Do Bank Loans Curb Corporate Moral Hazard?

Joung Hwa Choi\textsuperscript{a}, Paul Moon Sub Choi\textsuperscript{b,}\textsuperscript{*}

\textsuperscript{a}Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 151-742, Republic of Korea
\textsuperscript{b}Ewha Womans University, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul 120-750, Republic of Korea

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\textsuperscript{*} Choi (Ph.D. Candidate) can be contacted at choijh@snu.ac.kr; Business School, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 151-742, Republic of Korea; tel.: +82-10-4713-2730; fax: +82-2-884-0408. Choi (Assistant Professor) can be contacted at paul.choi@ewha.ac.kr; College of Business Administration, Ewha Womans University, 52 Ewhayeodae-gil, Seodaemun-gu, Seoul 120-750, Republic of Korea; tel.: +82-2-3277-3543; fax: +82-2-3277-2776. We thank Dimitri Andriosopoulos, Swarnava Biswas, and participants at Financial Engineering and Banking Society 2013 (Paris, France). Standard disclaimer rules apply and all errors are our own.
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Abstract

In this paper, we discuss optimal contract drafting between a lender with deficient monitoring capabilities and an agency-ridden borrower with insufficient budget to finance an investable project. The theoretical implications are as follows: First, the first best solution (FBS) is achievable under no hidden action. However, the borrower’s action is hardly observable in practice. Second, with unobservable managerial decisions the borrower exerts sub-optimal effort (moral hazard), and the probability of default increases. Lastly, with a penalizing discretion entitled to the bank on a long-term contract, the financial intermediary will be able to control the firm’s managerial action effectively such that the solution is equivalent to the FBS attained under no hidden action.

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1. Introduction

The sources of corporate external financing are either direct or indirect or both. Direct, disintermediated, or market-based financing taps the long-term investors in the capital markets via investment banks by issuing bonds and/or equities; whereas indirect, intermediated, or bank-based funding channels the diversified depositors in the money market via commercial banks by taking loans (Tirole, 2005). Hidden managerial decisions incur agency costs, and this paper attempts to address the theoretical and empirical questions of varying moral hazard behavior of firms with respect to the external sources of financing.

In our moral hazard-prone theoretical framework, money changes hands from a lender with deficient monitoring capabilities to an agency-ridden borrower with insufficient budget to finance an investable project. The theoretical implications are as follows: First, the first best solution (FBS) is achievable under no hidden action. However, the borrower’s action is hardly observable in practice. Second, with unobservable managerial decisions the borrower exerts suboptimal effort (moral hazard), and the probability of default increases. Lastly, in case of a loan made with a penalizing discretion entitled to the bank on a long-term contract, the financial intermediary will be able to control the firm’s managerial action effectively such that the solution is equivalent to the FBS attained under no hidden action.

The remainder of this paper is organized as follows: In Section 2, a theoretical moral hazard model shows that when the lender-borrower relationship is settled in the long run, the first best solution is achievable. Section 3 designs statistical inference procedures to empirically validate the model provided in Section 2. We conclude in Section 4.
2. Model

2.1. First-best solution under no hidden action

We first consider an optimal contract under no hidden managerial decisions. The assumptions are as follows:

- There exist a lender (bank) and a borrower (manager).
- The project outcome \( q \) of the borrower will turn out either as a success \( u \) or a failure \( d \) whose second-differentiable probability measure of a successful operation \( u \) depends on the borrower’s effort level \( a \): 
  \[
P(u) = P(a), \quad P(0) = 0, \quad P(\infty) = 1, \quad P'(a) > 0, \quad \text{and} \quad P''(a) < 0.
\]
- The lender earns \( D = au \), which depends on the financing type. For simplicity, let \( a = 1 \), thus \( D = u \): The lender can extract all rent from the borrower.
- The borrower is paid off by \( C_i \), which depends on the project outcome and on the financing type. It may be a managerial compensation, or a benefit/fine from relationship banking, where \( C_u = r + k \), \( C_d = 0 - k \), \( r \equiv u - D \), and \( k \) is the benefit from repayment or a loss due to a halt in banking relationship or a higher interest rate etc.
- The respective utility functions of lender and borrower are \( V(q - C_i) \) and \( U(C_i) - \Phi(a) \), where \( \Phi(a) \) is the cost of effort. Furthermore, the reservation utility of the borrower is zero.

Under these assumptions, the optimal contract can be drafted by solving the lender’s utility maximization subject to the borrower’s participation constraint:

\[
\begin{align*}
\text{Max}_{C_i,a} & \left[ P(a)V(u - C_u) + \{1 - P(a)\}V(d - C_d) \right] \\
\text{s.t.} & \quad P(a)U(C_u) + \{1 - P(a)\}U(C_d) \geq a.
\end{align*}
\]

By Lagrangian,
MaxC,α,λ \[ P(a) V(u - C_u) + [1 - P(a)] V(d - C_d) \]
\[ + \lambda [P(a) U(C_u) + [1 - P(a)] U(C_d) - a] \]  
(3)

With respect to the argument variables, the first order conditions (FOCs) are

\[ C_u: -P(a) V'(u - C_u) + \lambda P(a) U'(C_u) = 0 \]  
(4)

\[ C_d: -(1 - P(a)) V'(d - C_d) + \lambda [1 - P(a)] U'(C_d) = 0 \]  
(5)

\[ a: P'(a) V(u - C_u) - P'(a) V(d - C_d) + \lambda [P'(a) [U(C_u) - U(C_d)] - 1] = 0 \]  
(6)

\[ \lambda: P(a) U(C_u) + [1 - P(a)] U(C_d) \geq a \]  
\[ \lambda [P(a) U(C_u) + [1 - P(a)] U(C_d) - a] = 0 \]  
(7)

\[ \lambda \geq 0. \]  
(8)

From these FOCs, we know that \( \lambda = \frac{V'(u-C_u)}{U'(C_u)} = \frac{V'(u-C_d)}{U'(C_d)} \neq 0 \) per Borch rule. Thus, Equation (8) is binding as follows:

\[ P(a) U(C_u) + [1 - P(a)] U(C_d) = a. \]  
(10)

Now, let us assume that both lender and borrower are risk-neutral: \( V(x) = U(x) = x \). The upper conditions boil down to

\[ -P(a) + \lambda P(a) = 0 \]  
(11)

\[ -(1 - P(a)) + \lambda [1 - P(a)] = 0 \]  
(12)

\[ P'(a) [(u - C_u) - (d - C_d)] + \lambda [P'(a) (C_u - C_d) - 1] = 0 \]  
(13)

\[ P(a) C_u + [1 - P(a)] C_d = a. \]  
(14)

From Equations (11) and (12) it follows \( \lambda = 1 \), thus

\[ P'(a) (u - d) = 1 \text{ and } P(a) = \frac{a - C_d}{C_u - C_d}. \]  
(15)

Hence, the optimal levels of effort \( (a^*) \), upside \( (C_u) \) and downsize \( (C_d) \) managerial compensations are determined by \( P'(a^*) = \frac{1}{u-d} \) and \( P(a^*) = \frac{a^* - C_d}{C_u - C_d} \). Therefore, the FBS is
attained under no hidden action as follows:

\[
FBS = \left\{ (a^*, C_u^*, C_d^*) \right\} \mathbb{P}'(a^*) = \frac{1}{u-a} \cap \mathbb{P}(a^*) = \frac{a^*-C_d}{C_u-C_d}.
\] (16)

However, in reality observing the effort level \((a)\) is infeasible or monitoring is very costly, thus agency problems arise. This nuisance may persist if (1) lender-borrower relationship is not set on a long-term basis, and/or (2) the fine (punishment) for a bad outcome is non-negative \((C_d \geq 0)\). Let us now turn to when the action \((a)\) is unobservable to see how the managerial effort level diminishes.

2.2. Second-best solution under hidden action

In addition to the assumptions previously given in Section 2.1 the borrower’s effort level is now assumed to be unobservable to the lender. The borrower maximizes her expected utility less effort level \(a\) such that

\[
Max_a[\mathbb{P}(a)U(C_u) + \{1 - \mathbb{P}(a)\}U(C_d) - a],
\] (17)

whose FOC is

\[
\mathbb{P}'(a)U(C_u) - \mathbb{P}'(a)U(C_d) = 1,
\] (18)

and this serves as her binding incentive criterion (IC) to be reflected in the lender’s decision making procedure. With conjectured effort level of the borrower, the lender faces his optimization problem as follows:

\[
Max_{c,u}[\mathbb{P}(a)U(u - C_u) + \{1 - \mathbb{P}(a)\}V(d - C_d)]
\] (19)

s.t. \(\mathbb{P}(a)U(C_u) + \{1 - \mathbb{P}(a)\}U(C_d) \geq a\) (20)

\[
\mathbb{P}'(a)U(C_u) - \mathbb{P}'(a)U(C_d) = 1
\] (21)

\(C_d \geq 0\). (22)

Assuming that both parties are risk-neutral, the objective Lagrangian function is

\[
Max_{c,u,a,\lambda,u} \mathbb{P}(a)(u - C_u) + \{1 - \mathbb{P}(a)\}(d - C_d)
\]

\[ +\lambda [\mathbb{P}(a)C_u + (1 - \mathbb{P}(a))C_d - a] + \mu [\mathbb{P}'(a)C_u - \mathbb{P}'(a)C_d - 1] + \gamma C_d, \]  

whose FOCs are

\[ C_u: \quad -\mathbb{P}(a) + \lambda \mathbb{P}(a) + \mu \mathbb{P}'(a) = 0 \]  
\[ C_d: \quad -(1 - \mathbb{P}(a)) + \lambda (1 - \mathbb{P}(a)) - \mu \mathbb{P}'(a) + \gamma = 0 \]  
\[ a: \quad \mathbb{P}'(a)(u - C_u) - \mathbb{P}'(a)(d - C_d) + \lambda [\mathbb{P}'(a)(C_u - C_d) - 1] + \mu \mathbb{P}''(a)(C_u - C_d) = 0 \]  
\[ \lambda: \quad \mathbb{P}(a)C_u + (1 - \mathbb{P}(a))C_d - a \geq 0, \; \lambda \geq 0, \; \lambda [\mathbb{P}(a)C_u + (1 - \mathbb{P}(a))C_d - a] = 0 \]  
\[ \mu: \quad \mathbb{P}'(a)(C_u - C_d) - 1 = 0 \]  
\[ \gamma: \quad C_d \geq 0, \gamma \geq 0, \text{ and } \gamma C_d = 0. \]  

First, consider Equation (28): Assuming \( C_d > 0 \) implies \( \gamma = 0 \), then \( \lambda = 1 - \mu \frac{\mathbb{P}(a)}{\mathbb{P}'(a)} = 1 + \mu \frac{\mathbb{P}(a)}{1 - \mathbb{P}'(a)} \). This means \( \mathbb{P}'(a) = \mathbb{P}'(a) - 1 \) which is a contradiction. Thus, \( C_d = 0 \). From Equation (26) we get \( C_d = 0 \). If \( \lambda = 0 \),

\[ \mu = \frac{\mathbb{P}(a)}{\mathbb{P}'(a)} \text{ thus} \]

\[ \mathbb{P}'(a)C_u = 1 \Rightarrow C_u = \frac{1}{\mathbb{P}'(a)}, \]  

hence

\[ \mathbb{P}'(a^{**}) = \left( \frac{1}{u - d} \right) \left( 1 - \frac{\mathbb{P}''(a)\mathbb{P}(a)}{\mathbb{P}'(a)^2} \right). \]  

Because \( \frac{\mathbb{P}''(a)\mathbb{P}(a)}{\mathbb{P}'(a)^2} \) is strictly positive and \( \mathbb{P}() \) is strictly concave, \( a^{**} < a^* \). State-contingent compensations \( C_u \) and \( C_d \) can be derived as follows:

\[ \mathbb{P}(a^{**})C_u \geq a^{**} \Rightarrow C_u \geq \frac{a^{**}}{\mathbb{P}(a^{**})} \text{ and } C_d = 0. \]  

If \( \lambda > 0 \), then

\[ \mathbb{P}(a)C_u = a \Rightarrow \frac{1}{C_u} = \frac{\mathbb{P}(a)}{a}, \]  

and
That is, the only effort level satisfying \( a \mathbb{P}'(a) = \mathbb{P}(a) \) is zero \( (a^* = 0) \) which is less than the optimal level \( (a^* \) under observable action. To this end, we find that when the borrower’s managerial decision is unobservable she exerts less effort and the probability of default increases: corporate moral hazard. Therefore, the resulting second-best solution (SBS) is

\[
SBS = \{(a^{**}, C^{**}, C^{**}_d) | a^{**} = C^{**}_d = 0 \land C^{**}_u = [\mathbb{P}'(0)]^{-1}\}.
\]

(35)

2.3. First-best solution when the lender can penalize the borrower’s losses

In case where the lender-borrower relationship is a repeated game, i.e. a long-term series of loan contracts between the bank and the firm, the lender can penalize the borrower’s moral hazard behavior. The bank can raise the interest rate when the operating performance of the corporate project is poor thereby increasing the likelihood of a borrower’s default on the bank loan, or the bank can reject a subsequent debt rollover or re-financing. This is due to the nature of indirect financing the firm sought in the first place. Had the firm raised capital through direct financing, the shareholder may unload her stakes in times of bad operating results, or the bond investor may liquidate the firm: no re-negotiation.

Thus, a feature of indirect financing that the bank can punish or compensate for the corporate earnings performance means that the downside compensation \( C_d \) can either be positive or negative. This makes the FBS feasible for the lender which was only achievable under unobservable borrower’s managerial decisions. The optimal contract can be drafted by maximizing the bank’s profit (Equation (36)) subject to the individual rationality (Equation (37)) and incentive criterion (Equation (38)) constraints as follows:

\[
\text{Max}_{C_u, a}[\mathbb{P}(a)V(u - C_u) + \{1 - \mathbb{P}(a)\}V(d - C_d)]
\]

\[
\text{s.t. } \mathbb{P}(a)U(C_u) + \{1 - \mathbb{P}(a)\}U(C_d) \geq a
\]

(36)  (37)
\[ \mathbb{P}'(a)U(C_u) - \mathbb{P}'(a)U(C_d) = 1. \tag{38} \]

Assuming that both parties are risk-neutral, by Lagrangian

\[
\begin{align*}
\text{Max}_{C_l,a,\lambda,\mu} \quad & \mathbb{P}(a)(u - C_u) + (1 - \mathbb{P}(a))(d - C_d) \\
& + \lambda[\mathbb{P}(a)C_u + (1 - \mathbb{P}(a))C_d - a] + \mu[\mathbb{P}'(a)(C_u - C_d) - 1]. \tag{39}
\end{align*}
\]

The FOCs are

\[
\begin{align*}
C_u: & \quad -\mathbb{P}(a) + \lambda \mathbb{P}(a) + \mu \mathbb{P}'(a) = 0 \tag{40} \\
C_d: & \quad -(1 - \mathbb{P}(a)) + \lambda (1 - \mathbb{P}(a)) - \mu \mathbb{P}'(a) = 0 \tag{41} \\
a: & \quad \mathbb{P}'(a)(u - C_u) - \mathbb{P}'(a)(d - C_d) + \lambda[\mathbb{P}'(a)(C_u - C_d) - 1] + \mu \mathbb{P}''(a)(C_u - C_d) = 0 \tag{42} \\
\lambda: & \quad \mathbb{P}(a)C_u + (1 - \mathbb{P}(a))C_d - a \geq 0, \quad \lambda \geq 0, \quad \lambda[\mathbb{P}(a)C_u + (1 - \mathbb{P}(a))C_d - a] = 0 \tag{43} \\
\mu: & \quad \mathbb{P}'(a)(C_u - C_d) - 1 = 0. \tag{44}
\end{align*}
\]

From Equation (43), if \( \lambda = 0 \), then \( \mu = \frac{\mathbb{P}(a)}{\mathbb{P}'(a)} \) which is a contradiction, thus \( \lambda > 0 \) and this gives a binding condition such that

\[
\mathbb{P}(a)C_u + (1 - \mathbb{P}(a))C_d = a \implies \mathbb{P}(a) = \frac{a - C_d}{C_u - C_d}. \tag{45}
\]

Equations (40) and (41) yield

\[
\mu = \frac{\mathbb{P}(a)(1 - \lambda)}{\mathbb{P}'(a)} = \frac{[\mathbb{P}(a) - 1](1 - \lambda)}{\mathbb{P}'(a)} \implies \lambda = 1 \text{ and } \mu = 0. \tag{46}
\]

Equation (44) prescribes

\[
\mathbb{P}'(a)(C_u - C_d) = 1 \implies (C_u - C_d) = \frac{1}{\mathbb{P}'(a)}. \tag{47}
\]

which further implies

\[
\mathbb{P}'(a) \left\{ u - d - \frac{1}{\mathbb{P}'(a)} \right\} = 0 \implies \mathbb{P}'(a) = \frac{1}{u - d}. \tag{48}
\]

Thus, with presence of a downside penalizing option entitled to the bank, the optimal contract is equivalent to the FBS under no hidden action. In other words, a bank loan plays an effective monitoring role in curbing moral hazard incentive. Therefore, the optimal contract is
3. Empirics

Other than the monitoring role of a bank loan modeled in Section 2, equity and debt financing instruments also are known for their effective functions in preventing managerial moral hazard by facilitating independent board members, institutional monitoring creditors etc. Does corporate moral hazard behavior vary in the cross-section of various financing methods? In order to answer this “by-nature” empirical question, we now turn to identifying the objective, explanatory and control variables to be collectively framed in regression models.

3.1. Variables and regression model

Following the literature (Beatty and Ritter, 1986; Carter and Manaster, 1990; Yung and Zender, 2010), a likely proxy for moral hazard ($MoralHazard$) is the abnormal variance ($AbVariance$) of stock return (or return on assets) which is bench-marked with the average of industry return. So is free cash flow ($FreeCashFlow$) a proxy for moral hazard (Jensen, 1986). The key explanatory variables to gauge the degree of moral hazard of corporate managerial decisions are the financing means which are the proportions of bond ($Bond$), bank loan ($Loan$), and equity ($Equity$) over the total value of external financing and the squared terms of respective instruments to control for the effect of over-financed excess capital. The auxiliary variables to see additional effect as interaction terms are categorized into three groups of respective financing vehicle. For the bank loan, these are the period of relationship with the main bank ($Period$), the number of loaning banks ($NumBank$). The ones associated with debt capital are the share of main creditor ($MainCreditor$), government share in percentage or as a dummy variable ($Government$). The last group of interacts with equity financing are the number of independent board members
(IndepBoard), largest ownership (LargestOwner), and institutional holdings (Institution). The controls for firm characteristics are the age of incorporation (Age), firm size (Size), industry indicators (Industry), and developed market dummy (Develope).

\[
\text{MoralHazard}_i = a + b_0 \cdot \text{Loan} + b_1 \cdot \text{Loan} \times \text{Period} + b_1 \cdot \text{Loan} \times \text{NumBank} \\
+ c_0 \cdot \text{Bond} + c_1 \cdot \text{Bond} \times \text{MainCreditor} + c_2 \cdot \text{Bond} \times \text{Government} \\
+ d_1 \cdot \text{Equity} \times \text{IndepBoard} + d_2 \cdot \text{Equity} \times \text{LargestOwner} + d_3 \cdot \text{Equity} \times \text{Institution} \\
+ e \cdot \text{Age} + f \cdot \text{Size} + g_1 \cdot \text{Industry} + h_1 \cdot \text{Develope} + \epsilon_i. 
\]  

(50)

3.2. Predictions

- Moral hazard is expected to be less the higher the weight of bank loan over total external financing, the longer the relationship with the main bank, or the more the number of loaning banks.
- The degree of moral hazard will alleviate the larger the bond share, or the higher the share of main creditor and/or government.
- The degree of moral hazard will aggravate the less the number of independent board members, the larger the share of the largest ownership (not related to the CEO), or the lower the institutional holdings.
- These predictions may vary across the borders in terms of magnitude depending on the degree of economic development, and also between common and civil law systems.

4. Conclusion and further agenda

In this paper, we discussed optimal contract drafting between a lender with deficient monitoring capabilities and an agency-ridden borrower with insufficient budget to finance an investable project. The theoretical implications are as follows: First, the first best solution (FBS) is achievable under no hidden action. However, the borrower’s action is hardly observable in
practice. Second, with unobservable managerial decisions the borrower exerts sub-optimal effort (moral hazard), and the probability of default increases. Lastly, with a penalizing discretion entitled to the bank on a long-term contract, the financial intermediary will be able to control the firm’s managerial action effectively such that the solution is equivalent to the FBS attained under no hidden action.

In our forthcoming revision, we will identify and procure ideal databases to implement statistical exercise procedures suggested in Section 3. The empirical results and appropriate robust tests with further discussion will follow.

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References


