Information asymmetries and debt financing: New evidence from the 2007-2008 financial crisis

Andrea Bafundi[*], Claudia Imperatore[**]

Abstract

Purpose: Focusing on the 2007-2009 financial crisis, this study investigates how firms' and debtholders' information sensitivity jointly shape corporate debt financing. According to the pecking order theory, opaque firms prefer bank loans over more information-sensitive sources like bonds and equity. When external conditions worsen, firms face difficulties accessing bank loans and look for alternatives. Yet, as bondholders are more information-sensitive than banks, the substitution effect may not occur especially for firms with lower financial reporting quality (FRQ).

Design/methodology/approach: A matching difference-in-differences approach is used to compare the debt financing of firms with and without access to corporate bond markets before and after the onset of the financial crisis. A sample of quarterly data of US-listed firms is analyzed for the 2006Q3-2009Q2 period.

Findings: The reduction in debt financing due to the crisis was greater for firms with access to bond markets. The effect is more pronounced for firms with lower FRQ. These firms also looked more for alternatives such as equity and cash resources.

Keywords: information asymmetries, financial crisis, debt financing, financial reporting quality.

JEL: D53, D81, E41, F34

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1. Introduction

There is ample evidence that information asymmetries influence corporate financing choices (Becker et al., 2020). Information asymmetries arise when managers know more about the value of firm's assets and opportunities than outside investors (Myers & Majluf, 1984). When information asymmetries are high, capital providers face more difficulties in evaluating a firm's type. Consequently, they either ask for a greater premium or decline to finance the firm (Myers & Majluf, 1984). Capital providers, in general, and debtholders, in particular, are unequally exposed to information asymmetries. Banks are less information-sensitive than bondholders because they can directly monitor borrowers and access private information. Thereby, several studies show that opaque firms prefer loans to bonds (Bharath et al., 2008).

When economic conditions worsen and uncertainty about firms' fundamentals increases, banks become more information-sensitive, strengthen their monitoring activities, and tighten their lending standards (Dell'Ariccia & Marquez, 2006; Huber, 2018; Ruckes, 2004). Firms can substitute debt funds with bonds in line with the pecking order theory (Myers & Majluf, 1984). However, such substitution may not occur if bondholders are more vulnerable to upturns in uncertainty about firms' fundamentals following the deterioration of credit conditions (Easton et al., 2009). Whether bondholders' higher information sensitivity exceeds banks' tighter lending standards during an economic downturn remains an open question.

We shed new light on this topic by examining how debtholders' and firms' exposure to information asymmetries shape corporate debt financing when external conditions worsen. First, we analyze how the different information sensitivities of banks and bondholders are associated with changes in debt financing during a financial crisis. Subsequently, we study the moderating role of firms' financial reporting quality (FRQ) because it affects both firms' demand for less information-sensitive financing and debtholders' willingness to supply capital[1]. Specifically, we contend that firms with lower FRQ are more exposed to greater uncertainty during an economic downturn. Although opaque firms might have a stronger preference for debt, they are less likely to pass the stricter lending requirements of banks and bondholders. Thus, we expect firms exposed to bondholders to exhibit a larger decrease in debt financing when they are more opaque.

[1] We use the terms financial reporting quality and transparency interchangeably throughout the paper.

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We test our hypotheses using a sample of US-listed firms by comparing debt financing of firms with and without access to bond markets before (2006Q3-2007Q2) and during the Great Financial Crisis (2007Q3-2009Q2). We adopt a matching difference-in-differences research design to attenuate the concern that firms with and without access to bond markets have different characteristics and demands for financing. We rely on Compustat quarterly data to measure debt financing and, following Faulkender and Petersen (2006), proxy firms' access to bond markets using credit ratings. FRQ is measured before the start of the sample period (i.e., 2006Q2) by combining accounting quality (Dechow & Dichev, 2002), the absolute value of discretionary accruals (Jones, 1991), performance-matched discretionary accruals (Kothari et al., 2005), and occurrence of non-timely filings and restatements.

Empirical evidence shows that the drop in overall debt financing during the financial crisis was greater for firms with access to bond markets. Moreover, the negative association between firms' access to bond markets and debt financing during the crisis was stronger for opaque firms. These results suggest that bondholders were more exposed to uncertainty about firm types following the crisis and avoided more opaque firms, in line with the idea that they are more susceptible to information asymmetries.

We corroborate our findings by conducting a battery of robustness tests. First, we exploit the cross-sectional variation in firms' credit ratings and find that firms with poor credit quality experienced a greater reduction in debt financing than those without credit rating. Second, our results do not differ between the first and second phases of the crisis (i.e., before and after the passage of the Troubled Asset Relief Program - TARP), thus excluding the possibility that changes in demand or the regulatory environment drive our findings. We then validate our assumption that bondholders are more exposed to information asymmetries during an economic downturn, showing that firms with access to bond markets were less likely to raise new bonds during the financial crisis, especially when they had lower FRQ. Finally, we analyze whether firms with access to bond markets sought alternative sources of financing during the financial crisis. We find that these companies reported higher equity financing and greater cash holding reductions than bank-dependent firms, and both effects were stronger for opaque firms.

Our study makes several contributions to the literature. Considering both supply- and demand-side factors, we demonstrate that differences in information sensitivity between banks and bondholders last during a financial downturn. Moreover, firms with lower FRQ experienced a greater reduction in debt financing because they had difficulty accessing both bank loans and bonds. Corporate transparency also shapes firms' exposure to the higher in-

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formation sensitivity of capital providers. Higher transparency can ensure access to debt funds despite the bondholders' higher skepticism and reduced trust. Instead, the substitution effect might not occur when firms have information asymmetries because the higher bondholders' sensitivity to information asymmetries during an economic downturn makes them more reluctant to finance less transparent firms. Thus, the substitution effect documented by Adrian et al. (2013) and Becker and Ivashina (2014) depends on both the information sensitivity of banks and bondholders and information asymmetries of firms. We also contribute to the literature on corporate financing outcomes when firms face adverse external conditions (Erel et al., 2011; Ivashina & Scharfstein, 2010; Kahle & Stulz, 2013). Extant research shows that US firms are diversely exposed to financial downturns depending on their credit quality (Erel et al., 2011), ability to access alternate funds (Leary, 2009), bank relationships (Chava & Purnanandam, 2011; Kahle & Stulz, 2013), debt maturity (Almeida et al., 2012), and cash reserves (Duchin et al., 2010), among others. We show that firms' information environment also influences financing decisions.

Our study speaks to the accounting literature examining the role of FRQ when financial conditions deteriorate by investigating the real effects of FRQ and the role of capital supply conditions in firms' corporate financing decisions. Lang and Maffett (2011) and Ng (2011) show that transparent firms have higher liquidity and lower liquidity risk when market uncertainty is high; however, they do not consider the real impact of such improvements. Chang et al. (2009) argue that the equity issuances of transparent firms are less vulnerable to capital market conditions. Similarly, B. Francis et al. (2013) and Balakrishnan et al. (2016) document that conservatism mitigates the negative consequences of the financial crisis on market performance, corporate investments, and financing. We enrich this evidence by demonstrating the pivotal role of debtholders' sensitivity to information asymmetries in this regard. Finally, this study has practical and policy implications. As the COVID-19-related crisis suggests, financial crises and economic downturns are not rare (Claessens et al., 2012; Çolak et al., 2017). Thus, a better understanding of the factors that attenuate or exacerbate the adverse effects of economic downturns is warranted to find effective policy remedies and is of interest to managers and regulators.

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2. Literature review and hypotheses development

2.1. Information asymmetries, corporate financing, and business cycles

There is a broad consensus that outside investors are not equally exposed to information asymmetries. For instance, equity investors are more sensitive to information asymmetries than debtholders, and, among debtholders, bondholders are more information-sensitive than banks. The differences in information sensitivity between banks and bondholders result from their different abilities to access information, monitor borrowers, and renegotiate contracts. Banks have superior information gathering and processing advantages and can access private information to reduce adverse selection problems and monitor borrowers (Bharath et al., 2008; Naranjo et al., 2020). Moreover, private debt contracts are easier to renegotiate than public contracts. Conversely, bondholders are more vulnerable to information asymmetries because they do not directly access borrowers' information. They must rely on publicly available information and credit ratings to evaluate borrowers' creditworthiness. In line with the idea that different information sensitivities of capital providers shape firms' financing choices, the pecking-order theory (Myers & Majluf, 1984) suggests that firms prefer less information-sensitive sources of financing (i.e., internal financing and loans) to more information-sensitive ones (i.e., bonds and equity), which will only be used when firms are under financial distress.

More recently, the finance literature recognizes that information asymmetries are significant under adverse external conditions (Becker et al., 2020) when uncertainty about firm type increases and there is a loss in confidence among capital providers. Ivashina and Scharfstein (2010) demonstrate that banks in the US cut their corporate loans after the 2007-2008 financial crisis, while Campello et al. (2010) show an increase in firms' financial constraints in the aftermath of the crisis. Simultaneously, a loss of confidence moves capital providers away from risky and illiquid firms, giving rise to the flight-to-quality and flight-to-liquidity phenomena (Caballero & Krishnamurthy, 2008; Guerrieri & Shimer, 2014; Vayanos, 2004). Debt providers also strengthen their lending requirements (Ruckes, 2004) by relying more on hard information (Lisowsky & Sutherland, 2017), raising their cost of debt in market-oriented countries (Santos, 2006), or disinvesting from firms perceived as riskier in bank-oriented countries (De Haas & Van Horen, 2013). Finally, higher uncertainty affects firms' demand for financing. Specifically, time-varying adverse selection models (Choe et al., 1993) predict

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how, as external conditions worsen, firms prefer debt to equity as it is a less information-sensitive type of financing.

Although there is broad consensus that characteristics of firms and capital suppliers shape corporate financing and capital structure choices (Erel et al., 2011; Leary, 2009), prior studies consider the demand and supply sides separately. Conversely, we adopt a more comprehensive perspective by jointly investigating how the debt providers' information sensitivity and firms' information asymmetries affect firms' debt financing during a downturn.

2.2. Corporate financing, business cycles, and debtholders' information sensitivity

The different information sensitivities of lenders shape firms' exposure to an economic downturn. Studies in bank-oriented countries suggest that banks' information advantage ensures a firm's access to debt financing when external conditions deteriorate. Bolton et al. (2016) show that in Italy, where banks are the most important capital providers for firms, the information advantage of relationship lending persisted during a period of turmoil. Conversely, studies in market-oriented countries suggest that when external conditions worsen, banks become more information-sensitive, exerting stronger monitoring over firms, and strengthening their lending standards (Dell'Ariccia & Marquez, 2006; Ruckes, 2004). Becker and Ivashina (2014) find that the predictive ability of US banks' internal ratings improved during the last financial crisis, while Lisowsky and Sutherland (2017) show that US banks require more verified financial statements after the last financial crisis. Similarly, using an international sample, De Haas and Van Horen (2013) show that banks cut cross-border lending during the last financial crisis when borrowers lacked experience in specific countries because of greater difficulties in reducing information asymmetries.

As stronger monitoring and stricter lending standards during an economic downturn impair firms' access to bank loans, firms need to look for alternative sources of financing. Specifically, Becker and Ivashina (2014) and Adrian et al. (2013) document that US firms substituted bank loans with corporate bonds during the last financial crisis so that their debt financing remained unchanged. Thus, firms can substitute impaired loans with bonds to reduce their debt financing exposure if they have access to bond markets. This evidence corroborates the pecking order theory (Myers & Majluf, 1984), but contradicts firms' preferences for less information-sensitive financing and bondholders' higher information sensitivity when external con-

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ditions worsen (Shivakumar et al., 2011). Specifically, if bondholders are exposed to higher uncertainty and are more reluctant to finance, firms may not tap the bond markets and may experience a greater reduction in debt financing.

We first posit that a financial downturn negatively affects a firm's debt financing. Then, we expect that this negative relation will vary depending on the firm's exposure to more information-sensitive debtholders and formulate the following non-directional hypothesis:

H1: A negative association exists between debt financing and a financial downturn
H2: The negative association between debt financing and a financial downturn is moderated by firms' exposure to information-sensitive debtholders

2.3. Role of financial reporting quality

Building on theoretical models emphasizing the importance of information asymmetries in firms' financing decisions (Stiglitz & Weiss, 1981), previous studies show that transparency affects corporate financing by influencing outsiders' ability to discern a firm's type (Shakespeare, 2020). If accounting information is of low quality, investors face more difficulties in evaluating firm types; thus, they are either less willing to finance firms or require a greater investment return. This is especially the case for capital providers that rely heavily on accounting information to assess firms' fundamentals (e.g., equity holders and bondholders). Several studies find that opaque firms are more likely to use bank loans than more information-sensitive financing types, both in the US (Bharath et al., 2008; Petacchi, 2015) and internationally (Florou & Kosi, 2015; Naranjo et al., 2020).

As FRQ can dampen information asymmetries between firms and outsiders and reduce uncertainty about firm type, it is reasonable to expect that it will also play a role in firms' financing decisions during financial turmoil. Prior studies in market-oriented countries show that information quality has several benefits during a financial crisis. Lang and Maffett (2011) and Ng (2011) show that transparency ameliorates firms' liquidity when financial conditions worsen. Chang et al. (2009) argue that auditor type and analyst coverage reduce firms' capital structure sensitivity to capital market conditions. Finally, Balakrishnan et al. (2016), B. Francis et al. (2013), Gunn et al. (2018), and Zhang (2020) document the benefits of accounting conservatism for the value, investment, and financing of US firms. Mitton (2002) shows

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that information quality has dampened the negative effects of the financial crisis on firm performance in emerging countries. However, prior research does not account for the capital providers' differential information sensitivity (i.e., the supply side). We jointly consider the demand and supply sides to shed new light on the role of information asymmetries under adverse external conditions.

When FRQ is low, debtholders perceive higher estimation (J. Francis et al., 2004) and liquidity risk (Lang & Maffett, 2011; Ng, 2011) that increase the cost of external financing. Thus, opaque firms seek less information-sensitive types of financing (Choe et al., 1993). Simultaneously, less-transparent firms need to look for alternatives as they are unlikely to satisfy the stricter lending requirements. If opaque firms cannot access bond markets, they also cannot substitute bonds with loans and will face a reduction in debt financing. This substitution is potentially available for firms with access to bond markets. However, to the extent that bondholders are arm's-length investors and particularly exposed to greater uncertainty, these companies may not successfully tap the bond market during a crisis. Therefore, opaque firms face a greater reduction in debt financing than their bank-dependent peers, as they might bear the negative implications of the higher information sensitivity of banks and bondholders.

When FRQ is high, debtholders have less difficulty in evaluating firms. Transparent firms are also more likely to pass the stricter requirements of banks, and because they are perceived as "safer," the increase in the cost of debt financing due to unfavorable external conditions would be lower. Consequently, they are less likely to look for less information-sensitive types of financing. Transparent firms with access to bond markets will face less uncertainty, as bondholders would prefer them over opaque firms that are riskier and illiquid. Thus, differential access to bond markets is less likely to play a role in debt financing as transparent firms are less exposed to the higher information sensitivity of debtholders. Therefore, Hypothesis 3 is:

H3: When FRQ is low, firms' exposure to information-sensitive debtholders strengthens the negative association between debt financing and financial downturn

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3. Data and empirical strategy

3.1. Sample

We use a sample of quarterly data of US-listed firms for the 2006Q3-2009Q2 period from Compustat North America. We define the financial crisis as the period from 2007Q3 (i.e., the collapse of the subprime market in the US in August 2007) to 2009Q2, and consider one year before the effective start of the financial crisis (2006Q2-2007Q2)[2]. We use consolidated data, while excluding private, non-US, financial firms (SIC code: 6000-6999) and companies operating in regulated industries (SIC code: 4400-5000). Furthermore, we exclude firms that adopted non-GAAP standards and those that changed their accounting policies during the quarter to ensure comparability in accounting numbers. After computing all variables of interest, the initial sample consists of 26,587 firm-quarter observations. Table 1 summarizes the sampling procedures.

Table 1 – Sample definition

The population of firm-quarter obs. from Compustat Northern America for the period 2006Q3 - 2009Q2	**131,221**
- Private firms	(21,111)
- Non-U.S. firms	(29,293)
- Financial firms	(24,221)
- Firms in regulated industries	(4,943)
- Firms with non-US GAAP and accounting changes	(3,628)
- Firms with missing values for variables in the model	(21,438)
Sample before propensity score matching	***26,587***
Final sample after propensity score matching	**3,726**

3.2. Identification strategy

To test our first hypothesis, we undertake a matching difference-in-differences approach to compare the debt financing of firms with and without access to corporate bond markets before and after the onset of the crisis. We use the following regression model:

$$Debt\ Fin_{it} = \alpha_1 + \alpha_2\ Crisis_t + \alpha_3\ Crisis_t * Rating_i + \Sigma\ Controls_{it} + \varepsilon_{it} \qquad (1)$$

[2] Our definition of the financial crisis aligns with prior studies (Duchin et al., 2010; Kahle & Stulz, 2013).

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Here, α_3 is the coefficient of interest. *Debt Fin* is the net cash received from (paid for) the issuance (reduction) of long-term debt in a given year scaled by the lagged value of total assets (Leary & Roberts, 2005; Lemmon & Roberts, 2010)[3]. Our measure of debt financing includes bank loans and corporate bonds, thus accounting for the potential substitution effects between loans and bonds. If firms substitute bank loans for bonds, no change in the amount of debt financing should be observed following the crisis (Adrian et al., 2013; Becker & Ivashina, 2014). Instead, if such substitution is incomplete, because either bond markets are turbulent or firms face difficulties in accessing them, the reduction in debt financing would be more substantial for companies with access to bond markets. *Crisis* is a dummy variable equal to 1 for 2007Q3-2009Q2 and 0 otherwise. *Rating* is an indicator variable equal to 1 if the firm has a bond rating as of 2006Q2 and 0 otherwise[4]. Following Lemmon and Roberts (2010), we use credit rating as a proxy for a firm's ability to access the public debt market[5]. As firms can obtain or lose credit ratings over time, we also consider the presence of a credit rating at time *(t)*[6]. Following Duchin et al. (2010) and Kahle and Stulz (2013), firms' classification is determined in 2006Q2 to reduce concerns related to the simultaneity of corporate financing decisions and firms' access to bond markets.

We use a propensity score matching to ensure that the differences between firms with and without access to corporate bond markets are due to the diverse exposure to the financial crisis rather than the inherent characteristics of those companies choosing to access the bond markets. Specifically, we match firms with and without credit ratings based on size (logarithm of total assets), profitability (income before extraordinary items divided by total assets), leverage (long-term debt divided by total assets), growth opportuni-

[3] We use cash flow data rather than balance sheet items (Kahle & Stulz, 2013) because we are interested in the effective cash flows related to the issuance of debt financing.

[4] We use Compustat to identify the presence of a credit rating. We acknowledge that Compustat only holds S&P ratings. Thus, in additional tests, we replicate the analyses by using FSID Mergent as an alternative source of data. FSID Mergent provides credit rating information for all three rating agencies (S&P, Moody's, and Fitch) and a broader array of credit instruments. We obtain similar evidence using this alternative source of data.

[5] We are interested in the possibility for the firm to access bond markets to substitute impaired debt funds. The presence of a credit rating captures this possibility as firms issuing bonds look for a credit rating. Consistent with the idea that firms with credit ratings access more bond markets than those without, we document that the average number of bonds issued by firms with a credit rating during the period is 0.067, while the average value for firms without a credit rating is 0.035, and the difference is statistically significant at the 1% level.

[6] During our sample period, 40 and 36 firms (out of 287) lost and gained their credit rating, respectively.

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ties (Tobin's Q), a dummy variable equal to 1 if the firm's sales growth is above the industry median value in the quarter and 0 otherwise, cash reserves (cash and equivalents divided by the lagged value of total assets), and industry membership (two-digit sic code) before the start of the sample period (2006Q2) (Almeida et al., 2012; Kahle & Stulz, 2013; Lemmon & Roberts, 2010)[7]. Observations are matched by propensity score within common support, and without replacement, using a caliper distance of 0.01. After implementing the matching procedure, we reduce the sample quarterly observations to 3,726 firms-quarterly observations. Finally, we include a set of control variables to account for firm-level characteristics that can affect the level of debt financing. These include firm size, performance (return on assets [ROA]), cash flows from operations (cash flows divided by lagged total assets), leverage ratio, tangibility (Almeida & Campello, 2007), growth (percentage change in sales), managerial ability (Demerjian et al., 2012), distress proxied by a dummy variable equal to 1 if the Altman Z-score (Altman, 1968) is lower than 2.9 and 0 otherwise, and Tobin's Q[8,9,10]. We also control for the demand for debt financing using the Senior Loan Officer Opinion Survey on Banking Lending Practices conducted by the Federal Reserve Board (FED)[11]. We include the firm- and time-fixed effects to account for time-invariant characteristics and time factors, respectively[12]. Including firm-fixed effects implies a drop in the main effect for credit rating as it is measured once in the sample period. We cluster standard errors at the firm and time levels (Petersen, 2009)[13]. All variables are winsorized at 1% to mitigate the effects of outliers.

[7] Results are robust to alternative matching procedures using additional firms' features, and different algorithms.

[8] We obtain similar evidence if we add the level of cash reserves (cash and equivalents divided by the lagged value of total assets) as a control variable.

[9] The MA-Score data are available at https://community.bus.emory.edu/personal/PDEMERJ/Pages/Home.aspx for the periods 1980-2010 and 1980-2011.

[10] In the robustness tests, we include additional variables to control for real economic conditions (presence of a recession based on negative variation of GDP for two consecutive quarters) and firm's financial constraints. Results are robust to the inclusion of such additional control variables.

[11] http://www.federalreserve.gov/boarddocs/snloansurvey/. The proxy captures the net percentage of domestic banks reporting stronger demand for loans from last year so that negative values indicate a perceived drop in demand.

[12] Because of the inclusion of time-fixed effects, the coefficient for financial crisis is not always significant. As our coefficient of interest is the interaction term of crisis with credit rating, the inclusion of time-fixed effects is warranted to control for other features of the quarter. Results are robust if time-fixed effects are excluded.

[13] Conclusions are qualitatively the same using robust standard errors and standard errors clustered at the firm level.

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To examine the role of FRQ, we re-run model (1) separately for firms with high and low FRQ based on the median value of FRQ in 2006Q2[14]. Nevertheless, as variations in FRQ are likely to occur and they can affect our inferences, we include the level of opacity at time *(t*; *Current_Opacity*). *Current_Opacity* is a composite proxy determined through a factor analysis of *A.Q.*, *abs_DA*, *abs_PDA*, *Late_filing*, and *Rest* at time *(t)*. As we include firm-fixed effects, *Current_Opacity* captures the effect of within-firm changes in FRQ. In line with Bharath et al. (2008), we expect a higher level of opacity to be associated with greater debt financing. Moreover, we also expect the result to vary depending on the pre-existing level of FRQ and, specifically, to be stronger for firms with higher information asymmetries in the past. To measure FRQ, we rely on a composite proxy determined through a factor analysis of the following inverse measures of FRQ used in prior studies[15]: accounting quality (*A.Q.*) (Dechow & Dichev, 2002), the absolute value of discretionary accruals computed based on the modified Jones Model (*abs_DA*; Jones, 1991), and the absolute value of performance-matched discretionary accruals (*abs_PDA*; Kothari et al., 2005). As the accrual-based measures of accounting quality are related to the firm's risk profile, we also consider alternative measures less affected by measurement concerns, such as the presence of a non-timely (*N.T.*) filing (*Late_filing*) and restatements in the last calendar year (*Rest*)[16]. Higher values of the *Opacity* index indicate firms with lower FRQ and, hence, higher information asymmetries.

Regarding firms' access to bond markets, FRQ measures are computed before the sample period (2006Q2), that is, before the financial crisis, and earlier than managers could envisage the deterioration in external conditions. This is because the level of FRQ at time *(t)* depends on firms' current characteristics and growth opportunities and expected future growth opportunities, which determine their need for external financing. As a financial crisis occurs, the decision to be transparent at time *(t)* can also be affected by the impact of the crisis on firms' business operations, which potentially confounds our inferences. However, decisions on FRQ taken before the financial

[14] Our results hold if we use a three-way interaction term between crisis, rating, and FRQ. However, the interpretation of the coefficients is simpler using a sub-sample approach. Moreover, by running separate analyses, we are implicitly accounting for the possibility that the control variables affect debt financing in a different way depending on the ex-ante level of FRQ.

[15] Results for the factor analysis yields a unique factor with an eigenvalue greater than 1.

[16] If the firm is unable to comply with the rule, the SEC should be notified of the delay through an N.T. filing within 15 days. Thus, it is a signal of potential errors in financial statements that reduce the extent to which financial reporting truthfully reflects the underlying firms' operations.

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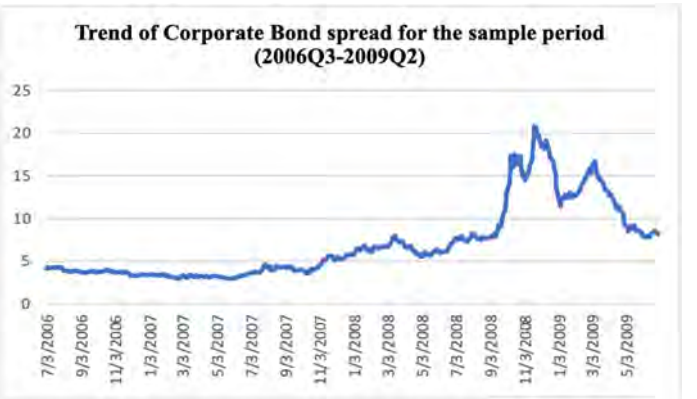
crisis are less likely to be tied to actual macroeconomic conditions allowing us to better capture the moderating role of transparency when unexpected upsurges in uncertainty about firms' fundamentals occur[17]. Specifically, we expect the coefficients of the interaction term between crisis and credit rating (α_3) to be negative and statistically significant for firms with low FRQ[18].

4. Results

4.1. Descriptive evidence

Graph 1



[17] Despite such advantages, the use of FRQ before the starting of the sample period can cast doubts on the ability of accounting information to reduce uncertainty about firm type when the crisis occurs. Accounting choices made in the past can still dampen information asymmetries in the future for two reasons. First, because the level of FRQ at time (*t-1*) is based on firms' characteristics at time (*t-1*), it is not necessarily optimal when capital supply conditions worsen. For instance, because of the chosen level of FRQ at time (*t-1*), firms can reveal information about their prospects that become detrimental during the crisis. Moreover, Sadka (2006) argues that earnings manipulation is effective if there is a correspondence between what firms disclose and how they operate. Hence, by considering past accounting choices, we assume that capital providers had enough time to evaluate whether the information reported by the firm corresponded to reality. Both factors make the accounting information disclosed at time (*t-1*) more credible and reduce information asymmetries at time (*t*).

[18] In additional tests, we use different cut-offs based on means, quartiles, and deciles; the results are robust.

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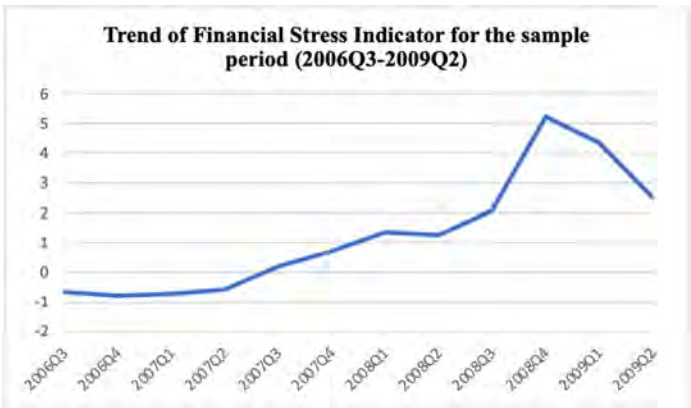
Graph 2



We examine the financial market conditions during the sample period. Graph 1 shows the trend of credit spreads for the period of interest. Credit spread is computed as the difference between the average yield to maturity of high-yield US corporate bonds[19] and US government bonds[20]. Graph 2 displays the time trend of the financial stress indicator developed by the Federal Reserve of Kansas City[21]. Both indicators suggest the existence of turmoil in financial markets from 2007Q3 (i.e., panic in the subprime market). The turmoil peaked in 2008Q3 and 2008Q4, that is, after the bankruptcy of Lehman Brothers when credit markets de facto ceased to function properly.

Table 2 – Summary statistics

Panel A: Descriptive statistics

Variable	N	Mean	SD	P25	P50	P75
Debt fin	3726	0.0073	0.0637	-0.0045	0.0000	0.0000
Rating	3726	0.5021	0.5001	0.0000	1.0000	1.0000
Current Rating	3726	0.4895	0.5000	0.0000	0.0000	1.0000
Opacity	3030	-0.1964	0.2370	-0.3268	-0.2525	-0.1506
Current Opacity	3726	-0.1919	0.2542	-0.3432	-0.2593	-0.1382
Distress	3726	0.7477	0.4344	0.0000	1.0000	1.0000
Size	3726	7.1751	1.0166	6.5290	7.2054	7.7948

[19] We use the FINRA – BLP Active HY US Corporate Bond Index Average Yield to Maturity as reported in Bloomberg.

[20] We use US Generic Govt. 30-Year Yield provided in Bloomberg. We use the US government bond with 30-year maturity because prior works computing financial stress indicators use long-term government yield to compute spreads with respect to corporate bond yield as an indicator of low-risk security (Hakkio & Keeton, 2009).

[21] Data are taken from https://www.kansascityfed.org/research/indicatorsdata/kcfsi.

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Panel A: Descriptive statistics

Variable	N	Mean	SD	P25	P50	P75
Total assets ($)	3726	2574.7440	6866.3800	683.7230	1345.6350	2426.9000
ROA	3726	-0.0001	0.0745	-0.0005	0.0107	0.0214
Cash	3726	0.0283	0.0447	0.0094	0.0277	0.0467
Tangibility	3726	0.4449	0.1430	0.3549	0.4566	0.5356
Demand for bank financing	3726	-15.9754	17.1089	-19.2000	-16.7000	-3.7000
Managerial ability	3726	0.0133	0.1503	-0.0723	-0.0053	0.0924
Leverage	3726	0.2640	0.2635	0.0892	0.2231	0.3519
Growth	3726	0.0307	0.2944	-0.0550	0.0116	0.0808
Tobin	3726	1.7540	1.0096	1.1656	1.4853	1.9929

Panel B: Industry breakdown

One digit SIC	Freq.	Percent
1	386	10.36
2	860	23.08
3	1154	30.97
4	46	1.23
5	564	15.14
7	568	15.24
8	146	3.92
9	2	0.05
Total	3726	100

Panel C: Goodness of matching at time 2006Q2

Variable	*No access to bond markets*	*Yes access to bond markets*	*p-value for the difference*
Debt fin	*0.0173*	*0.0086*	*0.1513*
FRQ	*-0.1695*	*-0.2194*	*0.0546**
Distress	*0.6747*	*0.7183*	*0.2901*
Size	*7.0207*	*7.014*	*0.9393*
ROA	*0.0104*	*0.0107*	*0.9348*
Cash	*0.0195*	*0.0286*	*0.0195***
Tangibility	*0.4519*	*0.4418*	*0.4453*
Managerial Ability	*0.0115*	*0.0407*	*0.0363***
Leverage	*0.2725*	*0.2782*	*0.8167*
Growth	*0.0724*	*0.0893*	*0.5675*
Tobin	*1.9134*	*1.8685*	*0.5989*

Debt Fin is the difference between debt issuance and debt repurchase, scaled by lagged total assets. Opacity is the result of the principal component analysis of accounting quality computed according to Dechow and Dichev (2002); the absolute value of discretionary accruals computed following the modified Jones Model (1991); the absolute value of performance-matched discretionary accruals computed according to Kothari et al. (2005), the presence of an N.T. filing and the presence of the restatement at time 2006Q2. Current_Opacity is the result of principal component analysis of accounting quality computed according to Dechow and Dichev (2002); the absolute value of discretionary accruals computed following the modified Jones Model (1991); the absolute value of performance-

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matched discretionary accruals computed according to Kothari et al. (2005) and the presence of an N.T. filing. Current Rating is a dummy variable equal to 1 if the firm has a credit rating and 0 otherwise. Distress is equal to 1 if Altman's Z-score (Altman, 1968) is lower than 2.9 and 0 otherwise. Size is the logarithm of total assets. ROA is income before extraordinary items divided by total assets. Cash is cash flow from operations divided by lagged total assets. Tangibility is the tangibility of assets computed according to Almeida and Campello (2007). Demand for bank financing is the demand for bank financing reported in the FED survey. Managerial ability is computed following Demerjian et al. (2012). Leverage is long-term debt divided by total assets. Growth is the percentage change in sales. Tobin is the ratio of the market value of equity and debt divided by the book value of assets

Panel A of Table 2 shows that firms in our sample are larger (average value of size is 7.17, corresponding to $2,574,550) and more profitable (ROA is -0.01% and cash flow from operations is 2.83%) with lower growth (% growth change is 3.07% and Tobin's Q is 1.75) and higher leverage ratio (26.4%) than the firms in Compustat[22]. The average value for tangibility is 44.49%, while 74.77% of the firms have Altman Z-scores lower than 2.9. Companies have relatively good managers with the average value of managerial ability being 0.0133. Finally, the average value of debt financing is 0.73% (the median value is 0).

Panel B of Table 2 provides the industry distribution of sample firms. Most of our firms belong to the manufacturing sector (SIC Codes 2 and 3), while the public administration (SIC Code 9), transportation, communications, electric, gas, and sanitary service (SIC Code 4) industries are the least represented ones.

As firms with and without access to bond markets are matched to make them as comparable as possible, we expect them to be similar at the inception of the sample period. Panel C of Table 2 shows the differences in the mean values of the variables of interest for the two groups of firms. Firms with and without credit ratings do not exhibit differences in debt financing at the start of the sample period but are slightly different in terms of opacity[23]. The only variables for which a difference occurs are *Managerial Ability* and *Cash Flow*, which supports the validity of our matching procedure[24].

[22] We replicate our analyses on the unmatched sample and find similar evidence.
[23] Although the mean values are statistically different, the distributions are not.
[24] None of the two variables were used in the matching procedure.

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4.2. Debt financing and firms' access to corporate bond markets

Table 3 – Debt financing

	(1)	(2)	(3)	
VARIABLES	*Full sample*	*High FRQ*	*Low FRQ*	*t-test (p-value)*
Crisis	-0.0114*	-0.0173*	0.0006	NS
	(0.0063)	(0.0096)	(0.0115)	
Crisis * Rating	-0.0132***	-0.0057	-0.0325***	***
	(0.0045)	(0.0061)	(0.0076)	
Current_Opacity		0.0032	0.0248***	
		(0.0088)	(0.0085)	
Current Rating	0.0063	-0.0032	0.0077	
	(0.0089)	(0.0109)	(0.0116)	
Distress	0.0101**	0.0087	0.0143	
	(0.0046)	(0.007)	(0.0088)	
Size	0.0588***	0.0455***	0.0668***	
	(0.0107)	(0.0099)	(0.011)	
ROA	-0.0585**	-0.0231	-0.0541	
	(0.0228)	(0.0244)	(0.0355)	
Cash	-0.217***	-0.092	-0.206***	
	(0.045)	(0.0569)	(0.0496)	
Tangibility	0.0803**	0.0556	0.0853**	
	(0.037)	(0.0358)	(0.0354)	
Demand for bank financing	0.0001	-0.0001	0.0002	
	(0.0001)	(0.0002)	(0.0002)	
Managerial Ability	0.0482*	0.101***	0.022	
	(0.0256)	(0.0315)	(0.0297)	
Leverage	0.0810***	0.119***	0.0715***	
	(0.018)	(0.0188)	(0.0155)	
Growth	0.0254***	0.0210***	0.0299***	
	(0.0071)	(0.0065)	(0.0071)	
Tobin	-0.004	0.0012	-0.0099**	
	(0.0028)	(0.0042)	(0.0048)	
Time F.E.	Yes	Yes	Yes	
Firm F.E.	Yes	Yes	Yes	
Observations	3726	1513	1517	
R-squared	0.209	0.221	0.217	

This table shows the results of firm fixed effect regressions of debt financing over the financial crisis, credit rating, their interaction term, and control variables for the period 2006Q3-2009Q2. Column (1) shows the results for the full sample; Column (2) for firms with FRQ at time 2006Q2 higher than the median value of the sample; Column (3) for firms with FRQ at time 2006Q2 lower than the median value. The constant is omitted because the inclusion of firm fixed effects makes it uninterpretable. Standard errors are reported in parentheses. Statistical significance is denoted as follows: *** p<=0.01; ** p<=.05; * p<=.1

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Table 3 reports the effect of the financial crisis on debt financing depending on firms' access to bond markets. Column (1) shows the empirical evidence for the entire sample, while Columns (2) and (3) present the findings for firms with high and low levels of FRQ.

Column (1) shows that larger firms with more tangible assets and better managers issue more debt. High-growth, highly leveraged, and distressed firms use more debt, while well-performing and highly liquid firms issue less debt because of lower demand for external financing. The coefficient of the financial crisis is negative and statistically significant, consistent with a reduction in debt financing after the occurrence of the crisis. This result upholds the findings of Erel et al. (2011) and supports our first hypothesis. The interaction between the financial crisis and credit rating is also negative and statistically significant, corroborating the idea that bondholders are information-sensitive debtholders. Hence, when a financial crisis occurs and uncertainty arises, bondholders are more reluctant to finance firms and the benefits of accessing bond markets are reduced. In economic terms, the debt financing of firms without access to bond markets decreases by 0.0114 in the post-crisis period, which represents a decrease of 1.56% relative to the sample mean[25]. Further, the debt financing of firms with access to bond markets decreases by 0.0132 in the post-crisis period, representing a reduction of 1.81% relative to the sample mean[26].

Column (2) of Table 3, shows the effects of firms with high FRQ (i.e., low value of *Opacity*)[27]. The interaction term between *Crisis* and *Rating* is not statistically significant, suggesting that the crisis did not diversely impact firms with and without access to bond markets if they had high levels of transparency. Conversely, the coefficient for the interaction term is negative and statistically significant in Column (3) of Table 3 when we consider firms with high values of *Opacity*, and hence, lower FRQ. A standard t-test suggests that the coefficients of the interaction terms are statistically different at conventional levels. Thus, in line with our expectations: opaque firms with access to bond markets significantly reduced debt financing during the crisis.

[25] The economic significance of the coefficient is computed by dividing the coefficient of *Crisis* by the sample mean of debt financing reported in Table 2.

[26] The economic significance of the coefficient is computed by dividing the coefficient of the interaction term *Crisis * Rating* by the sample mean of debt financing reported in Table 2.

[27] As our proxy for FRQ (*Opacity)* is only available for 3,030 firm-quarter observations, the total sample in Columns (2) and (3) is smaller than that in Column (1).

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Specifically, they experienced a 4.45% reduction in debt financing relative to the sample mean[28].

Notably, the coefficients of *Crisis* are not statistically different between the two subsamples. As these coefficients capture the effect of the financial downturn on debt financing for firms without access to bond markets, the lack of significance suggests that the ex-ante level FRQ did not attenuate the reduction in debt financing of bank-dependent firms. This result suggests that although banks may become more information-sensitive when external conditions worsen, they will still have an information advantage over bondholders. Moreover, the coefficient of *Current_Opacity* is not significant in Column (2), whereas it is positive and statistically significant in Column (3). Thus, in line with our conjecture, for firms that were more transparent before the start of the sample period, subsequent changes in FRQ are not associated with changes in debt financing. In contrast, when firms were more opaque ex-ante, subsequent increases in their opacity are associated with increases in debt financing.

4.3. Credit rating classes

We exploit the cross-sectional variation in firms' credit ratings. Specifically, we replicate our analyses by using the credit rating class in 2006Q2 and classifying firms into three groups: high-grade (firms with an A credit rating – 3.14% of the observations), non-investment grade (firms with a B credit rating – 45.06% of the sample), and junk firms (firms with a C credit rating – 1.74% of the sample). We expect the negative effect of the financial crisis to be more pronounced for firms with lower credit evaluations.

[28] The economic significance of the coefficient is computed by dividing the coefficient of the interaction term *Crisis* * *Rating* by the sample mean of debt financing reported in Table 2.

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Table 4 – Credit rating classes

Panel A: Full sample

	(1)
VARIABLES	*Debt Fin*
Crisis	-0.0115*
	(0.0063)
Crisis * Class_A	-0.0054
	(0.0054)
Crisis * Class_B	-0.0143***
	(0.0047)
Crisis * Class_C	0.0052
	(0.0167)
Controls	Yes
Time F.E.	Yes
Firm F.E.	Yes
Observations	3726
R-squared	0.21

Panel A shows the results of firm financing over the financial crisis, credit rating classes, their interaction terms, and control variables for the period 2006Q3-2009Q2 for the full sample. Column (1) shows the results for debt financing. Time-fixed effects include d, and standard errors are clustered at firm and time levels. The constant is omitted because the inclusion of firm fixed effects makes it uninterpretable. Standard errors are reported in parentheses. Statistical significance is denoted as follows: *** p<=0.01; ** p<=.05; * p<=.1

Panel B: Subsamples by FRQ

	(1)	(2)	
VARIABLES	*Debt Fin* *High FRQ*	*Debt Fin* *Low FRQ*	*t-test (p-value)*
Crisis	-0.0172*	0.0002	NS
	(0.0096)	(0.0115)	
Crisis * Class A	-0.0132	-0.013	NS
	(0.0165)	(0.0217)	
Crisis * Class B	-0.0054	-0.0334***	***
	(0.0062)	(0.0078)	
Crisis * Class C	0.0189	-0.0369**	***
	(0.0282)	(0.0264)	
Controls	Yes	Yes	
Time F.E.	Yes	Yes	
Firm F.E.	Yes	Yes	
Observations	1507	1523	
R-squared	0.22	0.218	

Panel B shows the results of firm financing for subsamples by the median value of FRQ. Columns (1) and (2) show the results for debt financing. Time-fixed effects are included, and standard errors are clustered at firm and time

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levels. The constant is omitted because the inclusion of firm fixed effects makes it uninterpretable. Standard errors are reported in parentheses. Statistical significance is denoted as follows: *** p<=0.01; ** p<=.05; * p<=.1

Panel A of Table 4 shows the results for the entire sample. The negative effect of the financial crisis on debt financing is stronger for firms with non-investment-grade bonds. However, we find weak evidence that the negative effect of the crisis is different for firms with high-grade and junk bonds (Column 1). Specifically, the reduction in debt financing for non-investment grade firms is 1.96% relative to the sample mean[29]. Thus, the proposed effects are stronger for firms with a lower credit rating, suggesting that firms with access to bond markets experienced greater reductions in debt financing during the crisis if they were perceived risky. Panel B of Table 4 reports the findings for the subsamples based on the pre-crisis level of FRQ. In Column (1), the interaction terms of the financial crisis and credit rating classes are not statistically significant at conventional levels. Whereas, in the case of opaque firms (Column 2), the negative effect of the financial crisis is stronger for investment-grade firms and firms with junk bonds. The differences are statistically significant at the 1% level.

4.4. Different phases of the 2007–2008 financial crisis

To address the differential impact of the financial crisis on firms' access to financing because of the diverse demand for debt, we analyze the different stages of the 2007-2008 financial crisis: the initial phase of the crisis (August 2007-September 2008) and the most severe phase following the Lehman Brothers collapse (September 2008-August 2009) (De Haas & Van Horen, 2013; Mishkin, 2011). Notably, the post-Lehman Brothers failure period was characterized by several relevant events occurring in a short period. Starting from October 2008, the US government attempted to restore market confidence by establishing TARP by injecting money into the banking sector (Kahle & Stulz, 2013). Moreover, there was a severe drop in demand owing to the reduction in consumption, leading to a recession. Finally, both equity and credit market conditions deteriorated severely.

We run our main models by substituting the indicator variable for *Crisis* with two new dummy variables: *Before Lehman* (1 for the period 2007Q3-2008Q3 and 0 otherwise) and *After Lehman* (1 for the period 2008Q4-

[29] The economic significance of the coefficient is computed by dividing the coefficient of the interaction term *Crisis * Class_B* by the sample mean of debt financing reported in Table 2.

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2009Q2 and 0 otherwise). The base period is 2006Q3–2007Q2. The results for the entire sample and subsamples are reported in Panels A and B of Table 5, respectively, based on the level of transparency.

Table 5 – Different phases of the 2007-2008 crisis

Panel A: Full sample

	(1)
VARIABLES	*Debt Fin*
Before Lehman	-0.0064
	(0.0049)
Before Lehman * Rating	-0.0136***
	(0.0049)
After Lehman	-0.0118*
	(0.0065)
After Lehman * Rating	-0.0123**
	(0.0056)
Controls	Yes
Time F.E.	Yes
Firm F.E.	Yes
Observations	3726
R-squared	0.209

Panel A shows the results of firm fixed effect regressions of financing over different phases of the financial crisis, credit rating, their interaction terms, and control variables for the period 2006Q3-2009Q2 for the full sample. Column (1) shows the results for debt financing. Time-fixed effects are included, and standard errors are clustered at firm and time levels. The constant is omitted because the inclusion of firm fixed effects makes it uninterpretable. Standard errors are reported in parentheses. Statistical significance is denoted as follows: *** p<=0.01; ** p<=.05; * p<=.1

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Panel B: Subsamples by FRQ

	(1)	(2)	
	Debt Fin	*Debt Fin*	
VARIABLES	*High FRQ*	*Low FRQ*	*t-test (p-value)*
Before Lehman	-0.0098	0.0007	NS
	(0.0079)	(0.0093)	
Before Lehman * Rating	-0.0075	-0.0323***	**
	(0.0067)	(0.0082)	
After Lehman	-0.0194*	0.0004	NS
	(0.0102)	(0.012)	
After Lehman * Rating	-0.0021	-0.0325***	***
	(0.0084)	(0.0105)	
Controls	Yes	Yes	
Time F.E.	Yes	Yes	
Firm F.E.	Yes	Yes	
Observations	1507	1523	
R-squared	0.22	0.217	

Panel B shows the results of firm financing subsamples by the median value of FRQ. Columns (1) and (2) show the results for debt financing. Time-fixed effects are included, and standard errors are clustered at firm and time levels. The constant is omitted because the inclusion of firm fixed effects makes it uninterpretable. Standard errors are reported in parentheses. Statistical significance is denoted as follows: *** p<=0.01; ** p<=.05; * p<=.1

In Column (1) of Panel A of Table 5, the interaction term between crisis and rating is negative and statistically significant for both phases of the crisis. Panel B of Table 5 shows that the negative coefficients for the interaction terms of the two phases of the crisis with credit ratings observed in Panel A are stronger for firms with lower FRQ. The differences in coefficients between the two subsamples are statistically significant at conventional levels. Hence, the empirical evidence is consistent with our theoretical predictions in both the period before and after Lehman Brothers' failure, reducing the concern that the drop in debt financing is merely due to a deterioration in economic conditions.

4.5. Bond issuance

So far, we have assumed that firms with access to bond markets reported a greater reduction in debt financing than other firms because bondholders were more reluctant to finance these firms during the financial crisis. To corroborate this, we examine bond issuances by substituting *Debt Fin* with i) an indicator variable equal to 1 if the firm issued a bond at time (*t*) and 0 otherwise (*Bond issuance*) and ii) the number of bonds issued by the firm at time (*t*) (*Num Bonds*). The empirical evidence is reported in Panel A of Table 6

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for the full sample and Panel B for firms with high FRQ (Columns 1 and 3) and firms with low FRQ (Columns 2 and 4).

Table 6 – Bond issuance

Panel A: Full sample

	(1)	(2)
VARIABLES	*Prob (Bond issuance =1)*	*Num Bonds*
Crisis	-0.0471***	-0.0538**
	(0.0168)	(0.0260)
Crisis * Rating	-0.0268**	-0.0270
	(0.0136)	(0.0189)
Current Rating	0.0564*	0.0798
	(0.0313)	(0.0489)
Controls	Yes	Yes
Time F.E.	Yes	Yes
Firm F.E.	Yes	Yes
Observations	3,726	3,726
R-squared	0.230	0.232

Panel B: Subsamples by FRQ

	(1)	(2)		(3)	(4)	
	High FRQ	*Low FRQ*	*t-test (p-value)*	*High FRQ*	*Low FRQ*	*t-test (p-value)*
VARIABLES	*Prob (Bond issuance =1)*	*Prob (Bond issuance =1)*		*Num Bonds*	*Num Bonds*	
Crisis	-0.0667***	-0.0467	NS	-0.0574	-0.0634*	NS
	(0.0251)	(0.0295)		(0.0496)	(0.0369)	
Crisis * Rating	-0.0202	-0.0373*	NS	-0.0191	-0.0427*	NS
	(0.0198)	(0.0227)		(0.0317)	(0.0257)	
Current_Opacity	0.0052	0.0497*		-0.0047	0.0584*	
	(0.0221)	(0.0273)		(0.0351)	(0.0310)	
Current Rating	0.0030	0.104**		0.0621	0.102**	
	(0.0470)	(0.0427)		(0.103)	(0.0429)	
Controls	Yes	Yes		Yes	Yes	
Time F.E.	Yes	Yes		Yes	Yes	
Firm F.E.	Yes	Yes		Yes	Yes	
Observations	1513	1517		1513	1517	
R-squared	0.281	0.202		0.268	0.195	

This table shows the results of firm fixed effect regressions of the probability of issuing bonds, and the number of bonds issued over the financial crisis, credit rating, interaction term, and control variables for the period 2006Q3-2009Q2. Panel A shows the results for the full sample; Panel B for firms with FRQ at time 2006Q2 higher than the

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median value of the sample (Columns 1 and 3) and for firms with FRQ at time 2006Q2 lower than the median value (Columns 2 and 4). The constant is omitted because the inclusion of firm fixed effects makes it uninterpretable. Standard errors are reported in parentheses. Statistical significance is denoted as follows: *** p<=0.01; ** p<=.05; * p<=.1

Analyzing the full sample (Panel A), we find that firms with a credit rating were less likely to access the bond market during the financial crisis. Regarding the moderating role of FRQ, in Panel B, we observe that the interaction term between *Crisis* and *Rating* is not statistically significant for transparent firms (i.e., firms with high FRQ) and is negative and statistically significant for more opaque firms (i.e., firms with low FRQ). Although the differences in coefficients are insignificant between the two subsamples, these results support our idea that bondholders became more information-sensitive during the financial crisis. Their higher information sensitivity reduces the possibility for firms with a credit rating to effectively access the bond markets and, above all, substitute impaired debt funds with bonds leading to an overall reduction in debt financing. Moreover, firms with lower FRQ are more exposed to such adverse effects because of the higher level of information asymmetries, which increases the bondholders' reluctance to finance them.

4.6. Substitution toward equity financing and internal resources

An alternative explanation for our findings is that firms with access to bond markets experienced a greater reduction in debt financing during the crisis because they had a lower demand for external financing. To rule out this alternative explanation, we investigate whether firms with access to bond markets looked for alternative sources of financing such as equity. If the greater reduction in debt financing was due to lower demand, these firms should have experienced a greater reduction in equity financing (Becker & Ivashina, 2014; Kahle & Stulz, 2013). Whereas, if the higher decrease in debt financing resulted from the debtholders' reluctance to finance firms, firms with access to bond markets should have used more equity financing during the crisis than those without access, as suggested by Leary (2009). Moreover, the differences should be more pronounced for opaque firms as they face more difficulties in obtaining debt funds (Bolton & Freixas, 2000).

We test these predictions by re-running model (1) with equity financing as a dependent variable instead of debt financing. Equity financing is measured as the net cash received from the sale (repurchase) of equity scaled by the lagged value of total assets.

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Table 7 – Equity financing

	(1)	(2)	(3)	
VARIABLES	*Full sample*	*High FRQ*	*Low FRQ*	*t-test (p-value)*
Crisis	-0.0036	0.0053	-0.0148***	***
	(0.0025)	(0.0036)	(0.0056)	
Crisis * Rating	0.0052**	-0.0005	0.0140***	***
	(0.0021)	(0.0023)	(0.0037)	
Current_Opacity		-0.0028	0.0023	
		(0.0033)	(0.0041)	
Current Rating	0.0068**	0.005	0.0079	
	(0.0031)	(0.004)	(0.0057)	
Distress	0.0024	0.0012	0.0028	
	(0.0027)	(0.0026)	(0.0043)	
Size	0.0053	0.0041	0.0054	
	(0.0038)	(0.0037)	(0.0054)	
ROA	-0.0025	-0.0058	0.0035	
	(0.0067)	(0.0091)	(0.0173)	
Cash	-0.0487**	-0.034	-0.0740***	
	(0.0194)	(0.0211)	(0.0241)	
Tangibility	0.0554***	0.0477***	0.0651***	
	(0.0152)	(0.0133)	(0.0172)	
Demand for bank financing	-0.0001**	-0.0001	-0.0003***	
	(0.0001)	(0.0001)	(0.0001)	
Managerial Ability	-0.0092	-0.0083	-0.001	
	(0.0095)	(0.0117)	(0.0145)	
Leverage	-0.0081	0.0128*	-0.0206***	
	(0.0072)	(0.0069)	(0.0076)	
Growth	0.0023	0.0045*	-0.0052	
	(0.0022)	(0.0024)	(0.0035)	
Tobin	-0.0001	-0.0023	0.0027	
	(0.0016)	(0.0016)	(0.0024)	
Time F.E.	Yes	Yes	Yes	
Firm F.E.	Yes	Yes	Yes	
Observations	3726	1513	1517	
R-squared	0.335	0.386	0.363	

This table shows the results of firm fixed effect regressions of equity financing over the financial crisis, credit rating, their interaction term, and control variables for the period 2006Q3-2009Q2. Column (1) shows the results for the full sample; Column (2) for firms with FRQ at time 2006Q2 higher than the median value of the sample; Column (3) for firms with FRQ at time 2006Q2 lower than the median value. Time-fixed effects are included, and standard errors are clustered at firm and time levels in Column (1). The constant is omitted because the inclusion of firm fixed effects makes it uninterpretable. Standard errors are reported in parentheses. Statistical significance is denoted as follows: *** p<=0.01; ** p<=.05; * p<=.1

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Column (1) of Table 7 shows the results for the entire sample, while Columns (2) and (3) provide the results for firms with high and low levels of FRQ, respectively. A credit rating's presence at time (t) has a positive and statistically significant effect on equity financing (Column 1), suggesting that the higher visibility and monitoring ratings generated over companies make them more attractive to equity investors. Furthermore, the interaction term between the financial crisis and the presence of a credit rating is positive and significant, suggesting that the reduction in equity financing during the 2007–2008 financial crisis was smaller for firms with access to bond markets. The smaller reduction is in line with the firms that have access to bond markets looking for alternative financing.

Columns (2) and (3) of Table 7 show the results for firms with high and low FRQ, respectively. In Column (2), we fail to find evidence for a significant effect of the crisis and its interaction term with credit rating. However, in Column (3), equity financing is lower after the occurrence of the financial crisis, and the reduction is smaller for firms with access to bond markets. Thus, empirical evidence suggests that the reduction in equity financing due to the crisis was greater for firms with greater information asymmetries. However, this decrease was smaller for firms relying on arm's-length debt, as equity was used as an alternative to debt financing. We find a similar result when analyzing the probability of issuing debt over equity and considering the interrelation of debt and equity financing choices.

Equity financing is not the only alternative source of financing that companies can access (Myers & Majluf, 1984). Firms can also use internal sources of financing (i.e., cash reserves), especially during a crisis when the cost of external financing is higher (Leary, 2009). Therefore, we expect that firms with a credit rating would have reported a higher decrease in cash holdings during the financial crisis than their peers without a credit rating if the crisis impaired their access to debt financing. We test our conjecture by replacing debt financing with cash holdings as the dependent variable in model (1).

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Table 8 – Cash holdings

	(1)	(2)	(3)	
VARIABLES	*Full sample*	*High FRQ*	*Low FRQ*	*t-test (p-value)*
Crisis	-0.0229***	-0.0167***	-0.0303***	NS
	(0.0060)	(0.0058)	(0.0091)	
Crisis * Rating	-0.0066**	-0.0052	-0.0061	NS
	(0.0031)	(0.0037)	(0.0059)	
Current Opacity		-0.0179***	0.0012	
		(0.0053)	(0.0067)	
Current Rating	-0.0049	-0.0047	-0.0061	
	(0.0062)	(0.0065)	(0.0092)	
Distress	0.0028	0.0001	0.0078	
	(0.0033)	(0.0042)	(0.0069)	
Size	0.0921***	0.0502***	0.119***	
	(0.0102)	(0.0060)	(0.0087)	
ROA	0.0985***	0.0822***	0.127***	
	(0.0368)	(0.0147)	(0.0281)	
Cash	0.153***	0.173***	0.148***	
	(0.0390)	(0.0342)	(0.0392)	
Tangibility	1.039***	0.985***	1.093***	
	(0.0450)	(0.0215)	(0.0280)	
Demand for bank financing	-0.0004***	-0.0004***	-0.0004**	
	(0.0001)	(0.0001)	(0.0002)	
Managerial Ability	-0.0544**	-0.0376**	-0.0677***	
	(0.0213)	(0.0189)	(0.0235)	
Leverage	0.0141	0.0273**	0.0210*	
	(0.0213)	(0.0113)	(0.0123)	
Growth	-0.0036	-0.0089**	0.0056	
	(0.0045)	(0.0039)	(0.0056)	
Tobin	-0.0001	0.0011	-0.0032	
	(0.0033)	(0.0025)	(0.0038)	
Time F.E.	Yes	Yes	Yes	
Firm F.E.	Yes	Yes	Yes	
Observations	3726	1513	1517	
R-squared	0.935	0.957	0.908	

This table shows the results of firm fixed effect regressions of cash holdings over the financial crisis, credit rating, their interaction term, and control variables for the period 2006Q3-2009Q2. Column (1) shows the results for the full sample; Column (2) for firms with FRQ at time 2006Q2 higher than the median value of the sample; Column (3) for firms with FRQ at time 2006Q2 lower than the median value. Time-fixed effects are included, and standard errors are clustered at firm and time levels in Column (1). The constant is omitted because the inclusion of firm fixed effects makes it uninterpretable. Standard errors are reported in parentheses. Statistical significance is denoted as follows: *** p<=0.01; ** p<=.05; * p<=.1

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Column (1) of Table 8 reports the results for the entire sample, while Columns (2) and (3) present the findings for firms with high and low levels of FRQ, respectively. Column (1) shows a significant reduction in cash holdings during the financial crisis, which is greater for firms relying on bond markets. Firms that did not access bond markets decreased their cash holdings by 0.18% during the financial crisis, while firms relying on bond markets for financing reduced their cash holdings by 0.051%. However, there is no evidence that such an effect is more pronounced for firms with low FRQ.

These results suggest that firms with access to public debt markets faced more difficulties in obtaining debt funds during the 2007–2008 financial crisis and looked for equity and internal resources as alternative funding sources. This reduces the concern that our findings are merely due to lower demand for financing.

5. Conclusion

During the 2007-2008 financial crisis, bondholders were exposed to higher uncertainty and became more reluctant to finance companies. Firms with access to bond markets experienced a greater reduction in debt financing than comparable firms did during the 2007-2008 financial crisis. This was particularly pronounced for firms with greater information asymmetries, suggesting that the increase in uncertainty about firms' fundamental assets played a major role in the crisis. Specifically, firms with low FRQ faced a greater reduction in accessing bond markets. Bondholders became more information-sensitive during the financial crisis. Their higher information sensitivity also reduced the possibility for firms with a credit rating to effectively access the bond markets and substitute impaired debt funds with bonds. As a result, firms with access to public debt markets obtained fewer debt funds during the crisis and attempted to substitute debt with equity and cash holdings as alternative sources of financial resources. Moreover, we consider the diverse credit rating classes and different phases of the 2007-2008 financial crisis. All robustness tests are in line with the idea that the drop in demand for financing was not the only driver of our findings.

This study adds to the accounting literature by analyzing the association between FRQ and corporate financing under bad capital supply conditions. Furthermore, it speaks to the finance literature on the role of information asymmetries in firms' exposure to financial downturns. Above all, we demonstrate that capital providers' vulnerability and firms' exposure to information asymmetry jointly shape firms' access to debt financing under ad-

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verse external conditions. Finally, empirical evidence suggests that the impact of transparency is not the same for all types of debt financing, as firms substitute one type with another.

6. Limitations and future research

Our study has several limitations. The first is associated with the potential generalizability of our results. The study is based in the US, a market-oriented country. These results may differ in other countries with less developed markets and more bank-oriented economic systems. Furthermore, access to bond markets is unequal across countries as it varies depending on the level of creditor protection. Second, the 2007-2008 financial crisis did not have a unique and generalizable impact on a global level, and the impact and timing differed across countries. Therefore, future research could exploit the sources of such heterogeneity to measure the potential differential impact of crises across countries and, if any, the potential spillover effects between markets. Second, the potential differential impact of crises on banks might be different and conditional on the banks' capital structure. This study implicitly assumes that banks have similar capital structures and, hence, akin strategies in screening and monitoring borrowers. Future research could exploit lender–borrower relations to understand how banks and debtholders' idiosyncrasies could further explain their role in lending during a financial crisis. Third, we excluded private firms from our analysis. Although, potentially limited by data availability, future research might explore this specific setting and analyze the potential parallelism between the two groups of firms. Finally, although we ran a set of analyses to attenuate the concerns that our findings are due to changes in demand for financing, concerns remain. Future research could adopt a cleaner approach by examining firms' loan demand.

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