Capital Structure, Derivatives and Equity Market Quality

Abstract

We examine how the existence of individual equity options, publicly traded corporate bonds and credit default swap (CDS) contracts affect equity market quality for a panel of NYSE listed firms during 2003-2007. We find that firms with listed equity options have more liquid equity and more efficient stock prices. By contrast, firms with traded CDS contracts have less liquid equity and less efficient stock prices, especially when these firms or their capital structures are complex (i.e., hard to value). The impact of having a publicly traded bond market is somewhat mixed; however, we observe a significantly negative role for all trading activity in the related markets (i.e., in both bonds and options) for efficiency and liquidity. Taken together, these results imply an overall negative effect of related markets when those markets are tied to debt in a firm's capital structure.

1 Introduction

Do multiple security markets, representing different claims on the same underlying asset, impact equity market quality? Although this question is not new, it has re-emerged as a central issue of debate among policymakers, academics, and financial market participants. The growth of derivatives markets, hedge funds and multi security trading strategies has brought increasing attention to important questions regarding their impact on liquidity and market efficiency.[1] The main goal of this paper is to examine the effect of related, traded securities on equity market quality. In particular, using a broad panel of New York Stock Exchange (NYSE) stocks for the period 2003-2007, we examine the impact of individual equity options, publicly traded corporate bonds and credit default swap (CDS) contracts on both liquidity and price efficiency in equity markets. On one hand, derivatives are valuable hedging tools. They can also provide informed traders with incentives to trade, facilitating price discovery. However, there may be costs as well. For example, prices may become less informative if the new market expands informed traders' strategy sets, making it more difficult for market makers to learn from their trades (as in Biais and Hillion, 1994). Equity markets may also become less liquid if the ability to hedge a position in a related market increases the willingness of risk-averse informed traders to trade, driving out uninformed liquidity traders (as in Dow, 1998). Given the theoretical ambiguity of the impact of derivatives markets on equity market quality, the dominant effect is an empirical question.

Prior literature has focused on the impact of equity options markets on equity market quality; however, when there is debt in a firm's capital structure, the markets for debt-

[1] Credit default swaps (CDS) have been particularly controversial. See e.g., *Testimony Concerning Credit Default Swaps by Erik Sirri, Director, Division of Trading and Markets, U.S. Securities and Exchange Commission, Before the House Committee on Agriculture October 15, 2008*: "The SEC has a great interest in the CDS market because of its impact on the debt and cash equity securities markets and the Commission's responsibility to maintain fair, orderly, and efficient securities markets. These markets are directly affected by CDSs due to the interrelationship between the CDS market and the claims that compose the capital structure of the underlying issuers on which the protection is written. In addition, we have seen CDS spreads move in tandem with falling stock prices, a correlation that suggests that activities in the OTC CDS market may in fact be spilling over into the cash securities markets"

linked securities can become important. Equity can be viewed as a call option on the firm's assets with a strike price equal to the value of the firm's debt (as in Merton (1974)), and any information regarding the value of the firm's assets can produce trading incentives in both equity- and debt-linked securities. This view of the firm suggests a precise pricing relationship between debt and equity which arbitrageurs should identify and correct via their trades. In fact, capital structure arbitrage, which involves trading in both equity and credit derivatives to take advantage of mispricing across different securities representing claims on the same firm, has grown in popularity among hedge funds (see Yu (2006) for a description and analysis of the profitability of the strategy). Cross-market trading by these arbitrage investors may play a role in equity market quality. In addition, Gorton and Pennacchi (1990) suggest a separate channel through which capital structure might impact equity market quality: by issuing debt, managers can create information-insensitive securities. As a result, uninformed traders are expected to buy the firm's debt while the informed traders buy equity.

Market quality has several dimensions and we examine a range of measures that have been suggested in the market microstructure literature. Specifically, we divide market quality along two dimensions: liquidity and price efficiency. We further divide liquidity variables into transactions cost and trading imbalance categories. The latter category measures asymmetry in trading costs between buy and sell transactions. The price efficiency measures that we use assume that efficient stock prices follow a random walk and are constructed to capture deviations of price movements from this benchmark. Our primary objective is to estimate how the existence of related markets affects all of these characteristics of equity market quality.

We report several important findings. The first and most important of these is that the related markets impact market quality, albeit in different ways. Consistent with prior literature, we find that firms with listed equity options have more liquid equity and more efficient stock prices. By contrast, firms with traded CDS contracts have less liquid equity and less efficient stock prices. The impact of CDS contracts on market quality is very robust, and, in the case of liquidity, is economically larger than the impact of the other markets. The overall impact of having publicly traded bonds is also negative but results are more mixed (i.e., traded bonds are generally associated with higher trading costs and lower price efficiency, but lower trading imbalances). When we rank the estimated effects of the related markets, we find that the impact of CDS markets is generally most negative, followed by corporate bond markets, and then equity options (which are generally beneficial).

Related markets impact market quality by their existence alone (e.g., more market participants monitoring different aspects of a firm) or via market participants trading in these markets. Our second key finding is that trading in both bond and options markets appears to reduce efficiency and liquidity in the equity market. The third main finding is that leverage is associated with lower equity market quality, even after controlling for the independent effects of traded bonds and CDS contracts. These two findings are interesting because they shed some light on a potential mechanism by which the related markets can have such different implications for equity markets (i.e., generally positive role for equity options and negative role for debt-linked securities): it is possible that dividing claims to firms' assets via capital structure decisions increases the complexity associated with analyzing equity. The ability to trade in markets tied to debt may exacerbate this problem. The finding that greater leverage in a firm's capital structure is associated with lower liquidity in the equity market, even after controlling for equity price volatility, is consistent with findings in Lipson and Mortal (2009) and Frieder and Martell (2006); however, the efficiency finding is new to the literature. Finally, our identification of a proxy for passive trading activity in the stock, as opposed to speculative or informed trading, shows that passive, multi-security trading is associated with higher equity market quality. This result is useful for two reasons: (1) it suggests that passive trades due to hedging demands are beneficial, rather than destabilizing and (2) controlling for passive multi-security trading allows us to isolate the impact of speculative trading in the related markets analysis.

As mentioned previously, our results indicate that CDS markets are particularly destabilizing. One potential concern is that CDS firms could be different from other firms in that they have credit ratings and publicly traded bonds. Firms with public bonds and credit ratings may differ from other firms in ways that are systematically related to equity market quality. In order to control for potential unobserved differences between CDS firms and non-CDS firms, we repeat the analysis for the subsample of firms with traded public debt. The main results of a negative role for CDSs on equity market quality remain.

To understand the dynamic relationship between related markets and equity market efficiency we also introduce firm fixed effects in our empirical specification. This forces all variation in the related markets variables to be driven by firm-level changes in whether such a market exists. The interpretation of the results of these regressions is dynamic (it captures the impact of introducing a market for a related security), rather than cross-sectional as in the main analysis. It also controls for any unobserved heterogeneity between firms with and without related markets. We find strong evidence of a negative role for the introduction of debt-linked markets (public bond and CDS) for both stock price efficiency and trading costs. We do, however, find more balanced trading activity following the introduction of these markets. As in the main analysis, the implications of the introduction of options markets for both the price efficiency and liquidity dimensions of equity market quality are positive.

Our paper contributes to the literature on the impact of derivatives markets for equity market quality. Biais and Hillion (1994) and Dow (1998), show that when there are asymmetrically informed agents, the introduction of a related securities market can, in some circumstances, reduce market quality. In a more extreme case, Bhattacharya, Reny and Spiegel (1995) describe destructive interference, in which a new securities market can cause collapse of the existing market. Given the ambiguous theoretical impact of related markets, prior empirical work has focused on estimating the impact of equity options on equity market quality; however, there is little work on the impact of traded debt or of debt derivatives.

Our paper helps fill this gap.

This paper also sheds light on recent findings regarding the relationship between equity market quality and capital structure. Lipson and Mortal (2009) report that firms with more liquid equity have lower leverage and tend to issue new equity rather than debt. Frieder and Martell (2006) report similar findings. Our findings are complementary in that we identify the existence of and trading in debt-linked securities markets as one mechanism by which capital structure choice impacts equity market quality. In particular, we find evidence consistent with a negative role for potentially speculative trading when firms have publicly traded debt. This effect is magnified when there are traded CDS contracts on that debt. Thus, it is may not be debt alone that drives the prior findings of a negative relationship between leverage and equity market quality, but rather the creation of multiple venues in which informed traders and speculators execute their trades. Ours is the first paper (to our knowledge) to examine empirically the potential trade-based links among capital structure, liquidity and price efficiency.

The most recent financial crisis has brought new policy attention to the question of how the introduction of new markets impacts existing ones and the role of credit default swaps in particular.[2] Informed policy making requires the identification and measurement of both the benefits and costs associated with financial innovation. Because derivatives markets have developed rapidly, there have been few academic studies documenting empirically the dominant effects (and their magnitudes) of having traded CDS contracts. Our results strongly suggest a negative role for CDSs in equity price efficiency. However, we emphasize that our findings identify *one* cost associated with traded CDSs on a firm's debt. This does not rule out other potential benefits of CDSs, particularly the ability to hedge, which can decrease the cost of supplying capital to firms and increase suppliers' willingness to extend credit. What is important is that each of the potential costs and benefits associated with CDSs be identified and measured. Our analysis takes one step in this direction.

[2]See, for example Stulz (2009) for a discussion of debates regarding CDS markets.

Multi-asset trading strategies are growing in popularity among investors. In fact, *Institutional Investor's* October 2008 issue, "A Guide to Multi-Asset Trading Strategies" is devoted to this subject. In response to demand from investors, there have been recent successful launches of cross-market trading platforms such as *Realtick*, cross-market valuation tools such as *PrimeSource* by NYSE/EuroNext and credit spread valuation tools such as Moody's *KMV Credit Edge* which uses information from equity, bond and credit default swap markets. These products all highlight the potential growing importance of linkages between related markets.

This paper is organized as follows. Section 2 discusses related literature. Section 3 describes the data and market quality variable construction. The empirical methodology and results of the investigation of the impact of option, bond and CDS markets on equity market quality are given in Section 4. Robustness analysis, including the dynamic examination of introducing a related market is given in Section 5. Section 6 concludes.

2 Literature

The idea that related markets can generate liquidity and efficiency externalities underlies much of the analysis in this paper. There is a substantial theoretical literature on the impact of the introduction of a related market on an existing security market (see, e.g., Mayhew (2000) for an excellent survey). Overall, the theoretical effect is ambiguous. The empirical literature has typically sought to answer this question by analyzing linkages between individual options and stock markets. Overall, findings suggest that individual equity options improve equity market quality (DeTemple and Jorion (1990); Kumar, Sarin, and Shastri (1998)) and that these options markets can be preferred venues for informed traders (Easley, O'Hara and Srinivas (1998), Chan, Chung and Fong (2002), Cao, Chen and Griffin (2005) and Pan and Poteshman (2006)). Despite the renewed attention to this issue of stock and options market linkages (Muravyev, Pearson and Broussard (2011)), empirical work on the linkages between stock and debt markets remains scarce. Understanding the impact of trading in debt-linked securities on equity market quality is of particular interest because, under the trade-off theory of capital structure, managers should choose debt levels to balance the costs and benefits of debt. As Groton and Pennacchi (1990) show, corporate debt issuance is analogous to the creation of an informationally insensitive security, causing uninformed traders to buy debt and informed traders to buy equity. Thus, debt-linked securities markets are expected to impact equity market quality.

Although we are unaware of studies that have explicitly examined the role of corporate debt markets on liquidity and overall stock price efficiency, there are a handful of recent papers (e.g., Downing, Underwood and Xing (2009) and Ronen and Zhou (2010)) that examine lead-lag effects in individual stock and corporate bond returns. Overall findings on whether corporate bonds contribute to price discovery are mixed. Corporate bonds are traded over the counter; however many are subject to mandatory trade reporting. The impact of the introduction of bond information dissemination on the TRACE system on corporate bond market liquidity (e.g., transaction costs) has also been studied. Bessembinder, Maxwell and Venkataraman (2006), Edwards, Harris and Piwowar (2007), and Goldstein, Hotchkiss and Sirri (2007) all report increases in bond market quality following trade reporting. In addition to its effect on bond markets, the information disseminated on the TRACE system may also have equity market implications.

Corporate debt derivatives markets have received considerable attention in the literature over the past few years. Credit default swaps are essentially insurance on a firm's risky debt. They are useful for hedging and also as a tool for speculating on credit risk. Recent studies of insider trading in credit default swap markets (e.g., Berndt and Ostrovnaya (2007); Acharya and Johnson (2007, 2009)) typically find evidence of informed trading in CDS markets.[3] This insider trading can improve market quality by improving price informativeness; however, it

[3]Researchers have also found that prices in CDS markets are more informative about the issuing companies' credit quality than the prices of bonds (see e.g., Blanco, Brennan, and Marsh (2005)).

can also decrease market quality if liquidity traders are driven out of the market. In contemporaneous work, Das, Kalimipalli and Nayak (2010) examine the impact of CDS trading on the quality of the market for corporate bonds. Their findings are consistent with our equity market findings in that they report evidence that the introduction of CDS trading made corporate bond markets less efficient and less liquid. Ashcraft and Santos (2009) investigate the impact of CDS markets on firms' cost of debt and find no impact for the average firm and a negative effect (i.e., higher credit spreads) for a subsample of informationally opaque firms. Our equity market analysis complements the findings in this recent literature by estimating the overall impact of traded CDS contracts for equity market quality in a broad cross-section of firms.

Finally, our paper is related more generally to the literature on related markets and cross-market spillovers. Amihud, Lauterbach and Mendelson (2003) examine market fragmentation and the impact of market size on liquidity. When two identical securities of the same company are traded in the market they find that the stock's value is depressed due to fragmentation. A similar argument may explain the interactions among leverage, debt-linked securities and equity market quality that we observe. The market fragmentation that occurs via separate markets for claims across a firm's capital structure may cause a reduction in equity market quality. Spiegel (2008) identifies several important puzzles relating to cross-market liquidity, and in the extreme, poses the question: "Why do some markets exist and not others?" Our evidence regarding the impact of the existence of a related market on the liquidity and efficiency of equities may shed some light on this larger question.

3 Data

3.1 Sample Construction

We use data from several sources. We begin with all NYSE listed firms from the CRSP/Compustat merged database. We then use the NYSE's Trade and Quote (TAQ) database to construct market quality measures for these firms. Because we are, in part, interested in isolating the potential impact of the ability to trade in related markets on informed traders' activities, we introduce a proxy for passive multi-security trading using program trading information from NYSE's proprietary Consolidated Equity Audit Trail Data (CAUD).[4] Option listing, trading volume and price data are from OptionMetrics. Corporate bond data for all bonds for which trades are publicly disseminated on the FINRA TRACE (Trade Reporting and Compliance Engine) are from TRACE.[5] Finally, we use Bloomberg to identify all firms for which we observe CDS quotes on their debt. Given the wide use of Bloomberg among financial market participants, we assume that CDS contracts for which there is quote information on Bloomberg are actually traded.[6] The OptionMetrics, TRACE and CDS data are matched with the CRSP/Compustat database based on 6-digit Cusips; TAQ and CAUD data are matched based on Cusips and, where necessary, ticker identifiers from the TAQ Master File. The sample period covers the years 2003-2007 because TRACE reporting did not begin until July 2002 and our NYSE CAUD data end in 2007. For inclusion in the final sample, we require non-missing data on all variables of interest.

[4]The NYSE account types have been used in a handful of other papers. For example, using the same data set, Kaniel, Saar, and Titman (2007) investigate retail trading and Boehmer and Kelley (2009) look at the relationship between informational efficiency and institutional trading. Boehmer, Jones, and Zhang (2008) analyze differences in the informativeness of short selling across account types.

[5]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 just 50 high yield issues as well as all investment grade issues of $1 billion or more. By October 2004, dissemination for all TRACE-eligible bonds was complete.

[6]We are extremely grateful to Alessio Saretto for providing us with the Bloomberg CDS data.

3.2 Market Quality Measures: Data

We are interested in two dimensions of market quality: liquidity and price efficiency. We examine two measures of trading costs; three measures of order imbalances; and two price efficiency measures, both of which capture deviations of price movements from a random walk. We use intraday data to construct all variables; however, the liquidity variables are aggregated to the daily level and the stock price efficiency measures are calculated at monthly intervals (due to the relatively large number of transactions required for reliable estimation of the Hasbrouck (1993) efficiency measure, described below).

We rely on the TAQ data to construct all equity market quality measures. We use only trades and quotes that occur during regular market hours. For trades, we require that TAQ's CORR field is equal to zero, and the COND field is either blank or equal to *, B, E, J, or K. We eliminate trades with non-positive prices or sizes. We also exclude a trade if its price is greater than 150% or less than 50% of the price of the previous trade. We include only quotes that have positive depth for which TAQ's MODE field is equal to 1, 2, 3, 6, 10, or 12. We exclude quotes with non-positive ask or bid prices, or where the bid price is higher than the ask price. We require that the difference between bid and ask be less than 25% of the quote midpoint. These filters are the same as those that are applied in Boehmer and Kelley (2009).

For each stock, we aggregate all trades during the same second that execute at the same price and retain only the last quote for every second if multiple quotes are issued. We assume no trade reporting delay and make no time adjustment (Lee and Ready (1991); Bessembinder (2003)).

3.3 Variable Construction

3.3.1 Liquidity Measures

The five (inverse) liquidity variables fall into two categories: transactions costs and order imbalances.

Transactions Costs

We compute time-weighted quoted spreads and trade-weighted effective spreads (QS and ES, respectively) from TAQ as measures of trading costs. Effective spreads are computed as twice the absolute difference between the execution price and the quote midpoint prevailing when the trade is reported. Quoted spreads are the difference between ask and bid prices, weighted by the duration for which a quote is valid. To normalize both QS and ES, we divide by the closing price of the stock. Lower spreads are interpreted as greater equity market liquidity.

Order Imbalances

We estimate daily imbalances of dollar volume, shares and the number of trades from TAQ ($|dollarimb|$, $|shareimb|$ and $|tradeimb|$, respectively). Trade direction is determined using Lee and Ready's (1991) algorithm. We take the ratio of the absolute value of buy minus sell transactions to total transactions. Small imbalances imply that buyers and sellers trade with similar aggressiveness. While spreads measure the level of trading costs, one can view the balance of order flow as a measure of the asymmetry of trading costs. For example, a large imbalance implies that the costs associated with buy orders differ substantially from the costs associated with sell orders. Generally, we regard lower imbalances as an indicator of greater market quality.

Efficiency Measures

Hasbrouck (1993) decomposes the (log) transaction price, p_t, into a random walk component,

m_t, and a transitory pricing error, s_t, where t represents transaction time:

$$p_t = m_t + s_t$$

Under the assumption that informationally efficient prices follow a random walk, we measure efficiency based on the distance between actual transaction price movements and a random walk.

The unobservable random walk component m_t represents the expectation of security value. Innovations in m_t reflect both new public information and the information content of order flow. The pricing error, s_t, which captures temporary deviations from the efficient price, may arise from the non-information-related portion of transaction costs, uninformed order imbalances, price discreteness, and dealer inventory effects. It is assumed to follow a zero-mean covariance-stationary process but may be serially correlated or correlated with the random walk innovation of the efficient price process. Because the pricing error has a mean of zero, its standard deviation, σ_s, is a measure of its magnitude. Intuitively, σ_s describes how closely transaction prices follow the efficient price over time, and can therefore be interpreted as an (inverse) measure of informational efficiency.

We follow Hasbrouck (1993) and estimate a lower bound for σ_s using a VAR system over $\{r_t, x_t\}$, where r_t is the first difference of p_t and x_t is a vector of explanatory variables whose innovations relate to innovations in m_t and s_t. Specifically, we impose the identification restriction that innovations in s_t must be correlated with $\{r_t, x_t\}$, and obtain the estimate of σ_s from the vector moving average representation of the VAR system(Beveridge and Nelson 1981). The VAR has five lags, and x_t is defined as a three-by one vector of the trade variables: (1) a trade sign indicator, (2) signed trading volume, and (3) the signed square root of trading volume. This structure of x_t allows for a concave relationship between prices and the trade series.

We follow Boehmer and Kelley (2009) and use all trade observations except when reported prices differ by more than 30% from the previous price, which we consider to be erroneous and eliminate from the sample. To sign trades, we assume that a trade is buyer-initiated if the price is above the prevailing quote midpoint (and seller-initiated for the converse). Midpoint trades are not signed, but we include them in the estimation (with $x = 0$). To eliminate overnight price changes, we restart each process at the beginning of each trading day. We estimate σ_s monthly. To assure meaningful estimates in this case, we only include stock-months with at least 200 stock transactions per month.

We use $V(s)$ or "pricing error" to refer to σ_s. *Hasbrouck* is defined as $V(s)$, normalized by $V(p)$, the standard deviation of (log) transaction prices. *Hasbrouck* is our main stock price efficiency measure.

Similar to Boehmer and Kelly (2009) and Choi, Getmansky and Tookes (2009), we construct an alternative efficiency measure based on return autocorrelations. We estimate quote midpoint return autocorrelations ($|AR|$), using 30-minute quote midpoint return data over one-month horizons. We exclude periods without quote changes to avoid using stale quotes in these computations.

Like the *Hasbrouck* measure, $|AR|$ captures deviations of stock prices from a random walk. Low (absolute) return autocorrelations suggest that prices more closely follow a random walk. Both the *Hasbrouck* and $|AR|$ measures look over short horizons (transaction-to-transaction and 30-minute intervals, respectively), as traders are assumed to move very quickly to eliminate pricing errors in NYSE stocks (see Chordia, Roll, and Subrahmanyam, 2005). Unlike the *Hasbrouck* measure, the $|AR|$ measure is sensitive to price changes due to trade reversals and is calculated at uniform intervals that do not depend on trade intensity. We include the $|AR|$ measure for comparison (the two are generally consistent), but rely mainly on the *Hasbrouck* measure in interpreting our results.

3.3.2 Explanatory Variables

Related Markets

We include three related markets dummies: *opt* is a dummy variable equal to 1 if the firm has listed options, 0 otherwise; *trace* is a dummy variable equal to 1 if the firm's bond information is disseminated on the TRACE system[7]; *cds* is a dummy variable equal to 1 if the firm has a CDS traded on its debt (defined as firms for which there are CDS quotes on Bloomberg).[8] Of course, related markets can exist without a mechanism for disseminating quote and/or trade information (i.e., private bilateral trades). By "related markets," we refer to markets in which there is substantial trading activity and about which there is sufficiently broad dissemination of information that equity market participants (especially liquidity providers) can analyze. Coefficients on these three dummy variables in the regression analysis are interpreted as the impact of having a related market on the market quality variables.

In extended analysis, we also include trading activity in the option and bond markets. *Optvol* is the (log) sum of the dollar volume of all trades in the firm's listed stock options from OptionMetrics. *Bondvol* is the (log) sum of the dollar volume of all of the firm's bonds as reported on the TRACE system.[9] Note that for large trades, transaction size is not disseminated on TRACE. We set the value of trades reported as "greater than \$5 million" at their lower bound (\$5M). The idea behind including the trading activity measures is that related markets can impact equity market quality in two ways: (1) they can change incentives for market participants to gather price-relevant information and (2) they can change incentives for market participants to trade on price-relevant information. These information-gathering and trading incentives can have separate effects on market quality

[7]The TRACE system reveals information regarding transactions in a firm's publicly traded bonds to all market participants. In this way, TRACE eligibility could impact market quality beyond the potential impact of a firm having debt in its capital structure. See e.g., the discussion of the impact of TRACE on transparency in the corporate bond market Bessembinder and Maxwell (2008). To isolate the impact of the "related market" as distinct from the impact having debt, all regressions control for firms' debt-to-equity ratios.

[8]The Bloomberg historical CDS data has also been used in Das, Hanouna and Sarin (2009).

[9]Because there are zero trade days, *Optvol* and *Bondvol* are calculated as ln(dollar trading activity + \$1).

Control Variables

We control for stock market trading activity using two variables. The first, *dvolume,* is the natural log of total daily trading volume as reported on CRSP, times the closing price. The second, *program,* is the dollar volume of program trading, defined as the (log) sum of institutional buy and sell dollar volume for their program trades, based on the daily NYSE CAUD data.[10] The NYSE defines program trades as the trading of a basket of at least 15 NYSE securities valued at $1 million or more. Many of these trades are part of index arbitrage strategies, and it is not clear that they represent trading on firm-specific factors. Other program trades may bundle uninformed order flow, perhaps originating from index funds or a broker's retail clients, where the bundling serves as a way to signal the absence of security-specific information. We are interested in the impact of informed and speculative participants in related markets on equity market quality. Because the existence of related markets may generate passive multi-security trading we include the *program* variable to control for these passive transactions. To our knowledge, this proxy is new to the literature.

We include the firm's debt-to-equity ratio $\frac{debt}{equity}$ to address the potential concern that any findings regarding *trace* or *cds* are capturing the impact of debt in firms' capital structures rather than the related markets. This control is particularly important given recent findings in Lipson and Mortal (2009) that firms with low leverage have more liquid equity. The $\frac{debt}{equity}$ variable is defined as the sum of the firm's long term and current debt outstanding, divided by the end-of-quarter market capitalization (based on quarterly data for quarter *t-1*, from

[10] We obtained NYSE's proprietary Consolidated Audit Trail Data (CAUD) for the period January 2000 and August 2007. The CAUD cover nearly all trades executed at the NYSE and show, for each trade, the individual buy and sell orders executed against each other (or market maker interest). Each component is identified by an account type variable that gives some information on trader identity. Several different regulatory requirements include obligations to indicate: orders that are part of program trades, index arbitrage program trades, specialist trades, and orders from market makers in the stock who operate at other trading venues. We focus on program trades, taking the sum of buy and sell share volume for each day and security. We exclude trades that are cancelled or later corrected, trades with special settlement conditions, and trades outside regular market hours. Note that because we define program as the sum of buy and share volume, in order to directly compare the magnitude of this measure to the *dvolume* variable, we would divide the sum by 2.

Compustat). We also control for equity price *volatility*, defined as the square of the daily stock return in CRSP in all regressions.[11]

3.4 Descriptive Statistics

Descriptive statistics for all variables are presented in Table 1. There are 1,690 unique firms, with between 1357 and 1460 firms in the sample each year. There are 1,518,792 daily observations (used in the liquidity analysis) and 72,900 monthly observations (used in the efficiency analysis). We observe related markets for a significant number of firms during our sample period: 70% have traded options; 38% have bond information disseminated on the TRACE system; and 13% have a CDS quoted on the Bloomberg system. Descriptive statistics for these subsamples are presented in Panels B through D of Table 1. Unconditionally, market quality measures improve relative to the full sample (shown in Panel A) for all of the related markets subsamples. However, it is also important to note that average stock market trading activity (*dvolume*) is higher and equity price volatility (*volatility*) is lower for these firms. It will be important to control for both of these in the multivariate regressions.

4 Empirical Analysis

4.1 Methodology

Our goal is to measure the impact of the related markets on equity market quality. Our first regression specification is:

$$\text{Market Quality}_{it} = \alpha + \beta_1 * opt_{it} + \beta_2 * trace_{it} + \beta_3 * cds_{it} + \beta_4 * X_{it} + e_{it} \tag{1}$$

[11]Both the *dvolume* and *volatility* variables control for findings in Mayhew and Mihov (2004), who report that firms selected for options listing have high trading volume, market capitalization and volatility.

The coefficients β_1, β_2, and β_3, have straightforward interpretations: they capture the impact of having a listed option, bond on the TRACE system, or CDS on its debt, on the firm's equity market quality. The variables in control vector X are: one-period lagged dollar volume of program trades (*lprogram*); one-period lagged dollar volume in the stock (*ldvolume*); contemporaneous stock price *volatility*; and the debt-to-equity ratio of the firm ($\frac{debt}{equity}$).[12] Recall that high values for the market quality measures are associated with low market quality (e.g., large trading costs indicate low liquidity). Therefore, negative estimated coefficients on any of the explanatory variables are interpreted as a positive relationship between the right-hand-side variables and market quality.

We employ multivariate panel regressions with standard errors clustered at both the time and firm levels. All liquidity measures are calculated using daily data. Because of the large number of trade observations required to estimate the Hasbrouck (1993) measure, the efficiency measures are calculated over monthly intervals. For comparability, we also calculate the |AR| efficiency measure (30-minute return autocorrelations) using data at monthly intervals. In this case, all independent variables are calculated at monthly intervals (i.e., we take monthly averages of daily data).

4.2 Results

4.2.1 The Impact of Related Markets on Equity Market Quality

Table 2 shows results from estimating Equation (1). The most important observation from the table is that the related markets impact both liquidity and market quality, albeit in different ways (depending on the related market). The negative and significant estimated coefficients on the options market dummy (*opt*) indicate that, else constant, traded equity options are associated with significantly improved equity market quality. For example: the estimated coefficient of -0.0002 on the *opt* dummy variable in the *QS* regression suggests

[12] *dvolume* and *lprogram* are calculated as ln(dollar trading activity in \$000 + .001).

that firms with listed options have quoted percentage spreads that are 2 basis points lower than firms without traded options (this represents approximately 10 percent of the mean *QS* of 21 basis points); the results also suggest firms with traded options have dollar trade imbalances ($|dollarimb|$) that are 56 basis points lower than firms without listed options (approximately 3 percent of the mean $|dollarimb|$ of 16.9%); and the pricing errors (*V(s)*) decrease by 0.23% of total price variance (*V(p)*) (approximately 20 percent of the mean value of 1.16%), suggesting that the prices of these firms more closely follow a random walk.

The *trace* results are more mixed: we find that, all else equal, the overall impact of having bond information disseminated on the TRACE system is associated with greater transaction costs and lower efficiency using the *Hasbrouck* measure, but trading is more balanced in the sense that OIB are closer to zero. It seems that the information on the TRACE system provides a more complex signal about equity value, making learning about equity prices more complicated for market makers (as in Biais and Hillion (1994)). At the same time, the information does not appear to cause equity market participants to trade asymmetrically based on signals from the bond market.

Finally, we find strong evidence that having a traded CDS is negatively and significantly related to all measures of liquidity and market efficiency. Moreover, the estimated magnitudes of the impact of *cds* in the liquidity regressions tend to be much greater than the magnitudes of the coefficients on *opt* or *trace*. In the efficiency regressions, the coefficients on *cds* are similar to the estimated impact of having listed options (in magnitude, not sign) and greater than the impact of *trace*. The implication is that the dominant impact of CDS markets is negative. This is consistent with the mechanisms in Dow (1998) and Biais and Hillion (1994). In Dow (1998), the entry of speculators in the old market due to their ability to hedge in the related market can in turn cause a withdrawal of pure hedging transactions from the equity market. This reduces liquidity. In Biais and Hillion (1994), the additional market can make the inference process for market makers learning from trades more complicated, thereby reducing efficiency.[13]

The estimated coefficients on two of the control variables provide additional insight. In particular, the positive and significant coefficients on the debt-to-equity ratio control ($\frac{debt}{equity}$) across most specifications suggests that the market segmentation that occurs when firms have more debt financing is associated with lower liquidity (i.e., higher transactions costs and less balanced trading) and lower efficiency of equity markets. The liquidity finding is consistent with findings in Lipson and Mortal (2009) and Frieder and Martell (2006). To our knowledge, the efficiency result is new to the literature. While the different signs of the coefficients for listed equity options versus traded CDS may be somewhat surprising at first glance, the negative ($\frac{debt}{equity}$) findings can aid in the interpretation. If market segmentation of a firm's liabilities is associated with information segmentation, we might expect that the existence of markets in which derivatives contracts on the firm's debt trade would further fragment the information regarding the value of the firm, making the traders' learning processes much more complex.

The second control variable that deserves note is the program trading volume (*lprogram*) variable, which we use to proxy for passive multisecurity trading in the stock. Consistent with the idea that these are passive trades, we find strong negative relationships between program trades and all (inverse) market quality measures. It appears that passive trades due to hedging demands have a stabilizing effect on equity prices. This is important, because it helps us isolate the potentially informative component of related markets (and trading in related markets, which we examine in the next section). Our finding regarding program trading complements recent findings in Hendershott, Jones and Menkveld (2009) that algorithmic trading improves equity market liquidity and quote informativeness.

After controlling for passive multi-security trading, (log) dollar volume in the stock is associated with more balanced trading and has mixed efficiency impact. These mixed dollar

[13] While we do not study the impact on underlying bonds, the CDS findings are also consistent with the argument in Gorton (2010) that the introduction of CDSs can cause previously non information sensitive debt to become information sensitive, thereby increasing incentives for private information production.

volume results are expected. While program traders are expected to be a fairly homogenous group of uninformed traders, all other trades come from a mixture of both informed and uninformed traders.[14] The coefficients on the equity *volatility* control suggest an effect that is similar to dollar volume, and additionally, all else equal, *volatility* is associated with higher trading costs.

The regression R^2's are generally between 0.20 and 0.55 and are consistent within each category of market quality measure, with the exception of price efficiency. The R^2 in the $Hasbrouck$ regression is 0.32, while it is only 0.04 in the AR regression. This difference is due, at least in part, to variable construction and the fact that *volatility* is a control variable in all regressions. Recall that $Hasbrouck$ is defined as $V(s)$, normalized by $V(p)$, the standard deviation of (log) transaction prices. With $V(p)$ in the denominator, *volatility* explains a significant portion of the variation in the Hasbrouck ratio. Even though return autocorrelation (AR) also has a variance term in the denominator, we use its absolute value, which decreases the explanatory power of *volatility.*

4.2.2 Trading Activity in Related Markets

In interpreting the results in Table 2, it is useful to distinguish between the market quality implications of having a related market versus the impact of trading activity in that market. On the one hand, the existence of the related market may provide market participants with incentives to gather more detailed information about the firm, including the links between the firm's equity and the related security. Trading on this information can lead to more informative prices and potentially more liquid markets. On the other hand, an increased likelihood of informed trading can reduce market liquidity and, if the informed trader's trading strategy is sufficiently complicated, prices can become less informative. It is also

[14] In untabulated analysis, we repeated the regression shown in Table 2, replacing dollar volume with the portion of dollar volume that is orthogonal to program trading (i.e., r_{it} in $ldvolume_{it} = \alpha + \beta * lprogram_{it} + r_{it}$). Qualitatively, the mixed results for efficiency remain; however, the negative impact of r_{it} on efficiency as captured by the *Hasbrouck* measure is stronger than the impact of *ldvolume* on *Hasbrouck* shown in Table 2 and is statistically significant.

possible that related markets are more susceptible to noise traders. To understand the potentially distinct roles of the existence of a related market and trading in that market, we estimate the following equation, which is an extension of (1) :

$$\begin{aligned} \text{Market Quality}_{it} = \alpha + \beta_1 * opt_{it} + \beta_2 * trace_{it} + \beta_3 * cds_{it} \\ + \beta_4 * loptvol_{it} + \beta_5 * lbondvol_{it} + \beta_6 * X_{it} + e_{it} \end{aligned} \tag{2}$$

The related markets trading activity variables are *loptvol* and *lbondvol*, the one-period lagged (log) dollar volume in the firm's options and bonds, respectively. The coefficients on these variables allow us to decompose the combined effect of the related market estimated in Equation (1) into two components: (1) the market quality effect of having a related market and (2) the impact of trading activity in those markets. This will provide some insight into the mechanisms by which related markets impact equity markets. We do not have data on daily trading activity in CDS markets so are only able to observe the combined impact of the existence of, and trading in CDS contracts. As in the prior specification, all standard errors are two-way clustered, by time and firm.

The results of estimating Equation (2) are presented in Table 3. The related market dummies have similar coefficients in Tables 2 and 3, except that the existence of a bond market on its own does not have a negative effect on liquidity or efficiency. Interestingly, the results show that the dominant effect of trading activity in both options and bond markets is negative. Thus, when options traders trade, the positive impact of having an options market shown in Table 2 is substantially dampened. For example, the coefficient of 0.0002 on the *loptvol* variable (the natural log of dollar trading volume in options + \$1) in the *QS* regression suggests that the average stock needs just \$147 in options trading volume to outweigh the positive impact of having listed options.[15] Similarly, increases in bond market

[15]This required options trading volume of \$147 is more than four times the average daily dollar volume of options trading for all firms in the sample and 80% of the average daily dollar volume in option for firms with listed options. Note that depending on moneyness, options prices can be very low.

trading have a negative impact on all market quality measures. We cannot observe trading in CDS contracts. Therefore, it may be that having a CDS market is "good" while trading in that market is "bad" (as in the TRACE/bond market results); however, because we do not observe trading in CDS contracts, we cannot disaggregate these individual components as we do for options and bonds.[16] We do, however, provide estimates of the overall impact of the existence of this market. As in Table 2, the results in Table 3 strongly suggest a negative role for CDS markets on both equity market liquidity and stock price efficiency.[17]

To summarize, our main findings are shown in Tables 2 and 3. We find a significant, positive role for options markets in equity market quality. CDS markets, on the other hand, are associated with lower quality. The results for having public bond information disseminated on TRACE are more mixed; however trading activity in TRACE bonds, as well as in options markets are negatively related to stock market quality. When we rank the estimated effects of the related markets, we generally find that the impact of CDS markets is most negative, followed by corporate bond markets, and then options (which have an overall positive effect). The negative association between market quality and related markets for debt-linked securities may stem from increased complexities associated with market segmentation when firms have traded debt in the capital structure. The finding of a negative relationship between market quality and debt in the firms' capital structure is consistent with this conjecture.

4.2.3 Public News Events

Does the role of related markets change during information events? The answer to this question can help market participants or policy makers identify the times in which related

[16]In robustness analysis, we introduce a proxy for CDS market activity, using lower frequency data to aid in the interpretation.

[17]Because debt-linked securities markets might be relatively more relevant to stock prices when they are declining, the difference in signs of the equity options and CDS/Trace results may be due to their being relevant at different times. In unreported tests, we investigate whether the patterns that we observe are driven by negative stock return days. We find very little difference in the main results on negative versus positive return days.

markets become more (or less) relevant. We further exploit time series variation in the data and examine the impact of these markets in earnings event settings. In particular, we examine the differential impact of related markets on equity market quality during days -2 to +2 relative to earnings announcements. The event analysis is conducted only for the trading cost and imbalance measures since they are measured at daily frequencies (efficiency measures are monthly). The event time analogue to Equation (1) is:

$$
\begin{aligned}
\text{Liquidity}_{it} = \alpha + \beta_1 * opt_{it} + \beta_2 * opt_{it} * event_{it} + \beta_3 * trace_{it} + \beta_4 * trace_{it} * event_{it} \\
+ \beta_5 * cds_{it} + \beta_6 * cds_{it} * event_{it} + \beta_7 * event_{it} + \beta_8 * X_{it} + e_{it}
\end{aligned}
\tag{3}
$$

In Equation (3), we interact each related markets dummy with an indicator vector, event, containing five dummies indicating whether day t is day -2, -1, 0, +1, or +2 relative to announcement day 0. Positive (negative) coefficients on these interaction variables suggests an incremental negative (positive) role for related markets in equity market liquidity near earnings events. We include both pre- and post- announcement days since pre-event days can be interpreted as periods with high information asymmetry and post-event days are interpreted as periods in which market participants trade on public news. Finally, we add the event indicator vector as a control variable to pick up the direct effect the earnings event has on our measures of market quality.

Table 4 shows results of estimating Equation (3). From the table, none of the related markets play major roles in pre-announcement liquidity. Options markets are associated with both lower trading costs and higher trading imbalances during the post event period. Trading costs may be lower if the existence of the options markets reduces information asymmetry by helping facilitate fast incorporation of the earnings news into prices. However, when it comes to trading imbalances, the evidence suggests that the positive role for options tends to be dampened near earnings events. We also observe a dampening of both the negative role of having bonds on the TRACE system for trading costs and the positive role of TRACE bonds for order imbalances. It may be that TRACE bonds and debt markets in general become less relevant near earnings events. Consistent with this, we observe a small dampening of the negative effect of CDSs on trading costs; however, the negative impact of CDSs order imbalance is higher immediately preceding the event, consistent with some speculative trading associated with information from CDS markets. The price discovery process for equity market makers may be more clearly defined when incorporating specific public news into prices, making them more willing to trade near these events.[18]

5 Robustness and Extensions

5.1 The Impact of CDS Markets: Conditional Analysis

In interpreting the results for the CDS dummy variable, one potential concern is that firms with CDS contracts may have characteristics that make them different from other firms. Most notably, these firms tend to be bigger than other firms, they have publicly traded debt and credit ratings. One important observation is that our empirical findings of a strong negative role for CDS in stock market liquidity and price efficiency are the opposite of what one would expect for firms with these characteristics. Moreover, we explicitly control for the dollar volume of trading in a firm's stock (correlated with size) and whether a firm has a bond listed on the TRACE system (i.e., has publicly traded debt and a credit rating). Still, we want to check that our results are robust within the subsample of firms that are more likely to have traded CDSs. Therefore, we repeat the main analysis using only the subsample of firms with bond information disseminated on TRACE. These are firms with publicly traded debt.

[18] In unreported tests, we repeated the analysis using high stock price volatility days rather than earnings announcement dates. High volatility dates are defined as the top 5% of absolute stock returns for stock i during year t. Results are qualitatively similar to those shown in Table 4.

Tables 5 and 6 are analogous to Tables 2 and 3, but regressions are based on only the TRACE subsample of firms. Specifications are identical, except the *trace* dummy is removed since it is equal to one for all firms in this subsample. All of the main results remain for this subsample. In Table 5, the estimated coefficients on *cds* are positive under all market quality measures. Moreover, they are statistically significant in all specifications, with the exception of the $|AR|$ efficiency measure. The same is true in the Table 6 regression results, which include trading activity in options and bond markets, although the negative effect of having a CDS market on efficiency becomes statistically insignificant. As in the main analysis (Tables 2 and 3), we find a positive role for listed options and negative roles for both options market and bond market trading volume. Thus, the main findings of a negative role for CDS markets and a positive role for options markets are robust even for the subsample of firms that have publicly traded bonds.

5.2 Within Firm Analysis: Related Markets and Equity Market Quality

The main results suggest that the equity market quality of firms with listed options, public bonds on the TRACE system and quoted CDS contracts differ from firms without these related markets. We find that the overall impact of having an options market is positive, but that firms with debt in their capital structures, particularly those with CDS contracts on their debt have equity markets with higher transactions costs, less balanced trading, and stock prices that are less efficient. One natural extension of the analysis is to examine the impact of the introduction of a related market on equity market quality. Because we have a panel of firms, we are able to exploit the time series properties of the data. In this section, we repeat the analysis in Table 2 and Table 3 and introduce firm fixed effects.[19] This controls for time-invariant firm characteristics and the related markets coefficients are therefore interpreted as

[19]Rather than clustering standard errors at both firm and time level, standard errors are now clustered at the time level and the model is estimated with firm fixed effects.

the change in market quality around the introduction of a related market. This is important because, although the main analysis controls for other factors known to impact liquidity and efficiency, there is always a potential concern that the related markets are capturing some unobservable firm characteristic. In the fixed effects specifications, all identification for the related markets coefficients comes from firms for which a related market is added over the sample period. Results are presented in Tables 7 and 8 and are analogous to Tables 2 and 3, respectively.

Table 7 shows the impact of adding a related market on equity market quality. Similar to Table 2, we find a significant, positive role for the introduction of options for all market quality measures. Public dissemination of bond information on TRACE is still associated with improvements in equity market balance but decreases in stock price efficiency. Consistent with the main analysis, we also find that introduction of a traded CDS is associated with a reduction in stock price efficiency. The liquidity implications of the introduction of CDSs are more mixed, with increases in trading costs, but improvements in dollar and share imbalances.

Table 8 shows the impact of adding a related market, and also incorporates trading activity in the related markets. In this specification, having a bond market improves trading costs. But consistent with the main analysis, the positive and significant estimated coefficients on both *loptvol* and *lbondvol* across market quality specifications suggests a negative role for trading activity in related markets. Results for the other explanatory variables are also similar to Table 7.

Taken together, these time-series results suggest a potentially important (negative) interaction between the introduction of related markets stemming from debt in firms' capital structures and stock price efficiency. The liquidity implications of the introduction of TRACE markets and CDSs are somewhat less clear in that spreads increase (i.e., negative impact), but so does the balance of trading activity (i.e., positive impact). The results also strongly suggest a positive role for the introduction of options markets.

5.3 Alternative Interpretation of the Role of Debt-Linked Securities Markets: Capital Structure and Firm Complexity

An alternative interpretation of the main findings is that CDS markets and corporate bond markets reflect complexity in firms' capital structures or complexities in the firms holding debt, rather than the segmentation of markets across firms' liabilities. To examine whether the finding that debt-linked securities markets negatively impact equity market quality is simply due to related markets proxying for capital structure complexity, we directly introduce a measure of capital structure complexity to the regression analysis. Using Compustat data, we construct *type_fract* as the number of different categories of debt in the firm's capital structure (out of a possible four), divided by 4. The four types of debt are: senior non-convertible; convertible; mortgage and equipment linked debt, and commercial paper. These categories are created to capture some of the capital structure heterogeneity identified in Rauh and Sufi (2010) but are based Compustat data in order to construct these measures for a large sample of firms. In Tables 9 and 10, we repeat the Tables 3 and 8 analyses (without and with firm fixed effects, respectively), adding *type_fract* to the specifications.[20] While we do find an independent, negative role for capital structure complexity in liquidity, we also find some evidence that having more types of securities in the capital structure is actually associated with improved price efficiency. Importantly, the inclusion of *type_fract* does not change the main observations regarding the roles of the related markets.

To examine the similar hypothesis that related markets capture firm complexity (as opposed to capital structure complexity), we introduce a firm complexity measure, *intang*, defined as the fraction of the firm's intangible assets relative to total assets. To aid in the interpretation, we also interact the CDS variable (which has the most negative effect on equity market quality, based on the main analysis), with *intang*. This allows us to test whether the impact of CDS markets varies with firm complexity. Results are presented

[20] We also added *type_fract* to the base specifications in Tables 2 and 7 (these do not include trading activity). Results are not reported, for brevity, but are similar to those shown in Tables 9 and 10.

in Tables 11 and 12, and are analogous to those in Tables 9 and 10, respectively. Table 11 shows a negative role for firm complexity in equity price efficiency and a mixed role for firm complexity in equity market liquidity (negative role for trading balance, but a positive role for spreads). Interestingly, the positive and significant coefficients on the interaction variable suggest that, holding all else constant, complex firms with traded CDSs have both lower price efficiency and lower liquidity. That is, the CDS effect is exacerbated when firms are complex. The results in Table 12 from the fixed effects specification are similar. They suggest that, when firms become more complex, both liquidity and efficiency decrease. This effect is magnified for firms with CDS markets. Importantly, the estimated direct effects of the related markets shown in both Tables 11 and 12 are consistent with the main analysis. Therefore, while related markets do interact with firm complexity, they also have independent effects on market quality. They are not simply picking up variation in capital structure or firm complexity.

5.4 CDS Quotes: A Market Activity Proxy

Given the recent debates regarding the impact of derivatives markets, particularly CDSs, the CDS findings in this paper are potentially the most useful to policy makers. Unfortunately, our CDS market data are also the most limited. For example, we would ideally observe daily trading activity in CDSs since it is natural to ask whether the CDS findings stem from the existence of these related markets or from trading activity in CDS. We do not have trading volume data as we do for equity options and corporate bonds; however, we do know on which days CDSs are quoted on Bloomberg. We use the number of days per year for which we observe CDS quotes on Bloomberg to capture variation in CDS market activity, albeit over longer horizons. We introduce a measure CDS_Quote, defined as the natural log of the number of days on which we observe CDS quotes on Bloomberg during year t, to capture market activity.

Table 13 is analogous to Table 3, with the *CDS_Quote* variable added to the analysis. The direct role of having a CDS market remains negative and significant for both spreads and for market efficiency remain; however, Table 13 also shows that more active CDS markets negatively impact the balance of trading (increased CDS market activity is associated with higher trade imbalances) while inactive CDS markets have little statistical impact on imbalances. We introduce firm fixed effects in Table 14. Recall that the coefficients in these regressions are interpreted in terms of changes. We find that increases in CDS market activity have a strong negative effect on spreads and on price efficiency (captured by the *Hasbrouck* measure), but a positive impact on the balance of trading. We also observe a negative direct effect of introduction of CDS markets on some of the market quality variables. These results provide an interesting contrast to the results for options and bonds (in which, once we control for the negative effect of trading activity, the existence of related markets plays a positive role), in that both the existence of and market activity in CDS markets appear to negatively impact market quality. One factor that may contribute to these findings, which we leave for future research, is that the structure of CDS markets may make them particularly harmful to equity market quality. The equity options that we study trade in organized exchanges, which are highly transparent. The corporate bonds that we examine trade in more opaque over-the-counter markets, but are subject to trade dissemination rules. CDSs also trade over-the-counter but these markets are much more opaque than the bond markets since CDS trades are not subject to trade reporting. This ranking of the opaqueness of the related markets is perfectly correlated with the ranking of the negative impact of these markets on equity market quality. This also complements the results in section 5.3 in that both market opacity and firm complexity have negative effects on the equity market quality.

To summarize, introducing a CDS market generally negatively impacts equity market liquidity and price efficiency and this effect tends to be even worse when the CDS market is an actively quoted one. The findings in Tables 13 and 14 lend support to the general interpretation that related markets linked to a firm's debt decrease market quality.

6 Conclusions

In this paper we analyze the implications of existence of derivatives and corporate debt markets on the equity market quality. Taken together, the results imply an overall negative effect of related markets when those markets are tied to debt in a firm's capital structure. Consistent with prior literature, we find that firms with listed options have more liquid equity and more efficient stock prices. By contrast, firms with traded CDS contracts have less liquid equity and less efficient stock prices. The impact of publicly traded bonds is mixed. When we rank the estimated effects of the related markets, we find that the impact of CDS markets is generally most negative, followed by corporate bond markets, and then options which generally have a positive effect. We also observe a consistently negative role for trading activity in bonds as well as options for both efficiency and liquidity.

Our robustness tests provide sharper interpretations of the role for debt linked securities. In particular, we examine an alternative "capital structure and firm complexity" conjecture (i.e., the interpretation that the negative role for markets in debt-linked securities is due to complicated capital structures or complex firms, rather than the segmentation of markets across a firm's liabilities). We find that while both capital structure and firm complexity tend to be associated with decreases in market quality, the existence of markets in which debt-linked securities trade has an independent, negative effect. This effect is particularly strong for CDS markets. While we emphasize that our analysis focuses on only one potential type of externality associated with related markets, our findings can help inform current policy debates regarding the costs and benefits of derivatives markets, in particular that about CDS markets.

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Table 1: **Descriptive Statistics**

The sample includes all NYSE stocks for the years 2003-2007 for which we have non-missing information for all of the liquidity, efficiency and control variables. In Panel A, we present summary statistics for the full sample. Panel B shows summary statistics for the subsample of firms with listed options; Panel C shows summary statistics for the subsample of firms for which with bond information is disseminated on the TRACE (Trade Reporting and Compliance Engine) system; and Panel D shows summary statistics for the subsample of CDS firms (firms for which there are CDS quotes on Bloomberg). The stock market liquidity statistics are based on daily spread and order imbalance data. QS is defined as the time-weighted average of the quoted spread on the primary exchange divided by the quote midpoint. ES is defined as the trade-weighted average of the effective spread divided by the quote midpoint. Trade imbalance variables are calculated based on the Lee and Ready (1991) trade classification algorithm. $\mid dollarimb \mid$ is the dollar trade imbalance and is calculated as the absolute dollar value of signed orderflow, divided by total dollar volume. $\mid shareimb \mid$ is defined as the absolute value of shares bought, minus shares sold, divided by the total number of shares traded. $\mid tradeimb \mid$ is defined as the absolute value of the number of buy transactions, minus sell transactions, divided by the total number of transactions. The stock market efficiency variables are measured using intraday data over monthly intervals. *hasbrouck* is defined as the pricing error variance (based on Hasbrouck (1993)), divided by the standard deviation of intraday (log) transaction prices. $|AR|$ is the absolute value of the 30-minute autocorrelation of quote midpoint returns. These efficiency variables measure the extent to which prices deviate from a random walk. The three related markets dummy variables are *opt*, *trace*, and *cds*. These are set equal to 1 if the firm has a listed option, public bond information on the TRACE system, and a CDS quote on Bloomberg, respectively. *lbondvol* is the (log) sum of the dollar volume of all of the firm's bonds as reported on the TRACE system. *loptvol* is the (log) sum of the dollar volume of all of the firm's listed stock options. Controls variables are: *ldvolume*, *lprogram*, *volatility* and $\frac{debt}{equity}$. *ldvolume* is the total daily trading volume as reported on CRSP, times the closing price; *lprogram* is the dollar volume of program trading, defined as the (log) sum of institutional buy and sell dollar volume for their program trades, based on daily summaries of NYSE CAUD data for each stock; volatility is the square of the daily stock return; the values used to calculate *ldvolume* and *lprogram* are both measured at period $t-1$ and are in thousands of dollars. $\frac{debt}{equity}$ is the firm's debt-to-equity ratio, defined as the sum of the firm's long term and current debt outstanding, divided by the end-of-quarter market capitalization (based on quarterly data for quarter t-1, from Compustat). There are 1690 unique firms in the full sample (Panel A) and 1289, 870 and 242 unique firms in the listed options (Panel B), TRACE (Panel C) and CDS (Panel D) respectively.

Table 1: **Descriptive Statistics (Contd.,)**

Panel A: Descriptive Statistics for Full Sample

	Mean	Median	25^{th} pcntl	75^{th} pcntl	Std. Dev
(Ia) Stock Market Liquidity Variables (Daily): Trading Costs					
qs	0.0021	0.0011	0.0006	0.0020	0.0037
es	0.0014	0.0007	0.0004	0.0014	0.0027
(Ib) Stock Market Liquidity Variables (Daily): Imbalances					
$\mid dollarimb \mid$	0.1688	0.1295	0.0598	0.2296	0.1549
$\mid shareimb \mid$	0.1687	0.1294	0.0598	0.2294	0.1549
$\mid tradeimb \mid$	0.1462	0.1099	0.0509	0.1974	0.1392
(II) Stock Market Efficiency Variables (Monthly)					
hasbrouck	0.0116	0.0084	0.0054	0.0137	0.0119
$\mid AR \mid$	0.0791	0.0650	0.0306	0.1128	0.0629
(III) Related Markets					
opt	0.7023	1.0000	0.0000	1.0000	0.4573
$trace$	0.3762	0.0000	0.0000	1.0000	0.4844
cds	0.1261	0.0000	0.0000	0.0000	0.3320
(IV) Related Markets Trading Activity					
$loptvol$	3.6671	3.4820	0.0000	6.6173	3.5490
$lbondvol$	3.3952	0.0000	0.0000	0.0000	6.1931
(V) Controls					
$ldvolume$	9.1771	9.3486	8.0453	10.5813	2.0800
$lprogram$	8.0637	8.5482	7.2125	9.6542	2.7276
$volatility$	0.0005	0.0001	0.0000	0.0003	0.0107
$\frac{debt}{equity}$	0.6863	0.2646	0.1014	0.6319	1.8303

Table 1: **Descriptive Statistics (Contd.,)**

Panel B: Descriptive Statistics for the Listed Options Sample

	Mean	Median	25^{th} pcntl	75^{th} pcntl	Std. Dev
(Ia) Stock Market Liquidity Variables (Daily): Trading Costs					
qs	0.0011	0.0008	0.0005	0.0013	0.0012
es	0.0008	0.0006	0.0004	0.0009	0.0009
(Ib) Stock Market Liquidity Variables (Daily): Imbalances					
$\mid dollarimb \mid$	0.1423	0.1163	0.0542	0.2024	0.1148
$\mid shareimb \mid$	0.1421	0.1162	0.0541	0.2022	0.1148
$\mid tradeimb \mid$	0.1198	0.0965	0.0453	0.1682	0.0990
(II) Stock Market Efficiency Variables (Monthly)					
hasbrouck	0.0095	0.0074	0.0049	0.0113	0.0085
$\mid AR \mid$	0.0735	0.0609	0.0288	0.1056	0.0577
(III) Related Markets					
cds	0.1699	0.0000	0.0000	0.0000	0.3755
$trace$	0.4697	0.0000	0.0000	1.0000	0.4991
(IV) Related Markets Trading Activity					
$loptvol$	5.2210	5.4269	3.0350	7.5569	3.1336
$lbondvol$	4.4555	0.0000	0.0000	12.0725	6.7798
(V) Controls					
ldvolume	9.9594	9.9459	8.9686	10.9676	1.4779
lprogram	9.0266	9.1000	8.1925	10.0086	1.4839
volatility	0.0004	0.0001	0.0000	0.0003	0.0118
$\frac{debt}{equity}$	0.6525	0.2473	0.0991	0.5914	1.8145

Table 1: **Descriptive Statistics (Contd.,)**

Panel C: Descriptive Statistics for the TRACE Sample

	Mean	Median	25^{th} pcntl	75^{th} pcntl	Std. Dev
(Ia) Stock Market Liquidity Variables (Daily): Trading Costs					
qs	0.0010	0.0007	0.0005	0.0011	0.0015
es	0.0007	0.0005	0.0003	0.0007	0.0011
(Ib) Stock Market Liquidity Variables (Daily): Imbalances					
$\mid dollarimb \mid$	0.1333	0.1074	0.0497	0.1881	0.1114
$\mid shareimb \mid$	0.1332	0.1073	0.0496	0.1879	0.1113
$\mid tradeimb \mid$	0.1096	0.0867	0.0405	0.1516	0.0957
(II) Stock Market Efficiency Variables (Monthly)					
hasbrouck	0.0093	0.0070	0.0046	0.0107	0.0095
$\mid AR \mid$	0.0724	0.0600	0.0286	0.1040	0.0568
(III) Related Markets					
opt	0.8768	1.0000	1.0000	1.0000	0.3287
cds	0.2753	0.0000	0.0000	1.0000	0.4467
(IV) Related Markets Trading Activity					
$loptvol$	5.4855	6.0121	2.8973	8.2067	3.4953
$lbondvol$	9.0156	12.1007	0.0000	15.2785	7.1540
(V) Controls					
$ldvolume$	10.3552	10.4437	9.3965	11.4254	1.5630
lprogram	9.4177	9.5821	8.6459	10.4319	1.5647
volatility	0.0004	0.0001	0.0000	0.0003	0.0053
$\frac{debt}{equity}$	0.8221	0.3227	0.1603	0.7255	2.1126

Table 1: **Descriptive Statistics (Contd.,)**

Panel D: Descriptive Statistics for the CDS Sample

	Mean	Median	25^{th} pcntl	75^{th} pcntl	Std. Dev
(Ia) Stock Market Liquidity Variables (Daily): Trading Costs					
qs	0.0006	0.0005	0.0004	0.0007	0.0004
es	0.0005	0.0004	0.0003	0.0005	0.0003
(Ib) Stock Market Liquidity Variables (Daily): Imbalances					
$\mid dollarimb \mid$	0.1239	0.1022	0.0474	0.1776	0.0981
$\mid shareimb \mid$	0.1237	0.1021	0.0474	0.1774	0.0980
$\mid tradeimb \mid$	0.0924	0.0759	0.0359	0.1301	0.0749
(II) Stock Market Efficiency Variables (Monthly)					
hasbrouck	0.0071	0.0058	0.0040	0.0084	0.0065
$\mid AR \mid$	0.0692	0.0571	0.0274	0.0995	0.0536
(III) Related Markets					
opt	0.9462	1.0000	1.0000	1.0000	0.2255
trace	0.8214	1.0000	1.0000	1.0000	0.3830
cds	1.0000	1.0000	1.0000	1.0000	0.0000
(IV) Related Markets Trading Activity					
loptvol	7.1817	7.7114	5.7032	9.2997	2.9493
lbondvol	10.1614	13.8155	0.0000	16.0401	7.1781
(V) Controls					
ldvolume	11.2483	11.2509	10.4818	12.0258	1.1197
lprogram	10.2242	10.2719	9.5958	10.9084	0.9952
volatility	0.0003	0.0001	0.0000	0.0003	0.0017
$\frac{debt}{equity}$	0.5792	0.2836	0.1546	0.5737	1.3062

Table 2: **Related Markets and Equity Market Quality**

This table presents the results of regression analyses that estimate the impact of related markets on equity market quality. The results are based on panel regressions for the sample of NYSE-listed stocks for the years 2003-2007. The dependent variables are equity market quality measures, which are divided into two groups: liquidity and efficiency. The liquidity measures are: quoted and effective spreads (QS and ES, respectively), dollar trade imbalance ($|\,dollarimb\,|$), share imbalance ($|\,shareimb\,|$) and trade imbalance ($|\,tradeimb\,|$). Efficiency measures are *hasbrouck*, defined as the pricing error based on Hasbrouck (1993), divided by the standard deviation of intraday log transaction prices, and $|AR|$, defined as the 30-minute autocorrelation in quote midpoint returns. Explanatory variables are: related market dummies *opt*, *trace*, and *cds* (indicator variables set equal to 1 if the firm has a listed option, bond information on the TRACE system, and CDS quote on Bloomberg, respectively), one period lagged dollar volume of program trades (*lprogram*) in thousands of dollars, one period lagged total dollar volume in the stock (*ldvolume*) in thousands of dollars, contemporaneous volatility (volatility), and the debt-to-equity ratio of the firm ($\frac{debt}{equity}$). Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day and firm level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month-firm level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	*hasbrouck*	$\mid AR \mid$
opt	-0.0002	-0.0001	-0.0056	-0.0056	-0.0074	-0.0023	-0.0033
	[-3.21]	[-2.74]	[-3.53]	[-3.55]	[-5.37]	[-7.90]	[-4.32]
trace	0.0002	0.0002	-0.0029	-0.0029	-0.0034	0.0015	0.0004
	[5.18]	[4.86]	[-2.26]	[-2.22]	[-3.05]	[6.35]	[0.49]
cds	0.0007	0.0005	0.0177	0.0177	0.0070	0.0013	0.0026
	[8.87]	[8.98]	[8.22]	[8.23]	[4.77]	[5.03]	[3.39]
lprogram	-0.0010	-0.0007	-0.0268	-0.0268	-0.0207	-0.0051	-0.0029
	[-10.09]	[-10.07]	[-28.25]	[-28.29]	[-25.50]	[-9.15]	[-6.77]
ldvolume	0.0000	0.0001	0.0005	0.0005	-0.0059	0.0014	-0.0024
	[0.25]	[0.73]	[0.39]	[0.40]	[-6.11]	[2.89]	[-4.38]
volatility	0.0230	0.0178	-0.2228	-0.2213	-0.2611	-1.4313	0.2896
	[2.52]	[2.56]	[-3.09]	[-3.08]	[-3.42]	[-1.99]	[1.13]
$\frac{debt}{equity}$	0.0002	0.0002	0.0016	0.0016	0.0008	0.0002	0.0003
	[4.25]	[3.99]	[2.21]	[2.21]	[1.30]	[2.39]	[1.90]
intercept	0.0095	0.0066	0.3844	0.3844	0.3737	0.0681	0.1610
	[28.15]	[27.84]	[60.11]	[60.08]	[72.68]	[27.57]	[32.96]
R^2	0.543	0.516	0.215	0.215	0.243	0.321	0.042
N	1518792	1517283	1517283	1517283	1517283	67082	72900

Table 3: **Trading in Related Markets and Equity Market Quality**

This table presents the results of regressions that estimate the impact of related markets and trading in those markets on equity market quality. The results are based on panel regressions for the sample of NYSE-listed stocks for the years 2003-2007. The dependent variables are equity market quality measures: quoted and effective spreads (QS and ES, respectively), dollar trade imbalance ($\mid dollarimb \mid$), share imbalance ($\mid shareimb \mid$), trade imbalance ($\mid tradeimb \mid$), *hasbrouck* (defined as the pricing error based on Hasbrouck (1993), divided by the standard deviation of intraday log transaction prices), and $|AR|$, defined as the 30-minute autocorrelation in quote midpoint returns. Explanatory variables are: related market dummies *opt*, *trace*, and *cds*; one period lagged dollar volume of trade in the firm's bonds (*lbondvol*); one period lagged dollar volume of trade in the firm's options (*loptvol*); one period lagged dollar volume of program trades in the stock measured in thousands of dollars(*lprogram*); one period lagged total dollar volume in the stock measured in thousands of dollars (*ldvolume*); contemporaneous volatility (*volatility*) and debt-to-equity ratio of the firm ($\frac{debt}{equity}$). Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day and firm level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month-firm level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	$hasbrouck$	$\mid AR \mid$
opt	-0.0008	-0.0005	-0.0176	-0.0176	-0.0148	-0.0027	-0.0039
	[-10.43]	[-9.50]	[-10.55]	[-10.56]	[-10.22]	[-6.87]	[-3.31]
$trace$	0.0000	0.0000	-0.0098	-0.0098	-0.0067	0.0005	-0.0018
	[0.60]	[0.26]	[-7.71]	[-7.68]	[-5.70]	[1.75]	[-1.82]
cds	0.0004	0.0003	0.0112	0.0112	0.0034	0.0008	0.0015
	[7.14]	[7.20]	[6.02]	[6.03]	[2.62]	[3.22]	[2.05]
$lprogram$	-0.0009	-0.0007	-0.0250	-0.0250	-0.0197	-0.0049	-0.0026
	[-9.61]	[-9.61]	[-28.26]	[-28.29]	[-25.00]	[-8.46]	[-6.02]
$ldvolume$	-0.0002	-0.0001	-0.0054	-0.0054	-0.0094	0.0009	-0.0030
	[-2.38]	[-1.76]	[-4.00]	[-4.00]	[-8.60]	[1.56]	[-4.49]
$volatility$	0.0219	0.0171	-0.2449	-0.2434	-0.2747	-1.4495	0.2755
	[2.57]	[2.61]	[-2.95]	[-2.93]	[-3.27]	[-1.97]	[1.10]
$\frac{debt}{equity}$	0.0002	0.0001	0.0010	0.0010	0.0005	0.0001	0.0002
	[3.76]	[3.54]	[1.56]	[1.55]	[0.80]	[1.85]	[1.36]
$loptvol$	0.0002	0.0001	0.0042	0.0042	0.0026	0.0002	0.0003
	[12.85]	[12.34]	[12.96]	[12.95]	[9.81]	[1.92]	[1.02]
$lbondvol$	0.0000	0.0000	0.0008	0.0008	0.0003	0.0001	0.0003
	[6.60]	[6.52]	[8.30]	[8.31]	[5.20]	[6.83]	[3.79]
$intercept$	0.0111	0.0076	0.4184	0.4183	0.3939	0.0732	0.1676
	[26.70]	[26.15]	[56.02]	[55.98]	[63.54]	[19.85]	[25.68]
R^2	0.559	0.529	0.219	0.219	0.244	0.324	0.042
N	1518792	1517283	1517283	1517283	1517283	67082	72900

Table 4: **Related Markets and Liquidity: Event Analysis**

This table presents the results of regressions that estimate the impact of related markets on equity market quality near earnings announcements. All variables are defined in Table 2, with the exception of the event interaction variables in which event days -2 to +2 are indicated as _n2, _n0, _0, _1 and _2. For example: opt_n2 is the options listing dummy (opt), times a dummy equal to 1 if the day is day -2 relative to an earnings announcement date 0. opt_2 is the options listing dummy times a dummy equal to 1 if the day is day +2 relative to earnings announcement date 0. All regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day and firm level.

	Trading Costs (daily)		*Imbalances (daily)*		
	QS	*ES*	| *dollarimb* |	| *shareimb* |	| *tradeimb* |
opt	-0.0008	-0.0005	-0.0184	-0.0184	-0.0154
	[-10.35]	[-9.38]	[-10.96]	[-10.97]	[-10.56]
opt_n2	-0.0000	-0.0000	0.0039	0.0040	0.0010
	[-1.29]	[-0.15]	[1.75]	[1.77]	[0.44]
opt_n1	-0.0000	-0.0000	0.0038	0.0038	0.0014
	[-0.15]	[-0.37]	[1.66]	[1.67]	[0.63]
opt_0	-0.0001	-0.0001	0.0159	0.0160	0.0139
	[-3.15]	[-4.31]	[6.52]	[6.55]	[6.09]
opt_1	-0.0001	-0.0001	0.0152	0.0152	0.0145
	[-2.01]	[-3.66]	[6.10]	[6.10]	[6.51]
opt_2	-0.0001	-0.0001	0.0078	0.0077	0.0091
	[-3.25]	[-3.96]	[3.54]	[3.52]	[4.70]
trace	0.0000	0.0000	-0.0101	-0.0101	-0.0068
	[0.64]	[0.33]	[-7.94]	[-7.91]	[-5.83]
trace_n2	0.0000	0.0000	0.0023	0.0023	-0.0010
	[0.65]	[1.23]	[1.30]	[1.30]	[-0.56]
trace_n1	0.0000	0.0000	-0.0022	-0.0022	-0.0027
	[0.59]	[0.57]	[-1.30]	[-1.31]	[-1.63]
trace_0	-0.0000	-0.0000	0.0088	0.0089	0.0059
	[-0.07]	[-1.61]	[4.78]	[4.79]	[3.37]
trace_1	0.0000	-0.0000	0.0077	0.0077	0.0069
	[0.32]	[-0.77]	[4.27]	[4.28]	[4.32]
trace_2	0.0000	-0.0000	0.0033	0.0032	0.0030
	[0.34]	[-0.37]	[1.91]	[1.91]	[1.90]

Table 4: **Related Markets and Liquidity: Event Analysis (Contd..)**

	Trading Costs (daily)		*Imbalances (daily)*		
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$
cds	0.0004	0.0003	0.0111	0.0111	0.0032
	[7.15]	[7.25]	[5.95]	[5.96]	[2.53]
cds_n2	0.0000	-0.0000	-0.0023	-0.0023	0.0021
	[0.09]	[-0.27]	[-1.14]	[-1.14]	[1.39]
cds_n1	-0.0000	-0.0000	0.0037	0.0037	0.0031
	[-1.15]	[-1.77]	[1.79]	[1.79]	[2.01]
cds_0	0.0000	-0.0000	0.0049	0.0049	0.0036
	[0.67]	[-2.27]	[2.14]	[2.14]	[2.23]
cds_1	0.0001	0.0000	-0.0002	-0.0002	0.0015
	[2.90]	[0.71]	[-0.11]	[-0.10]	[0.96]
cds_2	-0.0000	-0.0000	0.0003	0.0003	-0.0019
	[-1.80]	[-2.97]	[0.16]	[0.17]	[-1.12]
$earn2n$	0.0000	-0.0000	-0.0082	-0.0082	-0.0026
	[0.43]	[-0.46]	[-3.71]	[-3.73]	[-1.09]
$earn1n$	0.0000	0.0000	-0.0071	-0.0071	-0.0040
	[0.89]	[1.44]	[-3.21]	[-3.23]	[-1.73]
$earn0$	0.0002	0.0003	-0.0233	-0.0233	-0.0206
	[4.83]	[7.49]	[-9.53]	[-9.56]	[-8.21]
$earn1$	0.0003	0.0003	-0.0168	-0.0168	-0.0142
	[4.62]	[6.98]	[-6.88]	[-6.89]	[-6.04]
$earn2$	0.0004	0.0003	-0.0080	-0.0079	-0.0058
	[6.92]	[7.90]	[-3.86]	[-3.82]	[-2.78]
$lprogram$	-0.0009	-0.0007	-0.0250	-0.0251	-0.0197
	[-9.59]	[-9.59]	[-28.22]	[-28.26]	[-24.98]
$ldvolume$	-0.0003	-0.0001	-0.0053	-0.0053	-0.0094
	[-2.41]	[-1.80]	[-3.96]	[-3.95]	[-8.57]
$volatility$	0.0216	0.0168	-0.2343	-0.2328	-0.2660
	[2.57]	[2.62]	[-3.00]	[-2.99]	[-3.34]
$\frac{debt}{equity}$	0.0002	0.0001	0.0010	0.0010	0.0005
	[3.76]	[3.54]	[1.55]	[1.55]	[0.80]
$loptvol$	0.0002	0.0001	0.0042	0.0042	0.0026
	[12.82]	[12.30]	[12.93]	[12.92]	[9.77]
$lbondvol$	0.0000	0.0000	0.0008	0.0008	0.0003
	[6.59]	[6.51]	[8.26]	[8.28]	[5.16]
$intercept$	0.0111	0.0076	0.4191	0.4191	0.3945
	[26.67]	[26.13]	[55.95]	[55.91]	[63.50]
R^2	0.559	0.529	0.219	0.219	0.245
N	1518792	1517283	1517283	1517283	1517283

Table 5: **TRACE Subsample: Related Markets and Equity Market Quality**

This table presents the results of regressions estimate the impact of related markets on equity market quality for the subsample of firms with bond information on the TRACE system. All variables are as defined in Table 2. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day and firm level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month-firm level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	$hasbrouck$	$\mid AR \mid$
opt	-0.0005	-0.0003	-0.0073	-0.0073	-0.0066	-0.0029	-0.0040
	[-3.92]	[-3.51]	[-2.56]	[-2.57]	[-2.73]	[-5.76]	[-2.83]
cds	0.0002	0.0001	0.0090	0.0090	0.0024	0.0006	0.0016
	[3.86]	[4.02]	[4.06]	[4.06]	[1.67]	[2.20]	[1.60]
$lprogram$	-0.0008	-0.0006	-0.0272	-0.0272	-0.0252	-0.0076	-0.0045
	[-3.27]	[-3.22]	[-12.23]	[-12.27]	[-9.12]	[-10.18]	[-4.99]
$ldvolume$	0.0003	0.0002	0.0082	0.0082	0.0024	0.0043	0.0001
	[1.26]	[1.38]	[4.04]	[4.07]	[0.95]	[7.03]	[0.17]
$volatility$	0.0081	0.0058	-0.0988	-0.0940	-0.1613	-0.6676	0.5265
	[1.23]	[1.28]	[-3.09]	[-2.98]	[-3.75]	[-1.74]	[3.24]
$\frac{debt}{equity}$	0.0001	0.0001	0.0012	0.0012	0.0003	-0.0001	0.0000
	[2.36]	[2.46]	[1.89]	[1.88]	[0.79]	[-1.83]	[0.18]
$intercept$	0.0061	0.0042	0.3102	0.3100	0.3272	0.0622	0.1449
	[16.68]	[16.49]	[40.22]	[40.24]	[57.63]	[18.91]	[21.28]
R^2	0.453	0.439	0.080	0.080	0.149	0.346	0.016
N	564718	564685	564685	564685	564685	27102	27460

Table 6: **TRACE Subsample: Trading in Related Markets and Equity Market Quality**

This table presents the results of regressions estimate the impact of related markets and trading in those markets on equity market quality for the subsample of firms with bond information on the TRACE system. All variables are as defined in Table 3. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day and firm level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month-firm level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	$hasbrouck$	$\mid AR \mid$
opt	-0.0008	-0.0005	-0.0137	-0.0137	-0.0098	-0.0025	-0.0048
	[-5.22]	[-4.62]	[-4.52]	[-4.52]	[-3.60]	[-3.47]	[-2.46]
cds	0.0001	0.0001	0.0068	0.0068	0.0015	0.0004	0.0009
	[2.69]	[2.91]	[3.20]	[3.20]	[1.12]	[1.41]	[0.92]
$lprogram$	-0.0007	-0.0006	-0.0260	-0.0260	-0.0246	-0.0076	-0.0041
	[-3.18]	[-3.12]	[-13.61]	[-13.66]	[-9.26]	[-10.14]	[-5.02]
$ldvolume$	0.0001	0.0001	0.0037	0.0037	0.0004	0.0042	-0.0010
	[0.31]	[0.52]	[1.84]	[1.87]	[0.15]	[6.18]	[-1.04]
$volatility$	0.0077	0.0055	-0.1073	-0.1025	-0.1656	-0.6597	0.5102
	[1.26]	[1.31]	[-4.26]	[-4.12]	[-3.54]	[-1.76]	[3.23]
$\frac{debt}{equity}$	0.0001	0.0000	0.0007	0.0007	0.0001	-0.0001	-0.0001
	[1.93]	[2.07]	[1.20]	[1.19]	[0.23]	[-2.52]	[-0.41]
$loptvol$	0.0001	0.0001	0.0019	0.0019	0.0010	-0.0001	0.0003
	[6.14]	[5.38]	[5.08]	[5.06]	[3.09]	[-0.91]	[0.84]
$lbondvol$	0.0000	0.0000	0.0005	0.0005	0.0001	0.0001	0.0002
	[4.66]	[4.82]	[5.96]	[5.96]	[2.13]	[4.94]	[2.70]
$intercept$	0.0073	0.0050	0.3371	0.3368	0.3396	0.0625	0.1567
	[16.74]	[16.27]	[34.39]	[34.37]	[47.05]	[13.03]	[14.97]
R^2	0.474	0.457	0.082	0.082	0.149	0.350	0.017
N	564718	564685	564685	564685	564685	27102	27460

Table 7: **Within Firm Analysis: Related Markets and Equity Market Quality**

This table presentes the results of regressions that estimate the impact of the introduction of related markets on a firm's equity market quality. All variables are as defined in Table 2. All regression specifications contain firm fixed effects. Because we control for time-invariant firm characteristics, the related markets coefficients are interpreted as the change in market quality after the introduction of a related market. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	$hasbrouck$	$\mid AR \mid$
opt	-0.0003	-0.0002	-0.0131	-0.0131	-0.0121	-0.0011	-0.0051
	[-26.29]	[-27.26]	[-16.20]	[-16.20]	[-13.36]	[-3.68]	[-3.72]
$trace$	0.0000	0.0000	-0.0130	-0.0129	-0.0092	0.0009	-0.0009
	[3.77]	[0.96]	[-14.46]	[-14.41]	[-8.70]	[4.34]	[-0.87]
cds	0.0001	0.0001	-0.0096	-0.0095	0.0032	0.0010	0.0035
	[10.32]	[12.52]	[-9.96]	[-9.91]	[3.47]	[4.44]	[1.70]
$lprogram$	-0.0006	-0.0005	-0.0175	-0.0175	-0.0136	-0.0037	-0.0029
	[-55.48]	[-52.05]	[-61.01]	[-61.05]	[-47.52]	[-10.97]	[-5.79]
$ldvolume$	-0.0002	-0.0001	-0.0099	-0.0099	-0.0090	0.0011	-0.0018
	[-16.21]	[-12.54]	[-22.75]	[-22.79]	[-19.82]	[3.96]	[-2.76]
$volatility$	0.0123	0.0101	-0.1640	-0.1624	-0.2385	-1.2451	0.4779
	[2.24]	[2.30]	[-3.27]	[-3.27]	[-3.11]	[-1.82]	[2.01]
$\frac{debt}{equity}$	0.0002	0.0002	-0.0004	-0.0004	-0.0001	0.0002	0.0002
	[20.97]	[21.78]	[-2.11]	[-2.08]	[-0.78]	[2.18]	[0.91]
R^2	0.707	0.675	0.250	0.250	0.271	0.493	0.079
N	1518792	1517283	1517283	1517283	1517283	67082	72900

Table 8: **Within Firm Analysis: Trading in Related Markets and Equity Market Quality**

This table presentes the results of regressions that estimate the impact of the introduction of related markets and changes in trading in those markets on a firm's equity market quality. All variables are as defined in Table 3. All regression specifications contain firm fixed effects. Because we control for time-invariant firm characteristics, the related markets coefficients are interpreted as the change in market quality after the introduction of a related market. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	$hasbrouck$	$\mid AR \mid$
opt	-0.0005	-0.0004	-0.0146	-0.0145	-0.0127	-0.0015	-0.0054
	[-41.80]	[-42.45]	[-17.98]	[-17.98]	[-14.14]	[-5.36]	[-3.45]
$trace$	-0.0000	-0.0001	-0.0138	-0.0137	-0.0098	0.0003	-0.0023
	[-4.38]	[-7.39]	[-15.41]	[-15.36]	[-9.52]	[1.75]	[-2.05]
cds	0.0001	0.0001	-0.0100	-0.0099	0.0030	0.0009	0.0031
	[7.16]	[9.82]	[-10.43]	[-10.38]	[3.28]	[3.82]	[1.52]
$lprogram$	-0.0006	-0.0005	-0.0174	-0.0174	-0.0136	-0.0037	-0.0028
	[-55.51]	[-52.07]	[-60.86]	[-60.90]	[-47.49]	[-10.87]	[-5.67]
$ldvolume$	-0.0002	-0.0001	-0.0104	-0.0104	-0.0093	0.0008	-0.0021
	[-20.52]	[-16.78]	[-23.70]	[-23.74]	[-20.09]	[2.70]	[-2.74]
$volatility$	0.0122	0.0100	-0.1651	-0.1635	-0.2390	-1.2485	0.4768
	[2.25]	[2.30]	[-3.25]	[-3.26]	[-3.11]	[-1.82]	[2.01]
$\frac{debt}{equity}$	0.0002	0.0001	-0.0004	-0.0004	-0.0002	0.0002	0.0002
	[20.72]	[21.53]	[-2.27]	[-2.24]	[-0.87]	[2.00]	[0.84]
$loptvol$	0.0001	0.0001	0.0006	0.0006	0.0003	0.0002	0.0002
	[31.16]	[29.47]	[6.55]	[6.58]	[3.09]	[3.58]	[0.49]
$lbondvol$	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002
	[17.56]	[19.61]	[2.59]	[2.61]	[2.27]	[5.92]	[2.51]
R^2	0.708	0.676	0.250	0.250	0.271	0.493	0.079
N	1518792	1517283	1517283	1517283	1517283	67082	72900

Table 9: **Capital Structure Complexity, Trading in Related Markets and Equity Market Quality**

This table presents the results of regressions that estimate the impact of capital structure complexity, related markets and trading in those markets on equity market quality. *type_fract* is the number (out of a possible four) categories of debt in the firms capital structure, divided by 4. The four types of debt are: senior non-convertible; convertible; mortgage and equipment linked debt, and commercial paper. All other variables are as defined in Table 3. All regression specifications contain standard errors that are two-way clustered, by firm and time. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\lvert dollarimb \rvert$	$\lvert shareimb \rvert$	$\lvert tradeimb \rvert$	*hasbrouck*	$\lvert AR \rvert$
opt	-0.0008	-0.0005	-0.0178	-0.0178	-0.0149	-0.0027	-0.0038
	[-10.44]	[-9.56]	[-10.56]	[-10.58]	[-10.24]	[-6.93]	[-3.27]
$trace$	0.0000	-0.0000	-0.0103	-0.0103	-0.0071	0.0005	-0.0017
	[0.27]	[-0.11]	[-8.03]	[-8.00]	[-6.03]	[2.17]	[-1.77]
cds	0.0004	0.0003	0.0106	0.0106	0.0027	0.0010	0.0015
	[6.49]	[6.49]	[5.50]	[5.51]	[2.02]	[4.09]	[2.08]
$lprogram$	-0.0009	-0.0006	-0.0250	-0.0250	-0.0196	-0.0049	-0.0026
	[-9.41]	[-9.41]	[-27.90]	[-27.93]	[-24.65]	[-8.39]	[-6.10]
$ldvolume$	-0.0002	-0.0001	-0.0054	-0.0054	-0.0095	0.0009	-0.0030
	[-2.40]	[-1.79]	[-3.99]	[-3.98]	[-8.61]	[1.50]	[-4.47]
$volatility$	0.0213	0.0165	-0.2399	-0.2382	-0.2690	-1.4091	0.2619
	[2.56]	[2.61]	[-2.94]	[-2.93]	[-3.28]	[-1.93]	[1.08]
$\frac{debt}{equity}$	0.0002	0.0001	0.0012	0.0012	0.0006	0.0002	0.0003
	[3.65]	[3.42]	[1.73]	[1.73]	[1.03]	[2.02]	[1.55]
$lbondvol$	0.0000	0.0000	0.0008	0.0008	0.0003	0.0001	0.0003
	[6.60]	[6.46]	[8.24]	[8.25]	[5.18]	[6.86]	[3.55]
$loptvol$	0.0002	0.0001	0.0042	0.0042	0.0026	0.0002	0.0003
	[12.83]	[12.34]	[12.88]	[12.87]	[9.78]	[2.00]	[1.01]
$type\_fract$	0.0002	0.0002	0.0068	0.0067	0.0066	-0.0024	-0.0001
	[1.68]	[1.80]	[2.16]	[2.14]	[2.57]	[-4.61]	[-0.07]
$intercept$	0.0110	0.0075	0.4166	0.4165	0.3924	0.0461	0.1282
	[26.58]	[26.08]	[54.72]	[54.68]	[62.26]	[21.53]	[34.57]
R^2	0.559	0.529	0.218	0.219	0.244	0.332	0.042
N	1499823	1498328	1498328	1498328	1498328	66287	71991

Table 10: **Within Firm Analysis: Capital Structure Complexity, Trading in Related Markets and Equity Market Quality**

This table presents the results of regressions that estimate the impact of changes capital structure complexity, the introduction of related markets and changes in trading in those markets on a firm's equity market quality. *type_fract* is the number (out of a possible four) categories of debt in the firms capital structure, divided by 4. The four types of debt are: senior non-convertible; convertible; mortgage and equipment linked debt, and commercial paper. All other variables are as defined in Table 3. All regression specifications contain firm fixed effects. Because we control for time-invariant firm characteristics, the related markets coefficients are interpreted as the change in market quality after the introduction of a related market. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\|dollarimb\|$	$\|shareimb\|$	$\|tradeimb\|$	$hasbrouck$	$\|AR\|$
opt	-0.0005	-0.0003	-0.0147	-0.0147	-0.0130	-0.0014	-0.0051
	[-41.09]	[-41.60]	[-18.04]	[-18.04]	[-14.30]	[-5.19]	[-3.24]
$trace$	-0.0000	-0.0001	-0.0140	-0.0139	-0.0099	0.0003	-0.0022
	[-4.49]	[-7.62]	[-15.54]	[-15.49]	[-9.64]	[1.31]	[-2.01]
cds	0.0001	0.0001	-0.0100	-0.0099	0.0029	0.0008	0.0023
	[7.10]	[9.89]	[-10.33]	[-10.28]	[3.13]	[3.52]	[1.14]
$lprogram$	-0.0006	-0.0005	-0.0174	-0.0174	-0.0136	-0.0036	-0.0028
	[-54.83]	[-51.29]	[-60.25]	[-60.29]	[-46.89]	[-10.84]	[-5.65]
$ldvolume$	-0.0002	-0.0001	-0.0105	-0.0105	-0.0093	0.0007	-0.0021
	[-20.24]	[-16.62]	[-23.58]	[-23.63]	[-20.00]	[2.46]	[-2.67]
$volatility$	0.0119	0.0097	-0.1576	-0.1558	-0.2317	-1.1999	0.4639
	[2.22]	[2.28]	[-3.31]	[-3.32]	[-3.13]	[-1.78]	[2.02]
$\frac{debt}{equity}$	0.0002	0.0002	-0.0003	-0.0003	-0.0001	0.0002	0.0002
	[19.71]	[20.47]	[-1.37]	[-1.35]	[-0.59]	[1.75]	[0.87]
$lbondvol$	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002
	[17.34]	[19.39]	[2.81]	[2.84]	[2.34]	[6.04]	[2.26]
$loptvol$	0.0001	0.0001	0.0006	0.0006	0.0003	0.0002	0.0001
	[30.83]	[29.11]	[6.49]	[6.52]	[3.14]	[3.69]	[0.38]
$type\_fract$	0.0003	0.0002	0.0063	0.0063	0.0008	-0.0006	-0.0031
	[15.97]	[10.23]	[4.66]	[4.67]	[0.67]	[-2.19]	[-1.03]
R^2	0.704	0.672	0.250	0.250	0.271	0.501	0.079
N	1499823	1498328	1498328	1498328	1498328	66287	71991

Table 11: **Firm Complexity, Related Markets and Equity Market Quality**

This table presents results of regressions that estimate the impact of firm complexity, related markets, and trading in those markets on equity market quality. *intang* is the measure of firm complexity and is defined as intangible assets/total assets. *intang_CDS* is an interaction variable equal to *intang* times *CDS*. All other variables are as defined in Table 3. All regression specifications contain standard errors that are two-way clustered, by firm and time. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	$hasbrouck$	$\mid AR \mid$
opt	-0.0008	-0.0005	-0.0173	-0.0173	-0.0148	-0.0027	-0.0040
	[-10.22]	[-9.30]	[-10.02]	[-10.03]	[-9.80]	[-7.07]	[-3.43]
$trace$	0.0000	-0.0000	-0.0099	-0.0098	-0.0066	0.0006	-0.0019
	[0.15]	[-0.17]	[-7.57]	[-7.54]	[-5.52]	[2.28]	[-1.92]
cds	0.0004	0.0003	0.0105	0.0105	0.0024	0.0007	0.0002
	[6.62]	[6.71]	[4.97]	[4.98]	[1.68]	[2.49]	[0.22]
$lprogram$	-0.0009	-0.0006	-0.0248	-0.0248	-0.0195	-0.0049	-0.0026
	[-9.39]	[-9.40]	[-27.89]	[-27.93]	[-24.60]	[-8.39]	[-6.29]
$ldvolume$	-0.0003	-0.0002	-0.0058	-0.0058	-0.0096	0.0010	-0.0029
	[-2.65]	[-2.01]	[-4.28]	[-4.28]	[-8.67]	[1.66]	[-4.58]
$volatility$	0.0216	0.0169	-0.2414	-0.2399	-0.2722	-1.3848	0.2730
	[2.56]	[2.60]	[-2.95]	[-2.94]	[-3.27]	[-1.96]	[1.11]
$\frac{debt}{equity}$	0.0002	0.0001	0.0010	0.0010	0.0004	0.0001	0.0002
	[3.79]	[3.56]	[1.49]	[1.48]	[0.69]	[1.32]	[1.41]
$lbondvol$	0.0000	0.0000	0.0007	0.0007	0.0003	0.0001	0.0003
	[5.99]	[5.93]	[7.71]	[7.72]	[4.76]	[6.37]	[3.68]
$loptvol$	0.0002	0.0001	0.0043	0.0043	0.0026	0.0002	0.0002
	[12.65]	[12.12]	[12.83]	[12.83]	[9.72]	[1.86]	[0.77]
$intang$	-0.0000	-0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[-3.01]	[-3.54]	[4.99]	[4.98]	[6.50]	[8.00]	[2.09]
$intang\_cds$	0.0000	0.0000	0.0016	0.0016	0.0010	0.0001	0.0011
	[0.98]	[0.97]	[1.76]	[1.78]	[1.95]	[1.27]	[1.98]
$intercept$	0.0113	0.0077	0.4202	0.4201	0.3945	0.0451	0.1276
	[26.40]	[25.77]	[55.94]	[55.89]	[63.21]	[22.17]	[35.26]
R^2	0.560	0.530	0.221	0.221	0.245	0.340	0.042
N	1444005	1442540	1442540	1442540	1442540	63700	69319

Table 12: **Within-Firm Analysis: Firm Complexity, Trading in Related Markets and Equity Market Quality**

This table presents the results of regressions that estimate the impact of changes firm complexity, the introduction of related markets and changes in trading in those markets on a firm's equity market quality. *intang* is the measure of firm complexity and is defined as intangible assets/total assets. *intang_CDS* is an interaction variable equal to *intang* times *CDS*. All other variables are as defined in Table 3. All regression specifications contain firm fixed effects. Because we control for time-invariant firm characteristics, the related markets coefficients are interpreted as the change in market quality after the introduction of a related market. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	$hasbrouck$	$\mid AR \mid$
opt	-0.0005	-0.0003	-0.0152	-0.0152	-0.0134	-0.0016	-0.0051
	[-40.81]	[-41.14]	[-18.50]	[-18.50]	[-14.78]	[-5.71]	[-3.33]
$trace$	-0.0000	-0.0000	-0.0140	-0.0139	-0.0099	0.0003	-0.0024
	[-3.91]	[-6.94]	[-15.50]	[-15.46]	[-9.58]	[1.59]	[-2.15]
cds	0.0001	0.0001	-0.0100	-0.0099	0.0024	0.0007	0.0015
	[6.34]	[9.08]	[-9.68]	[-9.63]	[2.58]	[3.02]	[0.68]
$lprogram$	-0.0006	-0.0005	-0.0173	-0.0173	-0.0134	-0.0036	-0.0027
	[-54.51]	[-51.61]	[-59.37]	[-59.41]	[-46.43]	[-10.78]	[-5.55]
$ldvolume$	-0.0003	-0.0002	-0.0108	-0.0108	-0.0097	0.0008	-0.0021
	[-21.36]	[-17.35]	[-24.55]	[-24.59]	[-20.92]	[2.56]	[-2.66]
$volatility$	0.0121	0.0099	-0.1647	-0.1630	-0.2372	-1.2273	0.4637
	[2.23]	[2.30]	[-3.24]	[-3.25]	[-3.11]	[-1.81]	[1.95]
$\frac{debt}{equity}$	0.0002	0.0002	-0.0003	-0.0003	-0.0002	0.0002	0.0004
	[20.84]	[21.45]	[-1.64]	[-1.62]	[-1.18]	[2.98]	[1.55]
$lbondvol$	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0003
	[17.98]	[20.02]	[2.59]	[2.62]	[2.30]	[5.95]	[2.75]
$loptvol$	0.0001	0.0001	0.0007	0.0007	0.0003	0.0002	0.0001
	[31.23]	[29.54]	[7.21]	[7.24]	[3.35]	[3.68]	[0.42]
$intang$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[2.16]	[0.96]	[3.55]	[3.56]	[3.90]	[1.30]	[0.37]
$intang\_cds$	0.0000	0.0000	0.0002	0.0002	0.0008	0.0002	0.0016
	[9.15]	[8.05]	[0.53]	[0.55]	[2.59]	[2.99]	[1.75]
R^2	0.708	0.676	0.252	0.252	0.272	0.480	0.078
N	1444005	1442540	1442540	1442540	1442540	63700	69319

Table 13: **CDS Quote Activity, Related Markets and Equity Market Quality**

This table presents the results of regressions that estimate the impact related markets and trading in those markets on equity market quality. *CDS_Quote* is the number of days on which we observe CDS quotes on Bloomberg during year t. All other variables are as defined in Table 3. All regression specifications contain firm fixed effects. Because we control for time-invariant firm characteristics, the related markets coefficients are interpreted as the change in market quality after the introduction of a related market. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	$hasbrouck$	$\mid AR \mid$
opt	-0.0008	-0.0005	-0.0176	-0.0176	-0.0148	-0.0027	-0.0039
	[-10.42]	[-9.50]	[-10.52]	[-10.53]	[-10.23]	[-6.87]	[-3.31]
trace	0.0000	0.0000	-0.0098	-0.0098	-0.0067	0.0004	-0.0019
	[0.61]	[0.27]	[-7.69]	[-7.66]	[-5.71]	[1.73]	[-1.84]
cds	0.0003	0.0002	-0.0064	-0.0064	0.0061	0.0009	0.0026
	[2.37]	[2.59]	[-1.41]	[-1.40]	[1.73]	[2.97]	[1.48]
lprogram	-0.0009	-0.0007	-0.0250	-0.0251	-0.0197	-0.0049	-0.0026
	[-9.61]	[-9.61]	[-28.26]	[-28.29]	[-25.00]	[-8.45]	[-6.02]
ldvolume	-0.0002	-0.0001	-0.0054	-0.0054	-0.0094	0.0009	-0.0030
	[-2.38]	[-1.76]	[-4.00]	[-4.00]	[-8.60]	[1.56]	[-4.49]
volatility	0.0219	0.0171	-0.2447	-0.2432	-0.2747	-1.4496	0.2750
	[2.57]	[2.61]	[-2.95]	[-2.93]	[-3.27]	[-1.97]	[1.10]
$\frac{debt}{equity}$	0.0002	0.0001	0.0010	0.0010	0.0005	0.0001	0.0002
	[3.76]	[3.54]	[1.56]	[1.56]	[0.80]	[1.85]	[1.35]
lbondvol	0.0000	0.0000	0.0007	0.0007	0.0003	0.0001	0.0003
	[6.53]	[6.46]	[8.00]	[8.01]	[5.25]	[6.80]	[3.84]
loptvol	0.0002	0.0001	0.0042	0.0042	0.0026	0.0002	0.0003
	[12.85]	[12.34]	[12.98]	[12.97]	[9.81]	[1.91]	[1.01]
cds_quote	0.0000	0.0000	0.0036	0.0036	-0.0006	-0.0000	-0.0000
	[1.08]	[1.00]	[3.70]	[3.70]	[-0.78]	[-0.52]	[-0.71]
intercept	0.0111	0.0076	0.4184	0.4183	0.3939	0.0458	0.1285
	[26.70]	[26.15]	[56.06]	[56.01]	[63.53]	[21.35]	[34.70]
R^2	0.559	0.529	0.219	0.219	0.244	0.324	0.042
N	1518792	1517283	1517283	1517283	1517283	67082	72900

Table 14: **Within Firm Analysis: CDS Quote Activity, Trading in Related Markets and Equity Market Quality**

This table presents the results of regressions that estimate the impact of the introduction of related markets and changes in trading in those markets on a firm's equity market quality. *CDS_Quote* is the number of days on which we observe CDS quotes on Bloomberg during year t. All other variables are as defined in Table 3. All regression specifications contain firm fixed effects. Because we control for time-invariant firm characteristics, the related markets coefficients are interpreted as the change in market quality after the introduction of a related market. Liquidity regressions are based on daily data and t-statistics are calculated using standard errors that are clustered at the day level. Because efficiency variables are calculated over monthly horizons, the independent variables are defined as monthly averages and regressions are based on monthly data. Standard errors for the efficiency regressions are clustered at the year-month level.

	Liquidity					**Efficiency**	
	Trading Costs (daily)		*Imbalances (daily)*			*Efficiency (monthly)*	
	QS	ES	$\mid dollarimb \mid$	$\mid shareimb \mid$	$\mid tradeimb \mid$	*hasbrouck*	$\mid AR \mid$
opt	-0.0005	-0.0004	-0.0146	-0.0146	-0.0127	-0.0014	-0.0054
	[-41.77]	[-42.42]	[-18.03]	[-18.03]	[-14.18]	[-5.31]	[-3.46]
trace	-0.0000	-0.0001	-0.0137	-0.0136	-0.0097	0.0003	-0.0023
	[-4.47]	[-7.51]	[-15.40]	[-15.36]	[-9.50]	[1.75]	[-2.05]
cds	0.0000	0.0000	-0.0013	-0.0013	0.0095	0.0005	0.0032
	[0.74]	[1.78]	[-0.83]	[-0.82]	[6.39]	[1.97]	[1.45]
lprogram	-0.0006	-0.0005	-0.0174	-0.0175	-0.0136	-0.0037	-0.0028
	[-55.51]	[-52.07]	[-60.87]	[-60.91]	[-47.49]	[-10.87]	[-5.67]
ldvolume	-0.0002	-0.0001	-0.0104	-0.0104	-0.0093	0.0008	-0.0021
	[-20.52]	[-16.79]	[-23.67]	[-23.71]	[-20.09]	[2.68]	[-2.74]
volatility	0.0122	0.0100	-0.1652	-0.1636	-0.2391	-1.2475	0.4767
	[2.25]	[2.30]	[-3.25]	[-3.25]	[-3.11]	[-1.82]	[2.01]
$\frac{debt}{equity}$	0.0002	0.0001	-0.0004	-0.0004	-0.0002	0.0002	0.0002
	[20.72]	[21.53]	[-2.29]	[-2.26]	[-0.89]	[2.02]	[0.84]
lbondvol	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002
	[17.47]	[19.51]	[2.82]	[2.84]	[2.46]	[5.55]	[2.49]
loptvol	0.0001	0.0001	0.0006	0.0006	0.0003	0.0002	0.0002
	[31.17]	[29.48]	[6.60]	[6.63]	[3.13]	[3.55]	[0.49]
cds_quote	0.0000	0.0000	-0.0027	-0.0027	-0.0020	0.0000	-0.0000
	[7.45]	[9.46]	[-6.40]	[-6.37]	[-5.04]	[6.73]	[-0.13]
R^2	0.708	0.676	0.250	0.250	0.271	0.493	0.079
N	1518792	1517283	1517283	1517283	1517283	67082	72900