Firm Size and Business Fluctuations, the Responce of Small and Large Firms to Great Recession

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Abstract

This paper provides some evidences supporting the more fragility of the large firms during the Great Recession. This fact is inconsistent with the common view that small firms are more sensitive to credit shocks regarding their limited access to financial markets. By estimating a stochastic dynamic model of firms' debt structure, I formalize the fact that large firms are more leveraged than small ones considering the access to a more diversified credit portfolio. On top of this, I show how small vs large firms respond to different credit shocks. Based on the model, when a banking crisis occurs, large firms can rely on the direct financing and dampen the effect of shock while the small firms can only respond by cutting their spending. On the other hand, when the financial shock affects both the banking sector and the bond market, large firms may face even harsher credit constraints than small firms. In addition, being more leveraged, large firms might become quite fragile in these occurrences. This explanation is fully consistent with the nature of the recent shock which was spread over the credit sector as a whole versus the very common shocks in banking distresses.

1 Introduction

Lots of researches have bas done on how small and large firms respond to macroeconomic shocks. What we know from literature is that while small firms are affected harder by credit shocks, large firms are more sensitive to real shocks. The underlying theory for emerging this difference across firms is their respective access to capital market. The basic idea is that smaller firms rely heavily on intermediary funds while large firms can also fund themselves directly by issuing equity, corporate bonds and commercial papers, Gertler and Hubbrad (1988). Hence, small firms have less access to capital markets and are more likely to face credit constraints (Gertler and Gilchrist 1994). When credit condition worsens, large firms can rely on direct financing and dampen the effect of shock while the small firms can only respond by cutting their spending and economic operations. Thus, small firms decline more when credit tightens. In this paper, firstly I present some evidences showing that counter-intuitively, during the Great Recession which was mainly characterized by credit tightening, large firms responded more severely. More specifically, they relatively destructed more and created less jobs than small firms in US.

In this paper, I try to explain this counter-intuitive fact by highlighting the role played by leverage. Although the literature offers contradictory findings about the relation between size of the corporations and their leverage, I take the more common stand that large firms are more leveraged than small ones. In fact, this is fully consistent to the fact that larger firms are less risky as they have access to a more diversified credit portfolio. This view is supported by theoretical and quantitative analysis in this paper.

Then, I develop a stochastic dynamic programming model characterizing an economy with two financial sectors which are typically banking sector and the corporate bond market. The stochastic element of the modeled economy is the cost of credit in each financial sector in the following period and the credit tightening episodes correspond to the periods of high cost of credit. In this context, the main argument of the paper is as follows. When the economy is hit by a small credit shock, e.g. a typical banking crisis, large firms can dampen it by providing liquidity from the other market. More precisely, if the tied banks to the firms is shut down or the cost of bank loans increases, large firms could substitute this channel by issuing bond. So, firms without access to this market are severely affected by the shock. On the other hand, when the shock is large in the sense that both banking sector and bond market weaken, even large firms face harsh credit constraint as they cannot borrow from the other creditors in their portfolio. Meanwhile, we know that as firms are getting more leveraged, they become more fragile in the occurrence of credit tightening. Therefore, since large firms are generally more leveraged, when the shock is big enough to affect all credit markets, they suffer more from the credit shock. This story is in line with the nature of the recent financial crisis in which an extensive shock spread over all credit markets.

To put the whole matter into a nutshell, the highlighted difference between the previous episodes of credit tightening and the Great Recession could be simplified and stated as "only banking sector shocks versus shocks more spread over the credit sector as a whole". And this is the key factor by which my theoretical model explains the harsher response of the large firms in the recent crisis. Worthy to mention that as it is also documented, such an extensive shock to financial markets was unprecedented in the recent decades (e.g. Bordo and Haubrich (2010).

1.1 Firms' response to the Great Recession

The main aim of this examination is to see the behavior of firms with different size classes in the recent financial crisis. To establish the stylized facts about the response of small and large firms to the recent financial crisis, I borrow the empirical framework for this analysis from Moscarini and Postel-Vinay (2012) which is applied to the latest data from US Business Dynamics Statistics (BDS)[1]. This is a semi-aggregate data set of the job flows of the US firms.

Among different measures of firm size such as assets, sales and employees, which are strongly correlated, BDS uses the latter one and provide measures of job flows from different size classes of firms and establishments. Calculating the growth rate of a size class by the ratio between net job creation over the period of March to March. Here, net job creation is the standard notion of gross job creation (JC) minus gross job destruction (JD). Firms are reclassified in new size classes year by year when the new information is realized. The data set covers the quarterly data from 1977 up to now. Following Moscarini and Postel-Vinay, I choose the cutoffs of 50 and 1,000 employees to define small (less than 50 employees) and large firms (more than 1000 employees). These thresholds is motivated by the availability of data and also to keep the balance of size between two groups in terms of aggregate employment share to prevent the results to be driven by one size class with the most of total employment. However the results are qualitatively robust to other classification cutoffs for small and large firms (e.g. 5, 10 and 20 for small firms and 500 for large firms). Using the HP-filtered data of job flows for both groups, the cyclical behavior of size classes are depicted in figure 1[2] .

However, it is worthy to mention that small firms proportionally have proportionally greater job flows and a lower level of total employment. Thus, it might be possible that small firms lost a greater share of their employment during the recent crisis. But what matters here, is the firms'

[1] Althogh their analysis covers the crisis episode, but since HP-filter is not reliable near the endpoints, making inference from their work for the post-crisis period is not reliable.

[2] To keep the empirical structure the same as reference paper by Moscarini and Postel-Vinay (2012), all the other procedure is kept unchanged. The aim of this part is only to extend their empirical work by the most updated data and also to add sectoral level analysis to drive the stylized facts.

deviation of job flow rates from their own trends which is less for small firms.

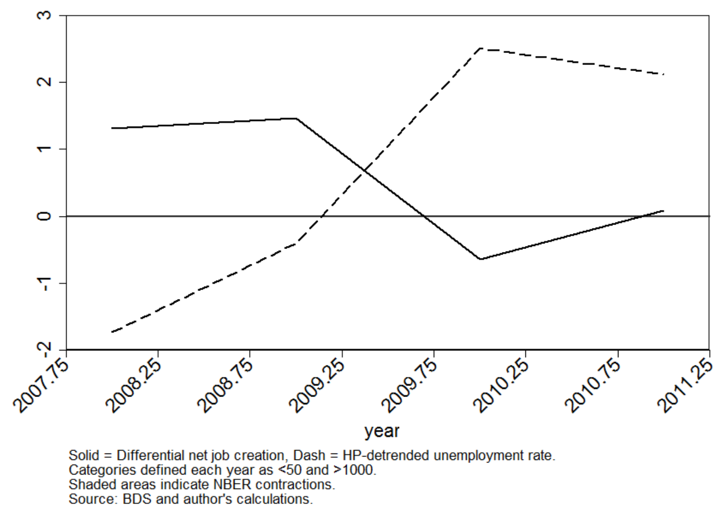

Figure 1: Differential net job creation between small and large firms

However, one might argue that such a trend could be driven by higher sensitivity of sectors with relatively larger firms, and not necessarily more sensitivity of larger firms per se. But, as my analysis at sectoral level shows, what is evidenced above at aggregate level is robust within different sectors as well. As depicted in figures (2) and (3), the same trends hold for two sample retail and manufacturing sectors. While the retail industry usually includes small firms, manufacturing sector is composed of large firms. As it is shown, the same trend could be evidenced in both sectors.

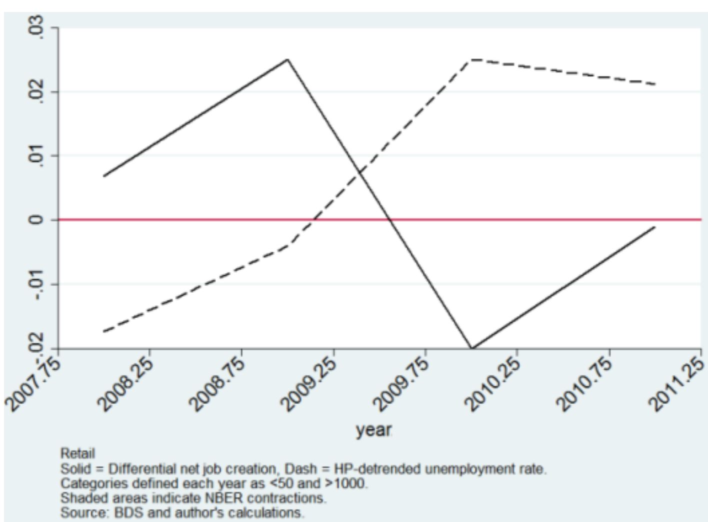

Figure 2: Differential net job creation - Retail

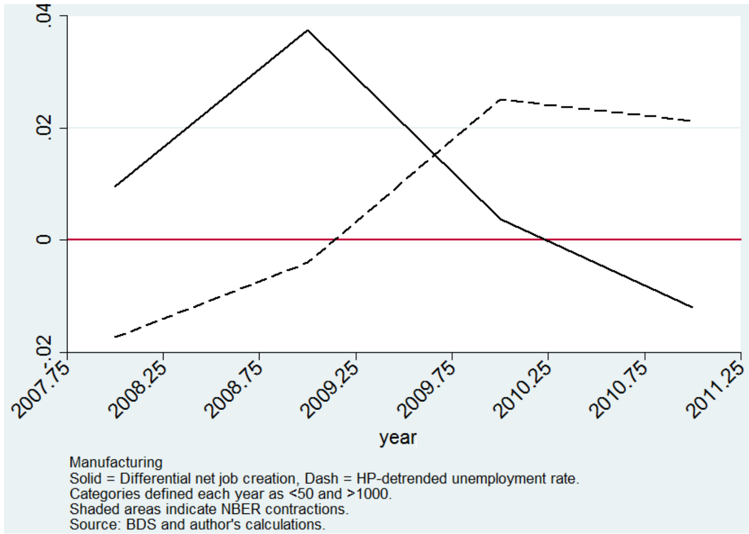

Figure 3: Differential net job creation - Manufacturing

Figure (4) provides another fact supporting the invalidity of more sensitivity of small firms during the Great Recession. Federal Reserve Board releases the information of US firms in different sector classes. Regardless of size, I compare the cumulative asset changes of the non-financial corporate and non-corporate businesses since the start of the 2008 Recession. Here, as described by data provider, non-corporate firms are not necessarily small, but they are generally the firms that do not have access to capital markets and thus rely on trade credit and loans from commercial banks and other credit providers for funding. This group of firms are supposed to be impacted harder by the credit shocks as by definition they have a more limited access to financial markets. A closer look at this figure reveals that non-corporate businesses have not been impacted more adversely by the shock, as we expected from the literature.

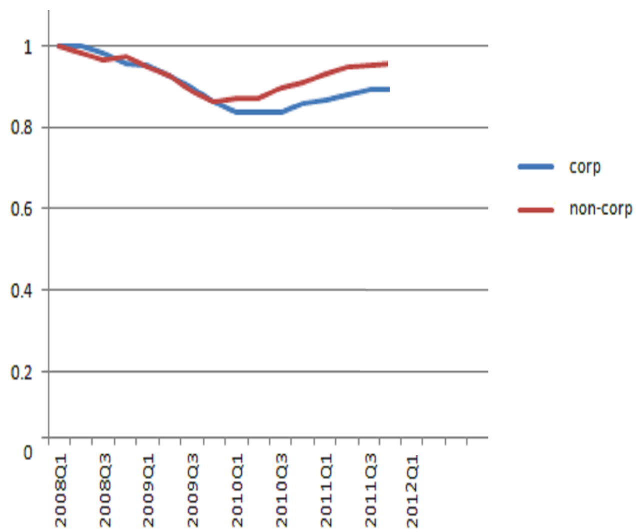

Figure 4: Asset sensitivity of corporate and non-corporate firms during the Great Recession

Finally, I would like to highlight another fact about the unemployment rate in the US. This is based on unemployment data provided by U.S. Bureau of Labor Statistics (BLS). This fact relates to the discrepancy between household-based (Current Population Survey, CPS) and payroll-based (Current Employment Statistics, CES) unemployment rates in US. CPS surveys about 140,000 individuals of 50,000 households and CES surveys 160,000 firms with 400,000 establishments at monthly frequencies. In the ideal case, the CES/CPS ratio is supposed to be equal to one as they both measure the same index. However, this ratio is almost always below 1. Although it is still not clear why such a discrepancy exists between these two measures, one explanation could be based on the firm size distribution (Moscarini and Postel-Vinay, 2009). Assuming a natural bias in the CES sample towards large firms, as a firm level survey is probably more skewed towards large firms and misses small ones, then CES/CPS fluctuations will probably reflect the job flows fluctuations of large vs small firms. So, as it is depicted in figure (5), there is a decline in the CES/CPS multiplier in the post crisis episode. This implies a harsher response of the large firms to the shock that hit the economy. In the other words, this procyclicality corresponds very much like the relative net job creation trend of large vs. small employers.

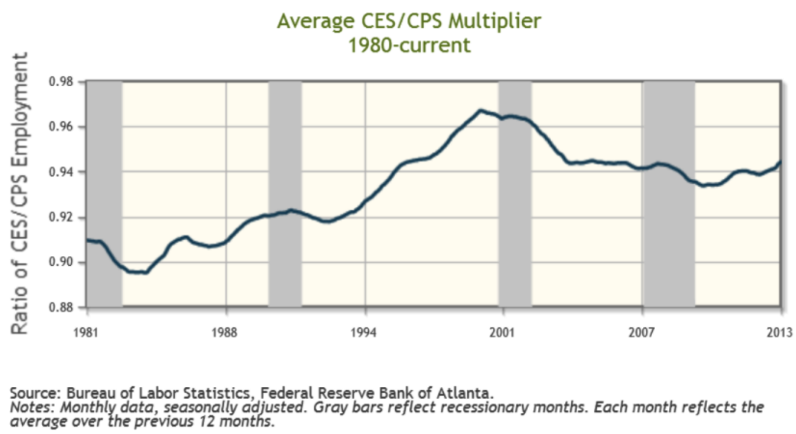

Figure 5: CES/CPE Multiplier

Collectively, these facts outline that counter-intuitively, during the Great Recession which was mainly characterized by credit tightening, large firms responded more severely. To be more conservative, at least the widespread view of more fragility of small firms is not valid anymore.

1.2 Literature Review

This paper relates to several strands of literature in macroeconomics and corporate finance. The first strands tries to explore the response of small versus large firms to macroeconomic shocks. May be the first seminal work directly addressed this question is Gertler and Gilchrist (1994) exploring the cyclical behavior of small and large manufacturing firms, and their differential responses to monetary shocks. They use the semi-aggregate data from Quarterly Financial Report for Manufacturing Corporations (QFR) from 1958 to 1992 and define firm classes based on their asset size. Accordingly, a firm falls in a given size category if its asset value falls inside a specific range in the time of evaluation. The response of the firms is also measures by the changes in the value of sales, inventories and short-term debt. As they argue, differences in the cyclical behavior of the firms emerges is justified by their relative access to credit markets. Hence, they proxy the access to capital market by firm size and show that small firms have been impacted harder by the exogenous monetary policy shocks. Here, the authors interpret periods of monetary contraction to be episodes of credit tightening specially for the small firms and argue how their economic activities shrinking during such periods.

Another recent work is Chari, Christiano and Keho (2013) who examine the findings of Gertler and Gilchrist by the more recent data. They construct the same measure of the sales and explore how small and large firms response to a contractionary monetary policy shock. Indeed, they ask a related question that what happens to the sales of large versus small firms during a business cycle contraction. The question is a different, to the extent that shocks other than monetary policy also play an important role in triggering recessions. They conclude that unlike the monetary policy shocks to which small firms respond more harshly, the response of large and small firms to real business cycle shocks is roughly the same.

In another seminal work, Moscarini and Posetl-Vinay (2012) document a stronger negative correlation between the net job creation rate of large employers to business cycles rather than small ones. They define employer size in terms of employees where "employers" means either firms or establishments, depending on the dataset at hand. They draw their data from the new Census Bureau's Business Dynamic Statistics (BDS), covering 1978–2009, as well as matched employer-employee datasets from Denmark and France. Indeed, they confirm the robustness of their results using quarterly data from Business Employment Dynamics (BED) initiated from 1992:III, and runs through 2010:III. Collectively, they present evidences of higher volatility of large firms in response to unemployment dynamics -which are matched with documented business cycles. Referring to a previous paper by the authors, Moscarini and Postel-Vinay (2011), they justify this evidence by putting the productivity shocks as the initiators of the unemployment cycles. The argument which is not convincing for the Great Recession[3]. In a related work, Kudlyak et. al. (2010) look at the responses of firms to tight credit Shocks of 2008 through the lens of Gertler and Gilchrist. After replicating their results for the earlier periods of tight credit, they try to find whether these findings could be reproduced for the case of the 2007–2009 recession. Using the same data set and methodology as Gertler and Gilchrist, they find that unlike the previous episodes of credit tightening, the short-term debt of large firms (consisting mainly of commercial paper and bank loans) and also their sales decreases relatively more than that of small firms.

Another strand of the literature surveys the interplay between cash holding and debt policy. There are generally four motives are identified for the firms to hold cash which are transaction motive, precautionary motive, agency motive and tax motive.

[3]Although their results are not very reliable for the Great Recession considering the problems of HP-filtering near end-points, however, they also show that in this episode, the net job creation of large employers slowed down much faster tahn the small firms. As I have argued above, stylized facts in the previous part were driven based on this work.

This paper contributes to the second motive and argues how firms balance the trade off between benefits of having cash reserves and the costs of holding debt. In this literature, Acharya et. al. (200) investigate the role of financial constraints in the interplay between cash and debt policies. They point the importance of hedging motive and argue that while saving cash allows financially constrained firms to hedge against future income shortfalls, reducing debt - "saving borrowing capacity" - is a more effective way of securing future investment in high cash flow states. ??? Also highlight the effect of debt adjustment cost and argue that firms prefer to keep on borrowing despite high cash flows to prevent future debt adjustment costs. In both works, there are motives for the firms to keep leveraged but not to use their cash to repay their debts. In this paper, I emphasize on the stochastic nature of interest rate to explain why firms hold cash instead of repaying their short term debt[4]. Although several researchers have argued how firms adjust cash reserves in their capital structure, however, still few writers have been able to motivate it by the role of stochastic interest rates. Among them, Ju and Hui Ou-Yang (2005) *develops a model in which an optimal capital structure and an optimal debt maturity are jointly determined in a stochastic interest rate environment. They argue that the long-run mean of the short-term interest rate process is a key variable in the determination of both the optimal capital structure and the optimal maturity structure. Akyildirima et. al. (2014) model* how optimal dividend policy of firms is governed by interest rates and issuance costs. As they conclude, all things being equal, firms distribute more dividends when interest rates are high and less when issuing costs are high. In this paper, I contribute to the literature by emphasize the importance of differential stochastic rates in multiple markets and how access to these markets matters in cash holding - debt holding trade off. In my model, even when firms don't face with a sever liquidity shocks and end up with unused cash, they hold it to secure themselves against future volatilities in interest rates. The rate of borrowing for each firm touches the lowest rate among the accessible markets for the firm.

So the firms with access to multiple markets which trivially expected a lower future rate, prefer to distribute all their unused cash as dividend and end up with high leverage. Consequently, they should rely on future borrowing which makes them more vulnerable to widespread credit

[4]It is a crutial concearn to rationalize why firms do not use their precautionary reserves to reduce their short therm debt. Because the costs of short term debt exceeds the return of holding precautionary reserves (in the form of commercial papers etc.). Qi (2014) argues that firms hold liquidity only by issuing long term debt.

shocks over the financial markets. On the other hand, small firms with limited access to financial markets prefer to keep their unused cash to be secure against the high rates in the credit market.

The rest of the paper is organized as follows. Next section is a simplified three period model to illustrate the central idea of the paper. In chapter four, the general dynamic model is presented. In section five, the model is structurally estimated and the properties are presented. All the quantitative analysis are discussed in the last section.

2 The economic environment

The economics environment consists of a set of firms maximizing the NPV of their shareholder cash flow distribution. In each period, every firm decides about its investment level, amount of borrowing and how much dividend and equity to issue. There is a single multi-purpose good which is produced, used as capital and distributed as dividend. Firms can borrow from financial markets: from a representative bank and/or issuing bond in the market. In each period, the firm faces a two stage stochastic program model.

In the first stage the firm decide how much to borrow from the market/bank (having an expectation about its productivity level). After the realization of productivity, the firms makes the optimal investment by equalizing the marginal cost of capital to marginal productivity.

There are two financial sectors in this economy which are bank and bond market. Firms can issue debt from either sector and the rates of the bank and the market are respectively denoted $r_b$and r_m. Some firms are allowed to borrow from both markets ($x = 1$) while the others not ($x = 0$). So, the cost function is denoted with $C(b, x) = \left\{ \begin{array}{ll} r_b b & \text{if } x = 0 \\ \min\{r_m, r_b\}.b & \text{if } x = 1 \end{array} \right|$

All firms face the technology shock denoted by z, where $z = \underline{z}$ with probability p and $z = \overline{z}$ otherwise.

After realizing the productivity shock, if the cash flow plus the borrowing exceeds the optimal investment level, the firm invests optimally and ends up with some unused cash. Then, the firms decide to hold the unused cash as precautionary reserves or to distribute it as dividend. In the former case, the reserves are held by issuing short term contracts in the market, such as commercial papers, with rate $(1 - \tau)r_m$. To rule out the arbitrage condition, I presume that the rate of issuing commercial papers is less than interest rate of either markets, alternatively: $(1 - \tau)r_m < \min\{r_m, r_b\}$. Moreover, I impose two more non-arbitrage conditions, $\beta r_m < 1$ and $\beta r_b < 1$ to prevent excessive borrowing.

This framework is depicted in figure 6.

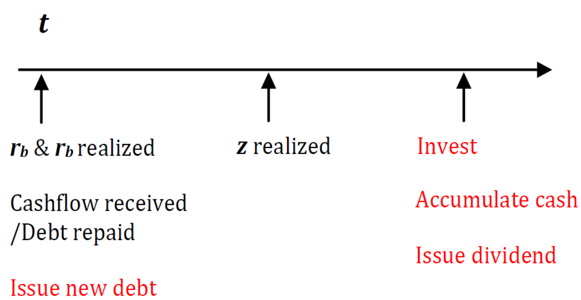

Figure 6. State Realization Structure

Each firm uses the following technology to invest:

$$f(k) = zk^{\alpha}$$

Here I assume that all firms share the same α and also the same z distribution. The In period t, we have firms with the state variables $(CF_t, x_t, r_{b,t}, r_{m,t})$ where CF_t is the firm's cashflow $CF_t = f(k_{t-1}) + (1-\tau)r_{t-1}c_{t-1} - r_{t-1}b_{t-1}$.Cash flow includes the return from the past investment, return of cash reserves which is held as commercial paper net of debt repayments. k_t is the firm's investment, b_t is the firm's total debt issued from both markets and c_t is the accumulated cash reserves. The accessibility of credit markets for firms is denoted by x_t, which is a dummy variable representing access to bond market in the current period. This is the only source of heterogeneity in this models. $x_t = 1$ for typical large unconstraint firms with access to both credit markets, while $x_t = 0$ for small credit constraint firms. This variable is determined exogenously in this paper. $r_{b,t}$ and $r_{m,t}$ are also the respective rates of the bank and the market.

2.1 A three-period model

To present the main idea of the paper, in this section I present a simple three-period model. In the last period, the cash flow of the firm is distributed as dividend among the shareholders. To simplify the model, I assume that in period 2 there is only uncertainty about the interest rates (z_2 is predetermined) while in period 1 we have only uncertainty about productivity. So, in the first period both markets offer loans with the same rate ($r_{1m} = r_{1b} = r_1$).

In the last period we simply have:

$$V_3(CF_3) = CF_3$$

In period 2, as there is no uncertainty about the productivity and the interest rate is realized at the beginning of the period, the optimal decision of the firm has the following structure:

$$
\begin{aligned}
V_2(CF_2, r_{2m}, r_{2b}, x_2) = & \max_{k_2, b_2 \geq 0} \beta V_3(CF_3) \\
& s.t. \\
k_2 \leq & CF_2 + b_2 \\
CF_3 = & f(z_2, k_2) - r_2 b_2
\end{aligned}
$$

It is easy to verify the optimal investment is $k_2 = (\frac{\alpha\beta z_2}{r_2})^{\frac{1}{1-\alpha}}$ and considering the cash flow from the previous period, the optimal debt is $b_2 = (\frac{\alpha\beta z_2}{r_2})^{\frac{1}{1-\alpha}} - CF_2$.

In the first period it is more complicated as the uncertainty about the productivity is realized after closing the debt market and we have a two stage decision process. Firms start with no previous investment, and the cash flow is zero. The whole cash in this period comes out of debt. Indeed, I assume both market offer the same rate, r_1, and there is no discrimination regarding credit market accessibility (x_1 doesn't matter). The optimal problem of the firm is a two stage programming model. In the first stage, firms decide how much debt to issue considering the productivity shock they will face. In the second stage, after realizing their productivity, they invest and decide about the cash holding/dividend policy schemes. More formally:

$$
V_1(0, r_1, r_1, .) = \max_{b_1 \geq 0} E_{z_1} U(0, b_1, z_1)
$$

where

$$
\begin{aligned}
U(0, b_1, z_1) = & \max_{k_1, d_1, c_1} d_1 + \beta E_{r_{2m}, r_{2b}} V_2(CF_2) \\
& s.t \\
k_1 \leq & b_1 - c_1 - d_1 \\
CF_2 = & f(z_1, k_1) - r_1 b_1 + (1-\tau) r_1 c_1
\end{aligned}
$$

Lemma 1 *$V_1(0, r_1, r_1, x_2)$ is single-peaked in b_1.*

Proof. See Appendix ■

This lemma implies the uniqeness of the optimal borrowing for the firm.

Lemma 2 *There exist firm specific probability threshold* $\widehat{p}(r_2, x_2) = \frac{r_1 - \gamma}{\gamma(\bar{z}-1)}$, *such that the optimal borrowing* b_1 *of the firm is:*

$$b_1 = \begin{cases} \underline{b} = (\frac{\alpha\theta E(z)}{r_1})^{\frac{1}{1-\alpha}} & \text{if} \quad p < \widehat{p} \\ \bar{b} = (\frac{\alpha\theta p\bar{z}}{r_1 - (1-p)\gamma})^{\frac{1}{1-\alpha}} & \text{if} \quad \widehat{p} \leq p \end{cases}$$

where $\gamma = \max\left\{(1-\tau)r_1, \frac{1}{\beta E(\lambda_2)}\right\}$ *and* λ_2 *is the shadow price of cash in period 2.*

This lemma states that firm's borrowing is determined by the probability of productivity shock. When the high productivity state is highly probable, the firm secure itself by issuing more debt ($\bar{b}$) to hold enough liquidity for high investment. On the other hand, when the low state is probable, it is optimal to be more conservative in borrowing cash ($\underline{b}$) since ending up with unused cash is costly. This holds regarding the non-arbitrage conditions that the cost of borrowing is larger than returns of commercial paper or benefit of dividend issuance.

Remark 3 *Constrained firms are more cautious in borrowing.*

It is easy to verify that $\widehat{p}$ is increasing in λ_2 which is the shadow price of cash, or the interest rate, in period 2. More formally, $E(\lambda_2) = E(\min\{r_{2m}, r_{2b}\})$ for unconstrained firms while $E(\lambda_2) = E(r_{2b})$ for constrained firms. Hence, not only $\widehat{p}$ is larger for constrained firms, but also the optimal $\bar{b}$ is smaller as it is decreasing in λ_2. This is intuitive. Since large debts leads to lower cash flow in the next period, as the debt must be repaid, constrained firms which face a tighter credit condition because of limited access to credit markets have more concerns about their next period cash flow and hence, they are more cautious about issuing excessive debt now.

Proposition 4 *The optimal investment, cash holding and dividend policy of the firm after realization of technology shock, is characterized as follows:*

if $\bar{z}$ *is realized:*

$$\begin{cases} k_1 = b_1 \\ c_1 = d_1 = 0 \end{cases}$$

and in case $\underline{z}$ *is realized:*

$$\begin{cases} k_1 = \min\left\{b_1, (\frac{\alpha\theta}{\gamma})^{\frac{1}{1-\alpha}}\right\} \\ c_1.d_1 = 0 \text{ where } c_1 > 0 \text{ iff } \beta E(\lambda_2)(1-\tau)r_1 > 1 \end{cases}$$

Proof. See Appendix ■

The intuition of the proposition is very straightforward. If the high productivity state is realized, the whole liquidity is pledged in production function. If the low productivity state is realized and the firm has borrowed $\underline{b}$, again it is optimal to invest all available liquidity. But if firm has borrowed, $\overline{b}$ and productivity is low, some part is pledged in production function and the rest is either held as cash reserves (in case the return of commercial paper exceeds the discount rate) or distributed as dividend.

Remark 5 *Constrained firms have higher tendency of investment and cash holding rather than unconstrained firms. On the other hand, unconstrained firms have relative tendency of issuing dividend.*

The specific notion here is also the role of shadow price in the period 2. The value of cash in the next period plays a crucial role in their decision about investment level and also how to manage the unused cash, either to issue dividend or to issue commercial paper. Both decisions depend on the expectations about the value of the future cash flow. The higher cash flow means lower reliance on external financing, the larger the expected interest rate in period 2 implies higher investment and also higher tendency of keeping cash rather than issuing dividend.

Next proposition discuss it more formally:

Proposition 6 *Unconstrained firms have higher debt to asset ration (leverage).*

The proof is trivial. Since borrowing is decreasing in λ_2 (Remark 1) while both investment and cash holding (total asset) are increasing in λ_2 (Remark 2), unconstrained firms which enjoy from lower λ_2 have a higher debt to asset ratio.

Proposition 7 *Sensitivity of firms to bank interest rate is state dependent as follows:*

$$\begin{cases} \frac{\partial V_2(.,.,.,x_2=1)}{\partial r_{2b}} < \frac{\partial V_2(.,.,.,x_2=0)}{\partial r_{2b}} & \text{if } r_{2m} < r_{2b} \\ \frac{\partial V_2(.,.,.,x_2=1)}{\partial r_{2b}} \geq \frac{\partial V_2(.,.,.,x_2=0)}{\partial r_{2b}} & \text{if } r_{2m} \geq r_{2b} \end{cases}$$

Proof. See Appendix ■

This is the main proposition of the paper. The proposition states that sensitivity of firms value to interest rate volatilities is state dependent. More specifically, this rules out the common view in the literature that small constrained firms are always more sensitive to credit shocks. The main idea of the proposition is that the relative responses of constrained and unconstrained firms depend on the accessibility and the cost of changing the lender. If having access to other credit markets provides cheap substitutable source of credit, then unconstrained firms could dampen the effect of shock. Otherwise, not only they are effected by the shock, but the effect might be even harsher as such firms have higher reliance on external resources rather than constrained firms.

2.1.1 Discussion

The theoretical analysis generates some testable implications that will be tested using micro-data of US industrial firms. There are three main implications generated from the discussions above. The first implication is higher sensitivity of constrained firms' cash holding/dividend policy to news about future bank rates. As constrained firms rely only on bank loans, when there is any expectation about increasing the banks rates, they respond by accumulating more reserves/issuing less dividend to secure themselves from relying on external financing. This is not the case on unconstrained firms as they can easily change their financier. Secondly, in normal times that bank rates are higher than market rates, constrained firms respond harsher to any increase in banks rates as they face higher cost of capital. On the other hand, unconstrained firms are not impacted considering their access to market loans. Thirdly, in case the market rate is higher than bank rate, which is not very often, not only the unconstrained firms are also impacted by bank rate volatilities, but also the impact will be harder on them. This is mainly because they keep less precautionary reserves. Hence, they are impacted harder in case high rates in the other market prevents them from substituting their lenders.

In the next section these implications are tested.

2.2 Empirical Analysis

I consider the sample from WRDS merged COMPUSTAT and RATING for US firms form 1989 to 2011. Using the information provided by RATING, I adapt two strategies to distinguish constrained and unconstrained firms based on their credit ratings. The first strategy is to treat firms without a credit rating as constrained. The main motivation for this is that unrated firms are assumed to have no access to the public debt markets. The second strategy follows Farre-Mensa and Ljungqvist (2013) to identify "junk bond issuers" which are firms with low ratings in S&P to treat them as constrained firms. These firms have limited or costly access to bond market and rely more on intermediaries such as banks. Moreover, high rating is a signal for information asymmetries between the firm and investors, which implies that junk bond issuers are more opaque and so more likely to be rationed by lenders. For such setting, I classify publics firms with ratings below "B" as junk bond issuers. I exclude all non-industrial firms as their balance-sheet might be impacted by specific regulatory forces such as capital requirement rather than economic reasons studied here. This causes different response of such firms to credit shock which is not the interest of this study.

The empirical strategy employed to test the implications of the theoretical analysis is firstly to compare the behavior of rated vs unrated firms and secondly among the rated firms, to compare the response of "junk bond issuers" to high rated firms. In both cases I explore how both groups respond to exogenous financial shocks in different episodes.

The main argument is that the economic activities of an unconstrained firm should not be impacted by small shocks to credit supply when there are other sources of credit provision. In the other words, firms with high ratings can simply substitute towards other channels when one source of credit becomes scarce or expensive. A constrained firm with costly or limited access to credit markets, on the other hand, faces an inelastic supply curve and so should decrease its activities. To test this implication, I examine state-level changes in bank taxes between 1989 and 2011, which I get from Farre-Mensa and Ljungqvist (2013). As they argue, for state tax purposes, states apportion a bank's income from lending to their state based on the location of the borrower, rather than the lender. Changes in state bank taxes, by affecting the after-tax profitability of lending, thus directly affect the supply of bank loans available to firms located in the state. As a result, we expect banks to expand lending in states with falling taxes and reduce it in states with rising taxes.

So, as the state tax changes, we expect the economic activities of the constrained firms to be effected more than the unconstrained firms. Moreover, as the firms forecast the impacts of the tax changes, they will optimize their balance sheet before the tax change is operationalized. So, according to the predictions of the theoretical model, we expect increase in cash holding and decrease in dividend distribution by constrained firms one period before the tax increases. On the other hand, we expect insignificant or very small precautionary reactions of unconstrained firms to tax change shocks.

I estimate the following dynamic panel model to test the cash holding of constrained and unconstrained firms.

$$CashCh_{ist} = \beta_0 + \beta_1 F.TaxCh_{st} + \beta X_{ist} + \alpha_i + \varepsilon_{ist}$$

where the dependent variable (data item *chech* in Compustat) is $CashCh_{ist}$. This variable measures the change in cash holding of firm i is state s at time t with respect to period $t-1$. $TaxCh_{st}$ is also the change in state tax on banks from the previous period. We are mainly interested to see how changes in the taxes on banks affects the cash holding strategy of the firms. Other controls include SIZE which is measured by the total asset (data item *at* in Compustat), R&D expenditure (data item *xrd* in Compustat), acquisition (data item *aqc* in Compustat), capital expenditure (data item *capx* in Compustat), dividend payments (data item *dv* in Compustat) and Q ratio. We control for size mainly to control for economy of scale in cash holding.

The results are reported in Table 1. Controlling for other influential factors, we can see that the coefficient of $F.TaxCh$ is positive and significant for unrated firms while it is not significant for rated firms. Interestingly, among rated firms, junk bond issuers display a significant respond like the unrated firms while the high rated firms do not respond. This is in-line with the predictions of the theoretical model. Increasing tax on banks will cause a higher expectation of the future interest rates, and motivates the constrained firms to increase their cash reserves while the unconstrained firms are not affected.

The next equation implements our empirical strategy to test the second implication of the model.

$$Divid_{ist} = \beta_0 + \beta_1 TaxCh_{st} + \beta_1 F.TaxCh_{st} + \beta X_{ist} + \alpha_i + \varepsilon_{ist}$$

Here the dependent variable is natural logarithm of cash dividend issuance by the firms. Table 2 reports the results of the regression. According to this table, changes in bank taxes motivates both group of constrained firms to respond by decreasing their dividend issuance while unconstrained firms are still not impacted. In this table, we also tax changes in the current period has some explanatory power. As we can see, both group of constrained firms respond to tax changes in the current period and also to the expected changes in future. In both cases, high rated firms do not show any response to the shock.

The next step is to explore how the firm market value is affected by the realized shock. To operationalize this test, using the historical data of US interest rates in both banking sector and market (Baa index), I split the time horizon based on the maximum rate between the two. Although usually the rates charged by banks are higher due to monitoring and other executive costs which are features of bank loans, but still there are some episodes during which the average rate of Baa bonds exceeds the bank rates. What we expect from the theory is the harsh response of unconstrained firms in episodes during which the market rate exceeds the bank rate. As discussed before, this is mainly due to impossibility of dampening the shock by changing the lender. The effect is estimated using the following reduced form in times of higher rates in banking sector and then in times of higher market rates:

$$Mkt\_Value_{ist} = \beta_0 + \beta_1 TaxCh_{st} + \beta X_{ist} + \alpha_i + \varepsilon_{ist}$$

Tables 3 and 4 describe the results for the related tests respectively. As reported in Table 3, when the market is a substitute for bank, changes in the tax rate impacts only the unrated firms. In such periods, neither high rated nor even junk bond issuers are impacted by negative shocks to banking sector. As presented in column (2), overally rated firms do not respond to shocks in these periods.

On the other side, Tables (4) shows that when the market is tight, both rated and unrated firms respond to the shocks in bank rates. Significance of the Lagged variable emphasizes the persistency of the effect. Interestingly, for both $TaxCh$ and $L.TaxCh$, a harsher impact on high rated firms relative to junk bond issuers is reported. These results verify our prediction that firm's response to credit shocks is state dependent.

3 Conclusion

This paper challenges the common belief in the literature that small firms with limited access to credit markets are more fragile to credit shocks. Considering the correlation between the firm size and its access to credit market, the findings indicate that the size of a firm may predict its fragility to credit shock depending on the state of the credit markets.

To verify this, I test how firms respond to credit shocks in two different episodes. One is the time when the market offers a lower rate than the bank, and the other is the times that bank rates are lower. This classification matters as in the latter case even high rated firms face some difficulties in substituting bank with other external resource. Then I tested the firms' response to changes in banks taxes in both episodes. According to the results, when the public market offers a higher rate than banks, even firms with access to both markets are impacted significantly. This is mainly because even such firms find it very costly to substitute bank loan with market debt. However, when the bank rates are higher, which is more often, we evidence more fragility of constrained firms.

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Table 1
Bank-tax Sensitivity of Firm's Cash Holding

CashCh	(1) Not-Rated	(2) All Rated	(3) High-Rated	(4) J.Bond Issuers
Size	0.211***	0.00167	-0.00361	0.123***
	(17.06)	(0.71)	(-1.38)	(27.85)
F.TaxCh	0.0166**	0.000913	0.000481	0.00598***
	(3.05)	(1.63)	(0.69)	(3.32)
Q	-0.000000138	2.00e-08	7.24e-08	0.000000456
	(-0.13)	(0.37)	(0.28)	(1.43)
Aqc	1.276***	-0.119***	-0.178***	-0.470***
	(47.84)	(-8.80)	(-9.90)	(-9.99)
R&D_x	-0.0740***	-0.530***	-0.576***	-0.0306***
	(-29.14)	(-10.05)	(-4.37)	(-12.70)
Cap_x	-15.40***	-0.167***	-0.402***	-0.619***
	(-152.22)	(-4.86)	(-7.48)	(-10.22)
Divid	-0.742***	-0.0627**	-0.346***	-0.630***
	(-17.88)	(-2.58)	(-7.30)	(-49.75)
L.Divid	-0.868***	0.0112	0.125*	-0.971***
	(-14.62)	(0.51)	(2.39)	(-54.71)
_cons	-0.193***	0.0182	0.0817***	-0.547***
	(-3.77)	(0.93)	(3.64)	(-25.99)
N	35932	6909	2178	24727

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 2
Bank-tax Sensitivity of Firm’s Dividend

Dividend	(1) Not-Rated	(2) All Rated	(3) High-Rated	(4) J.Bond Issuers
L.Divid	0.0000329	0.000217***	0.000111***	0.000258***
	(1.77)	(16.69)	(7.53)	(4.84)
Size	0.797***	0.768***	0.858***	0.794***
	(83.76)	(70.97)	(33.46)	(37.30)
TaxCh	-0.0289***	-0.0182***	-0.0175	-0.0236***
	(-7.50)	(-4.31)	(-1.80)	(-3.39)
F.TaxCh	-0.00896*	-0.00991*	-0.000395	-0.0175**
	(-2.45)	(-2.39)	(-0.04)	(-2.60)
Leverage	-0.786***	-0.331***	0.0531	-0.0855
	(-18.36)	(-5.86)	(0.37)	(-1.01)
Aqc	-0.373***	-0.365***	-0.374	-0.390*
	(-4.05)	(-3.41)	(-1.28)	(-2.46)
Revenue	0.110***	0.249***	0.385***	0.224***
	(7.57)	(10.82)	(5.58)	(6.45)
_cons	-2.804***	-2.344***	-3.021***	-2.981***
	(-46.31)	(-23.22)	(-12.59)	(-15.81)
N	21086	17301	3212	8073

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 3

Bank-tax Sensitivity of Firm's Value when bank rate exceeds market rate

Mkt Value	(1) Not-Rated	(2) All Rated	(3) High-Rated	(4) J.Bond Issuers
L.Mkt_val	0.503***	0.655***	0.784***	0.496***
	(47.39)	(28.11)	(17.73)	(9.60)
Size	0.000108***	0.000000361	0.000000783	-0.0000150
	(7.23)	(0.40)	(1.23)	(-0.82)
TaxCh	-0.222***	0.0462	-0.106	0.0922
	(-3.96)	(0.67)	(-1.28)	(0.50)
R&D	-0.0704***	0.335	-1.361	0.559
	(-4.47)	(0.35)	(-1.07)	(0.33)
Aqc	-0.0551***	0.646***	0.247	0.849*
	(-3.52)	(3.71)	(0.93)	(2.27)
Leverage	-0.000387***	-1.454***	-0.337	-1.850***
	(-4.06)	(-13.16)	(-1.52)	(-8.98)
Cash	1.043***	0.720***	0.154	0.585
	(17.07)	(3.50)	(0.50)	(1.37)
_cons	1.824***	3.483***	2.303***	4.475***
	(36.79)	(16.11)	(4.97)	(10.89)
N	11770	2319	481	814

t statistics in parentheses

* p<0.05, ** p<0.01, *** p<0.001

Table 4

Bank-tax Sensitivity of Firm's Value when market rate exceeds bank rate

Mkt Value	(1) Not-Rated	(2) All Rated	(3) High-Rated	(4) J.Bond Issuers
L.Mkt_val	0.465***	0.367***	0.584***	0.182***
	(68.52)	(25.85)	(21.42)	(6.52)
Size	0.0000161***	0.00000309***	0.00000134**	0.00000723
	(4.55)	(4.36)	(2.84)	(0.69)
TaxCh	-0.0126***	-0.0264***	-0.0141**	-0.0192
	(-4.39)	(-5.91)	(-2.93)	(-1.59)
L.TaxCh	-0.0400***	-0.0482***	-0.0299***	-0.0501***
	(-12.36)	(-10.50)	(-6.17)	(-3.95)
R&D	0.00220	-1.951***	-1.199*	-1.313
	(1.57)	(-3.75)	(-2.02)	(-1.37)
Aqc	0.0146*	0.691***	0.294	1.115**
	(2.42)	(4.23)	(1.43)	(2.86)
Leverage	-0.000225*	-1.839***	-0.518***	-2.529***
	(-2.29)	(-25.29)	(-3.51)	(-18.18)
Cash	0.781***	0.878***	1.086***	0.528
	(18.52)	(6.03)	(6.05)	(1.63)
_cons	2.045***	6.054***	4.288***	7.034***
	(63.31)	(44.70)	(14.87)	(28.94)
N	19914	4491	851	1612

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001