.00)	(1.89)	(1.93)
Profitability	0.131	0.129	0.103	0.099	-0.071	-0.073	-0.073	-0.075
	(1.63)	(1.60)	(1.26)	(1.20)	(-1.49)	(-1.51)	(-1.47)	(-1.50)
Size	-0.019	-0.019	-0.020	-0.020	-0.005	-0.005	-0.005	-0.005
	(-3.50)	(-3.51)	(-3.77)	(-3.79)	(-1.26)	(-1.27)	(-1.28)	(-1.30)
Volatility	-0.159	-0.164	-0.193	-0.203	-0.135	-0.139	-0.137	-0.141
	(-1.34)	(-1.39)	(-1.59)	(-1.67)	(-2.00)	(-2.06)	(-2.05)	(-2.11)
Abnormal Earnings	0.008	0.008	0.009	0.009	0.007	0.006	0.007	0.006
	(1.44)	(1.37)	(1.53)	(1.42)	(1.34)	(1.26)	(1.35)	(1.27)
Tax Credit	0.042	0.040	0.169	0.171	-0.023	-0.024	-0.016	-0.015
	(0.34)	(0.33)	(1.18)	(1.20)	(-0.27)	(-0.29)	(-0.16)	(-0.15)
Loss Carry Forward	0.043	0.043	0.050	0.050	0.020	0.020	0.021	0.021
	(2.12)	(2.11)	(2.42)	(2.41)	(1.65)	(1.64)	(1.63)	(1.63)
Rated	0.105	0.105	0.103	0.103	0.076	0.076	0.076	0.076
	(4.67)	(4.67)	(4.57)	(4.57)	(5.54)	(5.54)	(5.48)	(5.48)
Investment Grade	-0.082	-0.082	-0.079	-0.078	-0.081	-0.080	-0.081	-0.080
	(-6.48)	(-6.43)	(-5.94)	(-5.83)	(-7.89)	(-7.83)	(-7.50)	(-7.40)
CDS Traded	-0.000	0.000	0.011	0.012	0.000	0.000	0.001	0.001
	(-0.00)	(0.03)	(0.74)	(0.80)	(0.02)	(0.05)	(0.08)	(0.12)
CDS Trading	0.057	0.053	0.066	0.060	0.035	0.032	0.035	0.033
	(5.33)	(4.82)	(5.54)	(5.17)	(4.84)	(4.36)	(4.30)	(4.10)
State Defaults	0.004	-0.122	0.044	-0.153	0.022	-0.064	0.025	-0.066
	(0.05)	(-1.29)	(0.52)	(-1.56)	(0.40)	(-1.02)	(0.42)	(-1.03)
State Defaults × CDS Trading		0.349		0.549		0.239		0.253
		(2.06)		(2.64)		(2.21)		(1.84)
Time Fixed Effects	X	X	X	X	X	X	X	X
Industry Fixed Effects	X	X	X	X	X	X	X	X
Clustered SE	X	X	X	X	X	X	X	X
Adj-R^2	0.325	0.325	0.327	0.327	0.524	0.524	0.523	0.524
Obs	2820	2820	2820	2820	2820	2820	2820	2820
CDS Obs	1370	1370	1370	1370	1370	1370	1370	1370

Panel B: Maturity Regression

	Book Leverage				Market Leverage			
	OLS	OLS	2SLS	2SLS	OLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	5.504	5.652	9.296	9.370	6.011	6.156	8.971	9.023
	(2.03)	(2.09)	(1.85)	(1.86)	(2.30)	(2.36)	(2.08)	(2.09)
Leverage	0.127	0.057	-8.999	-8.856	-1.608	-1.696	-12.107	-11.829
	(0.07)	(0.03)	(-0.96)	(-0.95)	(-0.68)	(-0.71)	(-1.06)	(-1.04)
Asset Maturity	0.145	0.144	0.179	0.177	0.150	0.149	0.178	0.176
	(2.16)	(2.15)	(2.40)	(2.37)	(2.25)	(2.23)	(2.46)	(2.43)
Market to Book	-0.255	-0.259	-0.333	-0.336	-0.321	-0.329	-0.748	-0.741
	(-1.44)	(-1.47)	(-1.75)	(-1.77)	(-1.67)	(-1.71)	(-1.53)	(-1.52)
Size	0.028	0.022	-0.168	-0.170	0.017	0.012	-0.038	-0.041
	(0.09)	(0.07)	(-0.42)	(-0.43)	(0.06)	(0.04)	(-0.12)	(-0.13)
Volatility	-2.803	-3.103	-3.711	-4.027	-2.902	-3.204	-3.469	-3.776
	(-0.53)	(-0.61)	(-0.72)	(-0.80)	(-0.55)	(-0.63)	(-0.67)	(-0.75)
Abnormal Earnings	0.065	0.036	0.141	0.107	0.072	0.043	0.115	0.081
	(0.36)	(0.20)	(0.71)	(0.54)	(0.40)	(0.24)	(0.61)	(0.43)
Tax Credit	13.858	13.853	15.042	15.008	13.885	13.871	13.952	13.934
	(1.72)	(1.71)	(1.88)	(1.87)	(1.74)	(1.73)	(1.76)	(1.75)
Loss Carry F orward	1.065	1.063	1.412	1.401	1.108	1.105	1.354	1.342
	(1.24)	(1.25)	(1.58)	(1.59)	(1.30)	(1.31)	(1.59)	(1.59)
Rated	-0.398	-0.377	0.657	0.655	-0.249	-0.228	0.630	0.621
	(-0.43)	(-0.41)	(0.48)	(0.48)	(-0.27)	(-0.25)	(0.47)	(0.46)
Investment Grade	0.901	0.922	0.057	0.101	0.743	0.763	-0.209	-0.153
	(1.42)	(1.45)	(0.06)	(0.10)	(1.12)	(1.16)	(-0.17)	(-0.12)
CP Program	-1.647	-1.644	-1.400	-1.404	-1.631	-1.630	-1.553	-1.554
	(-3.38)	(-3.38)	(-2.50)	(-2.50)	(-3.39)	(-3.39)	(-3.12)	(-3.13)
CDS Traded	1.115	1.136	1.187	1.209	1.118	1.139	1.136	1.158
	(1.56)	(1.59)	(1.65)	(1.68)	(1.57)	(1.60)	(1.60)	(1.63)
CDS Trading	1.248	1.014	1.756	1.480	1.315	1.077	1.705	1.432
	(2.07)	(1.64)	(2.18)	(1.83)	(2.21)	(1.77)	(2.34)	(1.95)
State Defaults	5.912	-1.976	5.527	-3.347	5.901	-2.105	5.866	-2.821
	(0.97)	(-0.30)	(0.92)	(-0.53)	(0.96)	(-0.32)	(0.97)	(-0.44)
State Defaults × CDS Trading		21.785		24.532		22.118		24.002
		(1.73)		(1.97)		(1.75)		(1.93)
Time Fixed Effects	X	X	X	X	X	X	X	X
Industry Fixed Effects	X	X	X	X	X	X	X	X
Clustered SE	X	X	X	X	X	X	X	X
Adj-R^2	0.094	0.096	0.096	0.097	0.095	0.096	0.096	0.097
Obs	2820	2820	2820	2820	2820	2820	2820	2820
CDS Obs	1370	1370	1370	1370	1370	1370	1370	1370

Table 5: Three Equation System

Panels A and B present both ordinary least squares (OLS) and two-stage least squares (2SLS) results of regressing leverage and debt maturity, respectively, on the explanatory variables in Tables 3. All variables are defined in Tables 1 and 3. Leverage, Maturity, and CDS Trading are all treated as endogenous variables and their equations are estimated simultaneously using two stage least squares. Panel C presents the results of the CDS Trading regression, which is estimated via a probit model. The identifying variables for the leverage equation are Industry Leverage, Fixed Assets and Profitability. The identifying variables for the debt maturity equation are Asset Maturity and CP Program. The identifying variable for the CDS trading equation is Bond Turnover, defined as the total trading volume in the firm's publicly traded bonds during year t as reported on the Trade Reporting and Compliance Engine, divided by the total bonds outstanding as reported in the Capital IQ database. Time and industry fixed effects are included in all regressions. Standard errors are clustered at the firm level. The sample is composed of non-financial firms in the S&P 500 index during the 2002-2009 period.

Panel A: Leverage Regression

	Book Leverage		Market Leverage	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
Constant	0.314	0.418	0.222	0.344
	(6.34)	(4.98)	(6.42)	(6.09)
Debt Maturity	0.000	-0.008	-0.000	-0.001
	(0.20)	(-1.78)	(-0.30)	(-0.23)
Industry Leverage	0.371	0.326	0.364	0.340
	(5.50)	(4.28)	(6.99)	(5.99)
Market to Book	-0.010	-0.011	-0.032	-0.029
	(-1.90)	(-1.93)	(-5.71)	(-5.08)
Fixed Assets	0.080	0.098	0.044	0.028
	(2.37)	(2.57)	(1.97)	(1.08)
Profitability	0.131	0.120	-0.071	-0.034
	(1.63)	(1.37)	(-1.49)	(-0.62)
Size	-0.019	-0.025	-0.005	-0.019
	(-3.56)	(-2.71)	(-1.28)	(-2.71)
Volatility	-0.159	-0.212	-0.135	-0.198
	(-1.34)	(-1.58)	(-1.98)	(-2.68)
Abnormal Earnings	0.008	0.009	0.007	0.006
	(1.44)	(1.61)	(1.34)	(1.32)
Tax Credit	0.042	0.178	-0.023	0.007
	(0.34)	(1.28)	(-0.27)	(0.07)
Loss Carry F orward	0.043	0.051	0.020	0.024
	(2.12)	(2.49)	(1.66)	(1.90)
Rated	0.105	0.100	0.076	0.060
	(4.75)	(4.10)	(5.63)	(4.06)
Investment Grade	-0.082	-0.081	-0.081	-0.087
	(-6.49)	(-5.79)	(-7.88)	(-7.60)
CDS Trading	0.057	0.103	0.035	0.126
	(5.80)	(2.32)	(5.00)	(3.33)
Time Fixed Effects	X	X	X	X
Industry Fixed Effects	X	X	X	X
Clustered SE	X	X	X	X
Adj-R^2	0.325	0.304	0.524	0.519
Obs	2820	2820	2820	2820
CDS Obs	1370	1370	1370	1370

Panel B: Maturity Regression

	Book Leverage		Market Leverage	
	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)
Constant	5.299	11.473	5.818	12.117
	(1.97)	(2.28)	(2.23)	(2.43)
Leverage	0.176	-10.066	-1.584	-14.550
	(0.09)	(-1.09)	(-0.66)	(-1.26)
Asset Maturity	0.144	0.177	0.149	0.176
	(2.14)	(2.31)	(2.23)	(2.39)
Market to Book	-0.244	-0.242	-0.310	-0.715
	(-1.37)	(-1.14)	(-1.61)	(-1.44)
Size	0.103	-0.359	0.091	-0.312
	(0.35)	(-0.86)	(0.31)	(-0.79)
Volatility	-2.372	-4.742	-2.474	-4.984
	(-0.44)	(-0.80)	(-0.46)	(-0.83)
Abnormal Earnings	0.078	0.169	0.086	0.144
	(0.42)	(0.76)	(0.46)	(0.68)
CP Program	-1.711	-1.417	-1.695	-1.568
	(-3.58)	(-2.63)	(-3.59)	(-3.22)
Tax Credit	13.763	15.209	13.796	13.997
	(1.71)	(1.89)	(1.73)	(1.75)
Loss Carry Forward	1.059	1.485	1.102	1.454
	(1.22)	(1.68)	(1.27)	(1.72)
Rated	-0.118	0.777	0.036	0.708
	(-0.13)	(0.52)	(0.04)	(0.51)
Investment Grade	0.977	-0.062	0.818	-0.486
	(1.52)	(-0.06)	(1.22)	(-0.37)
CDS Trading	1.864	4.016	1.934	4.514
	(3.39)	(2.13)	(3.63)	(2.26)
Time Fixed Effects	X	X	X	X
Industry Fixed Effects	X	X	X	X
Clustered SE	X	X	X	X
Adj-R^2	0.092	0.083	0.092	0.084
Obs	2820	2820	2820	2820
CDS Obs	1370	1370	1370	1370

Panel C: CDS Regression

	Book Leverage		Market Leverage	
	Probit	Two Stage Probit	Probit	Two Stage Probit
	(1)	(2)	(3)	(4)
Constant	-8.613	-7.775	-8.428	-7.803
	(-18.19)	(-14.99)	(-17.84)	(-15.18)
Leverage	2.464	1.599	2.967	2.367
	(10.26)	(2.28)	(8.41)	(2.46)
Debt Maturity	0.026	0.004	0.027	0.007
	(5.65)	(0.18)	(5.91)	(0.33)
Market to Book	-0.280	-0.313	-0.141	-0.224
	(-6.86)	(-7.15)	(-3.10)	(-3.69)
Size	0.608	0.576	0.576	0.556
	(18.53)	(17.61)	(17.92)	(17.41)
Volatility	2.419	2.238	2.398	2.230
	(2.53)	(2.40)	(2.50)	(2.39)
Abnormal Earnings	-0.017	-0.014	-0.014	-0.010
	(-0.20)	(-0.17)	(-0.16)	(-0.12)
Bond Turnover	0.070	0.082	0.072	0.082
	(2.92)	(3.49)	(3.05)	(3.50)
Rated	1.697	1.788	1.681	1.764
	(5.18)	(5.31)	(5.09)	(5.23)
Investment Grade	0.410	0.349	0.443	0.420
	(5.11)	(3.55)	(5.37)	(3.64)
Time Fixed Effects	X	X	X	X
Industry Fixed Effects	X	X	X	X
Adj-R^2	0.326	0.289	0.317	0.290
Obs	2820	2820	2820	2820
CDS Obs	1370	1370	1370	1370

Table 6: Changes in Leverage and Debt Maturity around CDS Introduction — CDS Firms versus Matched Sample, Univariate Difference in Difference Analysis

This table presents univariate analysis of changes in leverage and maturity during the year of CDS introduction (year t) relative to year t-1 and from year t–1 to t+1. All variables are expressed in changes relative to a matched firm (variable definitions are in Table 1). The matched sample of non-CDS firms is chosen based on propensity scores obtained by estimating a probit model of the likelihood of CDS trading similar to the one reported in Panel C of Table 5. In such model, to guarantee that no outcome variable is included as a regressor, all independent variables are lagged by one year. Further, to guarantee that firms are on parallel trends prior to CDS introduction, one year changes in leverage and debt maturity are also included as regressors. We report difference in difference estimates for the cases where we match each CDS firm with the closest 1, 2, 3 and 4 control firms (respectively), based on propensity score. The sample is composed of non-financial firms in the S&P 500 index during the 2002-2009 period.

Number of Matches per CDS Firm	1		2		3		4	
	Year t–1 to t	Year t–1 to t+1	Year t–1 to t	Year t–1 to t+1	Year t–1 to t	Year t–1 to t+1	Year t–1 to t	Year t–1 to t+1
Δ Book Leverage	0.029	0.042	0.027	0.038	0.022	0.032	0.023	0.028
	(3.85)	(4.25)	(3.70)	(4.29)	(3.06)	(3.75)	(3.19)	(3.39)
Δ Market Leverage	0.020	0.021	0.019	0.020	0.016	0.017	0.017	0.014
	(2.79)	(2.25)	(2.87)	(2.47)	(2.63)	(2.26)	(2.74)	(1.87)
Δ Debt Maturity	1.249	0.958	0.986	0.748	0.928	0.800	0.948	0.654
	(2.69)	(1.84)	(2.61)	(1.74)	(2.52)	(1.92)	(2.53)	(1.52)
Δ Bond to Total Asset	0.021	0.037	0.016	0.034	0.011	0.028	0.009	0.023
	(2.50)	(3.33)	(2.09)	(3.70)	(1.47)	(3.25)	(1.31)	(2.80)
Δ Bond Maturity	0.889	0.721	0.745	0.642	0.628	0.672	0.604	0.517
	(1.91)	(1.43)	(2.08)	(1.57)	(1.77)	(1.65)	(1.66)	(1.24)
CDS Obs	140	140	140	140	140	140	140	140
Unique Matches	73	73	110	110	121	121	133	133
Mean Distance	0.010	0.010	0.015	0.015	0.018	0.018	0.022	0.022
Max Distance	0.046	0.046	0.099	0.099	0.099	0.099	0.099	0.099

Table 7: Changes in Leverage and Debt Maturity around CDS Introduction — CDS Firms versus Matched Sample, Multivariate Analysis

This table presents regression results of changes in leverage and maturity on changes in the explanatory variables defined in Tables 3. All variables are expressed in changes relative to a matched firm (variable definitions are in Tables 1 and 3.). Industry and year fixed effects are in all regressions. The matched sample of non-CDS firms is chosen based on propensity scores obtained by estimating a probit model of the likelihood of CDS trading similar to the one reported in Panel C of Table 5. In such model, to guarantee that no outcome variable is included as a regressor, all independent variables are lagged by one year. Further, to guarantee that firms are on parallel trends prior to CDS introduction, one year changes in leverage and debt maturity are also included as regressors. We report results only for the case where each CDS firm is matched to two control firms. The sample is composed of non-financial firms in the S&P 500 index during the 2002-2009 period.

Panel A: Leverage Regression

	Book Leverage		Market Leverage	
	Year t–1 to t	Year t–1 to t+1	Year t–1 to t	Year t–1 to t+1
Constant	-0.019	-0.048	-0.006	-0.016
	(-2.30)	(-4.48)	(-0.69)	(-1.68)
Δ Debt Maturity	0.001	0.001	0.000	0.000
	(2.01)	(0.65)	(0.08)	(0.04)
Δ Industry Leverage	0.414	0.275	0.512	0.517
	(4.14)	(2.42)	(4.90)	(4.42)
Δ Market to Book	0.000	0.000	0.000	0.000
	(10.80)	(2.62)	(2.25)	(2.32)
Δ Fixed Assets	-0.114	0.002	-0.174	-0.113
	(-1.36)	(0.02)	(-1.80)	(-1.28)
Δ Profitability	-0.480	-0.199	-0.549	-0.351
	(-3.46)	(-2.00)	(-4.29)	(-3.88)
Δ Size	0.014	-0.023	0.031	0.019
	(0.82)	(-1.30)	(1.83)	(1.20)
Δ Volatility	0.384	-0.848	0.436	-1.198
	(1.48)	(-3.12)	(1.76)	(-4.69)
Δ Tax Credit	-0.191	-0.265	0.049	-0.113
	(-0.81)	(-0.68)	(0.22)	(-0.38)
Δ Loss Carry Forward	0.365	0.023	0.270	-0.003
	(4.94)	(0.51)	(3.47)	(-0.14)
Δ Abnormal Earnings	-0.042	0.010	-0.021	0.015
	(-4.36)	(0.50)	(-2.14)	(0.59)
Δ Investment Grade	-0.002	-0.013	-0.030	-0.037
	(-0.09)	(-0.98)	(-1.51)	(-2.46)
CDS Trading	0.015	0.030	0.009	0.010
	(2.30)	(3.64)	(1.66)	(1.39)
Time Fixed Effects	X	X	X	X
Industry Fixed Effects	X	X	X	X
Adj-R^2	0.306	0.255	0.422	0.399
Obs	420	420	420	420

Panel B: Maturity Regression

	Book Leverage		Market Leverage	
	Year	Year	Year	Year
	t–1 to t	t–1 to t+1	t–1 to t	t–1 to t+1
Constant	-0.462	-0.338	-0.563	-0.396
	(-0.90)	(-0.55)	(-1.09)	(-0.66)
Δ Leverage	6.336	1.393	2.421	0.511
	(1.79)	(0.54)	(0.68)	(0.22)
Δ Asset Maturity	0.241	0.142	0.254	0.140
	(1.74)	(1.39)	(1.79)	(1.38)
Δ Market to Book	-0.004	-0.005	-0.003	-0.004
	(-0.53)	(-1.21)	(-0.37)	(-1.24)
Δ Size	0.189	-0.360	0.189	-0.412
	(0.23)	(-0.49)	(0.22)	(-0.58)
Δ Volatility	23.938	22.821	23.384	22.376
	(0.85)	(1.01)	(0.81)	(0.97)
Δ Tax Credit	-2.700	17.811	-4.121	17.535
	(-0.18)	(1.79)	(-0.29)	(1.85)
Δ Loss Carry Forward	-4.262	2.214	-2.747	2.253
	(-1.18)	(2.40)	(-0.79)	(2.56)
Δ Abnormal earnings	0.678	-0.253	0.473	-0.246
	(1.28)	(-1.23)	(0.89)	(-1.20)
Δ Investment Grade	-1.485	0.291	-1.488	0.291
	(-1.42)	(0.72)	(-1.41)	(0.73)
CDS Trading	0.923	0.879	1.038	0.916
	(2.26)	(1.90)	(2.52)	(1.93)
Time Fixed Effects	X	X	X	X
Industry Fixed Effects	X	X	X	X
Adj-R^2	0.044	0.029	0.037	0.029
Obs	420	420	420	420

Table 8: CDS Liquidity Proxies

This table presents two-stage least squares (2SLS) regression results of leverage and maturity on the explanatory variables in Tables 3, plus CDS market liquidity proxies for the sub-sample of firms for which CDS Trading equals one. CDS Count is defined as the log number of daily CDS quotes on Bloomberg during year t (across all maturities). Bid-Ask Spread is defined as the average daily bid-ask spread for CDSs on the firm's debt, as disseminated on Bloomberg, during year t. All other variables are defined in Tables 1 and 3. Year and industry fixed effects are included in all regressions. The sample is composed by non-financial firms in the S&P 500 index for which a CDS is trading during the 2002-2009 period.

Panel A: Leverage Regression

	Book Leverage				Market Leverage			
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	0.457	0.554	0.489	0.600	0.396	0.441	0.409	0.460
	(6.12)	(6.72)	(6.63)	(7.11)	(7.54)	(7.94)	(7.77)	(8.06)
Debt Maturity	-0.001	-0.015	-0.001	-0.014	-0.001	-0.007	-0.001	-0.007
	(-1.80)	(-2.98)	(-1.92)	(-2.92)	(-2.06)	(-2.20)	(-2.13)	(-2.15)
Industry Leverage	0.372	0.304	0.357	0.288	0.335	0.300	0.328	0.293
	(4.41)	(3.31)	(4.28)	(3.15)	(5.29)	(4.34)	(5.22)	(4.23)
Market to Book	-0.008	-0.011	-0.003	-0.005	-0.056	-0.057	-0.053	-0.054
	(-0.76)	(-1.04)	(-0.29)	(-0.46)	(-8.15)	(-8.04)	(-7.71)	(-7.60)
Fixed Asset	0.099	0.148	0.101	0.148	0.054	0.077	0.055	0.077
	(2.49)	(3.43)	(2.53)	(3.45)	(1.99)	(2.63)	(2.00)	(2.63)
Profitability	0.080	0.096	0.069	0.080	-0.043	-0.037	-0.048	-0.045
	(0.76)	(0.90)	(0.67)	(0.76)	(-0.60)	(-0.51)	(-0.68)	(-0.63)
Size	-0.019	-0.019	-0.017	-0.016	-0.008	-0.008	-0.007	-0.007
	(-2.42)	(-2.43)	(-2.32)	(-2.19)	(-1.46)	(-1.47)	(-1.40)	(-1.32)
Volatility	0.003	0.137	-0.030	0.086	0.005	0.070	-0.011	0.046
	(0.02)	(0.80)	(-0.18)	(0.52)	(0.04)	(0.59)	(-0.09)	(0.40)
Abnormal Earnings	0.020	0.015	0.020	0.015	0.011	0.008	0.011	0.009
	(2.02)	(1.59)	(1.97)	(1.57)	(1.43)	(1.12)	(1.40)	(1.11)
Tax Credit	-0.121	0.112	-0.113	0.108	-0.103	0.001	-0.100	-0.002
	(-0.92)	(0.71)	(-0.85)	(0.68)	(-1.18)	(0.01)	(-1.14)	(-0.02)
Loss Carry Forward	0.105	0.090	0.092	0.071	0.026	0.019	0.021	0.011
	(1.08)	(0.93)	(0.96)	(0.75)	(0.39)	(0.28)	(0.31)	(0.16)
Investment Grade	-0.059	-0.053	-0.054	-0.045	-0.061	-0.058	-0.059	-0.054
	(-3.43)	(-3.01)	(-3.16)	(-2.58)	(-4.56)	(-4.24)	(-4.42)	(-3.97)
CDS Count	0.006	0.011			0.003	0.005		
	(1.53)	(2.45)			(0.89)	(1.53)		
CDS Bid-Ask			-0.169	-0.230			-0.079	-0.106
			(-2.87)	(-3.64)			(-2.32)	(-2.88)
Time Fixed Effects	X	X	X	X	X	X	X	X
Industry Fixed Effects	X	X	X	X	X	X	X	X
Clustered SE	X	X	X	X	X	X	X	X
Adj-R^2	0.308	0.315	0.316	0.322	0.517	0.517	0.519	0.519
Obs	1370	1370	1370	1370	1370	1370	1370	1370

Panel B: Maturity Regression

	Book Leverage				Market Leverage			
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Constant	6.553	9.223	8.239	11.376	7.308	9.996	8.910	11.962
	(1.51)	(1.15)	(1.88)	(1.34)	(1.68)	(1.13)	(2.03)	(1.32)
Leverage	-4.065	-8.508	-4.407	-9.413	-6.561	-12.076	-6.907	-13.049
	(-1.36)	(-0.76)	(-1.47)	(-0.82)	(-1.65)	(-0.79)	(-1.73)	(-0.85)
Asset Maturity	0.164	0.176	0.163	0.177	0.162	0.169	0.160	0.168
	(1.47)	(1.51)	(1.46)	(1.51)	(1.45)	(1.49)	(1.44)	(1.48)
Market to Book	0.004	-0.034	0.095	0.079	-0.398	-0.765	-0.331	-0.722
	(0.01)	(-0.08)	(0.24)	(0.19)	(-0.86)	(-0.72)	(-0.71)	(-0.69)
Size	0.129	0.018	0.210	0.093	0.157	0.095	0.240	0.175
	(0.33)	(0.04)	(0.54)	(0.19)	(0.41)	(0.21)	(0.63)	(0.40)
CP Program	-1.826	-1.691	-1.860	-1.716	-1.859	-1.784	-1.897	-1.818
	(-2.75)	(-2.26)	(-2.79)	(-2.30)	(-2.82)	(-2.49)	(-2.86)	(-2.54)
Volatility	8.200	8.685	7.193	7.534	8.825	9.723	7.878	8.754
	(0.97)	(1.03)	(0.87)	(0.92)	(1.06)	(1.10)	(0.97)	(1.02)
Abnormal Earnings	-0.283	-0.201	-0.297	-0.204	-0.324	-0.296	-0.342	-0.310
	(-0.55)	(-0.36)	(-0.59)	(-0.37)	(-0.63)	(-0.57)	(-0.68)	(-0.61)
Tax Credit	16.031	16.234	16.288	16.559	15.761	15.690	15.989	15.935
	(1.58)	(1.59)	(1.61)	(1.63)	(1.56)	(1.54)	(1.59)	(1.57)
Loss Carry Forward	0.147	0.706	-0.403	0.167	-0.132	0.065	-0.692	-0.504
	(0.03)	(0.17)	(-0.09)	(0.04)	(-0.03)	(0.01)	(-0.15)	(-0.11)
Investment Grade	0.716	0.413	0.936	0.622	0.552	0.181	0.764	0.366
	(0.75)	(0.33)	(0.99)	(0.52)	(0.57)	(0.12)	(0.79)	(0.25)
CDS Count	0.394	0.421			0.383	0.394		
	(1.94)	(1.94)			(1.89)	(1.91)		
CDS Bid-Ask			-5.781	-6.717			-5.569	-6.112
			(-2.08)	(-1.95)			(-2.01)	(-2.06)
Time Fixed Effects	X	X	X	X	X	X	X	X
Industry Fixed Effects	X	X	X	X	X	X	X	X
Clustered SE	X	X	X	X	X	X	X	X
Adj-R^2	0.100	0.098	0.102	0.099	0.102	0.098	0.103	0.099
Obs	1370	1370	1370	1370	1370	1370	1370	1370