AGENCY COST OF DEBT AND CREDIT MARKET IMPERFECTIONS: A BARGAINING APPROACH
Agency Cost of Debt and Credit Market Imperfections: A Bargaining Approach

Key words: bank competition, agency cost of debt

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Abstract:
This paper studies the effect of credit market imperfections, measured by the relative bargaining power of banks, on the agency costs of debt finance. The threshold of obtaining loan finance is shown to be independent of the relative bargaining power of the financier. However, lower relative bargaining power of banks leads to lower lending rates and investment return distributions with lower, but less risky returns. Thus, our analysis does not support the view, presented in a large existing literature, that there would be a trade-off between reduced credit market imperfections and higher agency costs of debt finance.

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1. Introduction

According to widespread conventional wisdom among economists higher competition tends to promote allocative efficiency by reducing mark-ups under many circumstances. In addition, similar arguments frequently present competition as a powerful mechanism for eliminating slack within firms. However, and importantly, the banking industry has a number of features making it problematic to rely directly on these general insights. In particular, a number of factors, like limited liability associated with debt contracts, asymmetric information between lenders and borrowers and the nature of the borrower’s investment technology, determine how the degree of competition between lenders will affect the performance of the credit industry. In fact, it is still largely an open issue to characterize the efficient combinations of competition and financial stability in the banking industry.

An extensive literature in financial economics has shown that debt finance tends to imply excessive risk taking because debt contracts typically mean that the return structure to the project holder is convex as a function of the value of the firm. This tendency for excessive risk taking represents a distortion of the characteristics of the implemented projects based on debt finance and it forms the basis for an important type of agency costs associated with debt funding. In recent years many contributions in financial economics have explored the implications of these agency costs for the optimal financial structure of firms (see e.g. Harris and Raviv (1991) for a survey). Much less attention, however, has been paid to the fundamental issue of how credit market competition will impact on the agency costs of debt. Does a reduced degree of market imperfections promote efficiency of credit markets by reducing the agency costs of debt or does it lead to increased credit market fragility in the sense of higher bankruptcy risks for borrowers? Answers to these questions are central for all attempts to evaluate the potential welfare effects from, for example, the ongoing worldwide process of financial integration or the increased competitive pressure from an extended set of alternative financial instruments as part of the evolving new financial landscape.
As we mentioned earlier, there is a widespread view that intensified credit market competition induces project holders to choose more risky projects, thereby contributing to financial instability. According to this view competition might generate agency costs leading to a trade-off between competition and financial stability. In an influential article Keeley (1990) offered empirical evidence that the process of deregulation of the US banking industry in the 1970’s and 1980’s led to intensified competition and at the same time increased risk taking, which showed up in a dramatic increase in the number of bank failures. Keeley’s explanation for this observation was that reduced charter values magnified the agency costs of debt finance. Empirical relationships between intensified credit market competition and financial instability have also been reported in studies covering other countries (see Beck, Demirguc-Kunt and Levine (2003)).

Allen and Gale (2003) have recently surveyed the theoretical literature analyzing the potential trade-off between credit market competition and financial stability. Their survey shows that the relationship between allocative efficiency and financial stability seems to be fragile with respect to the specific way in which competition is modelled. In one type of model more market power has been shown to diminish the moral hazard problem banks face as lenders. Petersen and Rajan (1995) have argued that credit market competition imposes constraints on the ability of borrowers and lenders to intertemporally share the surplus from investment projects so that lenders may be forced to charge higher interest rates than lenders in a monopolistic market, which might exclude entrepreneurs with low credit capacity from funding in competitive lending markets. Other contributions (e.g. Besanko and Thakor (1993) and von Thadden (1995)) explain how banks with more market power might have stronger incentives to monitor the projects of borrowers and to establish long-term relationships. Caminal and Matutes (2002) study the welfare consequences of increased concentration in the lending industry when banks choose between credit rationing and monitoring in order to alleviate an underlying moral hazard problem. Increased market power will induce the bank to raise the lending rate, but it also strengthens the bank’s

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1 On the other hand, Beck, Demirguc-Kunt and Levine (2003) also argue that financial stability is promoted by fewer regulatory restrictions on banking activities and by national institutions that encourage competition.
incentives for project-specific monitoring. From the point of view of social welfare these effects typically operate in opposite directions suggesting that there need not be a monotonic relationship between lending industry concentration and social welfare. In contrast to this type of models Koskela and Stenbacka (2000) have used a model of mean-shifting investment technologies to study the relationship between market structure, risk taking and social welfare in credit markets. In their approach introduction of competition has been shown to reduce lending rates and to generate higher investments without increasing the equilibrium bankruptcy risk of borrowers. Thus, with endogenous investments there may not be a trade-off between market competition and financial fragility.

The relationship between lending market structure and credit market performance has also been extensively studied within the framework of models focusing on adverse selection. Broecker (1990), Riordan (1993) and Shaffer (1998) have studied the consequences of adverse selection resulting from the unobserved characteristics of borrowers. They argue that increased competition may make adverse selection problems more severe when borrowers who have been rejected at one bank can apply for loans at other banks so that the pool of funded projects will exhibit lower average quality as the number of banks increases. By identifying the intensity of competition with the degree of product differentiation under asymmetric information Villas-Boas and Schmidt-Mohr (1999) have demonstrated how banks facing stronger competition may expose credit applicants to more precise screening. When banks have to compete more aggressively for profitable projects, social welfare may actually decrease in their model.

To summarize, the existing literature gives mixed results concerning the relationship between credit market competition, financial stability and social welfare. The present paper offers a new analysis making it possible to explicitly address how credit market imperfections, measured by the bargaining power of banks, affects the agency costs of debt finance. It is shown that reduced credit market imperfections do not affect the threshold of obtaining loan finance. However, and importantly, reduced credit market imperfections will decrease the lending rates and induce the funding of less risky investment projects with a lower rate of return. Thus in our framework, the agency costs
generated by debt financing will decrease with lower lending market imperfections. Consequently, our study does not support the existence of a trade-off between lending market competition and financial fragility.

We proceed as follows. Section 2 presents the basic model of moral hazard describing the determination of investment projects for a given interest rate and the first-best project selection as the benchmark for the performance evaluation of the credit market. Section 3 explores the relationship between the agency cost generated by debt financing and credit market imperfections. Finally there is a brief concluding section.

2. A basic model of moral hazard

Consider an entrepreneur facing an investment opportunity, which requires exactly one unit of debt money. The investment yields a random return \( x \). Assume for simplicity that the investment project has two possible outcomes as follows

\[
(1) \quad x = \begin{cases} 
R & \text{with probability } p(R) \\
0 & \text{with probability } 1 - p(R).
\end{cases}
\]

The probability of success, \( p(R) \), is assumed to be a decreasing and convex function of the rate of return, \( R \), so that \( p'(R) < 0 \) and \( p''(R) > 0 \). The return structure (1) captures the notion that a higher rate of return can be achieved by sacrificing in terms of the success probability.

The risk-neutral entrepreneur finances the project with a limited liability debt contract. The investor makes the project selection, \( R \), so as to maximize the expected profit

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\(^2\) Since the analysis is focused on the relationship between credit market competition and the agency costs of debt, we directly restrict our attention to debt as the only available financial instrument without attempting to make the financial structure of firms an endogenous feature of our model. Also, we abstract from issues related to equilibrium credit rationing and refer to Bester and Hellwig (1987) for an analysis of credit rationing in the context of moral hazard.
where \(1+r\) describes the interest rate factor. When the lender has committed itself to the debt contract, the project holder’s first-order optimality condition can be expressed as\\[ (3) \quad \pi_R = p'(R)[R-(1+r)] + p(R) = 0. \]

Under the second order condition \(\pi_{RR} < 0\) (3) implicitly defines the optimal project selection, \(R^*\). The first-order condition (3) characterizes the optimal project selection in general form according to

\[
\frac{p'(R)}{p(R)} = \frac{-1}{R-(1+r)}. 
\]

The general solution of this differential equation cannot be easily used for further analysis in line with the purpose of this paper. In order to exhibit the underlying economic intuition as transparently as possible, we will restrict our analysis to the following parametric specification:

\[ (4) \quad p(R) = e^{-\lambda(R-1)}. \]

The parameter \(\lambda\) captures the hazard rate of the project with the property that \(p'(R) = -\lambda p(R) < 0\) and \(p''(R) = \lambda^2 p(R) > 0\). This functional form of the probability of success can be viewed as a reflection of a trade-off whereby a more complex project generates a higher return conditional on success, but that the probability of success

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\(^3\) In what follows the derivatives are noted by primes for functions with one argument and the partial derivatives by subscripts for functions with many arguments. Hence, for example \(p'(R) = dp(R)/dR\), while \(A_r(x,y) = \partial A(x,y)/\partial x\), etc.
diminishes with project complexity.\(^4\) Using the specification (4) the optimal project selection can be explicitly written as

\[
R^* = (1 + r) - \frac{1}{\lambda} ,
\]

The investor’s optimal project selection is associated with a rate of return exhibiting a premium relative to the cost of debt finance. Naturally, this premium is a decreasing function of the hazard rate \(\lambda\). Moreover, a higher lending rate leads both to a higher rate of return conditional on success, i.e. \(R_c^* > 0\), and to a lower probability of success.\(^5\)

The risk-neutral bank is assumed to have the zero opportunity cost of granting loans so that its expected profits can be written as

\[
V = p(R)(1 + r) - 1 .
\]

In order to evaluate the potential role of the degree of credit market imperfections, measured by the relative bargaining power of banks, we first characterize a benchmark of socially efficient project selection. We ask what is the result from maximizing the expected project surplus in a world where agency-based incentive problems do not exist. The socially efficient project selection (in a first-best sense) can be obtained as a solution to the following maximization problem

\[
Max_R \quad W = p(R)R - 1 ,
\]

\(^4\) It can also be seen to exhibit a moral hazard effect (for an elaboration of this effect, see e.g. Clemenz (1986), 65-66).

\(^5\) A more general way of describing project selection would be to assume that a project with a risk characteristic \(\theta\) yields a random return stream of \(R(\theta)\) with probability \(p(\theta)\) and zero with probability \(1 - p(\theta)\). Under such circumstances the project’s expected return varies with the chosen risk-return characteristics. It would be reasonable to assume that \(R'(\theta) > 0\) so that the return in the case of success is
We can conclude that the resulting project selection, \( R = R^{FB} \), has to satisfy \( R^{FB} = \frac{1}{\lambda} \).

This socially efficient project selection will generate an expected project surplus \( W = W^{FB} \) given by

\[
W^{FB} = \frac{\lambda}{\lambda} - 1.
\]

Thus, for the project to be a socially efficient undertaking, i.e. \( W^{FB} > 0 \), the probability of success \( p \) has to exceed the hazard rate \( \lambda \) of the project. In other words, from a social point of view it is justified to implement a project if \( p(R^{FB}) > \lambda \), while projects with \( p(R^{FB}) < \lambda \) should not be implemented.

Now we ask: What is the relationship between the socially efficient project selection and the project the entrepreneur selects in the credit market? Comparing the equations (5) and (8) reveals that \( R^* > R^{FB} \) and \( p(R^*) < p(R^{FB}) \). Hence, limited liability induces excessive risk taking from a social point of view, because the investor’s attention is restricted to the upper tail of the project return distribution.

3. Credit market imperfections and the agency cost of debt

In the literature there is no unique and standardised way to characterise the intensity of credit market competition. In traditional oligopoly models the consequences of intensified competition are often analysed by increasing the number of competitors in an industry. Another approach, frequently applied in industrial economics, is to measure the intensity of competition by the degree of product differentiation like, for example, in the Hotelling-type models of horizontal product differentiation. A third way of capturing the degree of credit market imperfections is to apply the Nash bargaining approach. In this

higher as \( \theta \) increases, while the probability of success decreases, i.e. \( p'(\theta) < 0 \). Such a formulation, however, leads to similar results as those reported in the present analysis.
study we measure credit market imperfections by the relative bargaining power of the bank. For the purposes of the present paper this approach has two advantages: it incorporates the polar market structures of monopoly and perfect competition as special cases and moreover, it avoids incorporation of market-specific, and often controversial, institutional details of credit markets.

A change in the bargaining power of the bank is not necessarily equivalent to a change in the competitiveness of the credit market. For example, in Bester (1995) a change in the degree of competitiveness means a change in the outside option of the project holder. Thus, if the credit market becomes more competitive in response to a larger number of banks, the outside option available to borrowers improves without affecting the bargaining power of the borrowers. For this reason it is important to emphasize that the precise interpretation of reduced credit market imperfections in the context of the present model is equivalent to decreased bargaining power of banks.

The lending rate is assumed to be determined as the outcome of a bargaining process between the financier and the entrepreneur subject to the constraint that the investor unilaterally determines the level of investment. In what follows we assume that zero expected profits represent the threat points of both the financier and entrepreneur. In such a situation the determination of the lending rate can be modelled as the solution to the following Nash bargaining problem

\[
\text{Max}_{\Omega} \quad \Omega = V^\beta \pi^{1-\beta} \quad \text{s.t.} \quad \pi_r = 0 ,
\]

in which \( \beta \) and \( 1 - \beta \) describe the relative bargaining power of the financier and the investor, respectively. The bank and the entrepreneur engage in this bargaining subject to the constraint that the participation constraint is not violated. The participation constraint for the financier is determined by the financier’s expected profit being non-negative. This

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6 This approach can be justified either axiomatically (see Nash (1950)) or strategically (see Binmore, Rubinstein and Wolinsky (1986)). For applications of the Nash bargaining approach to analyze credit market competition in slightly different contexts we refer to Besci, Li and Wang (2000), Koskela and
can be obtained by substituting $R^N$ and $r^N$ into the bank’s objective function (6) so as to get

\[(10) \quad V^N \geq 0 \iff p(R^N) \left(\frac{\beta}{\lambda}\right) + (1 - \beta) \geq 1 \iff \frac{p(R^N)}{\lambda} \geq 1.\]

According to equation (10) the participation constraint for the financier eliminates the implementation of such projects, for which the probability of success would be below the hazard rate. The expected profits of the project holder under the Nash bargaining can be obtained by substituting $R^N$ and $r^N$ into the objective function (3) so as to yield

$$\pi^N = \frac{p(R^N)}{\lambda}.$$

Conditional on the participation constraints presented above holding true, the first-order condition associated with (9) can be expressed as

\[(11) \quad \Omega_r = 0 \iff \beta \frac{V_r}{V} + (1 - \beta) \frac{\pi_r}{\pi} = 0,
\]

where $V_r$ and $\pi_r$ denote the partial derivatives with respect to the lending rate of the financier’s and the investor’s objective functions, respectively. Applying the envelope theorem\(^7\), according to which the lending rate does not have any indirect impact through the project choice by the entrepreneur, gives $\pi_r = -p(R) < 0$ and $V_r = p(R^*) + (1 + r)p'(R^*)R^* = p(R^*)[1 - (1 + r)\lambda]$, where we have utilized the equations (2) and (5). Substituting the derivatives mentioned above as well as the objective functions of the financier and the investor into the first-order condition (11) establishes that

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\(^7\) This way the constraint associated with the optimization problem (9) is taken into account.
is the Nash bargaining solution. Further, $R^N$ is determined by substituting $r = r^N$ into (5).

To characterize the relationship between the probability of success and the hazard rate and thereby the dependence of the lending rate on the degree of competition, measured by the relative bargaining power of the financier, we now investigate how the project selection $R^N$, the probability of success $p(R^N)$ and thereby the riskiness of investment project relate to the bargaining power of the financier. Substituting the lending rate $r^N$ into equation (5) we can directly express the project selection in the Nash solution as

$$R^N = \frac{1 + \beta}{\lambda} + \frac{1 - \beta}{p(R^N)} .$$

By differentiating (12) and (13) with respect to the financier’s relative bargaining power and using the specification (2) for the probability of success we find the following relationships to hold

$$R_{\beta}^N = A^{-1}\left(\frac{1}{\lambda} - \frac{1}{p(R^N)}\right) > 0 \text{ as } p(R^N) > \lambda$$

$$r_{\beta}^N = A^{-1}\left(\frac{1}{\lambda} - \frac{1}{p(R^N)}\right) > 0 \text{ as } p(R^N) > \lambda ,$$

where $A = 1 - \frac{\lambda(1 - \beta)}{p(R^N)} > 0$.

Next we ask the following question: What is the critical project type, $\tilde{\lambda}$, defined by the financier’s participation constraint $\nu^N = 0$? It has to satisfy
How does this critical project type depend on the financier’s relative bargaining power? Differentiating (16) with respect to $\beta$ and accounting for the fact that the probability of success depends on the bargaining power by affecting $R^N$ both directly and indirectly via $\tilde{\lambda}$ shows that $\tilde{\lambda}_\beta = 0$, where we have made use of the feature that the critical project type $\tilde{\lambda}$ is defined by $
abla^N(\tilde{\lambda}R^N)$. We are now in a position to summarize our finding in

**Proposition 1** *While the spectrum of project qualities obtaining loan finance is invariant to the bargaining power of the financier, reduced credit market imperfections will lead to lower lending rates and less risky projects.*

Proposition 1 provides two interesting results. First, the threshold of obtaining loan finance, i.e. the critical threshold determined by the financier’s participation constraint, is independent of the financier’s bargaining power because its threat point is zero regardless of the lender’s relative bargaining power. This feature is in contrast to Petersen and Rajan (1995), who argue that a bank’s willingness to lend in the initial stage of a dynamic banking relationship increases with the concentration of the credit market, as well as to the models emphasizing the adverse selection aspect of loan markets (see e.g. Broecker (1990), Riordan (1993) and Shaffer (1998) or Villas-Boas and Schmidt-Mohr (1999)). Consequently, our model thus suggests that aspects related to both intertemporal banking relationships and to adverse selection might represent crucial explanations for the emergence of different types of relationships between lending thresholds and lending market concentration.

Second, according to Proposition 1 there is no trade-off between credit market imperfections and financial fragility. The absence of such a trade-off lies in conformity with the models presented by Allen and Gale (2001), (2003), Boyd and De Nicolo (2003)
and Koskela and Stenbacka (2000). As Allen and Gale (2003) have shown, different ways of modelling credit market competition yields different characterizations of the efficient combinations of competition and financial stability. Also from an empirical point of view the question of whether there is a trade-off between credit market competition and financial stability still seems to be an open issue. In their survey of the empirical literature Carletti and Hartmann (2003) conclude that there does not appear to be a “single ever-valid relationship between competition and stability in the banking system”. The findings by Beck, Demirguc-Kunt and Levine (2003) can be interpreted to be similar.

We now turn to study the important issue concerning the relationship between the agency cost of debt financing and credit market imperfections. Under Nash bargaining about the lending rate the indirect profit functions of the project holder as well as the financier can be written respectively as follows

\[
\pi^N = p(R^N) \left[ R^N - (1 + r^N) \right] = \frac{p(R^N)}{\lambda},
\]

\[
V^N = p(R^N) \left[ 1 + r^N \right] - 1 = p(R^N) \left[ \frac{\beta}{\lambda} + \frac{1-\beta}{p(R^N)} \right] - 1.
\]

Adding equations (17) and (18) yields the aggregate expected profits of the project holder and the financier

\[
W^N = \pi^N + V^N = p(R^N) \left[ \frac{1+\beta}{\lambda} + \frac{1-\beta}{p(R^N)} \right] - 1.
\]

The agency cost of debt financing associated with Nash bargaining, denoted by \( a^N(\beta) \), can now be obtained as the difference between the expected project surplus generated by the socially optimal project selection and the one generated through the process of Nash bargaining. Using (8) and (19) the agency cost of debt financing can be expressed as
Differentiating the agency cost of debt financing under Nash bargaining with respect to the financier’s relative bargaining power parameter $\beta$ and accounting for the effect of $\beta$ on the rate of return, as captured by (17), and thereby on the probability of success according to (2), yields

\[
\alpha^N(\beta) = W^{FB} - W^N = \frac{p(R^{FB})}{\lambda} - p(R^N) \left[ \frac{1+\beta}{\lambda} + \frac{1-\beta}{p(R^N)} \right].
\]

Hence we can summarize our finding in

**Proposition 2** Reduced credit market imperfections will decrease the agency cost of debt finance via leading to lower lending rates and lower and less risky projects.

Thus our analysis does not lend support to the commonly held view that there would be a trade-off between intensified lending market competition and higher agency costs of debt finance as has been argued – though not along similar lines - for example, by Broecker (1990), Riordan (1993) and Petersen and Rajan (1995). They have focused on how phenomena associated with adverse selection or intertemporal aspects of customer relationships might present mechanisms demonstrating that more intense lending market competition may damage market performance. Although, for example, severe adverse selection problems leading to a sufficiently low probability of success might suggest that intensified lending competition could, in principle, increase the agency cost of debt finance, our analysis finds that such a possibility would be eliminated by the bank’s participation constraint. As the financier does not find it worthwhile to finance such projects it follows that the credit market would break down in those cases.

Our model has focused on agency costs in the form of incentives for project holders to engage in excessive risk taking. In addition to this type of agency costs the financial
structure and the credit market imperfections might impact on the internal agency costs due to separation of ownership from management. In this respect Aghion, Dewatripont and Rey (2000) have presented an agency model of entrepreneurs where the financial structure works as a disciplining device for management in interaction with external product market competition. Schmidt (1997) has also analysed the effects of competition on managerial incentives. On the one hand, higher competition increases the probability of liquidation and thereby stimulating managerial effort, but it also reduces the firm’s profits, which may make it less attractive to provide high effort.

4. Concluding Comments

This paper has shown that reduced credit market imperfections, measured by the lower relative bargaining power of the financier, will lead to lower lending rates and to investment return distributions which are shifted towards lower, but less risky returns. Therefore this kind of credit market competition will reduce the agency cost of debt financing, while the spectrum of project qualities obtaining credit finance is invariant to the bargaining power of the financier. Thus, overall our analysis does not lend support to the commonly held view that there would be a trade-off between reduced credit market imperfections and higher agency costs of debt finance.

Finally, it should be emphasized that our analysis has been carried out within the framework of a particular set of functional forms. Of course, formally the generality of all the conclusions reached is restricted accordingly. Strictly speaking our results therefore demonstrate the possibility that agency costs may respond favourably to competition, rather than establishing that they will certainly do it. However, within the framework of the present approach it appears unlikely that the assumptions with respect to functional form could be substantially relaxed while preserving analytical tractability.
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