When do banks mitigate investment inefficiency? *

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Abstract

We investigate the role of banks' monitoring on investment efficiency of US firms in three different years 2005, 2010 and 2015. Using debt ownership structure to proxy for the reliance of firms on different debt sources, we find that, in general, firms with higher bank debt proportions have higher investment inefficiency. This impact, however, is not present for smaller, loss-making, or high growth firms. Our findings suggest that while banks might not monitor all borrowers, they selectively discipline firms with certain level of risks and information asymmetry.

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1. Introduction

Investment is one of the most important corporate financial decisions. Since investment relates to the primary operating activities that firms count on to make a profit, investment is the main and long-term source of value creation. Overall, investment is at an optimal level when firms can undertake all available value-creating projects, as a result maximizing shareholders' wealth (Modigliani and Miller, 1958). When firms invest below or above their optimal level, investment inefficiency arises, and firms fail to achieve their value-maximizing objective. A large body of literature has attempted to discover the causes of investment inefficiency, and mechanisms to mitigate it. Information asymmetry is believed to be one of the reasons (Jensen and Meckling, 1976; Myers, 1977; Myers and Majluf, 1984), and therefore factors that can curb information asymmetry should also be able to address investment inefficiency issues. Myers (1977) and Jensen (1986) argue that debt can be used to effectively alleviate asymmetric information as high levels of debt can discipline managers via the pressure of repayment and their monitoring function, consequently mitigating investment inefficiency. We argue that not only debt in general but also where it comes from might make a difference. This is because debt sources have different strengths to curb information asymmetry and thus different abilities to solve suboptimal investment issues. There are three main debt sources in the literature: bank debt, non-bank private debt and public debt (Fama, 1985, Carey et al., 1993, Denis and Mihov, 2003). Bank debt is the most popular one among all borrowing sources (Carey et al., 1993; Johnson, 1997; Liu, 2006; Lin et al., 2013). However, how bank borrowing affects investment inefficiency is not straightforward.

Banks are generally considered to play an active role in monitoring firms that borrow from them. Banks, for instance, have a greater monitoring ability deriving from their large debt holdings and a better ability to acquire and produce information compared to other

debt providers. Concentrated holdings of debt provide banks with cost efficiency, stronger incentives and higher powers to conduct a monitoring job (Diamond 1984; Myers and Majluf, 1984; Diamond, 1991; Houston and James, 1996). Furthermore, banks have a unique informational advantage because of their deposit relationship with borrowers, allowing them to use day-to-day information within borrowing firms (Fama, 1985). Bank debt is often more short-term compared to other debt sources (Carey et al., 1993), triggering more frequent monitoring. Overall, the superior monitoring by banks should reduce agency issues and information asymmetry among the various stakeholders of borrowing firms, and should consequently restrain managers from investing in inefficient projects.

Recent evidence, however, poses a different picture in that banks might no longer be as effective in their supervising and monitoring role as has long been believed. Recent structural changes in the financial markets, stringent collaterals and strict debt covenants might have somewhat weakened the monitoring power of banks. Moreover, a bank's incentive to monitor its borrowers is diluted with the existence of the secondary bank loan market (Gande and Saunders, 2012). There have also been some suggestions regarding the negative effect of the collateral required by banks since most bank loans are secured, meaning that banks would get part or whole of their money back in the case of financial distress and thus may not necessarily monitor borrowing firms in an efficient manner. In addition, banks are also known for their strict covenants compared to other providers of debt (Smith and Warner, 1979; Berlin and Mester, 1992, Carey et al., 1993). This, on one hand, could help banks to detect problems early and prevent the borrowing firm's managers from undertaking opportunistic activities. On the other hand, too strict covenants would induce managers to misreport, worsening information asymmetry and related issues (Brooke and Vikram, 2011).

The above arguments raise an interesting question about whether having more bank debt

will lead to an increase or a decrease in investment efficiency. Our study attempts to answer this question by observing investment behaviour across firms that have different levels of bank debt. We argue that since information problems could make firms invest under or above their optimal level, if banks can monitor and mitigate information asymmetry as traditionally assumed, there should exist a relationship where bank debt reduces investment inefficiency.

Since monitoring is costly, alternatively it is possible that banks only monitor certain firms when they are concerned about their credit quality. Blackwell and Winters (1997) use policy and procedure manuals of six banks to classify loan risk based on how frequently banks monitor such loans to investigate the monitoring efforts of banks. They find that borrowers with a higher risk are required to provide more documentation when applying for a loan and are exposed to more frequent reviews from banks in the course of lending. In particular, they find that banks monitor smaller, higher leveraged and shorter-relationship firms more frequently than their larger, lower-leveraged and longer-relationship peers. In line with Blackwell and Winters (1997), Sampagnaro et al. (2015) uses actual measures of bank monitoring efforts to investigate determinants of monitoring strength in small business lending. They find that the monitoring strength of banks decreases with firm reputation, the bank-firm relationship strength and the borrowers' credit risk. Additionally, Jha et al. (2015) find that bank debt increases earning management unless firms are close to default, suggesting that banks might not always monitor and mitigate corporate misconduct except when they are concerned about the borrowers' credit risk. If this is the case, then we can only expect to observe a banks power in monitoring those borrowers with a certain level of risk. We, therefore, aim to shed some light on the impact of bank debt on investment efficiency and how this impact varies with a borrower's characteristics.

Our study contributes to the literature in several important ways. First, it sheds some

light on the question of whether banks are still special given the recent structural changes in the markets and the documented evidence on the diminishing monitoring role of banks. Second, we also add to the literature on investment efficiency by being the first investigating how a firm's investment efficiency varies with its reliance on bank debt. The closest research to ours is Liu (2006), who attempts to examine the link between private debt and investment and. The author then finds that firms with more bank loans invest more, while those with more non-bank private loans invest less. However, since Liu (2006) only looks at the impact of debt sources on the investment level, it cannot be concluded whether bank debt has a positive or negative impact on investment efficiency. Our study fills this gap by testing the direct link between bank debt and investment efficiency. Third, by examining what types of firms are more prone to being supervised by banks, given the vast diversity in borrowers' characteristics, we provide important implications on what kind of firms can use bank debt to improve their investment efficiency. Finally, previous studies on the monitoring power of bank debt only looks at its effect in isolation from other sources (e.g. Liu, 2006; Aivazian et al., 2006; Allen et al., 2012; Jha, 2015). This can lead to incorrect inferences regarding the role of bank debt. By collecting the detailed information on the debt sources of firms in our sample, we can examine the impact of bank debt on investment efficiency while controlling for the combination of bank and other debt sources, which additionally differentiates our study from the previous ones on banks' monitoring power.

My analysis has produced three main findings. First, bank debt overall has a negative impact on investment efficiency, suggesting that bank debt worsens the investment problems of firms. This finding, on one hand, can indicate that banks no longer have superior monitoring power as traditionally claimed. On the other hand, it might alternatively imply that banks do not monitor all firms in the same manner. Our study finds support for this conjecture in that the mitigation power of bank debt on investment

inefficiency exists in firms of a smaller size, with higher growth and a loss in the previous period. This observation confirms that banks impose more supervision on firms with more severe informational problems and a higher credit risk. This is consistent with prior evidence by Blackwell and Winters (1997) and Sampagnaro et al. (2015), which shows that banks impose stronger monitoring on firms with a shorter firm-bank relationship (suggesting a higher level of information asymmetry) and with a higher credit risk.

The remainder of our paper proceeds as follows. The next section provides a detailed literature review on investment efficiency and banks' monitoring and signaling power. Section 4.3 and 4.4 discuss the sample and research methodology, respectively. Section 4.5 reports some descriptive statistics and the results of the main model. Finally, section 4.6 carries out some robustness checks, and the last section concludes the paper.

2. Literature review

Firms are supposed to invest at an optimal level where the marginal benefits of their investment equal the marginal costs (Yoshikawa, 1980; Hayashi, 1982; Abel, 1983). Any variance in investment that cannot be explained by growth opportunities is therefore considered investment inefficiency.

Investment inefficiency can arise due to market imperfections such as information asymmetry and agency conflicts. In the presence of such frictions, investment levels can deviate from their optimal levels, leading investment inefficiency in the form of either under- or over-investment (Jensen and Meckling, 1976; Myers, 1977; Myers and Majluf, 1984). Discussions based on agency issues argue that managers are self-interested and do not always act for the benefits of shareholders (Jensen and Meckling, 1976). Therefore, moral hazards can occur when managers, knowing that shareholders cannot

fully observe their actions, make sub-optimal investments to protect their positions and benefits at the cost of the shareholders. Firms might also invest below their optimal level due to an adverse selection problem in the capital markets, mainly due to information asymmetry. Managers are better informed about a firm's future prospects and may try to time the market and sell overpriced securities. To avoid this, investors allot their capital and/or require higher returns for the supplied funds, thus reducing the amount of funds and raising the hurdle to accept a project. Consequently, some profitable opportunities are foregone, leading to underinvestment (Stiglitz and Weiss, 1981; Lambert et al., 1007; Biddle et al., 2009). Investment inefficiency, in the forms of either under or over-investment, is problematic and obstructs the wealth maximization objective of the firm.

Traditionally, the literature on the monitoring role of banks argues that banks have superior monitoring powers compared to other debt suppliers. This superiority derives from their high concentration of debt holdings and a superior ability to acquire and produce information compared to other lenders. Diamond (1984) finds that concentrated holdings of bank debt produce scale economies and comparative cost advantages in acquiring and producing information, as a result creating stronger incentives and the ability to effectively discipline borrowers. In line with Diamond (1984), Houston and James (1996) suggest that the high ownership concentration of bank debt allows banks to avoid duplicating costs and efforts when monitoring. Moreover, banks have a superior accessibility to firms' private information. First, banks can access firms' inside information as they have a unique informational advantage from the deposit relationship with borrowers that allows them to access a firm's day-to-day information (Fama, 1985). In addition, in the course of lending, banks can communicate with and obtain further information from firms that cannot easily be acquired by other lenders (Rajan, 1992). This superior access to private information enables banks to detect possible expropriation or wrongdoings by managers early and act as a credible venue to monitor

and punish any opportunistic actions of corporate insiders (Park 2000).

Bank debt also has the strictest covenants among all borrowing sources (Smith and Warner, 1979; Berlin and Mester, 1992, Carey et al., 1993). Most of a bank's debt covenants are related to maintenance aspects, which requires firms to meet certain conditions on a quarterly basis. Those in private and public debt contracts however are mostly related to incurrence aspects, which only require the criteria to be met at the time of a pre-specified event (Carey et al., 1993). These frequently checked and strict covenants of bank debt allow banks to better screen and detect problems in a timely manner, consequently intensifying supervision pressure on borrowers. In addition, according to Carey et al. (1993), bank debt tends to have relatively shorter maturities among all borrowing sources. Shorter maturity allows banks to produce a periodical evaluation, which is useful for the early detection of financial problems and the efficient monitoring of firms (Fama, 1985).

Consequently, banks have superior monitoring powers that can mitigate moral hazard problems and stimulate firms to make appropriate corporate decisions (Stiglitz and Weiss, 1983 and Rajan 1992). Markets, acknowledging the superior monitoring power and financial evaluation expertise of banks, take the presence of bank loans as a positive signal of a firm's quality. Supporting this view, James (1987) and Mikkelson et al. (1986), for example, suggest that the announcement of a bank debt agreement conveys positive news of a firm's quality to the stock market. In addition, Lummer and McConnell (1989) report that firms that renew their bank credit agreements experience significant positive announcements about abnormal stock returns. In summary, in the traditional framework, bank debt is believed to have a unique monitoring and signaling power, providing banks with a strong ability to mitigate information asymmetry related problems.

In contrast to the traditional view, recent studies question the superiority of bank debt in terms of their monitoring role. As the current literature evolves, the view of banks' uniqueness has been subdued somewhat due to the recent structural changes in the financial market, the development of information technology, and the possible adverse effects of imposition of strict covenant clauses in debt contracts.

The presence of relationship banking and the recent structural change in the bank loan market might have reduced the banks incentive to monitor. Supporting this view, Boot and Thakor (2000) argue that due to the greater interbank competition, banks make more and more relationship loans, each of which creates less value for borrowers. Dinc (2000) further shows that the increasingly competitive credit market enhances a bank's incentive to keep commitments to borrowers with deteriorating credit and encourages banks to make loans to lower quality borrowers. Gande and Sauders (2012), for example, find that recent developments in the secondary loan market dilute the banks incentive to monitor, since banks can easily sell their loans to third parties in the market. The presence of a secondary loan market has significantly altered the nature of the banks' uniqueness. Although their traditional special role in information production and monitoring still remains, it is weaker than before (Gande and Saunders, 2012).

The development of information technology also contributes to the weakening of the banks' certification effect. Petersen and Rajan (2002) argue that recent innovations in information technology have allowed potential lenders to easily acquire "hard" information about the credit quality of borrowers from publicly available sources at a lower cost than contacting the borrowers directly. Tracey and Carey (2000) also suggest that electronic accessibility to a huge amount of data has partially contributed to the development of complex internal credit rating systems at large U.S. banks and that most of this data is also available to other lenders. This makes information production no longer a monopoly of the banks. The reduction in monitoring incentive and informational

advantages can change the relative position of bank loans to non-bank private debt and public debt in terms of the disciplinary effect.

Moreover, while collateral and covenants can act as a screening device in monitoring firms, they can also have negative side effects. On the one hand, collaterals can protect banks from losing their loans and act as a screening device to mitigate moral hazards from borrowers (Bester, 1994; Karapetyan and Stacescu, 2014). On the other hand, collaterals can weaken the banks' incentives to monitor since banks can still get part or whole of their lending back in the worst case scenario. Moreover, Chen (2006) finds that if banks over-collaterize firms' assets in loan contracts, they might inefficiently liquidate borrowers' projects when borrowers encounter financial distress, suggesting that banks care less about the true financial conditions of firms when their lending is secured. In terms of covenants, although they are supposed to provide the best protection to the lenders, strict covenants can stimulate borrowers to misreport financial conditions to avoid potential covenant violations. Hence, bank monitoring may not be sufficient to prevent or detect misreporting. In addition, bank debt with strict covenants may even create an incentive for managers to misreport (Brooke and Vikram, 2011). Supporting this view, Jha et al. (2015) find that earning management is higher when bank monitoring is strong, unless firms are at the edge of default.

These findings contradict the traditional view of the banks' ability to better monitor a firm's behaviours and suggest that strict covenants do not necessarily result in better monitoring. A possible reason might also be that banks care more about maintaining their business relationship with firms rather than disciplining their managers, therefore banks will only monitor when firms are close to default (Cornett et al. 2007; Harris and Ravivi, 1990).

The above discussions lead to an argument that banks might not be or are no longer

superior in monitoring and mitigating information asymmetry as stated in the traditional literature. Indeed, the positive market reaction to bank loan announcements that was found in the past (Mikkelson and Parch, 1986; James, 1987; Lummer and McConnell, 1989; and many others) has diminished or even vanished in more recent studies (Dinc, 2000; Fields et al., 2006; Gande and Saunders, 2012). Billett et al. (2006) also show that even when positive abnormal returns associated with bank loan announcements are present, in the long-term bank loans seem to be no different from seasoned equity offerings or public debt issues, with a substantial underperformance. Also, Billett et al. (2006) find that larger bank loans are associated with inferior stock performance. Finally, they point out that bank loans are not particularly unique since a firm's earning volatility increases post bank loans, suggesting that banks do not reduce borrowers' information asymmetry. In line with this view, Dass and Massa (2009) document that bank – firm relationships can decrease borrowers' stock liquidity and increase firms' information asymmetry in the equity market.

The "collision" of traditional and recent alternative views on bank debt needs further investigation to discover the current role of this borrowing source with respect to its impact on the investment inefficiency of the borrowing firms. Moreover, since monitoring is costly and the firms that borrow are broadly different in their characteristics, it is likely that banks do not monitor all firms similarly. We argue that when banks are more concerned about certain borrowers, they will reinforce supervision on these firms to keep the credit risk under control. Supporting our argument, previous studies document that bank monitoring efforts vary with levels of information asymmetry and the credit risk of the borrowers. Blackwell and Winters (1997) categorize firms into risk classes based on the policy and procedure manuals of six banks to examine bank monitoring efforts given the riskiness of borrowers. They argue that banks intensify monitoring when a firm's default risk is high. Using screening documentation

requirements and the frequency of reviews as proxies for monitoring efforts, they find that borrowers with a higher risk are subject to stronger monitoring from banks. In particular, banks more strongly discipline firms of a smaller size, a higher leverage and a shorter firm-bank relationship. Following up the idea of Blackwell and Winters (1997), Sampagnaro et al. (2015) attempt to provide a more thorough investigation on the determinants of monitoring strength, using actual measures of bank monitoring efforts. They find that the monitoring strength of banks decreases with a firm's reputation and the bank-firm relationship strength, suggesting that banks supervise more when firms pose higher information asymmetry[1]. The authors also find a positive relationship between the monitoring time and the borrowers' credit risk, meaning that banks spend more effort disciplining borrowers with a higher risk as compared to those with a lower risk. Jha et al. (2015) study whether bank monitoring has a positive or a negative impact on the earning management of firms. They find a positive correlation between bank debt and earning management except when firms are close to default, suggesting that banks might not always monitor all borrowing firms and they only do so when they are concerned about the borrowers' credit risk. All these findings support our view that banks differentially discipline borrowers and thus the banks' mitigation impact on investment inefficiency can vary with the firm characteristics.

Based on prior empirical findings about what types of characteristics banks pay more attention to when they monitor, we predict the mitigation impact of banks on investment inefficiency is stronger for firms with more severe information problems and a higher credit risk. The rationale is that since monitoring is to mitigate information asymmetry and prevent opportunistic behaviours, banks might feel they need to supervise more when a firm has more severe information asymmetry problem than others. Moreover, a

[1] The lending relationship can generate valuable private information in asymmetric information environments. A stronger bank-firm relationship means a decrease in information related problems, including both adverse selection and moral hazard (Boot and Thakor, 1994)

greater information asymmetry between banks and borrowers can make banks more likely to suffer from a moral hazard risk. Therefore, banks might intensify monitoring in firms with higher asymmetric information, leading to a stronger impact of banks in curbing investment inefficiency. Second, given firms with the same level of information problems, those that pose a higher credit risk are also subject to stronger supervision from banks, since banks are under a credible threat of losing their money if they do not closely monitor these firms.

3. Data

We hand collect debt ownership structure data for a random sample of 1100 US non-financial firms listed on the NYSE, AMEX and the NASDAQ for three distinct financial years; 2004, 2009 and 2014. We choose a five-year gap due to the concern that debt ownership structures might persist over time. The outstanding amount and features of each debt source are collected from the firms' annual reports and the SEC 10K filings. Firms with no outstanding debt and/or major restructuring activities are removed from the sample to prevent unusual events distorting the relationship between investment efficiency and bank debt. The accounting data was collected from Compustat. Firm age is calculated using Datastream. We winsorize all the variables at 1% and 99%. The final sample with non-missing data consists of 1,876 firm year observations.

4. Research design

We follow Gomariz and Ballesta (2014) and Chen et al. (2011) and constructed a measure of sub-optimal investment level and directly study the effect of bank debt on investment inefficiency. Using this proxy of investment inefficiency, we investigate what types of firms banks impose more supervision on. As for the robustness check, we repeat these

tests for an alternative model and proxies of bank debt. We finally carry out the two stage least square (2SLS) approach to address the potential endogeneity issue due to self-selection bias.

Measure of investment inefficiency

Future growth opportunities should be the sole driver of investment (Modigliani and Miller, 1958), or in other words, investment is a function of growth opportunities. Any deviation from the expected investment, either positive (overinvestment) or negative (underinvestment), is investment inefficiency. Based on the concept of investment inefficiency, We run the regression of investment on growth opportunities to extract the residuals and use them as the proxy for investment inefficiency.

Following Biddle et al. (2009), Chen et al. (2011) and Gomariz and Ballesta (2014), We use sales growth as the proxy for investment opportunities in our model.

$$Investment_{i,t} = \beta_o + \beta_1 SalesGrowth_{i,t} + \varepsilon_{i,t} \qquad (1)$$

In Equation (1), $Investment_{i,t}$ is the sum of research and development expenditure, capital expenditure and acquisition expenditure minus cash receipts from sale of property, plant and equipment in year *t*. $SalesGrowth_{i,t}$ is the change in the rate of sale from year *t-2* to year *t-1* for firm *i*. Using 48,812 firm-year observations of all US non-financial firms from 2004 to 2015, we regress investments on the lagged sales growth by year and industry to extract the residual $\varepsilon_{i,t}$. Investment inefficiency $II_{i,t}$ is measured by negative 1 times absolute values of the residuals so that $II_{i,t}$ is always less than 0. By constructing it this way, a zero value of $II_{i,t}$ suggests that investment is at its optimal level and the closer to zero $II_{i,t}$ it is, the lower the investment inefficiency of the firms. If a right-hand

side variable in our main model, to be discussed below, is positive, it reduces investment inefficiency $II_{i,t}$.

Model specification

Similarly to Gomariz and Ballesta (2014) and Chen et al. (2011), we employ the following models to capture the impact of debt sources on investment efficiency.

$$II_{i,t+1} = \beta_o + \beta_1 BankDebt_{i,t} + \beta_2 PrivatePlacementDebt_{i,t} + \beta_3 PublicDebt_{i,t} + \beta_4 Short\_debt_{i,t} + \beta_5 Size_{i,t} + \beta_6 Age_{i,t} + \beta_7 Tang_{i,t} + \beta_8 CFOvol_{i,t} + \beta_9 SalesVol_{i,t} + \beta_{10} InvestmentVol_{i,t} + \beta_{11} TobinQ_{i,t} + \beta_{12} Zscore_{i,t} + \beta_{13} Loss_{i,t} + \beta_{14} CFO/TA_{i,t} + \beta_{15} Cycle_{i,t} + \beta_{16} Gov_i + \beta_{17} Ind_i + e_{i,t+1} \quad (2)$$

Where $II_{i,t}$ is investment inefficiency, $BankDebt_{i,t-1}$, $PrivatePlacementDebt_{i,t-1}$ and $PublicDebt_{i,t-1}$ are the three debt sources variables. All other variables are controls that capture the impact of common determinants of investment inefficiency in the literature.

In equation (2), $BankDebt_{i,t-1}$ is the main interest variable and β_1 shows the impact of bank debt on investment efficiency. Bank debt variables are constructed in two ways: (i) the proportion of bank borrowings in the total outstanding debt to proxy a firm's reliance on bank financing, i.e., $BankPercent_{i,t}$ = *log(1+bank debt*100/total debt)* and (ii) dummy variable $Bankdum_{i,t}$ to proxy the presence of bank debt. We also control for other main debt sources that have been extensively discussed in the literature; namely, non-bank private debt and public debt (e.g. Fama, 1985, Carey et al., 1993, Johnson, 1997; Denis and Mihov, 2003, Liu, 2006). Non-bank private debt is from non-bank financial institutions and is exempt from SEC registration. It can either be issued under the 144A

rule to Qualified Institutional Buyers (insurance companies or registered investment companies) or via US Private Placements to a small number of investors (mainly investment companies and US pension funds). Public debt refers to publicly registered debt securities issued by firms under the Security Act 1933 and regulated by the SEC. We control for these two debt sources since they might impact on investment efficiency and their omission could distort the true effect of bank debt. Moreover, since each debt source has different characteristics that might lead to differences in the monitoring role, it would be interesting to study the role of bank debt in combination with other debt sources. We also construct two measures for each of these two debt sources: (i) non-bank private debt proportion $PriPercent_{it}$ = *log(1+ non-bank private debt*100/total assets)* and non-bank private debt dummy $PriDum_{it}$; and (ii) public debt proportion $PubPercent_{it}$ = *log(1+ public debt*100/total assets)* and public debt dummy $PubDum_{it}$.

For other control variables, we follow Biddle et al. (2009), Chen et al. (2011), and Gomariz and Ballesta (2014) and include short term debt, firm size, firm age, tangibility, standard deviation of cash flow, sales and investment, Tobin's Q, Alman's Z-score, presence of loss, cash flow from operations, operating cycle length and industry dummies in our models. Short term debt, $Short\_debt_{i,t}$, proxies for the impact of debt maturity on investment inefficiency and is measured by the proportion of short-term debt to total debt. We use the natural logarithm of total assets as a proxy for firm size $Size_{i,t}$. Firm age is measured as the natural logarithm of the years since the firm was established, measured by its first year of data in Datastream. $Tang_{i,t}$ is the proxy for the tangibility of a firm's assets, measured by the ratio of tangible assets to total assets. $CFOvol_{i,t}$, $SalesVol_{i,t}$ and $InvestmentVol_{i,t}$ are the volatility of a firm's operation cash flows, volatility of sales, and volatility of investment, measured by their deviations from year t-2 to year t. To control for a firm's growth options, we use $TobinQ_{i,t}$, measured by the ratio between the market value of equity and debt over total assets. $Zscore_{i,t}$ is the proxy of the financial

solvency of firms, calculated following Altman (1968)[2]. We also control for the presence of loss by a dummy variable $Loss_{i,t}$, taking 1 if net income before extraordinary items was negative in the previous year and 0 otherwise. $CFO/TA_{i,t}$ is added to capture the impact of cash flow on investment inefficiency, which is measured by the ratio of operational cash flow to average total assets. We also add $Cycle_{i,t}$ to control for the length of the operating cycle, calculated by average receivables to sale plus average inventory to the cost of goods sold multiplied by 360. Following 48 industry categories, we control for industry dummies Ind_i to proxy the impact of industry on investment efficiency. Finally, to control for the effect of corporate governance $Gov_{i,t}$ on investment inefficiency, we use the percentage of institutional ownership, as in Chen (2016).

To investigate the impact of bank debt on investment inefficiency conditional on the borrowers' characteristics, we use size and the market-to-book ratio[3] to proxy for information asymmetry. Firm size is associated with the visibility of economic transactions that firms enter into, as argued by Carey et al. (1993), in that smaller firms tend to get into fewer externally observable contracts with stakeholders compared to larger firms. In line with Carey et al. (1993), Shockley and Thakor (1993) study market reactions to announcements of bank loan commitments and find a reduction in abnormal return when firm size decreases, suggesting that smaller firms are more information problematic. Moreover, since smaller firms tend to be younger (Berger and Udell, 1993b), they might have not had enough time to build their reputation, making them highly informationally problematic. Market-to-book proxies for a bank's perception of a firm's moral hazard risk - one of the information problems due to information asymmetry.

[2] Altman (1968) proposes a measure of bankruptcy risk Zscore. Zscore is defined as: $Z = 0.012*X_1 + 0.014*X_2 + 0.0033*X_3 + 0.006*X_4 + 0.999*X_5$ where X_1 is working capital/total assets, X_2 is retained earnings/total assets, X_3 is earnings before interest and taxes/total assets, X_4 is market value of equity/book value of total debt and X_5 is sales/total assets.

[3] Market-to-book ratio *MB* equals market value of assets by total book value of firm assets.

Barclay and Smith (1995) find that firms with high growth options, measured by market-to-book ratio, have higher incentive problems since shareholders of these firms can more easily substitute risky project for safe ones. Since lenders receive fixed predetermined returns, they are not compensated for the additional credit risk and their wealth is transferred to shareholders. We use three proxies for the borrowers credit risk: the presence of loss $Loss_{i,t}$, and bankruptcy risk $Zscore_{i,t}$. A firm's loss making can trigger covenants in the bank debt contract and therefore induce stronger monitoring from banks. Finally, banks might lose part or whole of their lending if firms go bankrupt. Therefore, bankruptcy risk can also proxy for a firm's credit risk.

5. Empirical results

In this section, we start by showing some descriptive statistics of variables in the main model, and then provide empirical results of bank debt's impact on investment inefficiency. We also present the findings on the types of firms that bear more bank monitoring. Then we report the results of some robustness checks. Following Petersen (2009), we estimate the model using t-statistics based on standard errors clustered at the firm and year level, which are robust to both heteroscedasticity and within-firm serial correlation. We also control for industry effects by adding 48 Fama-French industry dummies. For endogeneity, we use 2SLS.

5.1. Descriptive statistics

Table 1 presents the descriptive statistics of the sample. Investment inefficiency has a mean of negative 0.67 and a median of negative 0.6. These values are higher compared to, for example, those from Gomariz and Ballesta, (2014), and Biddle et al. (2009). This is due to the way we construct the investment variable in the regression model (1). In

contrast to previous studies where investments are measured at the level of total assets growth, we take the natural logarithm of asset growth[4].

Bank debt accounts for 43% of total debt held by sample firms with a median level of 29%, showing that bank debt is the most popular borrowing source. Public debt is only 20% of the total outstanding debt, while private placement debt is even lower at 11%. Both public debt and private placement debt have medians of 0, meaning that not many firms choose to borrow from these sources. Compared with prior work by Houston and James (1996), the bank debt proportion is smaller while those of public debt and non-bank private debt are larger. However, this is expected given the decreasing trend in bank debt and the rising trend in public and non-bank private debt found by Houston and James (1996).

[Insert Table 1 here]

Table 2 reports the pairwise correlation coefficients of all variables in the main models. Most coefficients have an absolute value below 0.2 except for the correlation coefficient between firm size and public debt of 0.54.

[Insert Table 2 here]

5.2. Regression results

5.2.1. Impact of bank debt on investment inefficiency

As discussed earlier, the impact of bank debt on investment inefficiency is unknown. On the one hand, banks are believed to have a superior ability to monitor and mitigate information asymmetry, thus likely improving investment efficiency. On the other

[4] When we use level investment, statistical characteristics of investment inefficiency are similar to those in the earlier literature.

hand, strict covenants and collaterals of bank borrowings can trigger a firm to misreport and weaken the banks supervision incentives, consequently worsening information problems and increasing investment inefficiency. Therefore, by observing the impact of bank loans on investment inefficiency, we attempt to answer the question of the monitoring role of banks.

This section provides empirical findings on the effect of bank debt on investment inefficiency. Since we construct investment inefficiency to be negative and come closer to 0 if investment inefficiency decreases, a positive coefficient shows an improvement in efficiency and vice versa. Table 3 reports the estimation outputs of the main model using two measures of bank debt: bank debt proportion and bank debt dummy. For each measure, we first run the regression without year dummies and then repeat the test controlling for year fixed effects. In columns (1) and (2), we use bank debt proportion to investigate the impact of bank reliance on investment inefficiency. The last two columns show the impact of the bank debt dummy. Regression results differ marginally before and after the addition of year dummies for both measures of bank debt. In all regressions, bank debt consistently has a highly negative significant impact on efficiency measures, suggesting that bank debt, in general, increases investment inefficiency. This result supports the idea that bank debt can adversely drive a firm's investment decisions instead of disciplining them, possibly due to the recent structural market changes and the negative effect of strict requirements on collaterals and covenants in bank debt contracts.

Since the results are similar with or without controlling for year fixed effects, we discuss the results with year dummies in columns 2 and 4 – Table 3. As in column (2), the loading of the bank debt proportion is -0.0134, suggesting that investment inefficiency increases by 0.0134% for every 1% increase in the bank debt proportion. Bank debt presence has a coefficient of -0.0438, which means firms that have

outstanding bank debt have a higher investment inefficiency by an average of 0.0438% than firms with no bank debt. Both bank debt reliance and the presence of bank debt are important in explaining investment inefficiency.

In terms of the control variables, in all regressions firm size has a positive and significant coefficient, showing that bigger firms have a higher investment efficiency than smaller firms. Cash flow volatility and the ratio of operating cash flow over total assets are also significant but in different directions. While higher cash flow volatility can worsen investment issues, cash flow ratio lowers investment inefficiency. The length of the operating cycle also reduces investment inefficiency. Finally, corporate governance, measured by the institutional holding percentage, shows a significant adverse impact on investment efficiency.

[Insert Table 3 here]

5.2.2. Interaction effect of bank debt and a firm's information problem on investment inefficiency

In Table 4, we extend the previous analysis by testing whether the banks mitigation power on investment inefficiency increases when firms have higher information problems. We add the interaction terms between the bank debt proportion and the bank debt dummy with firm size and the market-to-book ratio to the original model. Similarly, we do the tests with no year dummies first and redo the regressions with the addition of the year dummies. Again, the results barely changed after controlling for year fixed effects. Panel A and B respectively report the estimation outputs of interaction terms with Size and MB for the bank debt proportion (columns 1 and 2) and

the bank debt dummy (columns 3 and 4)[5].

[Insert Table 4 here]

As shown in panel A, the interaction between the bank debt proportion and firm size is negative and significant (-0.0052) at 5%. This finding suggests that bank debt can help mitigate investment inefficiency in smaller firms. This is consistent with our previous argument that due to costly monitoring, banks might only supervise when they are concerned about borrowers' information problems and credit risk, proxied by firm size and other characteristics. In particular, since smaller firms tend to have a higher level of information asymmetry, banks intensify their monitoring to keep their risk under control. The negative correlation between bank debt and firm size supports our prediction. The interaction term between the bank debt dummy and firm size is, however, insignificant although the signs are consistent with the above prediction. In panel B, we report the results of the interaction effect between bank debt and the market-to-book ratio. As discussed in section 4.4, MB proxies for the level of moral hazard since firms with higher growth options can more easily substitute risky assets for safe ones at the cost of the lenders. Therefore, firms with a higher MB pose a higher moral hazard risk, and thus are targets for intensified bank monitoring. Based on this argument, we expect bank debt to mitigate more investment inefficiency in firms with a higher MB. The results confirm this prediction as it shows positive and significant MB interaction terms for both the bank debt proportions (0.0117) at 1% and the bank debt dummy (0.0467) at 10%. This suggests that the mitigation impact of bank debt on investment inefficiency is stronger for firms with a higher moral hazard risk. These findings show that banks do not necessarily monitor their borrowers in a similar way. They tend to impose stronger supervision on firms with more severe information asymmetry,

[5] Since MB and Tobin'sQ are highly correlated, we drop Tobins'Q when testing interactive impact of MB.

proxied by smaller size and higher growth.

5.2.3. Interaction effect of bank debt and credit risk on investment inefficiency

In Table 5, we report the results of the interaction effect between bank debt and credit risk on investment inefficiency. The underlying rationale is that banks are more concerned about the security of their lending when borrowers have a higher credit risk. Therefore, banks more strongly monitor these firms to keep the credit risk under control. We use two proxies for firm credit risk: loss, and financial leverage. Loss is a dummy variable that equals 1 if a firm made a loss in the previous period and 0 otherwise. Loss making can trigger the activation of bank debt covenants, and thus stronger supervision from the banks. The bankruptcy risk is measured by the Z-score (Altman, 1968), in that a higher Z-score implies a lower bankruptcy risk. Since we argue that banks intensify supervision for firms with a higher credit risk, we expect bank debt is positively correlated with Loss and negatively correlated with the *Zscore*.

[Insert Table 5 here]

Panels A and B in Table 5 show results of bank interaction with loss presence and bankruptcy risk. In panel A, both *Loss* interaction terms with bank debt proportion and bank debt dummy is significant and positive at 1% and 10%, respectively. The banks power to mitigate investment inefficiency is stronger in firms that have made a loss in the previous period. This is consistent with our prediction, in which banks intensify monitoring when firms pose a higher credit risk. In this case, the bad performance of a firm violates bank debt covenants, inducing stronger supervision from banks.

We find no supporting evidence that bank debt monitoring power varies with

bankruptcy risk. As in panel B, the *Zscore* shows no significant interaction with bank debt variables, although the signs are in line with what we predict. It seems banks base themselves on realized performance rather than bankruptcy indicators to conduct their disciplinary job.

5.3. Robustness check

5.3.1. Alternative investment models

In this section, we introduce an alternative model to examine the general impact of bank debt. We follow Chen et al. (2011) to re-estimate the expected level of investment. In general, this model is similar to the model used in the previous part except that it adds a dummy variable, $SGRDum_{i,t}$, that equals 1 if sale growth is negative and 0 otherwise. The inclusion of this variable is based on the idea that the impact of sale growth on investment can be different depending on whether growth is positive or negative.

$$Investment_{i,t} = \beta_0 + \beta_1 SalesGrowth_{i,t-1} + \beta_2 SGRDum_{i,t-1} + SalesGrowth_{i,t-1} SGRDum_{i,t-1} + \varepsilon_{i,t} \qquad (4)$$

We use the equation (4) to obtain the regression residuals and then use these residuals to similarly construct a proxy for investment efficiency. Table 6 reports the impact of bank debt and its interaction terms using the alternative investment efficiency measure

generated from model (4). Panel A presents the general impact of bank debt variables. In both regressions, the bank debt proportion, *Bankpercent,* and the bank debt dummy, *Bankdum,* are significant and negative at 1%, which is consistent with previous findings. Panels B and C show the interaction effect of bank debt and information problem variables: firm size and market-to-book ratio. The results are similar to the patterns we found when using the original investment model. The size interaction term is negative and

significant, suggesting that banks monitor more when firms are smaller and vice versa. As for the market-to-book ratio, the positive and significant coefficients on the interaction terms confirm that firm growth increases supervision intensity from banks.

Panels D and E test the robustness of the banks supervision, conditional on a firm's credit risk. In line with previous findings, we find that banks care more about realized losses rather than the bankruptcy risk of borrowers when monitoring firms. The results show a significant interaction between bank debt and loss but an insignificant interaction between bank debt and the Z-score.

[Insert Table 6 here]

5.3.2. Alternative measures of bank debt reliance

In this section, we conducted further robustness checks by employing alternative measures of bank debt reliance. One might argue that debt ownership structures cannot reflect the relative size of bank debt or how much of a firm's assets are financed by bank borrowings. To address this concern, we redo all the tests with two alternative measures of bank debt that allow us to control for the relative size of bank debt. I, respectively, scale bank debt by total assets to obtain a bank debt to assets ratio, *BankAT*, and by market equity to obtain a bank debt to market equity ratio, *BankME.*

[Insert Table 7 here]

In Table 7, Panel A shows the general impact of bank debt on investment inefficiency for both *BankAT* and *BankME*. Across the two alternative measures, bank debt still shows a significant negative impact on investment inefficiency in general with coefficients of - 0.0139 and - 0.0173 at 1% for *BankAT* and *BankME,* respectively, suggesting that bank debt increases the investment inefficiency of firms. Panels B and C test the robustness of the interaction effect between bank debt and information

problem proxies, namely, *Size* and *MB*. We observe similar patterns where bank debt is negatively correlated with firm size and positively correlated with *MB*. This confirms that the banks mitigation role increases when firms have higher information problems, suggesting a stronger monitoring effect by the banks. The last two panels present the interaction between two bank debt alternative measures and credit risk variables, including loss presence and bankruptcy risk. *Loss* interaction terms with *BankME* and *BankAT* are both significant and positive at 1% and 5%, respectively, proving that a bank's supervision increases if firms have had a loss in the previous period. The *Zscore* interaction is positive across all alternative measures of bank debt but turns significant at 5% for *BankME,* although it remains insignificant for *BankAT*.

5.3.3. Endogeneity

Potential endogeneity could drive the results of the bank debt's effect on investment inefficiency. In our study, endogeneity possibly arises from the self-selection bias, in which firms that rely more on bank debt are also more likely to make suboptimal investment decisions. On the one hand, previous studies show that firms with higher information problems tend to choose bank debt (see, e.g., Carey et al., 1993). On the other hand, since these firms have more severe information asymmetry, which is one of the main causes of a firm's investing under or over its expected level, they might have a higher level of investment inefficiency.

To address this concern, we employ the two-stage least squares (2SLS) approach. This method requires instrumental variables that are correlated with debt sources but have no direct effect on investment inefficiency. We follow Jiraporn et al. (2011), Liu et al. (2014) and Ali et al. (2016) to use the industry median of bank debt as our first instrument. The rationale for this approach is that a firm-level factor might impact the same firm's policies

but does not affect the policies of the whole industry. In our case, the argument is similarly developed, in that although a firm's investment policies can have some influence on its own level of bank debt, it is highly unlikely that a particular firm's investment can drive the bank debt use of other firms in the same industry.

The second instrumental variable is the five-year lag of bank debt. We argue that because firms might have a policy or preference regarding the choice of borrowing sources that might be persistent, bank debt reliance five years ago can still correlate to the present reliance on bank debt. However, bank debt in the past can hardly drive today's investment, and vice versa, as investment can have some influence on bank debt today but little impact on that of five years ago.[6] Tests show that both variables are valid instruments.[7]

[Insert Table 8 here]

Table 8 reports the impact of bank debt and its interactions with information problems using 2SLS regression. Column (1) shows the general impact of bank debt on investment inefficiency and columns (2) to (5) report the interaction effects of bank debt with information problems and credit risk variables. Across all columns, bank debt and interactions are mostly insignificant except for the bank debt interaction effect with the market-to-book ratio (column 3). As shown in column 3, the interaction term between bank debt and MB is positive and significant at 1%. This result supports our previous findings, suggesting that banks monitor firms that pose higher information problems and risks. In column 1, although the result does not show a significant negative impact of bank

[6] One limitation is that since our data is not balanced and only has three periods with a five-year gap, using the lag in debt sources as instrumental variables leads to a large loss in the number of observations and thus might impact the results.

[7] We carried tests for the bank debt proportion only since it makes little sense to construct two instrumental variables based on a bank debt dummy.

debt, it is still consistent with our previous findings in the sense that bank debt in general does not improve investment efficiency.

6. Conclusions

In this chapter, we examine whether bank debt can help mitigate investment inefficiency and how this impact might vary with the firm characteristics. To conduct our research, we use a random sample of 1,100 US non-financial firms over three different periods: 2005, 2010 and 2015. The results indicate that, in general, bank debt has a significant and negative impact on the investment efficiency of firms, suggesting that either banks are losing their monitoring power, or they just simply do not monitor all firms. This is consistent with recent evidence on the waning importance of banks. However, when we extend our analysis by investigating what kinds of firms banks intensively monitor, we find that banks enhance their monitoring when firms are of a smaller size and have a higher market-to-book ratio. Supervision is also stronger when firms have a poor past performance. In conclusion, bank monitoring exists but possibly not for every firm. Banks selectively monitor borrowers that pose more severe information problems and have higher risks.

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Table 1: Descriptive statistics.

Variable	Mean	Std. Dev.	Min	25% Quartile	Median	75% Quartile	Max
II	-0.67	0.45	-1.79	-1	-0.6	-0.27	0
BankPercent	42.93	42.76	0	0	28.68	96.57	100
PubPercent	19.56	34.74	0	0	0	26.94	100
PriPercent	11.42	27.84	0	0	0	0	100
Short_debt	0.24	0.29	0	0.01	0.09	0.38	0.83
Size	6.01	1.62	3.21	4.85	6	7.13	8.99
Age	2.88	0.73	0	2.4	2.89	3.43	4.17
Tang	0.83	0.16	0.53	0.71	0.88	0.99	1
CFOVol	31.19	48.88	1.55	3.82	11.1	31.34	193.78
SaleVol	0.13	0.1	0.03	0.05	0.1	0.18	0.37
InvestmentVol	0.25	0.25	0.07	0.07	0.09	0.35	0.85
TobinQ	1.84	0.91	0.92	1.16	1.53	2.24	3.99
Zscore	3.39	2.86	-0.32	1.46	2.97	4.82	10.62
CFO/TA	-2.55	0.65	-3.37	-3.37	-2.49	-1.99	-1.49
Cycle	110.4	64.9	25.54	54.95	100.49	156.96	225.78
Loss	0.32	0.47	0	0	0	1	1
Gov	59.23	29.15	0	36.09	64.08	82.04	147.01

$II_{i,t+1}$ is a level of investment inefficiency. Bank debt proportion $BankPercent_{i,t}$ is bank debt*100/total outstanding debt. $Pubpercent_{i,t}$ and $PriPercent_{i,t}$ are proportions of public and private placement debt in total debt. $Short\_debt_{i,t}$ is the proportion of short-term debt in total debt. $Size_{i,t}$ is the natural logarithm of total assets. $Age_{i,t}$ is the natural logarithm of the years since the firm's establishment. $Tang_{i,t}$ is the ratio of tangible assets to the total assets of firms. $CFOvol_{i,t}$, $SalesVol_{i,t}$, and $InvestmentVol_{i,t}$ are deviations of a firm's operation cash flow, sales and investment from t-2 to t. $TobinQ_{i,t}$ is the ratio between market value of equity and debt over total assets. $Zscore_{i,t}$ is calculated following the paper of Altman (1968). Dummy variable $Loss_{i,t}$ equals 1 if net income before extraordinary items is negative and 0 otherwise. $CFO/TA_{i,t}$ is the ratio between operation cash flow and average total assets. Operating cycle $Cycle_{i,t}$ is calculated as (average accounts receivables/sales)*360 + (average inventory/cost of good solds)*360. $Gov_{i,t}$ is corporate governance variable, measured by the percentage of shares held by institutional investors. *MB* is the ratio between market value of assets and book value of assets at t-1.

Table 2: Correlation coefficients

	II	*Bank Percent*	*Pub Percent*	*Pri Percent*	*Short debt*	*Size*	*Age*	*Tang*	*CFO Vol*	*Sale Vol*	*Invest -ment Vol*	*Tobin Q*	*Zscore*	*CFO /TA*	*Cycle*	*Loss*	*Gov*
II	1.00																
BankPercent	-0.03	1.00															
PubPercent	0.07	-0.28	1.00														
PriPercent	0.05	-0.20	-0.13	1.00													
Short_debt	-0.11	0.04	-0.23	-0.15	1.00												
Size	0.18	-0.08	0.54	0.12	-0.33	1.00											
Age	0.12	0.03	0.24	0.01	-0.11	0.33	1.00										
Tang	-0.03	-0.06	-0.12	-0.06	0.13	-0.25	-0.01	1.00									
CFOVol	0.05	-0.19	0.48	0.04	-0.15	0.68	0.28	-0.07	1.00								
SaleVol	-0.12	-0.10	-0.08	0.08	0.07	-0.14	-0.19	0.06	0.03	1.00							
InvestmentVol	-0.02	0.16	-0.04	-0.01	-0.07	0.11	0.10	-0.23	0.03	0.01	1.00						
TobinQ	-0.08	-0.19	-0.07	-0.02	0.13	-0.17	-0.17	0.05	-0.04	0.22	-0.18	1.00					
Zscore	0.04	-0.05	-0.17	-0.14	0.18	- 0.11	0.03	0.05	-0.08	0.05	-0.11	0.44	1.00				
Cycle	0.20	0.04	0.04	-0.03	-0.09	0.17	0.09	-0.07	0.12	-0.13	0.05	0.15	0.27	1.00			
Loss	0.05	0.03	-0.01	-0.06	0.06	-0.07	0.15	0.03	-0.10	0.04	-0.03	-0.03	0.13	-0.12	1.00		
Gov	-0.17	-0.09	-0.07	0.03	0.12	-0.27	-0.17	0.11	-0.10	0.21	-0.01	0.04	-0.28	-0.44	0.01	1.00	
	0.05	-0.05	0.12	0.04	-0.10	0.28	0.07	-0.11	0.15	-0.09	-0.01	0.03	0.05	0.09	0.06	-0.08	1.00

$II_{i,t+1}$ are level of investment inefficiency. Bank debt proportion $BankPercent_{i,t}$ is bank debt*100/total outstanding debt. $Pubpercent_{i,t}$ and $PriPercent_{i,t}$ are proportions of public and private placement debt in total debt. $Short\_debt_{i,t}$ is the proportion of short-term debt in total debt. $Size_{i,t}$ is the natural logarithm of total assets. $Age_{i,t}$ is the natural logarithm of the years since the firm's establishment. $Tang_{i,t}$ is the ratio of tangible assets on total assets of firms. $CFOvol_{i,t}$, $SalesVol_{i,t}$, and $InvestmentVol_{i,t}$ are deviations of firms' operation cash flow, sales and investment from t-2 to t. $TobinQ_{i,t}$ is the ratio between market value of equity and debt over total assets. $Zscore_{i,t}$ is calculated following the paper of Altman (1968). Dummy variable $Loss_{i,t}$ equals 1 if net income before extraordinary items is negative and 0 otherwise. $CFO/TA_{i,t}$ is the ratio between operation cash flow and average total assets. Operating cycle $Cycle_{i,t}$ is calculated as (average accounts receivables/sales)*360 + (average inventory/cost of good solds)*360. $Gov_{i,t}$ is corporate governance variable, measured by the percentage of shares held by institutional investors.

Table 3: Impact of bank debt on investment inefficiency

	(1)	(2)	(3)	(4)
Bankpercent	-0.0135***	-0.0134***		
	(-8.64)	(-7.95)		
Pubpercent	-0.0026	-0.0032		
	(-0.69)	(-0.86)		
Pripercent	0.0069	0.0065		
	(0.73)	(0.7)		
Bankdum			-0.0441***	-0.0438***
			(-3.47)	(-3.29)
Pubdum			0.0072	0.0046
			(0.34)	(0.21)
Pridum			0.0403	0.0390
			(1.16)	(1.14)
ShortDebt	-0.0494	-0.0496	-0.0497	-0.0499
	(-1.12)	(-1.13)	(-1.07)	(-1.07)
Size	0.0562***	0.0576***	0.0554***	0.0568***
	(3.78)	(3.72)	(3.58)	(3.53)
Age	0.0268*	0.0302*	0.0269*	0.0303*
	(1.78)	(1.85)	(1.84)	(1.91)
Tang	0.0111	0.0118	0.0154	0.0159
	(0.1)	(0.11)	(0.14)	(0.15)
CFOvol	-0.0011**	-0.0011**	-0.0011**	-0.0011**
	(-2.29)	(-2.28)	(-2.36)	(-2.35)
Salevol	-0.1454	-0.1582*	-0.1422	-0.1553*
	(-1.64)	(-1.8)	(-1.61)	(-1.76)
InvestmentVol	-0.0760	-0.0617	-0.0790	-0.0651
	(-1.53)	(-0.95)	(-1.56)	(-1.01)
TobinQ	-0.0301	-0.0287	-0.0298	-0.0283
	(-0.82)	(-0.76)	(-0.8)	(-0.73)
Zscore	0.0047	0.0046	0.0050	0.0050
	(0.78)	(0.76)	(0.83)	(0.81)
CFO/AT	0.1061***	0.1057***	0.1054***	0.1049***
	(6.89)	(8.01)	(7.03)	(8.2)
Cycle	0.0005***	0.0005***	0.0005***	0.0005***
	(3.71)	(3.79)	(3.75)	(3.82)
Loss	-0.0257	-0.0240	-0.0244	-0.0229
	(-0.66)	(-0.64)	(-0.62)	(-0.6)
Gov	-0.0005***	-0.0005***	-0.0004***	-0.0004***
	(-5.16)	(-5.11)	(-4.32)	(-4.3)
Constant	-0.7286**	-0.7452**	-0.7521**	-0.7689**
	(-2.45)	(-2.42)	(-2.45)	(-2.41)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1305	0.1307	0.1298	0.13

$II_{i,t+1}$ is the level of investment inefficiency. Bank debt proportion $BankPercent_{i,t}$ is log(1+bank debt/total outstanding debt). $Bankdum_{i,t}$ is dummy variable that equal 1 if firms have bank debt and 0 otherwise. Controls for public debt are *PubPercent* and *Pubdum*. Controls for non-bank private debt are $PriPercent_{i,t}$ and $Pridum_{i,t}$. $Pubpercent_{i,t}$ and $PriPercent_{i,t}$ are log(1+proportion of Public debt/total debt) and log(1+non-bank private debt/total debt. $Pubdum_{i,t}$ and $Pridum_{i,t}$ are dummies of public and private placement debt. $Short\_debt_{i,t}$ is the proportion of short-term debt in total debt. $Size_{i,t}$ is the natural logarithm of total assets. $Age_{i,t}$ is the natural logarithm of the years since the firm's establishment. $Tang_{i,t}$ is the ratio of tangible assets to the total assets of firms. $CFOvol_{i,t}$, $SalesVol_{i,t}$, and $InvestmentVol_{i,t}$ are deviations of a firm's operation cash flow, sales and investment from t-2 to t. $TobinQ_{i,t}$ is the ratio between market value of equity and debt over total assets. $Zscore_{i,t}$ is calculated following the paper of Altman (1968). Dummy variable $Loss_{i,t}$ equals 1 if net income before extraordinary items is negative and 0 otherwise. $CFO/TA_{i,t}$ is the ratio between operation cash flow and average total assets. Operating cycle $Cycle_{i,t}$ is calculated as (average accounts receivables/sales)*360 + (average inventory/cost of good solds)*360. $Gov_{i,t}$ is the corporate governance variable, measured by the percentage of shares held by institutional investors. All the estimates is carried out using pooled time-series cross-sectional regressions OLS coefficients. t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroscedasticity and within firm serial correlation in brackets. ***, ** and *: Significances at 1%, 5% and 10% level respectively.

Table 4: Interaction impact of bank debt and information asymmetry on investment inefficiency

	(1)	(2)	(3)	(4)
Panel A: Interaction effect between bank debt and firm size on investment inefficiency				
Bankpercent	0.0163	0.0167		
	(1.2)	(1.22)		
Bankpercent*Size	-0.0052**	-0.0052**		
	(-2.34)	(-2.35)		
Bankdum			0.0174	0.0197
			(0.16)	(0.18)
Bankdum*Size			-0.0102	-0.0105
			(-0.54)	(-0.55)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1316	0.1319	0.1301	0.1303
Panel B: Interaction effect between bank debt and firm growth on investment inefficiency				
Bankpercent	-0.0359***	-0.0359***		
	(-6.34)	(-6.33)		
Bankpercent*MB	0.0117***	0.0117***		
	(3.89)	(3.94)		
Bankdum			-0.1331**	-0.1331**
			(-2.33)	(-2.33)
Bankdum*MB			0.0464*	0.0467*
			(1.78)	(1.81)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1329	0.1331	0.1319	0.1322

$II_{i,t+1}$ is the level of investment inefficiency. Bank debt proportion $BankPercent_{i,t}$ is log(1+bank debt/total outstanding debt). $Bankdum_{i,t}$ is dummy variable that equal 1 if firms have bank debt and 0 otherwise. Controls for public debt are *PubPercent* and *Pubdum*. Controls for non-bank private debt are $PriPercent_{i,t}$ and $Pridum_{i,t}$. $Pubpercent_{i,t}$ and $PriPercent_{i,t}$ are log(1+proportion of Public debt/total debt) and log(1+non-bank private debt/total debt. $Pubdum_{i,t}$ and $Pridum_{i,t}$ are dummies of public and private placement debt. $Short\_debt_{i,t}$ is the proportion of short-term debt in total debt. $Size_{i,t}$ is the natural logarithm of total assets. $Age_{i,t}$ is the natural logarithm of the years since the firm's establishment. $Tang_{i,t}$ is the ratio of tangible assets to the total assets of a firm. $CFOvol_{i,t}$, $SalesVol_{i,t}$, and $InvestmentVol_{i,t}$ are deviations of a firm's operation cash flow, sales and investment from t-2 to t. $TobinQ_{i,t}$ is the ratio between the market value of equity and debt over total assets. $Zscore_{i,t}$ was calculated following the paper of Altman (1968). Dummy variable $Loss_{i,t}$ equals 1 if net income before extraordinary items is negative and 0 otherwise. $CFO/TA_{i,t}$ is the ratio between operation cash flow and average total assets. The operating cycle $Cycle_{i,t}$ is calculated as (average accounts receivables/sales)*360 + (average inventory/cost of good solds)*360. $Gov_{i,t}$ is the corporate governance variable, measured by the percentage of shares held by institutional investors. *MB* is the ratio between the market value of assets and the book value of assets at t-1. All the estimates were carried out using pooled time-series cross-sectional regressions OLS coefficients. t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroscedasticity and within firm serial correlation in brackets. ***, ** and *: Significances at 1%, 5% and 10% level respectively

Table 5: Interaction impact of bank debt and credit risk on investment inefficiency

	(1)	(2)	(3)	(4)
Panel A: Interaction effect between bank debt and Loss on investment inefficiency				
Bankpercent	-0.0209***	-0.0208***		
	(-10.63)	(-10.9)		
Bankpercent*Loss	0.0235***	0.0234***		
	(3.28)	(3.23)		
Bankdum			-0.0592***	-0.0587***
			(-3.99)	(-3.89)
Bankdum*Loss			0.0476*	0.0474*
			(1.85)	(1.8)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	0.1329	1876	1876
R2	0.1327	1876	0.1303	0.1305
Panel B: Interaction effect between bank debt and Zscore on investment inefficiency				
Bankpercent	-0.0151***	-0.0149***		
	(-4.17)	(-4.06)		
Bankpercent*Zscore	0.0004	0.0004		
	(0.55)	(0.52)		
Bankdum			-0.0492	-0.0487
			(-1.48)	(-1.45)
Bankdum*Zscore			0.0013	0.0013
			(0.22)	(0.22)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1306	0.1308	0.1298	0.13

$II_{i,t+1}$ is the level of investment inefficiency. Bank debt proportion $BankPercent_{i,t}$ is log(1+bank debt/total outstanding debt). $Bankdum_{i,t}$ is a dummy variable that equals 1 if firms have bank debt and 0 otherwise. Controls for public debt are *PubPercent* and *Pubdum*. Controls for non-bank private debt are $PriPercent_{i,t}$ and $Pridum_{i,t}$. $Pubpercent_{i,t}$ and $PriPercent_{i,t}$ are log(1+proportion of Public debt/total debt) and log(1+non-bank private debt/total debt. $Pubdum_{i,t}$ and $Pridum_{i,t}$ are dummies of public and private placement debt. $Short\_debt_{i,t}$ is the proportion of short-term debt in total debt. $Size_{i,t}$ is the natural logarithm of total assets. $Age_{i,t}$ is the natural logarithm of the years since the firm's establishment. $Tang_{i,t}$ is the ratio of tangible assets to the total assets of a firm. $CFOvol_{i,t}$, $SalesVol_{i,t}$, and $InvestmentVol_{i,t}$ are deviations of firms' operation cash flow, sales and investment from t-2 to t. $TobinQ_{i,t}$ is the ratio between the market value of equity and debt over total assets. $Zscore_{i,t}$ was calculated following the paper of Altman (1968). Dummy variable $Loss_{i,t}$ equals 1 if net income before extraordinary items is negative and 0 otherwise. $CFO/TA_{i,t}$ is the ratio between operation cash flow and average total assets. Operating cycle $Cycle_{i,t}$ is calculated as (average accounts receivables/sales)*360 + (average inventory/cost of good solds)*360. $Gov_{i,t}$ is the corporate governance variable, measured by the percentage of shares held by institutional investors. *MB* is the ratio between the market value of assets and the book value of assets at t-1. All the estimates were carried out using pooled time-series cross-sectional regressions OLS coefficients. t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroscedasticity and within firm serial correlation in brackets. ***, ** and *: Significances at 1%, 5% and 10% level respectively

Table 6: Impact of bank debt and its interactions on investment inefficiency -Alternative investment model

	(1)	(2)	(3)	(4)
Panel A: Impact of bank debt on investment inefficiency				
Bankpercent	-0.0135***	-0.0134***		
	(-8.76)	(-8.09)		
Bankdum			-0.0445***	-0.0442***
			(-3.57)	(-3.38)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1294	0.1296	0.1287	0.1289
Panel B: Interaction effect between bank debt and firm size on investment inefficiency				
Bankpercent	0.0162778	0.0167184		
	(1.15)	(1.17)		
Bankpercent*Size	-0.0052**	-0.0052**		
	(-2.25)	(-2.26)		
Bankdum			0.0175	0.0198
			(0.16)	(0.18)
Bankdum*Size			-0.0103	-0.0106
			(-0.53)	(-0.54)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1305	0.1307	0.129	0.1292
Panel C: Interaction effect between bank debt and firm growth on investment inefficiency				
Bankpercent	-0.0355***	-0.0354***		
	(-6.22)	(-6.21)		
Bankpercent*MB	0.0115***	0.0115***		
	(3.76)	(3.8)		
Bankdum			-0.1318**	-0.1318**
			(-2.3)	(-2.29)
Bankdum*MB			0.0455*	0.0458*
			(1.73)	(1.75)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1317	0.1319	0.1308	0.131
Panel D: Interaction effect between bank debt and Loss on investment inefficiency				
Bankpercent	-0.0209***	-0.0207***		
	(-10.27)	(-10.58)		
Bankpercent*Loss	0.0233***	0.0232***		
	(3.17)	(3.12)		
Bankdum			-0.0592***	-0.0588***
			(-4.05)	(-3.95)
Bankdum*Loss			0.0465*	0.0462*
			(1.8)	(1.75)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1315	0.1317	0.1291	0.1293
Panel E: Interaction effect between bank debt and Zscore on investment inefficiency				
Bankpercent	-0.0150***	-0.0148***		
	(-4.07)	(-3.96)		
Bankpercent*Zscore	0.0004	0.0004		
	(0.49)	(0.46)		
Bankdum			-0.0492	-0.0487
			(-1.45)	(-1.42)
Bankdum*Zscore			0.0012	0.0012

			(0.2)	(0.2)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1876	1876
R2	0.1294	0.1296	0.1287	0.1289

$II_{i,t+1}$ are level of investment inefficiency. Bank debt proportion $BankPercent_{i,t}$ is log(1+bank debt/total outstanding debt). $Bankdum_{i,t}$ is dummy variable that equal 1 if firms have bank debt and 0 otherwise. Controls for public debt are *PubPercent* and *Pubdum*. Controls for non-bank private debt are $PriPercent_{i,t}$ and $Pridum_{i,t}$. $Pubpercent_{i,t}$ and $PriPercent_{i,t}$ are log(1+proportion of public debt/total debt) and log(1+non-bank private debt/total debt. $Pubdum_{i,t}$ and $Pridum_{i,t}$ are dummies of public and private placement debt. $Short\_debt_{i,t}$ is the proportion of short-term debt in total debt. $Size_{i,t}$ is the natural logarithm of total assets. $Age_{i,t}$ is the natural logarithm of the years since the firm's establishment. $Tang_{i,t}$ is the ratio of tangible assets on total assets of firms. $CFOvol_{i,t}$, $SalesVol_{i,t}$, and $InvestmentVol_{i,t}$are deviations of firms' operation cash flow, sales and investment from t-2 to t. $TobinQ_{i,t}$ is the ratio between market value of equity and debt over total assets. $Zscore_{i,t}$ is calculated following the paper of Altman (1968). Dummy variable $Loss_{i,t}$ equals 1 if net income before extraordinary items is negative and 0 otherwise. $CFO/TA_{i,t}$ is the ratio between operation cash flow and average total assets. Operating cycle $Cycle_{i,t}$ is calculated as (average accounts receivables/sales)*360 + (average inventory/cost of good solds)*360. $Gov_{i,t}$ is corporate governance variable, measured by the percentage of shares held by institutional investors. *MB* is the ratio between market value of assets and book value of assets at t-1. All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients. t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroscedasticity and within firm serial correlation in brackets. ***, ** and *: Significances at 1%, 5% and 10% level respectively

Table 7: Impact of bank debt and its interactions on investment inefficiency - Alternative measures of bank debt

	(1)	(2)	(3)	(4)
Panel A: Impact of bank debt on investment inefficiency				
BankAT	-0.0142***	-0.0139***		
	(-3.59)	(-3.68)		
BankME			-0.0174***	-0.0173***
			(-3.98)	(-4.08)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1850	1850
R2	0.1297	0.1299	0.127	0.1271
Panel B: Interaction effect between bank debt and firm size on investment inefficiency				
BankAT	0.0308	0.0313		
	(1.29)	(1.3)		
BankAT*Size	-0.0076**	-0.0077**		
	(-2)	(-1.98)		
BankME			0.0315**	0.032**
			(2.02)	(2.05)
BankME*Size			-0.0081***	-0.0081***
			(-3.43)	(-3.43)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1850	1850
R2	0.1308	0.131	0.1286	0.1288
Panel C: Interaction effect between bank debt and firm growth on investment inefficiency				
BankAT	-0.0488**	-0.0488**		
	(-2.12)	(-2.14)		
BankAT*MB	0.0193*	0.0194*		
	(1.73)	(1.75)		
BankME			-0.0467**	-0.047**
			(-1.98)	(-1.98)
BankME*MB			0.0200	0.0203
			(1.44)	(1.45)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1850	1850
R2	0.1324	0.1325	0.1292	0.1294
Panel D: Interaction effect between bank debt and Loss on investment inefficiency				
BankAT	-0.026***	-0.0257***		
	(-4.81)	(-4.89)		
BankAT*Loss	0.0373***	0.037***		
	(3.44)	(3.39)		
BankME			-0.0279***	-0.0277***
			(-3.8)	(-3.81)
BankME*Loss			0.0273**	0.027**
			(2.55)	(2.48)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1850	1850
R2	0.1323	0.1324	0.1288	0.1289
Panel E: Interaction effect between bank debt and Zscore on investment inefficiency				
BankAT	-0.0208***	-0.0206***		
	(-2.86)	(-2.81)		
BankAT*Zscore	0.0023	0.0023		
	(1.11)	(1.12)		
BankME			-0.0215***	-0.0277***
			(-4.41)	(-3.81)

BankME*Zscore			0.0018	0.0270**
			(1.11)	(2.48)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	No	Yes	No	Yes
N	1876	1876	1850	1850
R2	0.13	0.1302	0.1272	0.1289

$II_{i,t+1}$ are level of investment inefficiency. $BankAT_{i,t}$ is log(1+bank debt/total assets). $BankME_{i,t}$ is log(1+bank debt/total equity. Controls for public debt $PubAT_{i,t}$ and $PubME_{i,t}$ are natural logarithms of public debt over total assets and total equity respectively. Controls for non-bank private debt $PriAT_{i,t}$ and $PriME_{i,t}$ are natural logarithm of non-bank private debt scaled by total assets and total market equity respectively. $Short\_debt_{i,t}$ is the proportion of short-term debt in total debt. $Size_{i,t}$ is the natural logarithm of total assets. $Age_{i,t}$ is the natural logarithm of the years since the firm's establishment. $Tang_{i,t}$ is the ratio of tangible assets on total assets of firms. $CFOvol_{i,t}$, $SalesVol_{i,t}$, and $InvestmentVol_{i,t}$are deviations of firms' operation cash flow, sales and investment from t-2 to t. $TobinQ_{i,t}$ is the ratio between market value of equity and debt over total assets. $Zscore_{i,t}$ is calculated following the paper of Altman (1968). Dummy variable $Loss_{i,t}$ equals 1 if net income before extraordinary items is negative and 0 otherwise. $CFO/TA_{i,t}$ is the ratio between operation cash flow and average total assets. Operating cycle $Cycle_{i,t}$ is calculated as (average accounts receivables/sales)*360 + (average inventory/cost of good solds)*360. $Gov_{i,t}$ is corporate governance variable, measured by the percentage of shares held by institutional investors. $MB_{i,t}$ is the ratio between market value of assets and book value of assets at t. All the estimates have been carried out using pooled time-series cross-sectional regressions OLS coefficients. t-statistics clustered at the firm and year level (Petersen, 2009) robust both to heteroscedasticity and within firm serial correlation in brackets. ***, ** and *: Significances at 1%, 5% and 10% level respectively.

Table 8: Impact of bank debt and interactions on investment inefficiency – 2SLS approach

	(1)	(2)	(3)	(4)	(5)
Bankpercent	0.0109	0.0059	-0.0620	-0.0073	-0.0269
	(0.5)	(0.08)	(-1.54)	(-0.3)	(-0.84)
*Bankpercent*Size*		0.0006			
		(0.05)			
*Bankpercent*MB*			0.0383**		
			(2.03)		
*Bankpercent*Loss*				0.0548	
				(1.51)	
*Bankpercent*Zscore*					0.0085
					(1.37)
Controls	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
N	827	827	827	827	827
R2	0.1322	0.1328	0.1271	0.123	0.1304

$II_{i,t+1}$ are level of investment inefficiency. Bank debt proportion $BankPercent_{i,t}$ is log(1+bank debt/total outstanding debt). $Bankdum_{i,t}$ is dummy variable that equal 1 if firms have bank debt and 0 otherwise. Controls for public debt are *PubPercent* and *Pubdum*. Controls for non-bank private debt are $PriPercent_{i,t}$ and $Pridum_{i,t}$. $Pubpercent_{i,t}$ and $PriPercent_{i,t}$ are log(1+proportion of Public debt/total debt) and log(1+non-bank private debt/total debt. $Pubdum_{i,t}$ and $Pridum_{i,t}$ are dummies of public and private placement debt. $Short\_debt_{i,t}$ is the proportion of short-term debt in total debt. $Size_{i,t}$ is the natural logarithm of total assets. $Age_{i,t}$ is the natural logarithm of the years since the firm's establishment. $Tang_{i,t}$ is the ratio of tangible assets on total assets of firms. $CFOvol_{i,t}$, $SalesVol_{i,t}$, and $InvestmentVol_{i,t}$are deviations of firms' operation cash flow, sales and investment from t-2 to t. $TobinQ_{i,t}$ is the ratio between market value of equity and debt over total assets. $Zscore_{i,t}$ is calculated following the paper of Altman (1968). Dummy variable $Loss_{i,t}$ equals 1 if net income before extraordinary items is negative and 0 otherwise. $CFO/TA_{i,t}$ is the ratio between operation cash flow and average total assets. Operating cycle $Cycle_{i,t}$ is calculated as (average accounts receivables/sales)*360 + (average inventory/cost of good solds)*360. $Gov_{i,t}$ is corporate governance variable, measured by the percentage of shares held by institutional investors. *MB* is the ratio between market value of assets and book value of assets at t-1. All the estimates have been carried out using 2SLS method, standard errors are robust to heteroskedasticity. ***, ** and *: Significances at 1%, 5% and 10% level respectively. Estimates of control variables are not reported.