The Role of Long-Term Commitment in Bank Financing

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Abstract

This paper studies inefficiencies arising from the lack of long-term commitments between borrower (firm) and lender (bank). I develop a model of dynamic lending contracts with default decisions in an environment with uncertainty and learning. In absence of long-term commitment, uncertainty and agency frictions can lead to tight borrowing constraints and high default probability. Using a panel data on lending contracts between young firms and a bank in a market where long-term commitments are absent, I estimate the model and recover the level of uncertainty, level of agency frictions, and the speed of learning. The estimated model allows me to quantify inefficiencies from uncertainty and agency friction separately. In the counterfactual scenario of having long-term commitments in the firm-bank relationship, I find that long-term contingent contracts can alleviate frictions by using flexible inter-temporal pricing scheme and subsidy across states. As a result, firm grows faster and default rates drop.

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1 Introduction

Small and medium-sized enterprises (SMEs) are widely recognized as an engine of economic growth. However, the growth and development of SMEs faces the universal problem of financing obstacles, especially from external sources like banks.\(^1\) Constraints on bank lending can come from high uncertainty about the prospect of small and young firms, and agency friction aggravated by high costs in providing collateral. Alleviation of these constrains is crucial to support the survival and growth of small businesses.

Theory has shown that lending relationships with long-term commitments between firms and banks can help attenuate contracting distortions and gradually enhances credit flow (Petersen and Rajan, 1995; Boot and Thakor, 2000). However, long-term commitment is often absent in real-life credit markets. In many emerging countries where line of credit is not commonly available, firms and banks negotiate loan contract terms on a period-by-period basis. Banks lack necessary tools to make credible contingent multi-period contracts, and firms are not contractually bound to stick with the current bank for multiple periods.\(^2\)

Such inability to commit to long-term plans has been shown to have far-reaching implications for economic arrangements.\(^3\) The goal of this paper is to empirically examine and quantify how a lack of long-term commitment affects the dynamics of bank financing, and thus the survival and growth of firms, especially in the context of small and young bushiness.

I develop a dynamic model of firms (borrowers) and banks (lenders), in an environment where firm’s repayment behavior cannot be enforced, and firm’s quality type is unknown in the beginning, but can be learned over time. Under the assumption of an absence of long-term commitment, meaning that banks compete by offering single-period lending contracts in each period, the model is estimated using a proprietary panel data on lending contracts between small and young firms with a Chinese bank. I then consider the counterfactual scenario where firms and banks could commitment to long-term contingent lending contracts, and I find that on average, firm default rates would drop by 17.15\%, and total output increases by 2.63\%. Long-term contracts could recover 31.46\% of the welfare loss from both agency friction and uncertainty.

The data from the sample bank keeps track of all loan transactions with every corporate customers, which enables me to identify the beginning of each firm’s lending relationship

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\(^1\)See Abdulsaleh and Worthington (2013) for a review on the literature of SME financing.

\(^2\)See World Bank (2015) for a detailed reports on the lack of long-term financing in developing countries.

\(^3\)Examples can be found in Thomas and Worrall (1988, 1994); Ligon et al. (2002); Cochrane (1995); Hendel and Lizzeri (2003)
with the bank, and construct a complete panel of loan contracts over a period of eight years. For each loan transaction, I can observe not only the interest rate, loan size, but also the estimated value of collateral. Collateral is a crucial tool to disincentivize default (Barro, 1976; Benjamin, 1978; Stiglitz and Weiss, 1981), so observing collateral allows me to better estimate the level of agency friction in place, which is critical in determining the welfare improvement of long-term contracts. Moreover, a large percentage of the bank’s corporate customers are small and medium-sized, with many of them young or newly established. For these firms, uncertainty of future profitability looms especially large, which can exert a significant effect on their financing contracts. So my model with uncertainty built-in can be particularly relevant for these firms. Finally yet importantly, the loan contracts in my data are legally constrained to be one-year or less. This lack of long-term financing is not surprising given that China’s credit market in general is characterized by scarcity of long-term financial resources, especially for firms of smaller sizes (Li et al., 2009). Such setting justifies my assumption of a lack of long-term commitment in the model.

Several interesting features of the data inspire my model. First, almost all loans observed in the data are secured loans. This is consistent with the presence of agency friction, namely, firms have default incentives that are misaligned with the bank, and thus collateral is used to reduce default incentives. Using the appraised value of the collateral, and the bank’s internal discount factor on the value of collateral, I can calculate the collateral coverage ratio for each loan. The mean collateral coverage ratio is around 55%. The fact that this ratio is not near 1 suggests a high cost associated with the usage of collateral, which is particularly applicable to small and young firms as we see in the data.

Second, the dynamics of contract terms over the course of the relationship shows evidence of learning. Using bank’s dynamic internal rating on each firms, I measure the firm’s performance over time, and find that contract terms respond to new information about firm performance: interest rates go up and loan size go down following a poor performance. Furthermore, such responses become weakened over time. This can be explained by a learning process where performance information is used to update beliefs on the firm’s unobserved quality type, and belief updates are reflected in changes of contract terms. As information accumulates and learning proceeds, beliefs become less sensitive to new information, so do contract terms.

Given evidence of agency friction, uncertainty and learning, I develop an infinite-horizon dynamic structural model of the credit market to analysis firms’ repayment/default decisions and banks’ choice of contract terms. In the model, firms are heterogeneous in their
probability of getting a negative productivity shock, which constitutes their quality type. A firm’s quality type is unknown to all banks and to the firm itself, but the distribution of quality type conditional on observed firm characteristics is common knowledge, based on which the initial prior belief is formed. Assuming bank and firms are unable to make long-term commitments, banks compete at the beginning of each period by offering single-period contracts, which consists of interest rates, loan size, and collateral coverage. A firm takes offer from a bank, and then productivity realizes during the production stage, which is observed by all. Beliefs are then updated in the middle of this period based on this newly observed performance information. At the end of this period, the firm observes its liquidity shock, based on which it makes a choice of either repaying the loan, or default and loose the value of collateral. Defaulted firms exit the market with a salvage value.

Uncertainty leads to misallocation of capital and mispricing of risk, since firms with better quality types are pooled with other firms in the beginning, and their initial contract does not match their true types. In particular, firms with higher quality type are charged with an interest rate that is higher than their full-information interest rates because they are mixed with lower-type firms. The high interest rate translates into high default probability through the firm’s decision making on default. As a result, fewer high-type firms survive in the presence of uncertainty than in the full-information benchmark. Even for surviving high-type firms, they are offered a loan size that is smaller than their full-information loan size, so their output falls short of their full-information level. Low-type firms, on the other hand, get a larger loan size than their full-information benchmark. But since they are less productive, overall outputs are lower and we see less efficient use of capital.

Long-term contingent contracts can help because it allows contracts to become increasingly more favorable to firms over time, thus lowering firm’s default incentives. Specifically, the contract becomes more favorable in two aspects. First, interest rates decline and loan size grows rapidly over time. Second, interest rates are partially forgiven in bad states as an “insurance” against negative shocks. Under such structure, even in presence of uncertainty where high-type firms are mixed with low-type firms and charged with high interest rates, high-type firms do not default as much as in the previous case, since they are incentivized to stay in the contract and reap the future benefits as promised in the long-term contract. As a result, overall default rates drop and total outputs increase in the case of long-term contract.

The learning parameters are mostly identified from the responses of contract terms to performance information, and the over-time variation of such responses. In an extreme case of
complete learning after just one period, i.e., productivity has no random shocks and takes on a deterministic value that can be observed after period one, we would see contract terms respond only to to the first firm performance but not after. So the response shrinks to zero immediately. In another extreme case of two types having almost identical distribution of performance, learning is very slow, so the response of contract terms to new performance information is small in magnitude. But the response is very persistent and does not converge to zero immediately. Therefore the rate at which the response of contract terms to performance information converge helps identify parameters related to learning, namely how high-type firms are different from low-types in terms of performance.

The selection process helps pin down the distribution of types (conditional on observed characteristics). Selection happens because high-type firms are less likely to default than low-type firms, so unproportionally more low-types drop out than high-types, which changes the composition of the pool over time. The average quality is improving over time, which can be seen from observed firm performance data. The rate at which average performance improves is closely related to the true distribution of quality type in the population. This can be seen by imagining an extreme case of only having one type, where the composition of the pool does not change over time and average firm performance should be constant. On the other hand, if we see selection happens at a fast speed, there must be a relatively large proportion of low-type firms.

There are two parameters closely related to agency friction, salvage value and variance of liquidity shock. Salvage value after defaults changes the firm’s payoff of default, and variance of liquidity shock controls how “exogenous” the default decisions are. Both a large salvage value and a large variance of liquidity shock can contribute to high observed default rates, so how to separately identify them? I use the covariance between default rates and costs of funds to address this issue. The variance of liquidity shock determines how default probabilities are correlated with the difference in mean payoffs of default and repayment, and cost of funds can move this difference in mean payoffs by shifting the level of interest rates. Thus I can look at how defaults are correlated with funding costs to pin down the variance of liquidity shock, and then pin down the salvage value through average default rates observed in the data.

I also incorporate observed firm heterogeneity into the estimated specification of the model. The model is estimated using generalized method of moments. I use observed contract terms, firm’s default decisions, firm performance measures, and the co-movements between contract terms and default decisions with performance, as well as with funding costs, as empirical
moments. Estimation results show a significant amount of heterogeneity in productivity and performance for firms with different observed characteristics as well as unobserved types.

Given the estimates, I calculated the benchmark case of full information where quality types are known to all in the beginning. Compared with the full-information scenario, uncertainty lowers the survival probability of the high-type firms by 2.65%, and lowers total output of the high-type firms by 4.34%. Overall, survival probability is 0.44% lower and total output 0.15% lower. I then calculate the optimal long-term contingent contract for each firm over the same period of seven years. This counterfactual scenario shows significant improvement on firm outcomes and total surplus. First, overall survival probability drop by 17.15%, among which high-type firms see a drop of 16.84% and low-type firms see a drop of 17.41%. Second, firms grow faster and achieve larger size. At the end of the sample period, the high-type firms are 1.14% larger than in the factual model, and the low-types are 1.26% larger. Third, collateral is used less. Collateral coverage drops from 55% to 25%, which translate into large savings in transaction costs associated with the collateral. Finally, firm’s total output is 2.63% higher, among which high-types’ output is 2.84% higher and low-types’ output is 2.45% higher than in the factual model. In total, the case with long-term commitments could recover 31.46% of total welfare loss from both agency friction and uncertainty. And average Compensating Variation (CV) across firms is $92,106.

This model could be used to predict effects of various programs aimed at boosting small business lending. For example, an initial subsidy for the long-term contract would be effective given that the long-term contract has relatively high initial interest rates. Such program can further improve firm outcomes and total surplus. Loan guarantee programs, which are common in US, can also be evaluated using this model. It could alleviate the burden of providing collateral for the firms and further.

This paper relates to the literature of long-term financing contracts in which credit constraints emerge endogenously as a feature of the optimal contract design (Gertler, 1992; Thomas and Worrall, 1994; Albuquerque and Hopenhayn, 2004; Quadrini, 2004; Clementi and Hopenhayn, 2006; DeMarzo and Sannikov, 2006; DeMarzo and Fishman, 2007; Biais et al., 2010; Boualam, 2018). It extends this literature in three major ways. First, I incorporate firm heterogeneity, both on unobserved and observed levels, and show how various frictions affect different firms. Second, I consider the use of collateral as an additional tool to reduce default risk, and shows that long-term contracts is till effective in further disincen-

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4Here survival probability refers to the probability that a firm does not default through out the sample period.
tivize defaults. Third, I integrate a discrete choice structure on default decisions of firms by adding a random liquidity shock, which can generate positive default rates in equilibrium. Standard models like Albuquerque and Hopenhayn (2004) and Boualam (2018) assumes no random shocks in default decisions and look for optimal default-free contracts. But this cannot explain why we still see default in reality. The addition of liquidity shock allows default to be partly unpreventable due to the innate liquidity risk of running a business, and it is reflected in the prices through the model. So the equilibrium interest rates is able to reflect default risk, which is another difference from the standard model.

The paper also contributes to the relationship lending literature. Studies mostly focus on how the properties of a length relationship such as the relationship length determine the evolution of a financing contract during the course of the relationship (Petersen and Rajan, 1994; Berger and Udell, 1995; Degryse and Van Cayseele, 2000; Herrera and Minetti, 2007). The majority of them use survey data and conclusions they draw are mixed. My model is able to generate dynamics of financing contract over the course of the relationship, and show how frictions affects these dynamics. To my knowledge, this is also the first first framework that could quantify the value of a long-term committed relationship.

Another strand of literature this paper relates to is the role of commitment in life insurance and health insurance market. It draws insights from Hendel and Lizzeri (2003), which use data on life insurance contracts to study the properties of long-term contracts in a world where buyers cannot commit to a contract. The lack of commitment by consumers leads to front-loading (prepayment) of premiums in life insurance. In my paper, I consider the issue of a lack of commitment from both sides, instead of one-sided commitment. This is due to the different institutional settings we face: life insurance has built-in commitment from the company side in the form of legal implications, while in my setting the bank does not have such vehicle to legally commit. Framework in this paper can contribute to this discussion by quantifying welfare implication of commitment.

The rest of the paper is organized as follows. Section 2 shows general summary statistics and patterns of the dataset and provides institutional background of China’s loan market, Section 3 describes the model, Section 4 discuss identification concerns, specifies the empirical model, and estimates the model primitives, Section 5 conducts the counterfactual exercises of eliminating various frictions, and implementing long-term relationship with full commitments. Section 6 concludes.

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5In Albuquerque and Hopenhayn (2004), firms can be liquidated, but it happens prior to taking loans in this period, so firm’s liquidation does not mean default.