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STOCK LIQUIDITY AS A DETERMINANT OF CREDIT DEFAULT SWAP SPREADS

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ABSTRACT

This research investigates the effect of stock liquidity on credit default swap spreads. The relationship between stock liquidity and CDS spreads is tested empirically using a panel data of 82 companies spanning a period of 64 months. To ensure the accuracy of our findings, we use three proxies for stock liquidity, namely the bid-ask spread, Amihud illiquidity measure and the turnover ratio. When controlling for other known firm-level factors, we obtain a relationship between stock liquidity measures and CDS spreads, indicating that higher stock liquidity leads to lower CDS spread. This relation also holds when macroeconomic factors are used as control variables. Thereby, we manage to find a link between the stock market and the CDS market. This relationship helps predict the movement of CDS spreads by analyzing stock liquidity in the developed equity market.

KEYWORDS: Credit Default Swaps, Stock Liquidity, Default Risk, Bid-Ask Spread, Amihud Illliquidity, Turnover Ratio.

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I. INTRODUCTION

Credit derivatives and credit default swaps are pioneered in the late 20^{th} century and after a period of steady development, the derivatives market grows tremendously in the beginning of the 2000s. This rapid growth is believed to rise from the need of banks and insurance companies to hedge their bond and loan exposures and by the desire of hedge funds for highly liquid instruments to speculate on credit risk (Tang and Yan, 2008).

Hull (2003) defines credit derivatives as contracts in which the payoff depends on the creditworthiness of one or more entities. Ericsson et al (2005) further explain that these types of instruments allow default risk to be traded separately from other sources of uncertainty. The most widely used type of credit derivatives are the credit default swaps. Hull (2003) argues that credit default swaps are considered to be a type of insurance against the default risk of a company. Das et al (2006) define credit default swaps as “a default insurance contract in which the buyer pays the seller a periodic premium in return for compensation in the event that a reference firm defaults”. Therefore, credit default swap spreads highlight the market’s view on the financial stability of an entity (Annaert et al, 2010).

CDS spreads display information regarding the financial soundness of a firm. They are related to a firm’s credit risk and more directly to default risk. In understanding a firm’s financial standing and predicting its future financial reliability, the analysis of CDS spreads and their movements emerges as a crucial study. The importance of capturing a firm’s credit risk and default risk greatly increases after the recent financial crisis. Therefore, the requirement of investigating and analyzing the factors determining credit risk (default risk) and influencing CDS spreads is undisputed (Annaert et al, 2010). According to Merton Model (1974), leverage, asset value and asset volatility constitute the theoretical factors determining default risk of a firm. Other factors influencing CDS spreads are earnings, dividends of a firm as well as macroeconomic dynamics such as GDP growth rate. Some of these factors such as leverage and earnings are obtained from financial statements. Thus, their data availability is not so frequent resulting in a drawback when estimating CDS spreads. On the other hand, stock market related factors have the advantage of higher data frequency. Underlying determinants for default risk such as asset value and asset volatility of a firm are not observable. They are estimated with proxies based on the equity market: market value of equity and volatility of stock return. Following up and analyzing these factors helps investors understand the credit risk and default risk of a firm. Thereby, investors determine the pricing of CDS.

Another important characteristic of the stock market besides return and volatility is liquidity. It is known that stock volatility and return are market related factors influencing the CDS spreads. However, the relationship between liquidity in the stock market and CDS spreads is not sufficiently addressed. We believe that such a relationship exists. Our literature search reveals only one study focusing on the effects of stock market liquidity on CDS spreads.

In our study, we investigate comprehensively the relationship between stock liquidity and credit default swap spreads. Our research of the effect of stock liquidity on CDS spread is distinguished by taking into consideration the effects of well-known firm specific and macroeconomic factors as control variables. In doing this, we try to extend the literature concerning the effects of liquidity in credit markets and prove that stock liquidity is a factor that needs to be taken into account in CDS pricing. Our analysis is of particular interest for researchers and prudential authorities as they use CDS spreads to investigate any possible warning signals regarding the financial health of an entity.

Prior to the rapid growth of the CDS market, most researches focusing on extracting credit risk investigated the bond market (De Fonseca et al, 2012). Several studies such as Collin-Dufresne et al (2001) and Chen et al (2007) document illiquidity of the bond market as an important part of bond spreads. Related literature also focuses on the effects of overall CDS market liquidity on CDS spreads (Arakelyan et al, 2012) and the relationship between stock liquidity and credit risk (Rösch et al, 2012). To the best of our knowledge, the direct relationship between stock liquidity and CDS spreads has only been investigated in the work of Das and Hanouna (2008) who find strong evidence that “equity liquidity of the entity is negatively related to the CDS spreads”. Several other researches highlight the different impacts that certain variables have on credit default swaps. Benchmarks in credit default swap literature are the studies undertaken by Ericsson et al (2005) who investigate the effects that factors such as firm leverage, riskless interest rate and volatility have on the CDS premium.

Furthermore, Hull, Predescu and White (2004) investigate the impact of rating announcements on credit default swap pricing.

Strong evidence is found in the researches of Chen et al (2007) and Goldstein et al (2006) that illiquidity of bond market is a component of bond spreads. Since the underlying instrument behind the CDS contracts are bonds, we expect to find a similar liquidity effect on CDS spreads stemming from the stock market. However, as Das et al (2008) argues, dissimilarity exists between corporate bond liquidity and CDS liquidity stemming from the different uses of these instruments. As corporate bonds are used mainly for portfolio reasons and trade seldom, CDS are used in arbitrage and risk management. Therefore, this liquidity phenomenon on CDS spreads needs to be investigated separately (Das et al, 2008).

Das et al (2008:2) argue that CDS contract sellers "actively hedge their exposures through the equity markets and through the use of options and debt-related instruments". When the overall liquidity in the equity markets falls, the hedging costs "related to taking short positions in equity or long positions in put options" that CDS contract sellers have to bear increase. These increased hedging costs are recovered through increased CDS spreads, even when illiquidity is not systematic. (Das et al, 2008:2).

A further motivation for investigating the relationship between stock liquidity and CDS spreads is the flight-to-quality or flight-to-liquidity phenomenon (Ericsson and Renault, 2007). This relates to the tendency of high credit quality assets to become more liquid than low credit quality assets, especially in periods of crisis. This is mainly due to investor preference of shifting their portfolio weights towards safer assets in periods of market turbulence (Rösch et al, 2012). Rösch et al (2012) conclude in their research that investment grade stocks have lower liquidity costs than speculative stocks. This is in line with the idea that the more risky an asset is the more liquidity costs it incurs. According to this theory, we expect companies with a higher stock liquidity to have lower CDS spreads than companies with low stock liquidity.

Credit default swaps can be viewed as insurance premiums against the default risk of a firm (Hull, 2003). When a firm's asset value decreases, its credit risk increases. Thus, the firm gets closer to the default point. Under these circumstances, the demand for that firm's shares in the market decreases, implying less trade for these shares. This stock illiquidity triggers signals regarding the solvency of the firm to the bond market and CDS market. The CDS market requires a higher premium to insure against the default of that firm leading to an increase in the CDS spread. Investors somewhat compensate the increased insurance cost due the illiquidity in the stock market by increasing CDS spreads.

In our research, we use monthly data on 82 firms, encompassing a period of 64 months, starting from December 2007 until March 2013. We are limited to using this time window because CDS data is not available before December 2007 in the Datastream. Furthermore, for the accounting data used such as leverage and operating margin, we face with the limitation that these variables are only available with yearly frequency. We address this problem by using interpolation.

To investigate the effect of stock liquidity on CDS spreads we use a panel data regression in which the dependent variable is the CDS spread and the independent variable is stock liquidity. We use as control variables: stock return, stock return volatility, equity value, leverage and operating margin. In our analysis, we use three proxies for liquidity: the bid-ask spread, Amihud illiquidity measure and the turnover ratio. We prove that stock liquidity has a significant role in explaining the variation in CDS spreads when accounting for the above mentioned variables. Therefore, we manage to link the CDS market and stock market which are both ultimately assessing the performance of a firm.

In Section 2 of this paper, we discuss in detail the stock liquidity and other determinants of CDS spreads, by focusing on the credit default swaps (Section 2.1), literature review (Section 2.2) and the theoretical framework reasoning the impact of stock liquidity on CDS spreads and the choice of control variables (Section 2.3). Section 3 is devoted to the methodology behind our research. In this section, we investigate the data we use (Section 3.1) and the model we adopt in testing our hypothesis (Section 3.2). Empirical analysis is presented in Section 4, while Section 5 is finally dedicated to the conclusions of our study.

2. STOCK LIQUIDITY AND OTHER DETERMINANTS OF CDS SPREADS

2.1. Credit Default Swaps

Credit derivatives emerge in the 1990s and after a period of steady growth, the derivatives market expands in the 2000s with the International Swaps and Derivatives Association reporting a growth in CDS notional amounts from $632 billion in 2001 to over $45 trillion by midyear 2007; annual growth rate exceeding 100 percent from 2004 through to 2006 (Mengle, 2007). Moreover, even after the turmoil due to the 2008 financial crisis, data provided by the International Organization of Securities Commission shows that the amount of CDS trading continues to increase even with the expansion of risk management practices (IOSCO, 2012).

Tang and Yan (2012) further argue that the multi trillion dollar CDS contracts market plays an increasingly important role in the financial world, being a stepping stone in the analysis of market participants and regulators. Many important market participants such as Deutsche Bank, Bloomberg or Moody's use CDS spreads as measures of financial strength of corporations and sovereigns. For instance, Deutsche Bank provides an "online mapping from CDS spreads to default probabilities for sovereign entities", while Moody's calculates default frequencies based on implied CDS (Tang and Yan, 2012:1). However, the criticism regarding this new financial derivative instrument continues, Jarrow (2012) pointing out several problems with using CDS as a measure of default probabilities.

CDS are traded over-the counter, transactions being facilitated by inter-dealer brokers. Even though some companies CDS are traded daily or even multiple times within a day, a large amount of contracts are traded every few days or even weekly (Tang and Yan, 2012). Tang and Yan (2012) further argue that this issue should raise awareness regarding the information content of CDS and also shows the importance of liquidity in CDS pricing.

Das et al. (2006:1) defines that "the periodic payment or spread, taken as a percentage of the notional value of the CDS contract, is a metric of the credit risk of the reference firm and it is also a forecast of the expected loss on a reference bond issued by the reference issuer". A firm defaults when it is not able to meet its obligations against its debt holders. Thus, default risk causes lenders to ask a spread over the risk-free rate of interest from borrowing firms. Higher default risk implies a higher spread for a borrower in the borrowing fund as well as a higher CDS spread. In other words, spread is an increasing function of the default risk (Merton, 1974 and Vassalou & Xing, 2004).

2.2. Literature Review

Throughout the past years several researches are undertaken concerning the different impacts that certain variables have on credit default swaps. Such notable researches include Ericsson, Jacobs and Oviedo (2005); Benkert (2004); Annaert, De Ceuster, Van Roy and Vespro (2010); Kapar and Olmo (2011); Das and Hanouna (2008); de Jong and Driessen (2005); Alexander and Kaeck (2007); Norden (2008); Byström (2005); Callen, Livnat and Segal (2008); Hull, Predescu and White (2004); Daniels and Jensen (2005).

Ericsson, Jacobs and Oviedo (2005) investigate using CDS data the relationship between the market CDS premium and factors such as firm leverage, riskless interest rate and volatility. By using linear regressions, they find that the coefficients of all of these three determinants are significant both statistically and economically. With regards to volatility, a previous research is undertaken by Benkert (2004) using panel data of credit default swaps on 120 companies. His findings reveal that "option-implied volatility is a more important factor in explaining variation in credit default swap premiums than historical volatility" (Benkert, 2004).

Annaert, De Ceuster, Van Roy and Vespro (2010) determine the impact of certain credit risk drivers inspired by the Merton model on CDS spread changes of 31 European Banks. Their article also examines and compares how the determinants of CDS spreads change before and after the financial crisis. They find that these determinants vary widely across time implying that in order to get the whole picture; the models, which test the determinants of CDS spread changes, have to be estimated frequently. Another finding refers to the CDS market liquidity which plays an important part in explaining Euro-area bank CDS changes both before and after the financial crisis, while variables suggested by credit risk models become considerably more significant after the onset of the financial crisis (Annaert et al, 2010).

The conclusions of Annaert et al (2010) are also confirmed by the research of Kapar and Olmo (2011) which makes the distinction between non-financial and financial firms. They argue that before the financial crisis, credit risk in the CDS market is enough to explain overall credit risk; during the financial crisis, non-financial CDS contracts are still tightly related to the counterparty credit risk, while financial contracts are not. Kapar and Olmo (2011) suggest that this is mainly due to the fact that in case of default of a financial firm, investors would expect government intervention in order to avoid a possible domino effect and systemic risk.

Das and Hanouna (2008) find a direct relationship between stock liquidity and CDS spreads in the context of the Merton Model (1974) framework. Their result is robust to different measures of liquidity. Special attention is being given to the transmission mechanism of illiquidity from equity markets to CDS spread. In many respects, the paper of Das and Hanouna (2008) is similar to the work of de Jong and Driessen (2005) who prove that equity market illiquidity is priced into bond spreads.

Alexander and Kaeck (2007) demonstrate that CDS spreads “display pronounced regime specific behavior”. Their study shows that during CDS market turbulences the spreads are highly sensitive to stock volatility while in ordinary periods the spreads are more sensitive to stock returns rather than stock volatility. Their study also reveals that interest rates, stock returns and implied volatility have a significant effect on CDS spreads. These findings are in line with previous researches undertaken by Ericsson et al (2004) and Byström (2005).

Norden (2008) investigates in his study whether and how private and public information affects the CDS market’s response to rating announcements. His findings show that there are significant announcement effects for reviews of downgrades and to a smaller extent for downgrades, whilst there are significant anticipation effects for downgrades rather than for reviews of ratings. The research of Norden (2008) is closely related to the works of Daniels and Jensen (2005) and Hull, Predescu and White (2004) which investigate the impact of rating announcements on credit default swap pricing. Their findings show that reviews for downgrades contain significant information for the pricing of CDS while actual downgrades and negative outlooks do not. Another interesting observation pointed out by Hull, Predescu and White (2004) is that the results for positive rating events are much less significant than those for negative rating events.

Callen, Livnat and Segal (2009) investigate the impact of earnings on credit risk in the CDS market. They conclude that the earnings of reference firms are significantly negatively correlated with the CDS premiums. This result is in line with the fact that earnings display information regarding the credit risk of firms. Moreover, Callen et al (2008) find that CDS premiums are more correlated with earnings of low rated firms rather than with earnings of higher rated firms.

2.3. Theoretical Framework

Our study is tightly related to the above mentioned researches. We investigate the impact of stock liquidity on CDS spreads while controlling for other known determinants. The independent control variables we use in our analysis are: stock return, market value of equity, stock return volatility, leverage, operating margin, GDP growth rate and risk-free rate. Findings of Annaert et al (2010) suggest that these drivers change in significance throughout time. Their research shows that before 2006 credit risk drivers are the major determinants of CDS spreads while in the period just preceding the financial crisis and during the financial crisis, these drivers are not enough to explain the variation in CDS spreads, while liquidity and overall perception of bank stability explain an important part of this variation. We investigate in more detail the characteristics of stock liquidity and of the control variables.

2.3.1. Stock Liquidity

Based on the interaction between the stock market and the debt market, which both evaluate the solvency of a firm, we expect to find a relation between stock liquidity and CDS spreads and we aim to analyze the significance and direction of this relationship. To clarify the concept of stock liquidity, we appeal to the definition of De Jong & Driessen (2006: 11) who state that "a stock is defined to be liquid if large volumes can be traded without generating much price impact". It is thought that this definition of stock liquidity is captured well by the liquidity measure of bid-ask spread.

Credit risk and default risk are correlated with the firm's stock movements in the stock market. We conceptualize that if a firm's assets have a higher liquidity in the equity market, the firm have a lower spread for its CDS derivatives. When a firm has a higher default risk, not only the debt market reacts to this but also the equity market adjusts itself by a decrease in the transaction of the shares in the stock market. Firm stock illiquidity is viewed as increased credit risk, resulting in an increased CDS spread of that firm. One of the main sources of default (bankruptcy) risk relates to idiosyncratic factors (Opler & Titman, 1994; Asquith et al, 1994). In addition, the research of Spiegel and Wang (2005) confirms the negative relation between stock idiosyncratic risk and stock liquidity. This finding is in line with other previous studies.

Investors and debt holders have a chance to observe stock markets easier than debt markets because the former one is more developed and more liquid. For instance, Gunther et al (2001) argue that the stock market is a source of information for bank supervisors. They find that "markets for common shares are fairly liquid, so the quality of the price signals is reasonably high. Moreover, equity values are sensitive to changes in the condition of the issuing firm, making those changes easier to observe in share prices" (Gunther et al, 2001:3).

The stock and debt markets are dependent on each other. For instance, De Jong and Driessen (2006) point out the correlation between the returns on corporate bond, the returns on the Treasury bond market and the returns on the stock market. This argument is also emphasized in the work of Kwan (1996) which describes corporate bonds as a hybrid of the firm's stock and default-free bonds. Thereby, CDS as a derivative financial instrument developed over default risk of corporate bonds has to be related to equity market liquidity. The reasoning behind this is that "by controlling market risk using stock market index and equity index volatility, corporate bond returns are positively related to changes in the equity and bond market liquidity measures" (De Jong and Driessen, 2006: 2). The study of Fung et al (2008) gives us a direct relationship between stock market and CDS market especially with respect to volatility and pricing. They investigate the mutual feedback of information between two markets and argue that stock market tends to lead the investment-grade CDS market in terms of pricing. We think that if the volatility of stock market has an interaction with CDS market, the relationship between the CDS market and another characteristic of stock market, liquidity deserves to be analyzed.

In their study, Rösch et al (2012) search for the existence of a liquidity cost spread in the stock market between companies with a high credit quality and companies with a low credit quality. They find that “investment grade stocks have liquidity costs that are roughly 5% less than those of speculative grade stocks, indicating that stock market liquidity costs increase with credit risk” (Rösch, 2008: 18). This finding is in line with our expectation. Higher credit risk in a firm leads to illiquidity in that firm’s stock. Investors in the CDS market who observe this movement ask a higher CDS spread for that firm. Rösch et al (2008) comments that during crisis periods, credit risk intensifies and investors become more risk averse, thereby choosing liquid instruments. This leads us to believe that the magnitude of the relationship between liquidity in the stock market and CDS market increases (Rösch et al, 2008). In our study, we argue that liquidity of a firm’s shares in the stock market is an implication of lower credit risk for that firm.

CDS are regarded as insurance premiums against the default risk of a firm; an insurance against any possible decrease in the firm’s asset value (Hull, 2003). The shares of a firm, whose asset value is believed to be decreasing, create less demand for the stock in the stock market. Investors with long positions in shares of a firm experiencing financial distress and/or close to bankruptcy are stuck with their stocks. This is due to the fact that the market demand for this firm’s shares drops and the volume of traded shares decreases. Thereby, stock illiquidity signals higher credit risk. Less frequently traded stocks increase the need of insurance on the asset value of that firm which implies an increase in CDS spread.

The relationship between stock liquidity and CDS spread is not analyzed until now to the best of our knowledge except for one study written by Das and Hanouna (2008:1, 10-11). They theorize and confirm that “credit default swap spreads are directly related to equity market liquidity; equity market illiquidity is a component of CDS spreads at the individual firm level and this illiquidity component increases as the credit quality of the firm declines”. Das et al (2008) argue that a common procedure in the financial world is the active hedging of CDS contracts, which induces hedging costs to be incurred indifferent of whether liquidity risk is systematic or not. Therefore, we expect a transmission of these illiquidity costs from equity markets into CDS spreads. Evidence of a relationship between default risk and liquidity risk is also documented in the findings of Acharya et al (2007) who present a model in which declining credit quality is strongly linked with the drying up of liquidity in corporate debt markets (Das et al, 2008).

We argue that liquidity of a stock is a determining factor of the CDS spreads. Stock markets are more developed and more reactive to any new information regarding a firm or any changes in the performance of a firm in comparison to debt markets. Therefore, equity market leads the debt market by reacting to deteriorating credit quality in a firm which stems from a firm specific factor such as worsening business activity or an industry level factor such as changes in legislation which lead to narrowing profit margins in the sector. Both equity market and debt market are taking into consideration the riskiness of a firm *–business risk for stock market, credit risk for debt market-* by analyzing the changes in the firm's value. Business risk refers to asset risk which is defined by Crosbie and Bohn (2003:6) as "the uncertainty or risk of the asset value and which is a measure of a firm's business or industry risk." Because the value of the firm is estimated and uncertain, it is always likely to be understood in the context of the business or asset risk of the firm (Crosbie and Bohn, 2003). The stock and bond markets reflect this riskiness to the stock and bond prices as well as liquidity of the two assets. To sum up, all the ideas and research findings mentioned above bring about the hypothesis that there is a negative relationship between stock liquidity and CDS spreads.

Liquidity is a subtle concept in the sense that it is not directly observable and it is composed of numerous aspects which are not captured in one measure (Amihud, 2000). Therefore, in order to analyze in detail the effect of stock liquidity on CDS spreads, we use three measures of liquidity. These are: the bid-ask spread, the Amihud measure of illiquidity and the turnover ratio. Amihud (2000) argues that the bid-ask spread is a liquidity measure related to price impact. By using the classification of Spiegel and Wang (2005), the bid-ask spread is considered a cost based measure of liquidity that examines the loss a trader incurs from a transaction. A high bid-ask spread implies illiquidity in a particular stock. As defined by Spiegel and Wang (2005), a second type of liquidity class called reflective measures is distinguished. Reflective measures of liquidity, such as those that include volume of traded shares, are associated to different characteristics. These reflective measures focus on the volume, ignoring the costs associated to trading that share (Spiegel and Wang, 2005). Both Amihud's measure of illiquidity and the turnover ratio include the volume of traded shares in their formulas. However, Amihud's measure of illiquidity also touches upon the price impact by taking into account the dollar or euro volume of traded shares as well as the absolute value of returns in its calculation. On the other hand, the turnover ratio relies solely on the volume of traded shares and number of total shares outstanding to magnify liquidity. A higher Amihud illiquidity measure implies a higher CDS spread, whereas a higher turnover ratio denotes higher liquidity and thus a lower CDS spread.

2.3.2. Control Variables

The choice of control variables is made in line with previous researches. Stock return, equity value, equity (stock return) volatility, firm leverage, operating margin, risk-free rate and GDP growth rate are typical credit risk factors. Theory suggests that they are reflected in the CDS spreads. All of these factors are previously tested and results of the researches are in line one with another in that they all have a significant impact on the CDS spreads.

Stock Return

We select stock returns as a control variable because returns reflect a company's future prospects such as earnings and cash flows. By using equity returns as a proxy for asset returns in the Merton Model (1974), we test whether the equity market information has an effect on CDS spreads. Based on the Merton (1974) model, we expect that the higher the stock returns the lower the probability of default and as a result, we expect a lower CDS spread. A similar analysis is done by Annaert et al (2010). Articles such as Zhu (2006) show that CDS spreads are quite responsive to changes in stock returns.

Equity Value

A second independent control variable that we choose in our analysis is the equity value. Alexander and Kaeck (2007) argue that when the market value of a firm increases, the probability of default decreases. Since the firm value is not observed directly, we use as a proxy for firm value the equity value of the firm. Such an analysis is made by Alexander and Kaeck (2007) who argue that changes in a firm's equity value are the main determinant of changes in the firm value and the structural models indicate that upward trends in equity level are accompanied by decreases in the CDS spread.

Equity Volatility

As underlined by Alexander and Kaeck (2007), firm volatility is another theoretical determinant of CDS spreads as it is clear that the probability of default increases as the firm value fluctuations are more frequent and larger in scale.

The Merton Model (1974) bases its foundation on the option pricing model of Black and Scholes from 1973. The Black-Scholes model allows only two types of liabilities: a single class of debt and a single class of equity. Thereby, it becomes possible to compute the market value of total assets, which is not directly observable, based on following equations.

$$V_e = V_A * N(d_1) - (e^{-r(T-t)}) * D(t) * N(d_2)$$

$$d_1 = \frac{In\left(\frac{V_A}{D}\right) + (r + \frac{\sigma_A^2}{2}) * (T-t)}{\sigma_A * \sqrt{T}}$$

$$d_2 = d_1 - \sigma_A * \sqrt{(T-t)}$$

$$\sigma_e = \frac{V_A}{V_e} * N(d_1) * \sigma_A$$

where $D(t)$ is the value of debt at time t with a maturity time T, V_e is the market value of equity at time t, V_A is market the value of assets at time t, r is the risk free rate, σ_A is the volatility of assets, T is the maturity time of debt.

As with firm value, firm volatility is not observed directly. However, the positive relationship between equity volatility and firm volatility (asset volatility) is depicted by Ito's Lemma existing in the Merton Model:

$$\sigma_e = \frac{V_A}{V_e} * N(d_1) * \sigma_A$$

We use this relationship as a motivation for choosing equity volatility as a determinant for CDS spreads. Ericsson et al (2005) also follows the idea found in the Merton (1974) model which states that a firm defaults if the firm value falls below a certain threshold. As equity volatility increases, then this threshold is more easily reached and thus the firm has a higher chance of default. Furthermore, Hull and White (2004) argue that the Merton (1974) framework views equity as a call option on the underlying firm's assets and with a strike price equal to the face value of debt while debt is viewed as a put option on a firm's assets. Therefore, an increase in volatility decreases the value of risky debt and increase the CDS spread (Greatrex, 2008). In conclusion, we expect a positive relationship between equity volatility, asset volatility and the CDS spreads, a hypothesis which is in line with the research of Alexander and Kaeck (2008).

In this research, we follow the same procedure as in previous studies (i.e., Alexander & Kaeck, 2008) and we calculate the volatility of stock returns monthly to obtain equity volatility values in our model.

Operating Margin

Based on the Merton Model (1974), higher asset value implies lower distance-to-default and therefore lower default risk. Lower default risk implies lower credit spread and lower CDS spreads altogether. A company's earnings are the main financing sources for its asset growth. As a consequence, operating profit is the essential component of a company's future prospects. These ideas are researched by Callen, Livnat and Segal (2008:2) who find in their study that "earnings of firms are negatively and significantly correlated with the level of CDS premiums, consistent with earnings (cash flows, accruals) conveying information about default risk."

In addition, the profit margin of a publicly owned company reflects its stock price performance and its stock return volatility, two of the control variables in our study. The paper of Irvine and Pontiff (2009) reveals that over the period 1964-2003, the volatility of the average stock return drastically outpaces total market volatility which implies an increase in idiosyncratic return volatility. Their study documents a significant increase over 40-year period in the idiosyncratic volatility of firm-level earnings, cash flows and sales.

We choose operating profit as a proxy for a company's earnings because operating profit is an accounting data free from the effects of financing and taxes. It is the main profit or loss figure of a company's performance from its core business activities. We prefer to use it as a ratio by dividing it to sales (revenues) in order to cope with size differences between different companies and to get a better comparison across companies.

Leverage

Leverage is regarded as the central determinant of CDS spreads in all credit risk models (Ericsson et al., 2005). In general sense, equity and debt (liabilities) are claims on the firm's assets that constitute firm value. Merton Model (1974) interprets equity as a call option written on the firm value, whereas debt is regarded as a short put option written on the firm value. As a structural model, the Merton Model (1974) defines the state of default when the asset value of a firm is less than the value of its debt at maturity. Thereby, default becomes a function of capital structure (Greatrex, 2008). Capital structure and debt structure specifically give signals about the credit quality of a firm. The research performed by Rauh and Sufi (2008) reveals that low credit quality firms are more likely to have a multi-tiered capital structure consisting of both secured bank debt with tight covenants and subordinated non-bank debt with loose covenants rather than good quality firms.

In short, leverage is a core factor in determining the default risk and ultimately the CDS spread. As the leverage of a firm increases, its default risk increases and consequently, we expect the CDS spread to increase accordingly.

As the Merton (1974) model theoretically suggests, leverage is calculated based on the market value of debt rather than book value in order to not be restricted by accounting data. However, the market value of debt is not easily observable and due to the different types of debt that firms have on the balance sheet (with differences in convertibility, maturity and seniority), computing a total market value for all these types of debt is difficult. Therefore, in practice we use book values as the Merton (1974) model itself adopts.

We use three proxies for firm leverage. These are debt to equity ratio, total debt to assets ratio and interest coverage ratio. "The debt to equity ratio indicates the relative uses of debt and equity as sources of capital to finance the company's assets, evaluated using book values of capital resources. On the other hand, the total debt to assets ratio shows the proportion of assets that are financed with debt. The interest coverage is the ratio of the earnings available to the interest obligation" (Drake, 2013). The first two of them are main capital structure ratios which are based on balance sheet figures, whereas the last one is an income statement ratio that provides information as to what extent the firm can pay its interest expenses with its earnings before interest (EBIT). The interest coverage ratio gains more attention in regards to firm's solvency especially when firms are under financial distress and/or they are close to the default point.

Risk-free Interest Rate

One of the major theoretical determinants of CDS spreads is the risk-free interest rate which we introduce in our analysis. There are two reasons why we expect the risk-free interest rate to affect the CDS spreads. Firstly, Annaert et al (2010:9) argues that in the Merton (1974) model, "the risk free rate constitutes the drift in the risk neutral world" and thus the higher it becomes the lower is the chance of default and the lower the CDS spread. Ericsson et al (2004) find consistent results with the structural models suggesting that there is a negative relationship between the risk free rate and the risk-adjusted default probabilities. Secondly, from a macro-economic perspective, interest rates are positively linked to economic growth and ceteris paribus, higher growth leads to lower risk of default (Annaert et al, 2010 and Tang and Yan, 2006). In conclusion, we expect to find an inverse relationship between risk free rate and CDS spreads.

In this research, we use three proxies for the risk-free interest rate. The first one is the one year interbank rate in the respective country where the firm in the sample is headquartered. The rationale for selecting the interbank rate is that in the debt market, banks determine the interest rate in corporate lending based on this rate. If a borrower company has a higher credit risk, a spread over this interbank rate is charged to that firm. The interbank rate becomes a benchmark risk-free rate. For instance, Brooks and Yan (1999) argue that London Interbank Offer Rate (LIBOR) is the most commonly used proxy for the risk-free rate. Furthermore, Grbac and Papapantol (1999) use the interbank rate as risk-free rate in their research regarding default risk and CDS. As second and third risk-free rate proxies, we choose the five-year and ten-year government bond yields of the countries in our sample. We note that the choice of five-year bond yield is also in line with CDS data's five-year maturity in our analysis.

GDP Growth Rate

The last control variable included in our analysis is the GDP growth rate. Since the GDP growth is an indicator of economic growth, we expect periods with higher GDP growth, implying an economic boom phase, to be linked with lower default risk of companies. Thus, we expect a negative relationship between the two variables: CDS spreads and GDP growth rate. Similar analysis are performed by Tang and Yan (2010) and Suh and Lee (2011) who discover that credit spreads and CDS spreads decrease as GDP growth increases and vice-versa.

3. METHODOLOGY

3.1 Data

3.1.1. CDS Data

In gathering the data for credit default swap spreads, we use the Thomson Reuters source found in the Datastream database. Our sample consists of 82 firms' data encompassing a period of 5 years and 4 months from December 2007 to March 2013, resulting in a total of 5248 observations for each variable. We select the firms based on two criteria: the firms which have the longest CDS history and the firms which operate in non-financial sectors. We exclude banks and insurance companies from our sample, because they have different financial reporting standards and distinct business risk types than the firms in other sectors. This is likely to create problems when comparing them to other non-financial firms especially with regards to the calculation of leverage and operating margin. The list of firms included in our analysis, together with the countries in which they are headquartered is presented in Appendix (35).

The firms chosen are all part of the well known European iTraxx index. We prefer to base our analysis on this index since "the iTraxx CDS index family consists of the most liquid single-name CDSs in the European and Asian markets" (Alexander and Kaeck, 2007:2). The European iTraxx index consists of 125 equally weighted single firm investment grade CDSs. These indices are reviewed every six months when a new series is introduced to ensure that the most liquid CDSs are included in the index replacing defaulted, merged, sector changed or downgraded entities (Alexander and Kaeck, 2007). Many researchers use the iTraxx index in different analysis on CDS spreads and CDS spreads changes. One such notable research is carried out by Byström (2005) who finds that iTraxx index CDS spreads tend to increase when stock prices rise and vice versa.

These 82 firms are selected in our analysis since they are the only firms included in the iTraxx index for which we find CDS data for the desired period from Thomson Reuters in Datastream. The currency used in our analysis is Euro since the vast majority of the firms have CDS contracts traded in this currency. We use CDS spreads with five-year maturity since these are regarded as the most actively traded CDS contracts. Researchers such as Meng and Gwilym (2008) prove that CDS with five-year maturity are the most liquid type of CDS.

In our research, we use CDS data with monthly frequency, even though daily frequency is the most common type of CDS spread frequency adopted in literature. For instance, researchers who use daily CDS spread data are Norden and Weber (2004) and Ericsson et al (2005). On the other hand, we prefer to use monthly frequency and choose the CDS spread of the last work day of each month. Our reasoning behind this decision is that we observe that CDS spread data does not change drastically from one day to the next. Tang and Yan (2012) confirm this observation by highlighting the fact that many companies' CDS contracts are traded every few days or even weekly instead of daily. Therefore, we think that if we choose daily data, we come across with a large amount of noise in our data. By computing monthly frequency, we reach 64 monthly observations which are considered sufficient for a panel data analysis. Researches which don't use daily frequency CDS data include Annaert et al (2010) and Das et al (2008).

After collecting the monthly CDS spread data, we take the logarithm of the CDS spread values. The reasoning behind this decision is that the CDS spreads are depicted in basis points so we want to correct for the large values that exist for some of the companies, thereby smoothing the CDS spreads data before we run the regressions. A second reason is that taking logarithm of the CDS spreads (the dependent variable in our regression) helps eliminate prospective heteroskedasticity when we perform the regressions (Kennedy, 2009). The study of Das and Hanouna (2008:7) also uses logarithm of CDS spreads because "spreads are exponential functions of the state variables in the popular class of affine models".

3.1.2. Stock Liquidity Data

The data collection of our independent variable is founded on daily observations of stock prices as well as daily volume of traded stocks. We use three proxies for stock liquidity which are based on bid-ask spread, volume of traded stocks and the total number of outstanding shares.

We collect daily bid and ask prices for each stock to compute the bid-ask spread measure of liquidity. Data on the bid (bid price offered at close of market) and ask (ask price quoted at close of market) prices of the stocks is available on Datastream. After calculating the daily bid-ask spreads divided by their average, we average these values over a month to obtain monthly frequency data. In the calculation of the bid-ask spread, we use the formula below:

Bid-Ask Spread Measure as a proxy of stock liquidity:

$$Bas_{im} = {}^{1}/_{D_{im}} * \sum_{t=1}^{D_{im}} \left\{ [abs\ (bid\ p_{imt} - ask\ p_{imt})] \ / \left[\frac{bid\ p_{imt} + ask\ p_{imt}}{2} \right] \right\}$$

where Bas_{im} is the bid-ask spread measure of stock *i* for month *m*; D_{im} is the number of days for which data are available for stock *i* in month *m;* $bid\ p_{imt}$ is the bid price of stock *i* offered at the close of market on day *t* of month m; $ask\ p_{imt}$ is the asking price of stock *i* quoted at the close of market on day *t* of month m.

With regards to Amihud illiquidity measure, we collect the volume of traded shares and the closing price on a particular day from Datastream. After this, we calculate the euro volume of traded shares by multiplying the price of the stock quoted in Euro with the volume of traded shares. The absolute returns are calculated by taking the absolute values of daily log returns. When we calculate the Amihud illiquidity, we take the average of each month to obtain a monthly frequency for this variable. We base our computation on the study of liquidity measures developed by Amihud (2000).

Amihud Illiquidity Measure as a proxy of stock illiquidity:

$$Illiq_{im} = {}^{1}/_{D_{im}} * \sum_{t=1}^{D_{im}} \{ [abs\ (R_{imt})] \ / Vole_{imt} \}$$

where $Illiq_{im}$ is the Amihud measure of illiquidity of stock *i* for month *m*; D_{im} is the number of days for which data are available for stock *i* in month *m*; R_{imt} is the return on stock *i* on the day t of month *m;* $Vole_{imt}$ is the respective daily volume in euros which is the multiplication of volume of traded shares with the closing price of stock *i* at the day *t* of month *m*.

Turnover ratio is the third proxy for stock liquidity used in our study. We collect the volume of traded shares and the total outstanding shares for each firm on a particular day. Both data sets are available in Datastream on a daily basis. In the calculation of this measure we first compute the daily ratios of volume of traded shares over the total number of shares and then average these ratios over a month.

Turnover ratio measure:

$$Trnvr_{im} = {}^{1}\!/_{D_{im}} * \sum_{t=1}^{D_{im}} [Volshrs_{imt}/Nshrs_{imt}]$$

where $Trnvr_{im}$ is the turnover ratio of stock *i* for month *m*, D_{im} is the number of days for which data are available for stock *i* in month *m;* $Volshrs_{imt}$ is the trading volume in shares of stock *i* on day *t* in month *m*; $Nshrs_{imt}$ is the number of shares outstanding of stock *i* on particular day *t* of month *m*.

3.1.3. Control Variables Data

The independent variables that we use as control variables are: stock return, market value of equity, equity (stock return) volatility, leverage, operating margin, risk-free rate and the GDP growth rate. Literature considers these variables as significant factors in explaining the CDS spreads.

Stock prices are collected from Thomson Reuters with a daily frequency and are the official closing prices for the respective stock. We use these stock prices to calculate logarithmic daily returns using the formula: LN (P_t/P_{t-1}) in Excel. We use log returns rather than normal returns due to a few reasons. Firstly, log returns are interpreted as continuously compounded returns, thus facilitating comparisons across assets; secondly, log returns have symmetrical normal distribution. (Brooks, 2008) Articles such as Knaup and Wagner (2008) and Alexander and Kaeck (2007) use daily frequency stock returns in their analysis on CDS spreads.

As a proxy for firm value we use the market value of equity. This data is directly collected from Datastream. Since the firm value is not directly observable, we need to use the

Merton Model's two main equations based on the Black Scholes Model structure. Due to the fact that using these equations requires a number of assumptions and calculating the option values is cumbersome, we use equity value as a proxy for firm value. The market value of equity on a daily basis is already calculated by Datastream as the share price multiplied by the number of ordinary shares in issue. Because in our analysis we use monthly frequency of the variables, we collect the market value of the firms at the closing date of each month. To adjust the large numbers in the market value, we take natural logarithm of these values before using them in regressions.

The third control variable that we use in our model is equity volatility. It is a proxy for asset volatility in the Merton Model. We calculate stock return volatility to represent equity volatility. We compute monthly standard deviations of daily stock returns using Excel formula of STDEV.

To analyze leverage, we use three types of measures based on accounting data. Firstly, we divide total debt by common equity (*levde*).

$$levde = [(Long\ Term\ Debt + Short\ Term\ Debt\ \&\ Current\ Portion\ of\ Long\ Term\ Debt) / Common\ Equity\ ] * 100$$

A second measure for the leverage ratio is found by dividing total debt to total assets (*levdta*).

$$levdta = [(Long\ Term\ Debt + Short\ Term\ Debt\ \&\ Current\ Portion\ of\ Long\ Term\ Debt) / (Total\ Equity + Short\ Term\ Debt\ \&\ Current\ Portion\ of\ Long\ Term\ Debt)\ ] * 100$$

A third and final measure for firm leverage that we include in our analysis is the interest coverage ratio (*levintcov*). This is calculated by dividing EBIT to interest expense.

$$levintcov = [Earnings\ Before\ Interest\ and\ Taxes/Interest\ Expense\ ] * 100$$

All the financial statement data used is collected on a yearly basis as that is the only frequency available on Datastream. Since we assume that the previous period's leverage ratio affects the borrowing conditions of the firms in the coming period, we take the leverage of previous year (year *y-1*) as the leverage for the next year (year *y*) throughout our sample. We follow the procedure used by Ericsson et al (2005) and interpolate to obtain monthly figures to suit to other variables' frequencies.

As a measure of firm profitability, we collect operating margin from Datastream. Operating margin is already calculated by Datastream as the ratio of operating income over net sales. The result is shown in percentages and on a yearly basis. Since operating margin is also an accounting variable, we follow the same logic as we do in the case of leverage by using the previous year's (year *y-1*) operating margin figures for the following year (year *y*). We adopt the same method when dealing with leverage in that we interpolate to obtain monthly figures. The operating margin formula used in our study is shown below:

$$Operating\ Profit\ Margin = \ [Operating\ Income/Net\ Sales\ or\ Revenues\ ] * 100$$

We choose three proxies for the risk free rate to reflect whether CDS spreads manifest different relationships with different risk-free rate maturities. Thus, as risk free rate measures for each country, we use the one-year interbank interest rate, the five-year government bond yield and the ten-year government bond yield. Interbank interest rates are collected with a monthly frequency from Thomson Datastream, while government bond yields are obtained from the countries' national central banks.

To obtain the GDP growth rates, we collect GDP data of the countries in which the companies are headquartered, and then calculate growth rates using simple returns. We collect the country GDP data from Datastream on a quarterly basis. We interpolate the quarterly GDP growth rates to obtain monthly frequencies.

3.1.4. Descriptive Statistics

Table 1 reports summary statistics for all variables used in our analysis. We observe that the firms in our sample have an average negative return throughout the 64 months. We also note that the Amihud illiquidity measure shows very small values for the mean, median, maximum and minimum values. This is due to the way it is calculated, the ratio having a denominator (dollar trading volume) which is much larger than the numerator (absolute stock return). A further observation is made regarding the GDP growth rate which shows a negative mean throughout the sample period, in line with the turbulent times in European economies caused by the financial crisis. Finally, when analyzing the risk-free rate proxies used, we note that the higher the maturity of the risk-free rate the higher the yield. Furthermore, the standard deviation of the risk-free rates decreases with maturity. The Jarque-Bera test (not reported) rejects the normality assumption for all variables.

TABLE 1: Descriptive Statistics

		Symbol	Mean	Median	Max	Min	Std. Dev	Skewness	Kurtosis	N
	CDS spread	*lncds*	4,6361	4,5818	7,3460	3,0692	0,5590	0,5014	3,3589	5248
Stock liquidity	Bid-Ask Spread	*bas*	0,0019	0,0009	0,0908	0,0000	0,0043	9,0047	124,2350	5248
	Amihud Illiquidity	*illiq*	2,59E-08	3,06E-10	3,56E-06	8,52E-12	1,63E-07	11,4815	170,1561	5248
	Turnover Ratio	*trnvr*	0,0036	0,0031	0,0230	0,0000	0,0030	1,4212	6,5503	5248
	Return	*r*	-0,0036	0,0020	0,5337	-0,6699	0,0891	-0,7052	7,2716	5248
	Volatility	*vol*	0,0196	0,0166	0,1167	0,0015	0,0111	2,3144	11,8064	5248
	Equity Value	*lne*	9,7710	9,7848	12,1122	6,5273	1,0284	-0,1500	2,4525	5248
	Operating Margin	*opm*	13,0794	11,2700	51,0600	-12,1500	8,8218	1,0523	4,6014	5248
Leverage	Debt to Equity	*levde*	1,3063	0,8414	97,9366	-20,6812	5,0413	0,1598	31,024	5248
	Debt to Total Assets	*levdta*	0,4736	0,4447	1,6757	0,0735	0,1837	0,8255	44,836	5248
	Interest Coverage	*levintcov*	0,0786	0,0520	1,1965	-0,2892	8,6707	1,7706	13,1826	5248
	GDP Growth Rate	*gdp*	-0,0004	0,0009	0,0354	-0,0660	0,0092	-1,4066	7,5999	5248
Risk-free Rate	1-yr Interbank Rate	*intbankr*	2,2731	1,6375	7,8200	0,2564	1,5732	1,2793	3,3689	5248
	5-yr Bond Yield	*fiveyld*	2,2995	2,3800	5,2300	-0,0500	1,1174	0,3458	2,5119	5248
	10-yr Bond Yield	*tenyld*	3,2108	3,4400	5,2300	0,5300	0,9162	-0,2898	2,2800	5248

The table reports the mean, the median, the maximum value (*max.*), the minimum value (*min.*), the standard deviation (*std. dev.*), the skewness, the kurtosis and the number of observations (*N*) of the dependent variable (*lncds*) and the explanatory variables over the period December 2007 to March 2013. The CDS Spread is defined as the natural logarithm of the monthly average mid CDS spread quote for CDS with 5-year maturity. The Bid-Ask Spread is the monthly average of the ratio between the absolute difference of the ask quote and the bid quote divided by their average. The Amihud Illiquidity measure is the monthly average of the daily ratio between the absolute stock return and the euro trading volume. The Turnover Ratio is measured as the monthly average of the ratio between the volume of shares traded and the total number of shares outstanding. The Return is calculated as the monthly average of the natural logarithm of the ratio between the stock price in day $t+1$ and the stock price in day t. The Volatility is measured as the standard deviation of the stock returns over a month. The Equity Value is calculated as stock price multiplied by the number of shares and is collected directly from Datastream. The Operating Profit Margin is calculated as operating income divided by sales revenue. The Debt to Equity Leverage Ratio is calculated as the ratio of the sum of long term debt, short term debt and current portion of long term debt divided by common equity, in percentage terms. The Debt to Total Assets Leverage Ratio is the ratio of the sum of long term debt, short term debt and current portion of long term debt divided by the sum of total equity, short term debt and current portion of long term debt, in percentage terms. The Interest Coverage Ratio is measured as earnings before interest and tax (EBIT) divided by interest expense, in percentage terms. The GDP Growth Rate is calculated on a monthly basis using the simple return of the nominal GDP of the countries in which the companies in the sample are headquartered. The one-year Interbank Interest Rate is collected with a monthly frequency from Datastream. The five-year and ten-year Government Bond Yields are collected on a monthly frequency from the European Central Bank and national central banks of the countries in which the companies in the sample are headquartered.

3.2. Model

Our data is a longitudinal (panel) data in which we analyze firms from different industries in the cross section dimension throughout time. Based on the literature, using panel data has some advantages. First, as Kennedy (2009) argues, panel data deals with heterogeneity in cross-sectional units in each time period thus coping with the omitted variables problem. Omitting time series variables, which influences the behavior of firm-specific variables, causes bias in the estimation. Second, panel data provides more variability through combining variation across cross-sectional units with variation over time, eliminating any multicollinearity problems to some extent (Kennedy, 2009, 281-282). Third, panel data is more informative than cross sectional data. It enables us to examine and address how an independent variable behaves across firms over different months and explain its effects on the dependent variable. Fourth, panel data lets us perform a better analysis of dynamic adjustments: cross-sectional data standalone is not able to provide us dynamics, whereas we would need very lengthy times-series data to obtain better estimates of dynamic behavior (Kennedy, 2009, 281-282). We analyze 82 firms in the cross-sectional dimension over 64 months and have data for all variables in all firms and all periods. Therefore, we have a balanced panel data consisting of 5248 observations for each variable.

Before proceeding with the estimation of the model, we first search for multicollinearity between the independent variables. Multicollinearity refers to the situation where the explanatory variables are correlated (Gujarati & Porter, 2010). As a consequence of multicollinearity, "the ordinary least squares (OLS) estimating procedure is not given enough independent variation in a variable to calculate with confidence the effect it has on the independent variable" (Kennedy, 2009:193). The correlation matrix presented in *Table 2* reports two correlations higher than 0.8. These are the correlations between the five-year bond yield (*fiveyld*) and ten-year bond yield (*tenyld*) which is equal to 0.96 and between the five-year bond yield (*fiveylvd*) and one-year interbank rate (*intbankr*) which is equal to 0.81. However, these three measures are all proxies for the same variable, namely risk-free rate. Thus, they are not introduced simultaneously in the same regression throughout the analysis. Regarding the other variables, the correlation table shows that none are significantly correlated with each other, pairwise correlations not exceeding +/- 54%.

TABLE 2: Correlation Matrix

	LNCDS	BAS	ILLIQ	TRNVR	R	LNE	VOL	OPM	LEVDE	LEVINT COV	LEVDTA	GDP	INT BANKR	FIVE YLD	TEN YLD
LNCDS	1,00														
BAS	0,06	1,00													
ILLIQ	-0,03	0,54	1,00												
TRNVR	0,39	-0,14	-0,19	1,00											
R	-0,10	-0,01	0,00	-0,16	1,00										
LNE	-0,40	-0,13	-0,12	-0,36	0,03	1,00									
VOL	0,48	0,06	0,03	0,44	-0,25	-0,22	1,00								
OPM	-0,15	-0,05	-0,12	0,00	-0,02	0,26	-0,11	1,00							
LEVDE	0,04	0,01	0,00	0,01	0,00	-0,01	0,00	0,01	1,00						
LEVINTCOV	-0,20	-0,10	-0,07	-0,07	-0,01	0,36	-0,07	0,15	-0,08	1,00					
LEVDTA	0,23	0,06	0,00	0,07	0,00	-0,28	0,02	0,08	0,19	-0,36	1,00				
GDP	-0,29	-0,03	-0,02	-0,20	0,15	0,08	-0,42	-0,08	0,01	-0,01	0,00	1,00			
INTBANKR	-0,01	-0,01	0,00	0,32	-0,25	-0,03	0,41	0,08	-0,01	0,03	-0,04	-0,40	1,00		
FIVEYLD	-0,14	-0,02	0,00	0,29	-0,15	-0,04	0,29	0,04	0,03	-0,06	0,02	-0,23	0,81	1,00	
TENYLD	-0,12	-0,01	0,01	0,25	-0,12	-0,05	0,27	0,03	0,03	-0,09	0,05	-0,20	0,68	0,96	1,00

The table shows the correlations between monthly observations of the CDS spreads (*lncds*), the stock liquidity proxies, the firm-level control variables and the macroeconomic control variables. The stock liquidity proxies that we use are: the bid-ask spread (*bas*), Amihud illiquidity measure (*illiq*) and turnover ratio (*trnvr*). The firm-level variables are: stock return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*), debt to equity leverage (*levde*), debt to total assets leverage (*levdta*), interest coverage ratio (*levintcov).* The macroeconomic variables are: GDP growth rate (*gdp*), one-year interbank interest rate (*intbankr*), five-year bond yield (*fiveyld*), ten-year bond yield (*tenyld*). Data covers the period between December 2007 and March 2013. We note that the only correlations exceeding +/- 0.6 are between the three risk-free rate proxies: the one-year interbank rate and the five and ten year bond yields. Correlations among other variables do not exceed +-0.54, indicating that we do not have multicollinearity in the data set.

In order to look for initial signs of heterogeneity, to have a benchmark result for comparison purposes and to get an indication if any other potential problems occur, the pooled regression is run first. The equation for the pooled regression is shown below:

$$lncds_{i,m} = \alpha_i + \beta_i^{liq} \text{ x } liq_{i,m} + \beta_i^{r} \text{ x } r_{i,m} + \beta_i^{e} \text{ x } lne_{i,m} + \beta_i^{vol} \text{ x } vol_{i,m} + \beta_i^{opm} \text{ x } opm_{i,m} + \beta_i^{lev} \text{ x } lev_{i,m} + \varepsilon_{i,m}$$

where we denote the CDS spread of firm *i* in month *m* in natural logarithm as $lncds_{i,m}$; the intercept of the equation as α_i ; the stock liquidity of firm *i* in month *m* as $liq_{i,m}$; the monthly return of stock of firm *i* in month *m* as $r_{i,m}$; the natural logarithm of market value of equity of firm *i* at the end of month m as $lne_{i,m}$; the volatility of stock return of firm *i* in month *m* as $vol_{i,m}$; the operating profit margin of firm *i* in month *m* as $opm_{i,m}$; the leverage of firm *i* in month *m* as $lev_{i,m}$; the residual of firm *i* in month *m* as $\varepsilon_{i,m}$.

The output of this simple panel LS regression without any corrections is represented in Appendix (1). From the data output of the pooled regression, we see that volatility and leverage have a significant positive relation with the CDS spread, whereas equity value has a negative relationship. Stock liquidity, return and operating margin are insignificant at the 5% significance level. The regression's goodness of fit (R^2 = 0.335) is quite low. However, a quick examination of the Durbin-Watson test statistic (0.2546) suggests significant autocorrelation in the residuals.

To get an idea of whether heterogeneity is present in our data, we first plot the residuals of the pooled regression and check whether they seem "homogenous". The residuals plot is depicted in Appendix (2). If the residuals constantly tend to be either below or above zero, this is likely to be an indication of heterogeneity. This seems to be the case in our pooled regression result. The variance of the errors seems not to be constant, indicating that heteroskedasticity is likely to be an issue.

There are two main panel estimator approaches which are used in financial research. These are the fixed effects model and the random effects model. The panel data provides us with the option of controlling for cross-sectional heterogeneity and/or controlling for time-specificity (Brooks, 2008). In regards to the cross-sectional heterogeneity, we fix the model in the time-series dimension and we have a chance to examine the firm-specific variation of the parameters by letting them vary cross firms (Brooks, 2008). Alternatively, when we fix the model in the cross section dimension, we have a chance to isolate time-specificity and therefore analyzing how the relationship among our variables changes through time (Brooks, 2008).

Both the random effects model (also called the variance components or error components model) and the fixed effects model use different intercept terms for each entity. These intercepts are assumed to be constant over time and the relationships between the explanatory and explained variables are considered identical over time (Brooks, 2008). The difference between the fixed and random effects models is that under the latter, "intercepts for each cross-sectional unit are assumed to arise from a common intercept and a random variable which is constant over time but varies cross-sectional" (Brooks, 2008:498). This random variable measures the deviation of the individual intercept terms from the global intercept term. With regards to the fixed effects models, the cross-sectional fixed effects model decomposes the disturbance term in two separate parts: an individual specific effect and a "remainder disturbance" which varies over time and cross sectional (Brooks, 2008). In the time-fixed effects model, intercepts vary with time but don't change across entities at each given point in time (Brooks, 2008).

Since the random effects model saves degrees of freedom, it provides a more efficient estimator of variable coefficients than the fixed effects model (Kennedy, 2009). For this reason, we first investigate the presence of random effects in our model. To test whether we need to include random effects, we perform the Correlated Random Effects - Hausman Test, a specification test available in EViews. As we see from the results of the Hausman test shown in *Table 3*, the p-value for both the cross-section and period random effects is 0.0000 indicating that we reject the assumption of cross-section and period random effects. Therefore, we cannot apply the random effects model in our analysis.

TABLE 3: Correlated Random Effects – Hausman Test

HAUSMAN TEST

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	223,211557	6	0,0000
Period Random	143,032510	6	0,0000

Table 3 depicts the results of the Correlated Random Effects – Hausman Test for the regression using bid-ask spread as a measure of stock liquidity. The first column denotes in which dimension the test is performed. The Chi-squared test statistic and the degrees of freedom are presented in the second and third column. The p-value (Prob.) is presented in the fourth column. When the p-value for the Chi-Squared statistic is less than 0.05, we reject the null hypothesis indicating the presence of random effects in the model in favor of the alternative hypothesis suggesting that the random effects model is not applicable. The probability (Prob.) of the Chi-Squared Statistic is 0.0000 for both cross-section and period random effects. Therefore, we conclude that the specification using random effects is not applicable for this regression.

We draw our attention towards investigating the presence of fixed effects in our model. We estimate the model with dummy variables for cross-section units, then time periods and finally test the dummies jointly for significance. Across the entire sample, the mean of residuals is zero. However, if systematic average deviations from zero occur for each cross-section unit or time period, by using dummies, which explain this average deviation, we push the residuals back toward zero. The results of the regression with cross-section dummies are presented in Appendix (3). The results of the regression with time dummies are shown in Appendix (4) and finally the results of the regression with both cross-section and time dummies are displayed in Appendix (5).

With regards to the estimation with both cross-section and time dummies, we find that the variables' significance and coefficients are now qualitatively different. The stock liquidity is now significant and has a positive relationship with the CDS spread. Return, equity value, volatility and leverage are as well significant, whereas operating margin remains insignificant.

We can also observe that the R^2 increases; the goodness of fit of our regression now reaching 0.8514. This is a result of both decreasing the variation of residuals and introducing a large number of new explanatory variables (the dummies). We perform a redundant fixed effects test, shown in *Table 4* to check whether the specification using fixed effects is optimal for our model.

TABLE 4: Redundant Fixed Effects Tests

REDUNDANT FIXED EFFECTS TESTS

Effects Test	Statistic	d.f.	Prob.
Cross-section F	157,943006	(81,5097)	0,0000
Cross-section Chi Square	6589,447595	81	0,0000
Period F	63,303449	(63,5097)	0,0000
Period Chi-Square	3033,267801	63	0,0000
Cross-Section/Period F	123,093060	(144,5097)	0,0000
Cross-Section/Period Chi-Square	7867,226465	144	0,0000

Table 4 presents the results of the redundant fixed effects tests for the regression using bid-ask spread as a measure of stock liquidity. The first column denotes the fixed effects test we perform (cross-section fixed effects, period fixed effects and simultaneous cross-section and period fixed effects). The F and Chi-Squared Statistics are presented in the second column. The degrees of freedom and the p-value (prob.) are presented in the third and fourth columns.

When the p-value for the F-statistic and Chi-Squared statistic is less than 0.05, we accept the null hypothesis indicating the presence of fixed effects in the model and reject the alternative hypothesis indicating that the fixed effects model is not applicable. The probability (Prob.) of both the F statistic and Chi-Squared Statistic is 0.0000 for both cross-section and period fixed effects. Therefore, we conclude that the specification using both cross-section and period fixed effects is recommended.

We observe that both the F statistic and the Chi-Squared have a p-value of 0.0000 indicating that both the cross section and period dummies are significant at the 5% significance level. Thus, we need to account for heterogeneity in both dimensions and conclude that our model needs to use fixed effects. We note that when checking for fixed effects individually in the period dimension and individually in the cross-section dimension, we reach the same result in that the dummy variables are highly significant and heterogeneity needs to be accounted for both dimensions.

Therefore, the generic model that we use in this paper is of the following form:

$$lncds_{i,m} = \alpha_i + \beta_i^{liq} \text{ x } liq_{i,m} + \beta_i^{r} \text{ x } r_{i,m} + \beta_i^{e} \text{ x } lne_{i,m} + \beta_i^{vol} \text{ x } vol_{i,m} + \beta_i^{opm} \text{ x } opm_{i,m} + \beta_i^{lev} \text{ x } lev_{i,m} + D_m + D_i + \varepsilon_{i,m}$$

where we denote the CDS spread of firm *i* in month *m* in natural logarithm as $lncds_{i,m}$; the intercept of the equation as α_i ; the stock liquidity of firm *i* in month *m* as $liq_{i,m}$; the monthly return of stock of firm *i* in month *m* as $r_{i,m}$; the natural logarithm of market value of equity of firm *i* at the end of month m as $lne_{i,m}$; the volatility of stock return of firm *i* in month *m* as $vol_{i,m}$; the operating profit margin of firm *i* in month *m* as $opm_{i,m}$; the leverage of firm *i* in month *m* as $lev_{i,m}$; the dummy variable used to control time-effects present in our sample as D_m; the dummy variable used to control any cross-sectional (firm-specific) effects present in our sample as D_i ; the residual of firm *i* in month *m* as $\varepsilon_{i,m}$.

We use three proxies for the stock liquidity variable represented above by $liq_{i,m}$. These are: the stock liquidity of firm *i* at month *m* implied by bid-ask spread measure as $bas_{i,m}$; the stock illiquidity of firm *i* at month *m* implied by Amihud illiquidity measure as $illiq_{i,m}$; the stock liquidity of firm *i* at month *m* implied by turnover ratio as $trnvr_{i,m}$. Similarly for the leverage variable represented above by $lev_{i,m}$, we use three ratios: the leverage of firm *i* calculated by the debt to equity ratio at month m as $levde_{i,m}$; the leverage of firm *i* calculated by the debt to total assets ratio at month m as $levdta_{i,m}$; the leverage of firm *i* implied by the interest coverage ratio at month m as $levintcov_{i,m}$.

In our model we allow for heterogeneity, thus we want to capture any fixed time effects across firms as well as any firm specific effects (cross sectional effects) across time. This result is in line with the article of Annaert et al (2010) which suggests that the fixed effects model needs to be used for two reasons. Firstly, all the firms included in the sample have sufficient CDS quotes and have their stock listed at the stock market. As a result, we do not state that our sample is random. Secondly, in the panel regression, we have many time-series observations that enable us to use fixed effects model, because Hsiao (2005:37, cited in Annaert et al, 2010) states "the GLS estimator for random effects converges to the OLS estimator for fixed effects when the number of time-series observations grows."

In the next step, we investigate the presence of heteroskedasticity in our model. Heteroskedasticity implies that the variance of the error terms is not constant. To get an idea of whether we have heteroskedasticity in our model, we first look at the residual graph of the regression with cross-section and period fixed effects shown in Appendix (6). According to this plot, we are not able to affirm with certainty whether heteroskedasticity is present in the data. Thus, we manually perform a White heteroskedasticity test in EViews. The results of this test are shown in Appendix (7) and summarized in *Table 5*.

TABLE 5: White Heteroskedasticity Test

WHITE TEST FOR HETEROSCEDASTICITY

Dependent Variable: Residual^2	R-Squared	F-statistic	Prob. (F-statistic)
Values	0,3667	111,922	0,0000

Table 5 presents summarized results of the White test for heteroskedasticity performed for the model using bid-ask spread as proxy for stock liquidity. To perform the test, we select as dependent variable the squared residuals (residual ^2), while we use as independent variables all explanatory variables from the generic model, their squares and all cross-products. When the p-value of the F-statistic (Prob.) is less than 0.05, then we reject the null hypothesis of homoskedasticity in favor of the alternative hypothesis of heteroskedasticity. The p-value for the test is 0.0000, indicating that heteroskedasticity is present in the model. A detailed breakdown of the test together with the significance of all explanatory variables is presented in Appendix (7).

The p-value of the White test is 0.0000 indicating the problem of heteroskedasticity. By performing a Breusch-Pagan test presented in Appendix (8), we obtain the same result as in the White test, confirming that heteroskedasticity exists. To solve the problem of heteroskedasticity, we use the White (diagonal) standard errors in the regressions. Using White standard errors also helps us cope with clustering within each firm through time. The output of this regression of bid-ask spread stock liquidity using White diagonal standard errors is shown in Appendix (9).

The bid-ask spread, which is the most commonly used liquidity proxy, is a "cost based" measure of liquidity relying on transaction costs. To analyze the relation between stock liquidity and CDS in detail, we investigate two other proxies for liquidity, classified as "reflective" measures, which capture different characteristics of liquidity (Spiegel and Wong, 2005). These two measures are the Amihud illiquidity measure (*illiq*) and the turnover ratio (*trnvr*). Both measures use volume of traded shares in their calculation, which shows cross-sectional heterogeneity. We figure out that we have more outlier observations in volume data across cross section. Hence, we use fixed cross-section effects and let the variables vary across time. Because we use a model with only cross-section fixed effects, to account for heteroskedasticity in the cross-sectional dimension, we also run the regressions using White cross-section standard errors. If we use the model with both cross-section and time fixed effects, we obtain counter-intuitive results with insignificant probabilities for these liquidity measures.

In order to analyze whether stock liquidity remains significant when controlling for macroeconomic variables, we perform a separate regression model. We perform this analysis in a different regression because the macro level variables (GDP growth rate and risk-free rate) are time-oriented variables. These variables vary according to countries, whereas CDS spreads vary through firms. Therefore, the cross-section section dimension frequencies are not identical. Accordingly, we are not able to introduce these variables together with other control variables that vary across firms in the generic model, where we use time-fixed effects. Following the same procedure above, we first examine the pooled regression below:

$$Incds_{i,m} = \alpha_i + \beta_i^{liq} \text{ x } liq_{i,m} + \beta^{gdp} \text{ x } gdp_{j,m} + \beta^{rf} \text{ x } rf_{j,m} + \varepsilon_{i,m}$$

where we denote the CDS spread of firm *i* in month *m* in natural logarithm as $lncds_{i,m}$; the intercept of the equation as α_i ; the stock liquidity of firm *i* in month *m* as $liq_{i,m}$; the average GDP growth rate of country *j* where company *i* is located, in month *m* as $gdp_{j,m}$; the risk-free rate of country *j* where company *i* is located, in month *m* as $rf_{j,m}$; the residual of firm *i* in month *m* as $\varepsilon_{i,m}$.

We use three proxies for the risk-free rate variable represented above by $rf_{j,m}$. These are: the 1-year interbank interest rate of country *j* in month *m* as $intbankr_{j,m}$; the five-year government bond yield of country *j* in month *m* as $fiveyld_{j,m}$; the ten-year government yield of country *j* in month *m* as $tenyld_{j,m}$.

We investigate the presence of heterogeneity in the model including macroeconomic control variables through the residual graph presented in Appendix (10). We check for heterogeneity in the data by first investigating random effects in the cross sectional dimension. The Hausman test for random effects turns out to be invalid, indicating that the specification using random effects is not applicable. Then, we examine the presence of fixed effects in the cross-section dimension.

TABLE 6: Redundant Fixed Effects Test for the Model using Macroeconomic Variables

REDUNDANT FIXED EFFECTS TEST

Effects Test	Statistic	d.f.	Prob.
Cross-section F	87,0962	(81,5163)	0,0000
Cross-section Chi Square	4520,4995	81	0,0000

Table 6 presents the results of the redundant fixed effects tests for the regression using bid-ask spread as a measure of stock liquidity and macroeconomic factors as explanatory variables. The first column denotes the fixed effects test we perform (cross-section fixed effects). The F and Chi-Squared Statistics are presented in column two. The degrees of freedom and the p-value (prob.) are presented in the third and fourth columns. When the p-value for the F-statistic and Chi-Squared statistic is less than 0.05, we accept the null hypothesis indicating the presence of fixed effects in the model and reject the alternative hypothesis indicating that the fixed effects model is not applicable. The probability (Prob.) of both the F statistic and

Chi-Squared Statistic is 0.0000 for the cross-section fixed effects. Therefore, we conclude that we apply cross-section fixed effects in our model with macroeconomic explanatory variables.

By conducting a redundant fixed effects test presented in *Table 6*, we obtain a p-value for cross section fixed effects of 0.0000 indicating that the dummy variables are significant and that we have to account for fixed effects in the cross-section dimension. As stated above, we do not use fixed effects for the time-dimension. By interpreting the residual graph of the regression of bid-ask spread stock liquidity with macroeconomic control variables using cross-section fixed effects presented in Appendix (11), we ascertain that heteroskedasticity has to be accounted for by using White cross-section standard errors. As a consequence, the generic model for testing the significance of stock liquidity when controlling for macroeconomic variables is shown below:

$$Incds_{i,m} = \alpha_i + \beta_i^{liq} \text{ x } liq_{i,m} + \beta^{rf} \text{ x } rf_{j,m} + \beta^{gdp} \text{ x } gdp_{j,m} + D_i + \varepsilon_{i,m}$$

where we denote the CDS spread of firm *i* in natural logarithm as $lncds_{i,m}$; the intercept of the equation as α_i ; the stock liquidity of firm *i* at month *m* as $liq_{i,m}$; the risk free rate of country *j* in month *m* as $rf_{j,m}$; the GDP growth rate of country *j* in month *m* as $gdp_{j,m}$; the dummy variable used to control any cross-sectional (firm-specific) effects present in our sample as D_i; the residual of firm *i* at month *m* as $\varepsilon_{i,m}$.

4. EMPIRICAL ANALYSIS

According to the regression outputs, we make several interpretations. In the regression where we use both cross-section and time fixed effects, by controlling for return, equity value, volatility, operating margin and leverage measured by debt to equity ratio (*levde*), we observe a significant positive relation between stock liquidity measured as bid-ask spread and CDS spreads. The coefficients of the majority of the control variables confirm our intuition and the literature, having significant probabilities ($p<0.05$). However, stock return shows a significant positive relation with CDS spreads, which is counter intuitive and not in line with literature. With regards to operating margin, we observe an expected negative relationship with CDS spreads, however with an insignificant probability of 0.185. The R^2, the most commonly used goodness of fit statistic, has a value of 0.8514 which shows that our model fits the data well. The result of the regression using fixed effects in both dimensions is presented in *Table 7* together with the pooled regression and the regression using random effects for comparison purposes. Detailed information of each regression is depicted in the Appendices (1, 12, and 5).

TABLE 7: Regressions of Bid-Ask Spread Stock Liquidity: Pooled, Random Effects and Fixed Effects

Explanatory Variables		REGRESSION					
		Pooled		Random Effects Cross-Section & Period		Fixed Effects Cross-Section & Period	
		Ordinary SE		Ordinary SE		Ordinary SE	
		Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Intercept	*c*	5,7875 (0,0668)	0,0000	9,5425 (0,1313)	0,0000	10,1176 (0,1323)	0,0000
Bid-Ask Spread	*bas*	-0,3309 (1,4889)	0,8241	3,1265 (0,9857)	0,0015	3,0271 (0,9643)	0,0017
Return	*r*	0,1894 (0,0738)	0,0103	0,3091 (0,0432)	0,0000	0,3432 (0,0425)	0,0000
Equity Value	*lne*	-0,1601 (0,0066)	0,0000	-0,5229 (0,0128)	0,0000	-0,5800 (0,0135)	0,0000
Volatility	*vol*	21,7164 (0,6105)	0,0000	11,1933 (0,5343)	0,0000	10,2023 (0,5418)	0,0000
Operating Margin	*opm*	-0,0013 (0,0007)	0,0714	-0,0018 (0,0012)	0,1380	-0,0017 (0,0013)	0,1847
Leverage	*levde*	0,00003 (0,0000)	0,0016	0,00002 (0,0000)	0,0009	0,00002 (0,0000)	0,0012
R-squared		0,3347		0,3784		0,8514	
F-statistic		493,3983		531,6555		194,7053	
Prob. (F-statistic)		0,0000		0,0000		0,0000	
Hausman Test		-		0,0000		-	

*The numbers in brackets represent standard errors for each coefficient.

Table 7 reports the coefficient, standard errors and probabilities for the intercept (*c*), the bid-ask spread stock liquidity measure (*bas*) and the firm-level control variables: return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) in three different regressions: the pooled regression using ordinary standard errors, the regression with cross-section and period random effects using ordinary standard errors and the regression with cross-section and period fixed effects using ordinary standard errors. The R-squared, F-statistic, probability of F-statistic and Hausman test for random effects are also reported. We note several differences when comparing the three regression models presented. Firstly, in the pooled regression, the bid-ask spread is insignificant and shows a negative relationship with the CDS spread. This result is counter-intuitive as it suggests that a higher stock liquidity results in higher CDS spreads. However, when adjusting our model to include fixed effects, the coefficient of the bid-ask spread changes sign showing a positive relationship with CDS spreads. The p-value (Prob.) of the coefficient is 0.0017 indicating that it is significant at the 5% significance level. A second observation is related to operating margin which is insignificant in all three models.

As a further analysis, we examine the differences that occur when adjusting for heteroskedasticity and clustering through the White diagonal standard errors in the fixed effects model. We observe that the direction of the coefficients does not change, however the p-value of the bid-ask spread becomes 0.0228, remaining significant at the 5% level. The comparative results are shown in *Table 8*.

TABLE 8: Regressions of Bid-Ask Spread Stock Liquidity: Using Ordinary SE and White Diagonal SE

		REGRESSION			
Explanatory Variables		**Fixed Effects**		**Fixed Effects**	
		Cross Section & Time		**Cross Section & Time**	
		Ordinary SE		**White Diagonal SE**	
		Coeff.	**Prob.**	**Coeff.**	**Prob.**
Intercept	*c*	10,1176 (0,1323)	0,0000	10,1176 (0,1629)	0,0000
Bid-Ask Spread	*bas*	3,0271 (0,9643)	0,0017	3,0271 (1,3295)	0,0228
Return	*r*	0,3432 (0,0425)	0,0000	0,3432 (0,0632)	0,0000
Equity Value	*lne*	-0,5800 (0,0135)	0,0000	-0,5800 (0,0166)	0,0000
Volatility	*vol*	10,2023 (0,5418)	0,0000	10,2023 (0,7986)	0,0000
Op. Margin	*opm*	-0,0017 (0,0013)	0,1847	-0,0017 (0,0014)	0,2341
Leverage	*levde*	0,00002 (0,0000)	0,0012	0,00002 (0,0000)	0,0000
R-squared		0,8514		0,8514	
F-statistic		194,7053		194,7053	
Prob. (F-statistic)		0,0000		0,0000	

*The numbers in brackets represent standard errors for each coefficient.

Table 8 reports the coefficient, standard errors and probabilities for the intercept (*c*), the bid-ask spread stock liquidity measure (*bas*) and the firm-level control variables: return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) in two different regressions: the regression with cross-section and period fixed effects using ordinary standard errors and the regression with cross-section and period fixed effects using White diagonal standard errors. The R-squared, F-statistic and probability of F-statistic are also reported. When comparing the two models, the one with ordinary standard errors and the one with White diagonal standard errors, we observe that the coefficients of our variables do not change in direction or magnitude, but change in significance. The p-value for the bid-ask spread stock liquidity measure rises from

0.0017 to 0.0228, indicating that it is no longer significant at the 1% significance level but that it remains significant at the 5% significance level. Moreover, in the regression using White diagonal standard errors, we note that the standard errors are larger than the standard errors of the previous regressions.

We perform separately the regression of bid-ask spread stock liquidity by using the two other proxies for the leverage control variable: debt to total assets ratio (*levdta*) and the interest coverage ratio (*levintcov*). When using the debt to total assets ratio, bid-ask spread liquidity variable still displays a significant positive relation with CDS spread. The debt to total assets leverage proxy has a significant positive relationship with CDS spreads, also confirming the literature. The R^2 of the regression is 0.8531, which shows a good fit. The result of this regression with debt to total assets leverage measure (*levdta*) is depicted in Appendix (13). When using the interest coverage ratio, the bid-ask spread inference does not change. However, the interest coverage ratio proxy shows the expected coefficient sign with insignificant probability (p=0.2737). The detailed results of the regression of bid-ask spread stock liquidity when using the interest coverage ratio for leverage is presented in Appendix (14).

With regards to the Amihud illiquidity measure which is computed based on return and volume of traded shares, we perform a regression where we only use equity value, operating margin and leverage as control variables. We drop return and stock return volatility because the Amihud illiquidity measure directly uses return in its calculation. Otherwise, the correlation between these variables founded on the same input and not captured by the correlation matrix, is likely to distort the regression results. In this regression, all variables including Amihud illiquity show cross-sectional heterogeneity within the firms and therefore we use cross-section fixed effects and let the variables vary in the period dimension. We get significant results for all variables and the direction of the relationships of these variables with CDS spreads is in line with literature. A higher Amihud illiquidity measure is positively correlated with the CDS spreads. The R^2 of the regression is 0.6985 indicating a reasonably good fit of the regression. Therefore, we find a positive relation between stock illiquidity and CDS spreads which is valid for all firms and varies across time. The results of the regressions are shown in *Table 9* and detailed in Appendices (15, 16, and 17).

TABLE 9: Regressions of Amihud Stock Liquidity: Pooled, Fixed Effects Using Ordinary SE and White SE

Explanatory Variables		REGRESSION					
		Pooled		Fixed Cross-Section Effect & No Period Fixed Effect		Fixed Cross-Section Effect & No Period Fixed Effect	
		Ordinary SE		Ordinary SE		White Cross Section SE	
		Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Intercept	*c*	6,8054	0,0000	12,6513	0,0000	12,6513	0,0000
		(0,0681)		(0,1494)		(0,5027)	
Amihud Illiquity	*illiq*	-292850,7	0,0000	126172,00	0,0093	126172,00	0,0048
		(43613,01)		(48511,25)		(44691,74)	
Equity Value	*lne*	-0,2173	0,0000	-0,8312	0,0000	-0,8312	0,0000
		(0,0071)		(0,0156)		(0,0526)	
Operating Margin	*opm*	-0,0033	0,0001	0,0080	0,0000	0,0080	0,0160
		(0,0008)		(0,0017)		(0,0033)	
Leverage	*levde*	0,0000	0,0060	0,0000	0,6762	0,0000	0,3080
		(-0,00005)		(0,0000)		(0,0000)	
R-squared		0,1730		0,6985		0,6985	
F-statistic		274,2361		140,6686		140,6686	
Prob. (F-statistic)		0,0000		0,0000		0,0000	

*The numbers in brackets represent standard errors for each coefficient.

Table 9 reports the coefficient, standard errors and probabilities for the intercept (*c*), the Amihud illiquidity measure (*illiq*) and the firm-level control variables: equity value (*lne*), operating margin (*opm*) and debt to equity leverage (*levde*) in three different regressions: the pooled regression using ordinary standard errors, the regression with cross-section fixed effects using ordinary standard errors and the regression with cross-section fixed effects using White cross-section standard errors. The R-squared, F-statistic and probability of F-statistic are also reported. We note that the coefficient of the Amihud illiquidity measure changes its sign when opting for the model using cross-section fixed effects. Furthermore, the coefficients are significant at the 1% significance level. The R-squared of the regression using fixed effects is also considerably larger, mainly due to the introduction of the dummies. The large coefficients of the Amihud illiquidity measure are explained by the small values which this variable takes due to its computation.

When analyzing the turnover ratio, we reach a significant negative relationship with CDS spreads. This outcome indicates that a higher stock liquidity results in lower CDS spreads, which is in line with our intuition and the literature. We adopt a regression with fixed effects in the cross-section dimension and no fixed effects in the time dimension, same as in the analysis of Amihud illiquidity. However, turnover ratio is computed by using only volume of traded shares and total number of shares, so we don't need to drop any control variables from this regression due to any possible correlation concern among variables. The R^2 of the regression is 0.7414, indicating a good fit of the regression. Summarized results of the regression with fixed cross-section effects and White cross-section standard errors are presented in *Table 10*, together with the pooled regression and the cross-section fixed regression with ordinary standard errors. Detailed results of these regressions are displayed in Appendices (18, 19, and 20).

TABLE 10: Regressions of Turnover Ratio Stock Liquidity: Pooled, Fixed Effects Using Ordinary SE and White SE

Explanatory Variables		REGRESSION					
		Pool		Fixed Cross-Section Effect & No Period Fixed Effect		Fixed Cross-Section Effect & No Period Fixed Effect	
		Ordinary SE		Ordinary SE		White Cross Section SE	
		Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Intercept	*c*	5,5570 (0,0695)	0,0000	10,9199 (0,1581)	0,0000	10,9199 (0,4212)	0,0000
Turnover Ratio	*trnvr*	24,8707 (2,5059)	0,0000	-33,0434 (2,6857)	0,0000	-33,0434 (8,3829)	0,0001
Return	*r*	0,2199 (0,0732)	0,0027	0,2326 (0,0472)	0,0000	0,2326 (0,1653)	0,1595
Equity Value	*lne*	-0,1391 (0,0068)	0,0000	-0,6647 (0,0162)	0,0000	-0,6647 (0,0420)	0,0000
Volatility	*vol*	19,1090 (0,6589)	0,0000	15,0238 (0,5136)	0,0000	15,0238 (1,8570)	0,0000
Operating Margin	*opm*	-0,0023 (0,0007)	0,0020	0,0027 (0,0016)	0,0909	0,0027 (0,0022)	0,2068
Leverage	*levde*	0,0000 (0,0000)	0,0018	0,0000 (0,0000)	0,8662	0,0000 (0,0000)	0,7356
R-squared		0,3469		0,7414		0,7414	
F-statistic		464,0606		170,0073		170,0073	
Prob. (F-statistic)		0,0000		0,0000		0,0000	

*The numbers in brackets represent standard errors for each coefficient.

Table 10 reports the coefficient, standard errors and probabilities for the intercept (*c*), the turnover ratio (*trnvr*) and the firm-level control variables: return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) in three different regressions: the pooled regression using ordinary standard errors, the regression with cross-section fixed effects using ordinary standard errors and the regression with cross-section fixed effects using White cross-section standard errors. The R-squared, F-statistic and probability of F-statistic are also reported. When comparing the specification with cross-section fixed effects to the pooled regression we observe that the coefficient of the turnover ratio changes sign and magnitude. While in the pooled regression, the turnover ratio stock liquidity measure shows a positive coefficient, which is counter-intuitive, in the specification with cross-section fixed effects the turnover ratio coefficient becomes negative. Thus, the higher the turnover ratio becomes, the lower the CDS spread is, result which is in line with our expectation. The coefficients of the turnover ratio are significant at the 1% significance level. We also note that the return, operating margin and leverage variables are insignificant in the model with cross-section fixed effects.

The operating margin control variable shows an insignificant coefficient in all above regressions of stock liquidity using fixed effects. This finding is linked to the research of Callen et al (2008) which argues that earnings are less correlated with CDS spreads of high rated companies rather than with CDS spreads of low rated companies. As the iTraxx Index, from which the companies in our analysis are selected, includes reputable firms which are deemed to have high credit ratings, the results suggesting insignificance of operating margin in relation to CDS spreads confirm the finding of Callen et al (2008).

In the previous regressions, we find that return has a reverse relationship with CDS spreads than the one suggested by literature. This outcome is counter-intuitive as it states that a higher stock return implies a higher CDS spread. This is caused by two control variables (volatility and equity value) which include return as input data. Therefore, stock return is correlated with them. To prove our reasoning, we implement the regression by dropping the control variables: volatility and equity value. Consequently, when we do this adjustment, we obtain a correct negative relationship between return and CDS spreads as it is stated in previous researches. Summarized results are depicted in *Table 11*. Detailed results of the pooled regression and the regressions with cross-section and period fixed effects with ordinary and White diagonal standard errors respectively, are presented in Appendices (21, 22, 23).

TABLE 11: Regressions of Stock Liquidity with Return Variable Excluding Equity Value and Volatility Variables

Explanatory Variables		REGRESSION					
		Pooled		Fixed Effects Cross Section & Time		Fixed Effects Cross Section & Time	
		Ordinary SE		Ordinary SE		White Diagonal SE	
		Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Intercept	*c*	4,7351 (0,0142)	0,0000	4,8406 (0,0207)	0,0000	4,8406 (0,0297)	0,0000
Bid-Ask Spread	*bas*	7,3556 (1,7773)	0,0000	8,2012 (1,2062)	0,0000	8,2012 (2,1359)	0,0001
Return	*r*	-0,6472 (0,0850)	0,0000	-0,1570 (0,0522)	0,0026	-0,1570 (0,0710)	0,0270
Op. Margin	*opm*	-0,0093 (0,0009)	0,0000	-0,0172 (0,0015)	0,0000	-0,0172 (0,0022)	0,0000
Leverage	*levde*	0,00004 (0,0000)	0,0040	0,00003 (0,0000)	0,0000	0,00003 (0,0000)	0,0000
R-squared		0,0370		0,7645		0,7645	
F-statistic		50,2973		111,8628		111,8628	
Prob. (F-statistic)		0,0000		0,0000		0,0000	

*The numbers in brackets represent standard errors for each coefficient.

Table 11 reports the coefficient, standard errors and probabilities for the intercept (*c*), the bid-ask spread stock liquidity measure (*bas*) and the firm-level control variables: return (*r*), operating margin (*opm*) and debt to equity leverage (*levde*) in three different regressions: the pooled regression using ordinary standard errors, the regression with cross-section and period fixed effects using ordinary standard errors and the regression with cross-section and period fixed effects using White cross-section standard errors. The R-squared, F-statistic, probability of F-statistic are also reported. When we drop from the regression the equity value and volatility variables which are related to return due to their calculation, we obtain an expected negative relationship between return and CDS spreads. Moreover, the bid-ask spread stock liquidity measure has a positive significant relationship with the CDS spreads in all regressions. In addition, the operating margin explanatory variable becomes significant compared to the previous regression. Its coefficient shows an expected negative relationship with CDS spreads.

When controlling for macroeconomic factors such as GDP growth and risk-free rate, we observe a significant positive relationship between CDS spreads and stock liquidity when it is measured by the bid-ask spread and Amihud illiquidity ratio. These results are in line with our expectation. On the other hand, when we use turnover ratio as a proxy for stock liquidity, we obtain a counter-intuitive result, suggesting that a higher turnover ratio implies a higher CDS spread. The results of the regression with turnover ratio as a measure of stock liquidity and macroeconomic control variables are displayed in Appendix (24).

Regarding the control variables, we obtain the expected negative relationship between them and the CDS spread. In all regressions, the coefficients of GDP growth rate and risk-free rate are significantly negative. In regards to risk-free measures, we use all three proxies and obtain the expected negative relationship between CDS spreads and risk-free rate. The summarized results of regressions of bid-ask spread stock liquidity where we use the one-year interbank interest rate and five-year government yield are presented in *Table 12* and *Table 13*. The R^2 of the regressions using bid-ask spread stock liquidity range from 0.6217 to 0.6475, indicating a good level of fit. Detailed estimation outputs of the pooled regressions and cross-section fixed regressions using the one-year interbank interest rate and five-year bond yield are shown in Appendices (26 – 31). The detailed results of the regression of bid-ask spread stock liquidity using the ten-year bond yield and cross-section fixed effects is presented Appendix (25). We note that the results are not qualitatively different. The regression of Amihud stock liquidity using one-year interbank interest rate is shown in *Table 14.* The R^2 of the regression using Amihud illiquidity and cross-section fixed effects is 0.6166, indicating a good level of fit. Detailed results of the regressions of Amihud stock liquidity using macroeconomic controls are displayed in Appendices (32, 33, 34).

TABLE 12: Regressions of Bid-Ask Spread Stock Liquidity with Macro-level Control Variables; Pooled and Fixed Effects using Ordinary SE and White SE Regressions

Explanatory Variables		REGRESSION					
		Pooled		Fixed Cross-Section Effect & No Period Fixed Effect		Fixed Cross-Section Effect & No Period Fixed Effect	
		Ordinary SE		Ordinary SE		White Cross Section SE	
		Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Intercept	*c*	4,7341 (0,0140)	0,0000	4,7125 (0,0095)	0,0000	4,7125 (0,0391)	0,0000
Bid-Ask Spread	*bas*	6,7160 (1,7129)	0,0001	13,0017 (1,5083)	0,0000	13,0017 (3,3867)	0,0001
GDP Growth Rate	*gdp*	-21,0662 (0,8684)	0,0000	-19,8148 (0,5779)	0,0000	-19,8148 (2,6648)	0,0000
Risk-free rate (1-yr Interbank Rate)	*intbankr*	-0,0524 (0,0051)	0,0000	-0,0480 (0,0034)	0,0000	-0,0480 (0,0206)	0,0198
R-squared		0,1047		0,6217		0,6217	
F-Statistic		204,4443		100,9973		100,9973	
Prob. (F-statistic)		0,0000		0,0000		0,0000	

*The numbers in brackets represent standard errors for each coefficient.

Table 12 reports the coefficient, standard errors and probabilities for the intercept (*c*), the bid-ask spread stock liquidity measure (*bas*) and the macro-level control variables: GDP growth (*gdp*) and one-year interbank interest rate (*intbankr*) in three different regressions: the pooled regression using ordinary standard errors, the regression with cross-section fixed effects using ordinary standard errors and the regression with cross-section fixed effects using White cross-section standard errors. The R-squared, F-statistic, probability of F-statistic are also reported. The bid-ask spread shows a positive significant relationship with the CDS spread in all three regressions. Both macroeconomic variables have an expected negative relationship with the dependent variable.

TABLE 13: Regressions of Bid-Ask Spread Stock Liquidity with Five-year Bond Yield for Risk-free Rate Variable; Pooled and Fixed Effects using Ordinary SE and White SE Regressions

Explanatory Variables		REGRESSION					
		Pooled		Fixed Cross-section Effect & No Period Fixed Effect		Fixed Cross-section Effect & No Period Fixed Effect	
		Ordinary SE		Ordinary SE		White Cross Section SE	
		Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Intercept	*c*	4,8582	0,0000	4,8469	0,0000	4,8469	0,0000
		(0,0172)		(0,0113)		(0,0490)	
Bid Ask Spread	*bas*	6,4967	0,0001	12,1310	0,0000	12,1310	0,0001
		(1,6898)		(1,4565)		(3,0844)	
GDP Growth Rate	*gdp*	-20,3585	0,0000	-19,3418	0,0000	-19,3417	0,0000
		(0,8053)		(0,5227)		(2,3830)	
Risk-free rate (5-yr Bond Yield)	*fiveyld*	-0,1055	0,0000	-0,1051	0,0000	-0,1051	0,0000
		(0,0066)		(0,0043)		(0,0220)	
R-squared		0,1287		0,6475		0,6475	
F-Statistic		258,0934		112,9133		112,9133	
Prob. (F-statistic)		0,0000		0,0000		0,0000	

*The numbers in brackets represent standard errors for each coefficient.

Table 13 reports the coefficient, standard errors and probabilities for the intercept (*c*), the bid-ask spread stock liquidity measure (*bas*) and the macro-level control variables: GDP growth (*gdp*) and five-year bond rate (*fiveyld*) in three different regressions: the pooled regression using ordinary standard errors, the regression with cross-section fixed effects using ordinary standard errors and the regression with cross-section fixed effects using White cross-section standard errors. The R-squared, F-statistic, probability of F-statistic are also reported. The regressions in Table 13 are different to those in Table 12 only in respect of the proxy for risk-free rate. In this case, we use the five-year bond yield. We note that all variables, have expected significant relationships with the dependent variable, CDS spreads.

TABLE 14: Regressions of Amihud Stock Liquidity with Macro-level Control Variables; Pooled and Fixed Effects using Ordinary SE and White SE Regressions

Explanatory Variables		REGRESSION					
		Pooled		Fixed Cross-Section Effect & No Period Fixed Effect		Fixed Cross-Section Effect & No Period Fixed Effect	
		Ordinary SE		Ordinary SE		White Cross Section SE	
		Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Intercept	*c*	4,7520 (0,0136)	0,0000	4,7353 (0,0092)	0,0000	4,7353 (0,0413)	0,0000
Amihud Illiquidity	*illiq*	-134914,40 (44883,86)	0,0027	117751,70 (54821,41)	0,0318	117751,70 (61373,85)	0,0551
GDP Growth Rate	*gdp*	-21,2742 (0,8685)	0,0000	-20,0190 (0,5831)	0,0000	-20,0190 (2,7188)	0,0000
Risk-free rate (1-yr Interbank Rate)	*intbankr*	-0,0532 (0,0051)	0,0000	-0,0485 (0,0034)	0,0000	-0,0485 (0,0208)	0,0199
R-squared		0,1036		0,6166		0,6166	
F-Statistic		202,0913		98,8354		98,8354	
Prob. (F-statistic)		0,0000		0,0000		0,0000	

*The numbers in brackets represent standard errors for each coefficient.

Table 14 reports the coefficient, standard errors and probabilities for the intercept (*c*), the Amihud illiquidity measure (*illiq*) and the macro-level control variables: GDP growth (*gdp*) and one-year interbank interest rate (*intbankr*) in three different regressions: the pooled regression using ordinary standard errors, the regression with cross-section fixed effects using ordinary standard errors and the regression with cross-section fixed effects using White cross-section standard errors. The R-squared, F-statistic, probability of F-statistic are also reported. The Amihud illiquidity measure shows an expected positive relationship with the CDS spreads when using the specification with cross-section fixed effects. However, when using White cross-section standard errors, the significance of the illiquidity measure becomes 0.0551, which is insignificant at the 5% level. However, the result is still significant at the 10% significance level. We also note that White cross-section standard errors are larger than the ordinary standard errors.

5. CONCLUSION

This research studies the impact of stock liquidity on CDS spreads by taking into account the effects of other known CDS spread determinants. Several researches are made on the impact of bond market liquidity on bond spreads. However, the literature focusing on CDS spreads is quite narrow and the direct effect of stock liquidity on CDS spreads, to the best of our knowledge, is investigated only in the paper of Das and Hanouna (2008).

In this study, a panel data consisting of 82 firms on a 64-month time frame is used to examine the relation between CDS spreads and stock liquidity. To investigate in detail the nature of this relationship, we scrutinize three different liquidity measures: the bid-ask spread, Amihud illiquidity measure and turnover ratio. High stock liquidity is determined by a low bid-ask spread and a low Amihud illiquidity measure. On the other hand, a low turnover ratio implies low stock liquidity. All three liquidity measures demonstrate a significant relationship with the CDS spreads. The direction of the relationship indicates that a higher stock liquidity leads to a lower CDS spread, result which is in line with our expectation. Therefore, the regressions confirm that both "cost based" and "reflective" (Spiegel and Wang, 2005) liquidity measures have a significant impact on CDS spreads, when other firm-level CDS spreads determinants are controlled. This research also proves that stock liquidity is a significant constituent of CDS spreads when controlling for macroeconomic variables, such as GDP growth rate and risk-free rate.

This study builds up on the current literature by tying the developing CDS market with the well developed stock market. Furthermore, we add value by comprehensively investigating the scarcely researched relationship between stock liquidity and CDS spreads.

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7. APPENDIX:

1-) POOLED REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH FIRM-LEVEL CONTROL VARIABLES

The table depicts the results of the pooled regression with the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use ordinary standard errors. The time frame of the data is December 2007 until March 2013. Bid-ask spread has an insignificant relationship with CDS spread in the pooled regression.

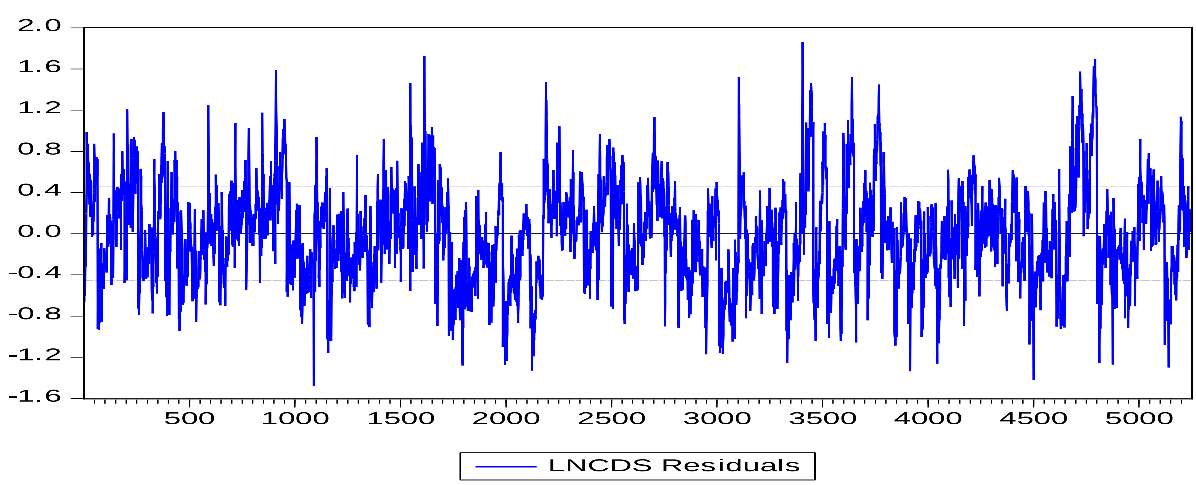
Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	5,7875	0,0668	86,5915	0,0000
Bid Ask Spread	*bas*	-0,3309	1,4889	-0,2222	0,8241
Return	*r*	0,1894	0,0738	2,5658	0,0103
Equity Value	*lne*	-0,1601	0,0066	-24,4367	0,0000
Volatility	*vol*	21,7164	0,6105	35,5689	0,0000
Operating Margin	*opm*	-0,0013	0,0007	-1,8031	0,0714
Lev. Debt to Equity	*levde*	0,0000	0,0000	3,1614	0,0016
R-squared	0,3347				
F-statistic	439,3983				
Prob (F-statistic)	0,0000				

Pooled Regression — *Periods :64*
Ordinary standard errors & covariance — *Cross-Sections :82*

2-) RESIDUAL GRAPH OF POOLED REGRESSION WITH FIRM-LEVEL CONTROL VARIABLES

The graph shows the distribution of the residuals of the pooled regression with firm-level control variables. The proxy used for stock liquidity is the bid-ask spread (*bas*). The presence of heteroskedasticity is observed from the graph.



3-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH FIRM-LEVEL CONTROLS USING CROSS-SECTION FIXED EFFECTS

The table shows the results of the regression using cross-section fixed effects, which includes the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity ratio (*levde*) are the firm-level control variables. We use ordinary standard errors. The time frame of the data is December 2007 until March 2013. Bid-ask spread has a positive relationship with CDS spreads implying that the higher the bid-ask spread (higher illiquidity), the higher the CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	10,6969	0,1598	66,9517	0,0000
Bid Ask Spread	*bas*	6,5747	1,2703	5,1758	0,0000
Return	*r*	0,2713	0,0477	5,6909	0,0000
Equity Value	*lne*	-0,6473	0,0164	-39,4093	0,0000
Volatility	*vol*	11,6520	0,4504	25,8666	0,0000
Operating Margin	*opm*	0,0019	0,0016	1,1536	0,2487
Lev. Debt to Equity	*levde*	0,0000	0,0000	-0,4141	0,6788
R-squared	0,7351				
F-statistic	164,6285				
Prob (F-statistic)	0,0000				

Cross-section fixed effects — *Periods :64*
Ordinary standard errors & covariance — *Cross-Sections :82*

4-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH FIRM-LEVEL CONTROLS USING PERIOD FIXED EFFECTS

The table shows the results of the regression using period fixed effects, which includes the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use ordinary standard errors. The time frame is from December 2007 to March 2013. The bid-ask spread has an insignificant relationship in the regression in which only period fixed effects are used.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	5,5414	0,0630	88,0152	0,0000
Bid Ask Spread	*bas*	-2,4678	1,3313	-1,8537	0,0638
Return	*r*	0,0526	0,0770	0,6825	0,4949
Equity Value	*lne*	-0,1462	0,0059	-24,7765	0,0000
Volatility	*vol*	27,0279	0,8143	33,1927	0,0000
Operating Margin	*opm*	-0,0008	0,0007	-1,1499	0,2502
Lev. Debt to Equity	*levde*	0,0001	0,0000	4,8416	0,0000
R-squared	0,4785				
F-statistic	68,8439				
Prob (F-statistic)	0,0000				

Period fixed effects — *Periods :64*
Ordinary standard errors & covariance — *Cross-Sections :82*

5-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH FIRM-LEVEL CONTROLS USING CROSS-SECTION AND PERIOD FIXED EFFECTS

The table shows the results of the regression using both cross-section and period fixed effects, which includes the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013. The regression using both fixed effects shows a significant positive relationship between bid-ask spread and CDS spread.

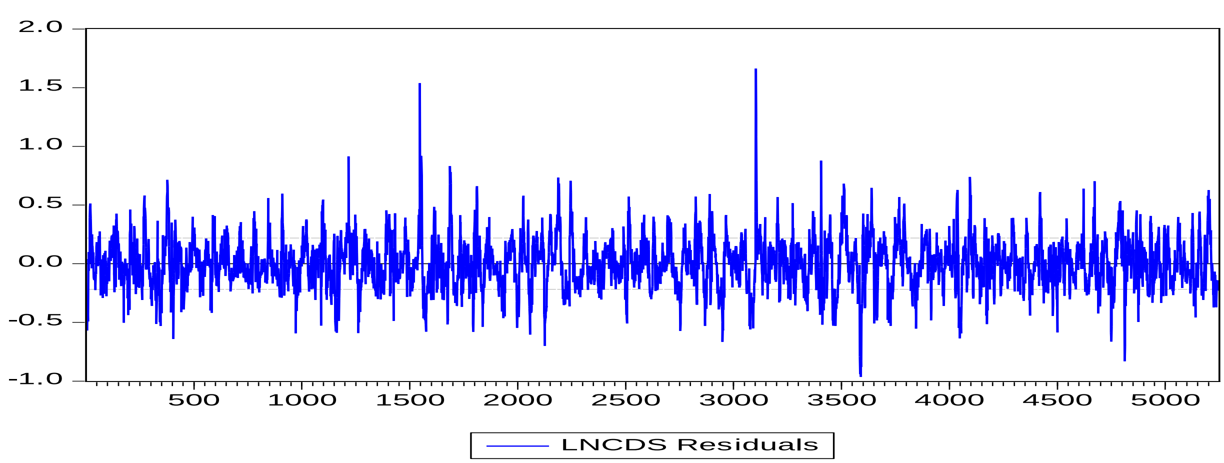
Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	10,1176	0,1323	76,5030	0,0000
Bid Ask Spread	*bas*	3,0271	0,9643	3,1392	0,0017
Return	*r*	0,3432	0,0425	8,0808	0,0000
Equity Value	*lne*	-0,5800	0,0135	-43,0638	0,0000
Volatility	*vol*	10,2023	0,5418	18,8294	0,0000
Operating Profit Margin	*opm*	-0,0017	0,0013	-1,3266	0,1847
Lev. Debt to Equity	*levde*	0,0000	0,0000	3,2425	0,0012
R-squared	0,8514				
F-statistic	194,7053				
Prob (F-statistic)	0,0000				

Cross-section and period fixed effects *Periods :64*
Ordinary standard errrors & covariance *Cross-Sections :82*

6-) RESIDUAL GRAPH OF THE REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY USING CROSS-SECTION AND TIME FIXED EFFECTS

The graph shows the distribution of the residuals of the regression of bid-ask spread (*bas*) stock liquidity measure using cross-section and period fixed effects with firm-level control variables. There is a substantial improvement regarding the variance of residuals in comparison to the one in the pooled regression. However, there are still sign of heteroskedasticity.



7-) WHITE TEST FOR HETEROSKEDASTICITY

In the White test for heteroskedasticity, we use square of residuals as the dependent variable and the stock liquidity measured by bid-ask spread (*bas*), firm-level control variables, their squares and cross-products as explanatory variables. Results of the test do not change when using the other two proxies for stock liquidity: the Amihud illiquidity measure (*illiq*) and turnover ratio (*trnvr*).

Dependent Variable: Squared Residuals
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	1,0137	0,1498	6,7671	0,0000
Bid Ask Spread	*bas*	-20,0114	6,2138	-3,2204	0,0013
Bid Ask Spread Squared	*bas2*	-11,0070	14,3665	-0,7662	0,4436
Return	*r*	-0,7608	0,1751	-4,3460	0,0000
Return Squared	*r2*	0,6635	0,1097	6,0462	0,0000
Equity Value	*lne*	-0,1791	0,0297	-6,0424	0,0000
Equity Value Squared	*lne2*	0,0086	0,0015	5,7934	0,0000
Volatility	*vol*	-9,5282	1,4572	-6,5387	0,0000
Volatility Squared	*vol2*	74,7066	1,5966	46,7908	0,0000
Operating Profit Margin	*opm*	-0,0003	0,0024	-0,1075	0,9144
Operating Profit Margin Squared	*opm2*	0,0000	0,0000	1,7459	0,0809
Lev. Debt to Equity	*levde*	0,0001	0,0000	1,8804	0,0601
Lev. Debt to Equity Squared	*levde2*	0,0000	0,0000	1,6114	0,1071
Bid-Ask Spread * Return	*bas_r*	17,5472	4,8861	3,5912	0,0003
Bid-Ask Spread * Equity Value	*bas_lne*	1,8671	0,6312	2,9579	0,0031
Bid-Ask Spread * Volatility	*bas_vol*	242,1353	35,4716	6,8261	0,0000
Bid-Ask Spread * Operating Margin	*bas_opm*	0,0028	0,0555	0,0499	0,9602
Bid-Ask Spread * Lev. Debt to Equity	*bas_levde*	-0,0009	0,0036	-0,2498	0,8027
Return * Equity Value	*r_lne*	0,0450	0,0180	2,5040	0,0123
Return * Volatility	*r_vol*	10,4955	1,0506	9,9903	0,0000
Return * Operating Margin	*r_opm*	-0,0003	0,0022	-0,1257	0,9000
Return * Lev. Debt to Equity	*r_levde*	0,0000	0,0000	1,6347	0,1022
Equity Value * Volatility	*lne_vol*	0,6351	0,1538	4,1298	0,0000
Equity Value * Operating Margin	*lne_opm*	-0,0001	0,0002	-0,4517	0,6515
Equity Value * Lev. Debt to Equity	*lne_levde*	0,0000	0,0000	-1,7879	0,0738
Volatility * Operating Margin	*vol_opm*	0,0115	0,0170	0,6742	0,5002
Volatility * Lev. Debt to Equity	*vol_levde*	-0,0015	0,0004	-3,5145	0,0004
Operating Margin * Lev. Debt to Equity	*opm_levde*	0,0000	0,0000	3,1785	0,0015
R-squared	0,3667				
F-statistic	111,9219				
Prob (F-statistic)	0,0000				

Pooled Regression — *Periods :64*

Ordinary standard errors & covariance — *Cross-Sections :82*

8-) BREUSCH-PAGAN TEST FOR HETEROSKEDASTICITY

The Breusch-Pagan test uses the squared residuals as dependent variable and the stock liquidity measured by bid-ask spread (*bas*) and firm-level controls as explanatory variables. The p-value (0,0000) of the test indicates that heteroskedasticity exists in the residuals

Dependent Variable: Squared Residuals
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	0,0012	0,0200	0,0619	0,9507
Bid Ask Spread	*bas*	1,9946	0,4459	4,4729	0,0000
Return	*r*	0,0601	0,0221	2,7172	0,0066
Equity Value	*lne*	0,0012	0,0020	0,6296	0,5290
Volatility	*vol*	1,9573	0,1829	10,7031	0,0000
Operating Profit Margin	*opm*	0,0007	0,0002	2,9876	0,0028
Lev. Debt to Equity	*levde*	0,0000	0,0000	0,4949	0,6207
R-squared	0,027298				
F-statistic	24,5141				
Prob (F-statistic)	0,0000				

Pooled Regression *Periods :64*

Ordinary standard errors & covariance *Cross-Sections :82*

9-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY USING WHITE SE

The table shows the results of the regression using both cross-section and period fixed effects, which includes the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use White diagonal standard errors. The time frame is from December 2007 until March 2013. The bid-ask spread has a significant positive relationship with CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

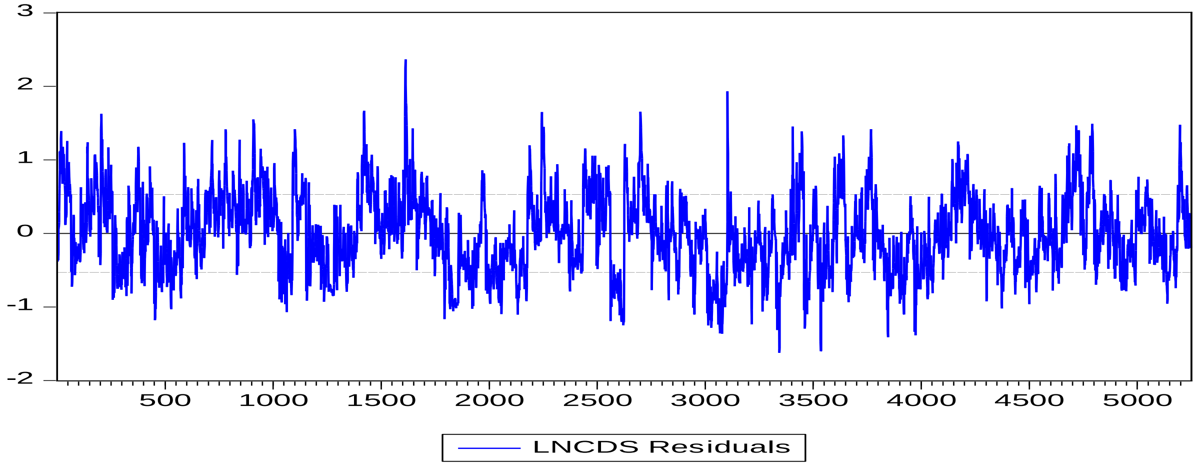
Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	10,1176	0,1629	62,0971	0,0000
Bid Ask Spread	*bas*	3,0271	1,3295	2,2769	0,0228
Return	*r*	0,3432	0,0632	5,4303	0,0000
Equity Value	*lne*	-0,5800	0,0166	-34,8498	0,0000
Volatility	*vol*	10,2023	0,7986	12,7751	0,0000
Operating Profit Margin	*opm*	-0,0017	0,0014	-1,1901	0,2341
Lev. Debt to Equity	*levde*	0,0000	0,0000	4,6382	0,0000
R-squared	0,8514				
F-statistic	194,7053				
Prob (F-statistic)	0,0000				

Cross-section and period fixed effects *Periods :64*

White diagonal standard errors & covariance *Cross-Sections :82*

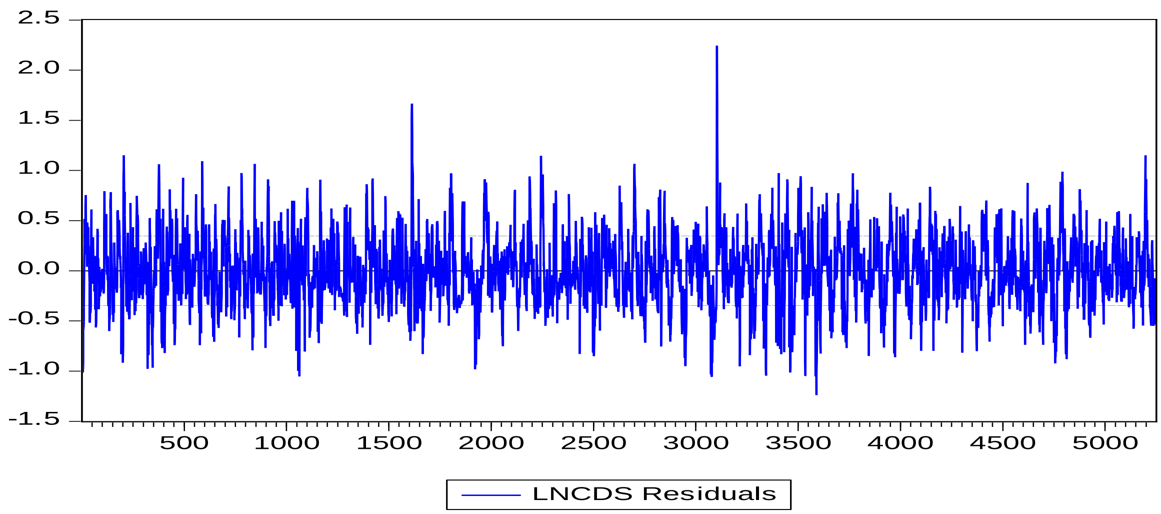
10-) RESIDUAL GRAPH OF THE POOLED REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH MACROECONOMIC VARIABLES

The graph shows the distribution of the residuals of the pooled regression with macroeconomic control variables. The proxy for stock liquidity is the bid-ask spread (*bas*). The plot indicates the presence of heteroskedasticity in the residuals of the pooled regression.



11-) RESIDUAL GRAPH OF THE REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH MACRO VARIABLES USING CROSS-SECTION FIXED EFFECTS

The graph shows the distribution of the residuals of the regression of bid-ask spread (*bas*) stock liquidity measure using cross-section and period fixed effects with macroeconomic control variables. The variance of the residuals displays a more constant trend when using cross-section fixed effects.



12-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH FIRM-LEVEL VARIABLES USING CROSS-SECTION AND PERIOD RANDOM EFFECTS

The table shows the results of the regression using both cross-section and period random effects, which includes the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. The time frame of the data used is December 2007 until March 2013. The R^2 of the regression using random effects in both dimensions is low.

Dependent Variable: CDS Spread

Method: Panel EGLS (Two-way random effects)

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	9,5425	0,1313	72,6996	0,0000
Bid Ask Spread	*bas*	3,1265	0,9857	3,1719	0,0015
Return	*r*	0,3091	0,0432	7,1625	0,0000
Equity Value	*lne*	-0,5230	0,0128	-40,7455	0,0000
Volatility	*vol*	11,1933	0,5343	20,9505	0,0000
Operating Profit Margin	*opm*	-0,0018	0,0012	-1,4834	0,1380
Lev. Debt to Equity	*levde*	0,0000	0,0000	3,3186	0,0009

R-squared	0,3784
F-statistic	531,6555
Prob (F-statistic)	0,0000

Random cross section and period effects *Periods :64*

Swamy and arora estimator component variances *Cross-Sections :82*

13-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH THE DEBT-TO-TOTAL ASSETS LEVERAGE PROXY

The table shows the results of the regression using both cross-section and period fixed effects, which includes the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to total assets ratio (*levdta*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to total assets leverage (*levdta*) are the firm-level control variables. We use White diagonal standard errors. The time frame of the data used is from Dec 2007 to March 2013. When using the debt to total assets ratio (*levdta)* proxy for leverage, the bid-ask spread still has a significant positive relationship with CDS spreads.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	9,6795	0,1842	52,5410	0,0000
Bid Ask Spread	*bas*	3,4496	1,3296	2,5946	0,0095
Return	*r*	0,3122	0,0626	4,9860	0,0000
Equity Value	*lne*	-0,5559	0,0174	-31,9590	0,0000
Volatility	*vol*	9,7740	0,8168	11,9664	0,0000
Operating Profit Margin	*opm*	-0,0020	0,0013	-1,5345	0,1250
Lev. Debt to Total Assets	*levdta*	0,0046	0,0007	6,6552	0,0000
R-squared	0,8531				
F-statistic	197,3801				
Prob (F-statistic)	0,0000				

Cross-section and period fixed effects *Periods :64*
White diagonal standard errors & covariance *Cross-Sections :82*

14-) REGRESSION OF STOCK LIQUIDITY WITH THE INTEREST COVERAGE RATIO LEVERAGE PROXY

The table shows the results of the regression using both cross-section and period fixed effects, which includes the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to total assets ratio (*levintcov*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to total assets leverage (*levintcov*) are the firm-level control variables. We use White diagonal SEs. The time frame of data is December 2007 until March 2013. The levintcov proxy for leverage has the expected negative but insignificant relationship with CDS spread. This result does not affect the bid-ask spread's relationship with the dependent variable.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	10,1225	0,1644	61,5611	0,0000
Bid Ask Spread	*bas*	3,0521	1,3321	2,2911	0,0220
Return	*r*	0,3396	0,0632	5,3770	0,0000
Equity Value	*lne*	-0,5796	0,0168	-34,4329	0,0000
Volatility	*vol*	10,1977	0,8023	12,7108	0,0000
Operating Margin	*opm*	-0,0017	0,0014	-1,2005	0,2300
Lev. Interest Coverage	*levintcov*	-0,0006	0,0006	-1,0946	0,2737
R-squared	0,8511				
F-statistic	194,2816				
Prob (F-statistic)	0,0000				

Cross-section and period fixed effects — *Periods :64*
White diagonal standard errors & covariance — *Cross-Sections :82*

15-) POOLED REGRESSION OF AMIHUD STOCK LIQUIDITY WITH FIRM-LEVEL CONTROL VARIABLES

The table depicts the results of the pooled regression with the Amihud illiquidity measure (*illiq*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The equity value (*lne*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013. Since there are not any fixed effects, Amihud illiquidity measure for stock liquidity shows an opposite relationship with CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	6,8054	0,0681	99,9924	0,0000
Amihud Illiquidity	*illiq*	-292850,70	43613,01	-6,7148	0,0000
Equity Value	*lne*	-0,2173	0,0071	-30,5819	0,0000
Operating Profit Margin	*opm*	-0,0033	0,0008	-3,9894	0,0001
Lev. Debt to Equity	*levde*	0,0000	0,0000	2,7462	0,0060
R-squared	0,1730				
F-statistic	274,2361				
Prob (F-statistic)	0,0000				

Pooled regression *Periods :64*
Ordinary standard errors & covariance *Cross-Sections :82*

16-) REGRESSION OF AMIHUD STOCK LIQUIDITY WITH FIRM-LEVEL CONTROLS USING CROSS-SECTION FIXED EFFECTS

The table depicts the results of the regression using cross-section fixed effects with the Amihud illiquidity measure (*illiq*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The equity value (*lne*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables. We use ordinary standard errors. The time frame is Dec. 2007 until March 2013. When using cross-section fixed effects, Amihud illiquidity measure demonstrates the expected positive relationship between illiquidity of a stock and the CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	12,6513	0,1494	84,7037	0,0000
Amihud Illiquidity	*illiq*	126172,00	48511,25	2,6009	0,0093
Equity Value	*lne*	-0,8312	0,0156	-53,1521	0,0000
Operating Profit Margin	*opm*	0,0080	0,0017	4,6698	0,0000
Lev. Debt to Equity	*levde*	0,0000	0,0000	-0,4177	0,6762
R-squared	0,6985				
F-statistic	140,6686				
Prob (F-statistic)	0,0000				

Cross-section fixed effects *Periods :64*
Ordinary standard errors & covariance *Cross-Sections :82*

17-) REGRESSION OF AMIHUD STOCK LIQUIDITY USING CROSS-SECTION FIXED EFFECTS AND WHITE CROSS-SECTION STANDARD ERRORS

The table depicts the results of the regression using cross-section fixed effects with the Amihud illiquidity measure (*illiq*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The equity value (*lne*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use White cross-section standard errors. The time frame of the data is December 2007 until March 2013. Amihud illiquidity measure for stock liquidity has a significant positive relationship with the CDS spread.

Dependent Variable: CDS Spread

Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	12,6513	0,5027	25,1667	0,0000
Amihud Illiquidity	*illiq*	126172,00	44691,74	2,8232	0,0048
Equity Value	*lne*	-0,8312	0,0526	-15,8073	0,0000
Operating Profit Margin	*opm*	0,0080	0,0033	2,4107	0,0160
Lev. Debt to Equity	*levde*	0,0000	0,0000	-1,0196	0,3080
R-squared	0,6985				
F-statistic	140,6686				
Prob (F-statistic)	0,0000				

Cross-section fixed effects *Periods :64*

White cross-section standard errors & covariance *Cross-Sections :82*

18-) POOLED REGRESSION OF TURNOVER RATIO STOCK LIQUIDITY WITH FIRM-LEVEL CONTROLS

The table depicts the results of the pooled regression with the turnover ratio (*trnvr*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013. A counter-intuitive positive relationship with turnover ratio measure for stock liquidity exists with CDS spread due to the pooled regression's specifications.

Dependent Variable: CDS Spread

Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	5,5570	0,0695	79,9708	0,0000
Turnover Ratio	*trnvr*	24,8707	2,5059	9,9248	0,0000
Return	*r*	0,2199	0,0732	3,0038	0,0027
Equity Value	*lne*	-0,1391	0,0068	-20,5051	0,0000
Volatility	*vol*	19,1090	0,6589	29,0013	0,0000
Operating Profit Margin	*opm*	-0,0023	0,0007	-3,0932	0,0020
Lev. Debt to Equity	*levde*	0,0000	0,0000	3,1197	0,0018
R-squared	0,3469				
F-statistic	464,0606				
Prob (F-statistic)	0,0000				

Pooled regression — *Periods :64*

Ordinary standard errors & covariance — *Cross-Sections :82*

19-) REGRESSION OF TURNOVER RATIO STOCK LIQUIDITY WITH FIRM-LEVEL CONTROLS USING CROSS-SECTION FIXED EFFECTS

The table depicts the results of the regression using cross-section fixed effects with the turnover ratio (*trnvr*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013. The regression with cross-section fixed effects gives the expected significant relationship between turnover ratio and CDS spread. The regression implies that the higher turnover ratio (higher liquidity), the lower CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	10,9199	0,1581	69,0656	0,0000
Turnover Ratio	*trnvr*	-33,0435	2,6857	-12,3034	0,0000
Return	*r*	0,2326	0,0472	4,9243	0,0000
Equity Value	*lne*	-0,6647	0,0162	-40,9324	0,0000
Volatility	*vol*	15,0238	0,5136	29,2515	0,0000
Operating Profit Margin	*opm*	0,0027	0,0016	1,6912	0,0909
Lev. Debt to Equity	*levde*	0,0000	0,0000	-0,1685	0,8662

R-squared	0,7414
F-statistic	170,0073
Prob (F-statistic)	0,0000

Cross-section fixed effects *Periods :64*
Ordinary standard errors & covariance *Cross-Sections :82*

20-) REGRESSION OF TURNOVER RATIO STOCK LIQUIDITY USING WHITE CROSS-SECTION STANDARD ERRORS

The table depicts the results of the regression using cross-section fixed effects with the turnover ratio (*trnvr*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), equity value (*lne*), volatility (*vol*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables. We use White cross-section standard errors. The time frame is Dec 2007 until March 2013. The regression using White cross-section SEs still demonstrates a significant negative relationship between turnover ratio and CDS spread as we expect.

Dependent Variable: CDS Spread

Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	10,9199	0,4212	25,9235	0,0000
Turnover Ratio	*trnvr*	-33,0435	8,3829	-3,9418	0,0001
Return	*r*	0,2326	0,1653	1,4071	0,1595
Equity Value	*lne*	-0,6647	0,0420	-15,8317	0,0000
Volatility	*vol*	15,0238	1,8570	8,0905	0,0000
Operating Profit Margin	*opm*	0,0027	0,0022	1,2626	0,2068
Lev. Debt to Equity	*levde*	0,0000	0,0000	-0,3377	0,7356

R-squared	0,7414
F-statistic	170,0073
Prob (F-statistic)	0,0000

Cross-section fixed effects *Periods :64*

White cross-section standard errors & covariance *Cross-Sections :82*

21-) POOLED REGRESSION OF STOCK LIQUIDITY WITHOUT VOLATILITY AND EQUITY VALUE CONTROL VARIABLES

The table depicts the results of the pooled regression with the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013. The return (*r*) now shows a significant negative relationship with CDS spreads as the theory states while the bid-ask spread has the expected positive relationship with CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,7351	0,0142	332,7158	0,0000
Bid Ask Spread	*bas*	7,3556	1,7773	4,1385	0,0000
Return	*r*	-0,6472	0,0850	-7,6126	0,0000
Operating Profit Margin	*opm*	-0,0093	0,0009	-10,7582	0,0000
Lev. Debt to Equity	*levde*	0,0000	0,0000	2,8796	0,0004
R-squared	0,0370				
F-statistic	50,2973				
Prob (F-statistic)	0,0000				

Pooled regression *Periods :64*
Ordinary standard errors & covariance *Cross-Sections :82*

22-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITHOUT VOLATILITY AND EQUITY VALUE USING CROSS-SECTION AND PERIOD FIXED EFFECTS

The table depicts the results of the regression using cross-section and period fixed effects with the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use ordinary SEs. The time frame is Dec. 2007 until March 2013. The return shows a significant negative relationship with CDS spreads.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,8406	0,0207	233,5545	0,0000
Bid Ask Spread	*bas*	8,2012	1,2062	6,7991	0,0000
Return	*r*	-0,1570	0,0522	-3,0096	0,0026
Operating Profit Margin	*opm*	-0,0172	0,0015	-11,2724	0,0000
Lev. Debt to Equity	*levde*	0,0000	0,0000	4,3108	0,0000
R-squared	0,7645				
F-statistic	111,8628				
Prob (F-statistic)	0,0000				

Cross-section fixed effects and period fixed effects *Periods :64*
Ordinary standard errors & covariance *Cross-Sections :82*

23-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITHOUT VOLATILITY AND EQUITY VALUE CONTROL VARIABLES USING WHITE STANDARD ERRORS

The table depicts the results of the regression using cross-section and period fixed effects with the bid-ask spread (*bas*) as a proxy for stock liquidity and debt to equity ratio (*levde*) as a proxy for the leverage control variable. The return (*r*), operating margin (*opm*) and debt to equity leverage (*levde*) are the firm-level control variables used in this regression. We use White diagonal standard errors. The time frame of the data used is December 2007 until March 2013. Using White diagonal SEs in the regression, the return (*r*) shows a significant negative relationship with CDS spreads.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,8406	0,0297	162,8637	0,0000
Bid Ask Spread	*bas*	8,2012	2,1359	3,8397	0,0001
Return	*r*	-0,1570	0,0710	-2,2120	0,0270
Operating Profit Margin	*opm*	-0,0172	0,0022	-7,8475	0,0000
Lev. Debt to Equity	*levde*	0,0000	0,0000	5,8149	0,0000
R-squared	0,7645				
F-statistic	111,8628				
Prob (F-statistic)	0,0000				

Cross-section fixed effects and period fixed effects *Periods :64*
White diagonal standard errors & covariance *Cross-Sections :82*

24-) REGRESSION OF TURNOVER RATIO STOCK LIQUIDITY USING THE 1-YEAR INTERBANK INT. RATE AND WHITE CROSS-SECTION STANDARD ERRORS

The table depicts the results of the regression using cross-section fixed effects with the turnover ratio (*trnvr*) as a proxy for stock liquidity and 1-year interbank interest rate (*intbankr*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 1-year interbank int. rate (*intbankr*) are the macro control variables. We use White cross-section standard errors. The time frame used is Dec 2007 until March 2013. The turnover ratio displays a counter-intuitive result as it has a positive relationship with CDS spreads, implying that a higher stock liquidity results in higher CDS spreads.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,6189	0,0421	109,8113	0,0000
Turnover Ratio	*trnvr*	52,8376	8,1467	6,4858	0,0000
GDP Growth Rate	*gdp*	-19,5113	2,7265	-7,1561	0,0000
Interbank Interest Rate	*intbankr*	-0,0791	0,0202	-3,9130	0,0001
R-squared	0,6384				
F-statistic	108,5188				
Prob (F-statistic)	0,0000				

Cross-section fixed effects *Periods :64*
White cross-section standard errors & covariance *Cross-Sections :82*

25-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY USING THE 10-YEAR BOND YIELD AND WHITE CROSS-SECTION STANDARD ERRORS

The table depicts the results of the regression using cross-section fixed effects with the bid-ask spread (*bas*) as a proxy for stock liquidity and 10-year bond yield (*fiveyld*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 10-yr bond yield (*tenyld*) are the macro-level control variables used in this regression. We use White cross-section standard errors. The time frame of the data used is Dec2007 until March 2013. When using the ten-year bond yield, the bid-ask spread still displays a positive relationship with the CDS spreads.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,9871	0,0834	59,7847	0,0000
Bid-Ask Spread	*bas*	12,3237	3,1372	3,9282	0,0001
GDP Growth Rate	*gdp*	-18,6407	2,3652	-7,8813	0,0000
10-year Government bond yield	*tenyld*	-0,1189	0,0270	-4,4065	0,0000
R-squared	0,6409				
F-statistic	109,7414				
Prob (F-statistic)	0,0000				

Cross-Section Fixed Effects *Periods :64*
White cross-section standard errors & covariance *Cross-Sections :82*

26-) POOLED REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY WITH MACROECONOMIC CONTROL VARIABLES

The table depicts the results of the pooled regression with the bid-ask spread (*bas*) as a proxy for stock liquidity and 1-year interbank rate (*intbankr*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 1-year interbank rate (*intbankr*) are the macro-level control variables used in this regression. We use ordinary standard errors. The time frame of the data used is Dec 2007 until March 2013. The bid-ask spread has an expected positive relationship with the dependent variable.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,7341	0,0140	338,3695	0,0000
Bid Ask Spread	*bas*	6,7159	1,7129	3,9209	0,0001
GDP Growth Rate	*gdp*	-21,0662	0,8684	-24,2582	0,0000
1-year Interbank rate	*intbankr*	-0,0524	0,0051	-10,3354	0,0000
R-squared	0,1047				
F-statistic	204,4443				
Prob (F-statistic)	0,0000				

Pooled Regression *Periods :64*
Ordinary standard errors & covariance *Cross-Sections :82*

27-) REGRESSION OF STOCK LIQUIDITY WITH MACROECONOMIC CONTROL VARIABLES USING CROSS-SECTION FIXED EFFECTS

The table depicts the results of the regression using cross-section fixed effects with the bid-ask spread (*bas*) as a proxy for stock liquidity and 1-year interbank rate (*intbankr*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 1-year interbank rate (*intbankr*) are the macro-level control variables used in this regression. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013. When using cross-section fixed effects, the explanatory power of bid-ask spread on CDS spread increases in comparison to the pooled regression.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,7125	0,0095	495,9753	0,0000
Bid Ask Spread	*bas*	13,0017	1,5083	8,6202	0,0000
GDP Growth Rate	*gdp*	-19,8148	0,5779	-34,2876	0,0000
1-year Interbank rate	*intbankr*	-0,0480	0,0034	-14,1356	0,0000
R-squared	0,6217				
F-statistic	100,9973				
Prob (F-statistic)	0,0000				

Cross-Section Fixed Effects *Periods :64*
Ordinary standard errors & covariance *Cross-Sections :82*

28-) REGRESSION OF BID-ASK SPREAD STOCK LIQUITIY WITH MACROECONOMIC CONTROL VARIABLES USING WHITE CROSS-SECTION STANDARD ERRORS

The table depicts the results of the regression using cross-section fixed effects with the bid-ask spread (*bas*) as a proxy for stock liquidity and 1-year interbank rate (*intbankr*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 1-year interbank rate (*intbankr*) are the macro-level control variables. We use White cross-section standard errors. The time frame of the data used is December 2007 until March 2013. Bid-ask spread has a significant positive relationship with CDS spread when using White cross-section standard errors.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,7125	0,0390	120,6527	0,0000
Bid Ask Spread	*bas*	13,0017	3,3867	3,8391	0,0001
GDP Growth Rate	*gdp*	-19,8148	2,6648	-7,4359	0,0000
1-year Interbank rate	*intbankr*	-0,0480	0,0206	-2,3308	0,0198
R-squared	0,6217				
F-statistic	100,9973				
Prob (F-statistic)	0,0000				

Cross-Section Fixed Effects *Periods :64*
White cross-section standard errors & covariance *Cross-Sections :82*

29-) POOLED REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY USING THE 5-YEAR BOND YIELD PROXY FOR RISK-FREE RATE

The table depicts the results of the pooled regression with the bid-ask spread (*bas*) as a proxy for stock liquidity and 5-year bond yield (*fiveyld*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 5-year bond yield (*fiveyld*) are the macro-level control variables used in this regression. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013. When using 5-yr bond yield proxy for risk-free rate, the bid ask spread continues to have a significant positive relationship with CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,8582	0,0172	283,1067	0,0000
Bid-Ask Spread	*bas*	6,4967	1,6898	3,8448	0,0001
GDP Growth Rate	*gdp*	-20,3585	0,8053	-25,2798	0,0000
5-year Government bond yield	*fiveyld*	-0,1055	0,0066	-15,9327	0,0000
R-squared	0,1287				
F-statistic	258,0934				
Prob (F-statistic)	0,0000				
Pooled Regression				*Periods*	*:64*
Ordinary standard errors & covariance				*Cross-Sections*	*:82*

30-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY USING THE 5-YEAR BOND YIELD AND CROSS-SECTION FIXED EFFECTS

The table depicts the results of the regression using cross-section fixed effects with the bid-ask spread (*bas*) as a proxy for stock liquidity and 5-year bond yield (*fiveyld*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 5-yr bond yield (*fiveyld*) are the macro-level control variables. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,8469	0,0113	427,3549	0,0000
Bid-Ask Spread	*bas*	12,1310	1,4565	8,3288	0,0000
GDP Growth Rate	*gdp*	-19,3418	0,5227	-37,0032	0,0000
5-year Government bond yield	*fiveyld*	-0,1051	0,0043	-24,3549	0,0000
R-squared	0,6475				
F-statistic	112,9133				
Prob (F-statistic)	0,0000				
Cross-Section Fixed Effects				*Periods*	*:64*
Ordinary standard errors & covariance				*Cross-Sections*	*:82*

31-) REGRESSION OF BID-ASK SPREAD STOCK LIQUIDITY USING THE 5-YEAR BOND YIELD AND WHITE CROSS-SECTION STANDARD ERRORS

The table depicts the results of the regression using cross-section fixed effects with the bid-ask spread (*bas*) as a proxy for stock liquidity and 5-year bond yield (*fiveyld*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 5-year bond yield (*fiveyld*) are the macro-level control variables. We use White cross-section SEs. The time frame is Dec. 2007 until March 2013. By controlling the risk-free rate measured by the 5-year bond yield in the regression using White cross-section SEs, we obtain a significant positive relationship between bid-ask spread and CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,8469	0,0490	98,9203	0,0000
Bid-Ask Spread	*bas*	12,1310	3,0844	3,9331	0,0001
GDP Growth Rate	*gdp*	-19,3418	2,3830	-8,1165	0,0000
5-year Government bond yield	*fiveyld*	-0,1051	0,0220	-4,7783	0,0000
R-squared	0,6475				
F-statistic	112,9133				
Prob (F-statistic)	0,0000				

Cross-Section Fixed Effects — *Periods :64*
White cross-section standard errors & covariance — *Cross-Sections :82*

32-) POOLED REGRESSION OF AMIHUD STOCK LIQUIDITY WITH MACROECONOMIC CONTROL VARIABLES

The table depicts the results of the pooled regression with the Amihud illiquidity measure (*illiq*) as a proxy for stock liquidity and 1-year interbank rate (*intbankr*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 1-year interbank rate (*intbankr*) are the macro-level control variables used in this regression. We use ordinary standard errors. The time frame of the data used is December 2007 until March 2013. The pooled regression with macro control variables gives a counter-intuitive negative relationship between Amihud illiquidity measure and CDS spread.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,7520	0,0136	349,3863	0,0000
Amihud Illiquidity Measure	*illiq*	-134914,40	4483,86	-3,0059	0,0027
GDP Growth Rate	*gdp*	-21,2742	0,8685	-24,4966	0,0000
1-year Interbank rate	*intbankr*	-0,0532	0,0051	-10,4787	0,0000
R-squared	0,1036				
F-statistic	202,0913				
Prob (F-statistic)	0,0000				

Pooled Regression — *Periods :64*
Ordinary standard errors & covariance — *Cross-Sections :82*

33-) REGRESSION OF AMIHUD STOCK LIQUIDITY WITH MACROECONOMIC CONTROL VARIABLES USING CROSS-SECTION FIXED EFFECTS

The table depicts the results of the regression using cross-section fixed effects with the Amihud illiquidity measure (*illiq*) as a proxy for stock liquidity and 1-year interbank rate (*intbankr*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 1-year interbank rate (*intbankr*) are the macro-level control variables used. We use ordinary SEs. The time frame is Dec. 2007 until March 2013. When cross-section fixed effects are used in the regression with macro control variables, Amihud illiquidity measure shows the expected positive relationship with a significance of 3.18%.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,7353	0,0092	514,7333	0,0000
Amihud Illiquidity Measure	*illiq*	117751,70	54821,41	2,1479	0,0318
GDP Growth Rate	*gdp*	-20,0190	0,5831	-34,3305	0,0000
1-year Interbank rate	*intbankr*	-0,0485	0,0034	-14,1885	0,0000
R-squared	0,6166				
F-statistic	98,8354				
Prob (F-statistic)	0,0000				

Cross-Section Fixed Effects *Periods :64*
Ordinary standard errors & covariance *Cross-Sections :82*

34-) REGRESSION OF AMIHUD STOCK LIQUIDITY WITH MACROECONOMIC CONTROL VARIABLES USING WHITE CROSS-SECTION STANDARD ERRORS

The table depicts the results of the regression using cross-section fixed effects with the Amihud illiquidity measure (*illiq*) as a proxy for stock liquidity and 1-year interbank rate (*intbankr*) as a proxy for the risk-free rate control variable. The GDP growth rate (*gdp*) and 1-year interbank rate (*intbankr*) are the macro-level control variables. We use White cross-section ordinary SEs. The time frame of the data is Dec. 2007 until March 2013. When using White cross-section SEs, Amihud illiquidity measure has the expected positive relationship with CDS spread but a significance of 5.51%, slightly higher than 5% significance level.

Dependent Variable: CDS Spread
Method: Panel Least Squares

Variables	Symbol	Coefficient	Standard Error	t-Statistic	Probabilities
Intercept	*c*	4,7353	0,0413	114,5980	0,0000
Amihud Illiquidity Measure	*illiq*	117751,70	61373,85	1,9185	0,0551
GDP Growth Rate	*gdp*	-20,0190	2,7188	-7,3631	0,0000
1-year Interbank rate	*intbankr*	-0,0485	0,0208	-2,3288	0,0000
R-squared	0,6166				
F-statistic	98,8354				
Prob (F-statistic)	0,0000				

Cross-Section Fixed Effects *Periods :64*
White cross-section standard errors & covariance *Cross-Sections :82*

35-) THE LIST OF 82 FIRMS USED IN THE SAMPLE:

*	Company Name	Country		Company Name	Country
1	Aktiebolaget Volvo	Sweden	42	Next PLC	UK
2	Akzo Nobel N.V.	Netherlands	43	PPR	France
3	Alstom	France	44	Sabmiller PLC	UK
4	Anglo American PLC	UK	45	Suedzucker AG Mannheim	Germany
5	Astrazeneca PLC	UK	46	Tate & Lyle PLC	UK
6	Atlantia S.P.A.	Italy	47	Tesco PLC	UK
7	BAE Systems PLC	UK	48	Unilever	UK
8	BASF SE	UK	49	BP PLC	UK
9	Bayer Aktiengesellschaft	Germany	50	Centrica PLC	UK
10	Bayerische Motoren Werke AG	Germany	51	E.ON AG	Germany
11	Bouygues	France	52	Electricite de France (EDF)	France
12	Compagnie de Saint-Gobain	France	53	EnBW Energie Baden-Wuerttemberg AG	Germany
13	Compagnie Financiere Michelin	France	54	ENEL S.P.A.	Italy
14	Daimler AG	Germany	55	ENI S.P.A.	Italy
15	Holcim Ltd	Switzerland	56	Fortum Oyj	Finland
16	Lanxess AG	Germany	57	Gas Natural SDG S.A.	Spain
17	Linde AG	Germany	58	GDF Suez	France
18	Rentokil Initial PLC	UK	59	Iberdrola S.A.	Spain
19	Rolls-Royce PLC	UK	60	National Grid PLC	UK
20	Sanofi	France	61	Royal Dutch Shell PLC	Netherlands
21	Siemens AG	Germany	62	RWE AG	Germany
22	Solvay	Belgium	63	Total SA	France
23	Valeo	France	64	United Utilities PLC	UK
24	Vinci	France	65	Veolia Environment	France
25	Volkswagen AG	Germany	66	Aegon N.V.	Netherlands
26	Xstrata PLC	UK	67	British Telecommunications PLC	UK
27	Accor	France	68	Deutsche Telekom AG	Germany
28	Aktiebolaget Electrolux	Sweden	69	France Telecom	France
29	Anheuser-Busch InBev	Belgium	70	Koninklijke KPN N.V.	Netherlands
30	British American Tobacco PLC	UK	71	Pearson PLC	UK
31	Carrefour	France	72	Publicis Groupe SA	France
32	Compass Group	UK	73	STMicroelectronics N.V.	France
33	Diageo PLC	UK	74	Telecom Italia S.P.A.	Italy
34	Experian Finance PLC	UK	75	Telefonaktiebolaget LM Ericsson	Sweden
35	Imperial Tobacco Group PLC	UK	76	Telekom Austria AG	Austria
36	Kingfisher PLC	UK	77	Telenor ASA	Norway
37	Koninklijke Ahold N.V.	Netherlands	78	TeliaSonera Aktiebolaget	Sweden
38	LVMH	France	79	Vivendi	France
39	Marks and Spencer PLC	UK	80	Vodafone Group PLC	UK
40	Metro AG	Germany	81	Wolters Kluwer N.V.	Netherlands
41	Nestle S.A.	Switzerland	82	WPP 2005 Limited	UK

Number of Companies per Country

United Kingdom	27	Sweden	3
France	19	Belgium	2
Germany	13	Switzerland	2
Netherlands	6	Norway	1
Italy	4	Finland	1
Spain	3	Austria	1

*The companies are selected from Markit iTraxx Europe Reference Portfolio